An experimental survey of investment decisions for retirement savings[*]

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Abstract

We implement a choice experiment to investigate the extent to which retirement savers follow standard mean-variance analysis when choosing from a menu of investment options. We conduct this survey once during a period of financial tranquility (March 2007) and once during financial crisis (October 2008). We model choices using the scale-adjusted version of a latent class choice (finite mixture) model. We identify income and age as important determinants of the preference classes, and underlying risk tolerance and age as key determinants of variability (scale). Estimated marginal effects of variations in net expected returns and risk on choice of investment option show classes populated by young and low income individuals as more likely to respond consistently with standard mean-variance analysis. However classes populated by older and higher income individuals react positively to both higher returns (lower fees) and increasing risk in returns where risk is presented as a widening range of possible investment outcomes. Crisis-period results confirm these conclusions, although we see some moderating of overall risk exposures compared with tranquil-period results.

Keywords: portfolio choice, investment decisions

JEL Classification: G11, G23, J26

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1 Introduction

As retirement income systems around the world move away from defined benefit arrangements towards privately-managed accumulation plans, pension plan participants increasingly are required to decide how their assets will be allocated across a menu of investment options. Consequently, plan providers, public regulators and researchers are concerned about how investment choice menus are constructed and composed, and what factors may influence the choices being made by retirement savers.

In line with this global trend, more investment choice is being offered by 401(k) plans in the US, and debate continues over the introduction of individual accounts as part of possible Social Security reforms. Swedish retirement savers are now offered choice from a menu of over 750 mutual funds and Australian retirement savers are offered significant investment choice under Australia's mandatory and voluntary superannuation (retirement saving) arrangements. In 2007, Australian retail pension funds on average offered choice of 97 mainly specialized investment funds, while Australian multi-employer (industry) pension funds on average offered choice of 10 mainly multi-manager diversified portfolios.

Standard finance theory (mean-variance analysis) predicts that, when choosing from a menu of investment options, a risk averse retirement saver should be concerned with the risk-return characteristics of the portfolio. Therefore, the retirement saver would reduce her exposure to risky portfolios as her aversion to risk increases, and would be more likely to choose a portfolio, the higher its expected return net of fees, at any given level of risk. If risk aversion changes or if the investor reassesses the expected distribution of returns, the optimal allocation changes.

To date, studies of investment choice by retirement savers have focused on behavioral factors which may be affecting choice of investment option(s) and thus overall asset allocation, as well as investigating the impact of personal and demographic characteristics on choice. Findings indicate that the length and characteristics of menus influence choices, and therefore aggregate asset allocation, and that personal and demographic characteristics are often important.

In this paper we take one step back and ask some fundamental questions about the role of standard finance theory in allocation decisions. We aim to identify the impact of variations in expected returns, fees and portfolio volatility on choice from a menu of investment options while also assessing the influence of demographic and personal characteristics on these marginal effects.

In addition, we conduct the experiments on two dates: first during March 2007, a relatively tranquil period for asset markets, then again in late October 2008 during a peak in the financial crisis. We might expect different investment choices in tranquility and crisis if risk aversion is non-constant and/or if large asset-price shocks lead individuals to change their subjective conditional expectations of asset returns. If investors have habit preferences,[1] for example, relative risk aversion increases as wealth falls, and people trade risky for safe assets in bear markets. Our surveys are repeated cross-sections and not a panel, so some underlying changes may be obscured by sampling effects. Further, we took the 2008 survey quite early in what turned out to be a long period of bad news, so some respondents may have viewed the shocks to their wealth as temporary at the time of the survey. Even so, we can conduct general tests for changes in portfolio allocations caused by external events.

We design and implement a choice experiment to investigate the extent to which retirement savers follow a simple theory of portfolio allocation and how external conditions might impact that allocation. Our experiment involves around 800-900 men and women aged between 18 and 65. Each subject completes an internet survey where they are asked to allocate their retirement saving contribution to one of six portfolios offered by a pension fund, five of which differ by the proportion of equities and cash (i.e. 100 percent cash/0 percent equities, 75/25, 50/50, 25/75 and 0/100) while the sixth is a retirement savings account (similar to a bank account).[2] Each subject is then presented with a treatment made up of (gross) return, fees and risk, where there are four levels for each of fees and risk. Risk is presented as a 'range' representing likely 'worst' case and 'best' case scenarios at a ten year horizon. Subjects are also asked to answer a number of questions about personal circumstances, demographics and risk preference.

We use the scale-adjusted version of the latent class choice model to simultaneously identify preference and scale classes and to estimate the marginal effects of variations in net expected returns (gross returns less fees) and risk (portfolio volatilities) on investment choice, by class. This means of estimation also identifies the relevance of the various personal and demographic characteristics to scale class and preferences. Our main findings are that the response of retirement savers to net expected returns and risk differs by age and income level. Classes populated by young and low income retirement savers are more likely to respond positively to net expected

[1] See, for example Merton (1973), Campbell and Cochrane (1999), and Chen and Ludvigson (2003).

[2] A retirement savings account is a product offered by an Australian financial services provider, as an alternative to a superannuation (pension) fund. It pays a fixed, net of fees, interest rate, which is generally lower than one would expect from investing in a 'cash' option from a pension fund investment option menu.

returns and negatively to risk as predicted by standard mean-variance analysis. However, classes populated by older and higher income retirement savers, although wary of risking fees, are more likely to react positively to increasing variance in returns when risk is presented as a widening range of possible investment outcomes. Of the many personal and demographic variables tested, only age, income level and risk tolerance were found to be relevant to the investment choice decision. We also demonstrate that respondents tend to make decisions by comparing two or three nearby portfolios, and we estimate significant cross-elasticities for nearby portfolio return and variance.

These results are true for both surveys. We do observe an overall moderating of risk exposure during the period of financial crisis in October 2008, as respondents mix higher proportions of cash with their equity investments, so that more balanced portfolios increase in popularity, but the marginal effects outlined above are still evident. Older, higher income investors remain strongly risk-seeking and younger lower income investors appear more risk averse.

The paper is set out as follows. In section 2 we survey relevant literature. The underlying theory is outlined in section 3. In section 4 we discuss the experimental design and outline the demographic characteristics of the people who took part in the survey. The estimated models and results are discussed in section 5. Section 6 concludes.

2 Literature

Investigations of investment choice by retirement savers have focused on a number of broad areas. These are the extent to which individual portfolio decisions may be influenced by behavioral factors (such as plan design and menu composition), the impact of demographic and personal characteristics (such as age, gender, marital status, income, wealth etc.) on choices made by retirement savers, and other issues in the decision making process (such as the role of inertia). This research covers the experience with 401(k) plans in the United States, the Swedish Premium Pension Plan, the Australian superannuation (private pension) system and occupational pensions in Denmark and the United Kingdom. It has included both simple experiments, and the analysis of individual and plan-level cross section and panel data of actual investment choice.

The broad question asked in the behavioral research has been whether (and to what extent) the number and character of options on the choice menu affect overall asset allocation in ways that would not be anticipated under standard finance theory. The overall finding is, yes. This strand of research can be traced back to the seminal work of Benartzi and Thaler who conducted a simple choice experiment where participants were required to allocate contributions across pairs of funds with differing characteristics, with the aim of determining whether the set of funds offered in the choice menu influences the overall asset allocation (Benartzi and Thaler 2001). Their experimental data (and further multivariate analysis of actual fund level cross section and times series data) supported the use of the simple rule of thumb (1/n) whereby retirement savers allocated their pension contributions equally across the options offered on the menu. By implication, the proportion invested in stocks depends strongly on the proportion of stocks in the plan. Evidence of naïve diversification has also been found using data on investment choices in Sweden (Hedesstrom, Svedsater and Garling 2004).

However, Huberman and Jiang (2006), using records of actual individual choices (from menus of between 4 and 59 options) rather than experimental data, found only qualified support for the 1/n heuristic. Retirement savers selected a small number of funds (typically 3 to 4) irrespective of the number of funds offered and allocated contributions equally across this subset. This result was supported in an analysis of decision making by UK pension fund trustees (Clark, Caerlewy-Smith and Marshall 2008).[3]

Further analysis of the impact of the menu of investment options and participant portfolio choice (and consequent asset allocation) was considered in Brown, Liang and Weisbenner (2007) using panel data of 401(k) plans in US. They find that the share of investment options in a particular asset class has a significant effect on aggregate participant portfolio allocations across these asset classes, so that, for example, adding more equity funds to the choice menu increases exposure of the retirement savers to equity. This result, that asset classes with more options are chosen proportionally more, was confirmed in a study of Swedish retirement accounts (Karlsson, Massa and Simonov 2006).

Other research on plan design has considered the behavioral impacts of the inclusion of employer stock on the choice menu – which has been shown to increase the overall allocation to employer stock (Benartzi 2001; Brown, Liang and Weisbenner 2006; Mitchell, Utkus and Yang 2005). Similarly, the availability of an employer match has been shown to increase participation and contributions (Huberman, Iyengar and Jiang 2007).

[3]In comparing their results with Benartzi and Thaler (2001), Huberman and Jiang (2006) highlighted some of the difficulties in making inferences about individual behaviour based on plan level data.

We are primarily concerned with the impact on choice of variations in net expected returns (that is gross expected returns less fees) and (risk) portfolio volatility. An interesting study in this context is Choi, Laibson and Madrian (2006) who conducted an experiment (using Wharton and Harvard MBA students as the subjects) which manipulates the transparency of mutual fund fees and the salience of past returns without changing the body of information available to investors. Overwhelmingly, the subjects fail to minimize fees (whether they are transparent or not) and chase past returns where they are made salient even if they are really irrelevant.

Finally, in a study of the competence and consistency of pension fund trustee decision-making, Clark, Caerlewy and Marshall (2007) found that portfolio choice differed by the value of the assets to be invested.

Another strand of investment choice research has investigated how personal and demographic characteristics may influence choice. Typical characteristics include gender, family structure, age, education, income, wealth and attitudes to risk.

Evidence of the importance of gender and family structure on investment choice is mixed. Research findings suggests that women in aggregate are less likely than men to include risky assets in their retirement portfolios (see Speelman, Clark-Murphy and Gerrans 2007; Watson and McNaughton 2007; Clark and Strauss 2008).[4] However, other studies suggest that any evidence of low risk tolerance may be restricted to single females. Using data from a large Australian multi-employer (industry) pension fund, Gerrans and Clark-Murphy (2004) find that after controlling for other characteristics, young single females emerge as more likely to select lower risk investment choices. Similarly a study using Danish data found that single women have a higher propensity to invest in bonds (than stocks) when controlling for a number of background characteristics (Christiansen, Joensen and Rangvid 2006).

Economic theory tells us that under strict conditions (including time additive CRRA preferences and i.i.d. returns), rational investors would hold a fixed equity allocation over their lifetime, regardless of age or wealth (Samuelson 1969, Merton 1971). However, relaxing some of the underlying assumptions suggests a more complex relationship. For example Bodie, Merton and Samuelson (1991) show that an inverse correlation between age and human capital risk should lead investors to hold less risky portfolios as they age, while arguments can also be

[4] Although the reverse has been found using a large data set of managed fund investment choices not restricted to retirement saving (Brown, da Silva Rosa and McNaughton 2006).

made for more risky portfolios with increasing age (see Viceira 2007). Evidence on this question from the analysis of actual investment choices is mixed. Using data from TIAA-CREF 403(b) accounts and the Survey of Consumer Finances, Ameriks and Zeldes (2004) found that households did not decrease equity shares with age. On the other hand, an examination of investment choices made by Australian academics when moving from defined benefit to defined contribution plans indicated that younger fund members were choosing low risk/low return options (Clark-Murphy and Gerrans 2004). However, analysis of more recent data on the investment choices of Australian academics indicated a negative relationship between age and choice of risky portfolios (Watson and McNaughton 2007). Clark and Strauss (2008) also found a negative relationship between age and risk tolerance in their analysis of a survey of UK occupational pension participants.

Also important is investment experience and financial literacy. Many studies have found a positive relationship between financial literacy and participation in retirement saving plans (Agnew, Szykman, Utkus and Young 2007; Lusardi and Mitchell 2007). Agnew and Szykman (2005) provide evidence that individuals with below average financial knowledge become 'overwhelmed' by making investment decisions and opt for the default.

Finally, another line of research, again mainly in relation to 401(k) plans in the US, has considered the impact of member inertia in aligning investment choice for current contributions and pre-existing assets (past contributions). Retirement savers are shown to be slow to rebalance portfolios, which can lead to allocations of total holdings that look very different compared with allocations of contributions (Samuelson and Zechhauser 1988; Ameriks and Zeldes 2001; Madrian and Shea 2001; Agnew, Balduzzi and Sunden 2003; Choi, Laibson, Madrian and Metrick 2004; and Mitchell, Mottola, Utkus and Yamaguchi 2006).

In sum, analysis using experimental and actual plan and member choice data clearly shows that the composition and design of investment choice menus impacts on choices made, the resultant risk adjusted returns and therefore the quantum of the retirement accumulation.

In this paper we analyze how retirement savers respond to a menu of investment options using stated preference modelling. We start in the next section by outlining the underlying theory.

3 Mean-Variance utility

Consider a mean variance (MV) investor (i) with expected utility function, V_i, where

$$V_i = \mu_i - \eta_i \sigma_i^2 \tag{1}$$

Here, μ_i is the expected rate of return of investor i's investment portfolio, σ_i^2 is her expected portfolio variance and η_i is her risk parameter, which is increasing in risk aversion. In the investment choice experiment investor i is confronted by six portfolio choices ($j = 1, \ldots, 6$) which convert to $\{V_{ij,}\}_{j=1}^{6}$ The investor's responses to the investment choice menu reveal $\max\{V_{ij,}\}_{j=1}^{6}$ and $\min\{V_{ij,}\}_{j=1}^{6}$.

To this end, we have calculated conditions of preference in terms of the risk parameter and the investment proportions. This only addresses expected rate of return, range (variance), and fees (which can be incorporated into returns). We assume i.i.d returns, so this model is linear in investment horizon. Under assumptions of mean reverting returns, we would expect the mean to go up faster than the variance and hence equity to appear more attractive in the long run.

Under the mean-variance framework, utility for each of the cash and equity portfolios can be written as a function of the portfolio j return and variance. (For the time being we set aside the notation i for an individual investor). Utility for each portfolio j is then represented as

$$V_j = V(\theta_j) = \mu_s \theta_j + \mu_c (1 - \theta_j) - \phi_j - \eta \left[\theta_j^2 \sigma_s^2 + 2\theta_j (1 - \theta_j) \sigma_{sc} + (1 - \theta_j)^2 \sigma_c^2 \right] \tag{2}$$

where θ_j is the proportion of the portfolio allocated to stocks, μ_s is the return to stocks, μ_c is the return to cash, ϕ_j is the fee deducted from returns, σ_s^2 is the variance of stock returns, σ_{sc} is the covariance between stocks and cash and σ_c^2 is the variance of cash returns.

The investor chooses between the six options by comparing the expected utility of each and selecting the one with the highest utility. The difference in utility between each of these options is

$$V_k - V_j = \left(\phi_j - \phi_k\right) + (\theta_k - \theta_j) \left\{ (\mu_s - \mu_c) + 2\eta\sigma_c^2 - 2\eta\sigma_{sc} - \eta (\theta_k + \theta_j) \left[\sigma_s^2 - 2\sigma_{sc} + \sigma_c^2\right] \right\} \tag{3}$$

and we can infer that $V_k \succ V_j$ when the difference $V_k - V_j$ is positive. See Appendix A for a derivation of equation (3).

However we can also compare each of the stock/cash portfolios with the constant choice. In our experiment this is the retirement savings account which is fixed and offered in every choice set. The difference in utility between options $j = 1, ..., 5$ and the retirement savings account (portfolio option r)[5] simplifies to

$$(V_j - V_r) = [\mu_s \theta_j + \mu_c (1 - \theta_j) - \mu_r] - \phi_j - \eta \left[\theta_j^2 \sigma_s^2 + 2\theta_j (1 - \theta_j) \sigma_{sc} + (1 - \theta_j)^2 \sigma_c^2 \right] \quad (4)$$

where V_r is the utility of the retirement savings account, μ_r is the return to the retirement savings account. (There is no fee on the retirement savings account and no variability of return.). So we have two explanatory variables: net return, which is excess return over the risk free rate μ_r and net of fees:

$$NR = [\mu_s \theta_j + \mu_c (1 - \theta_j) - \mu_r] - \phi_j \quad (5)$$

and portfolio variance

$$PV = \left[\theta_j^2 \sigma_s^2 + 2\theta_j (1 - \theta_j) \sigma_{sc} + (1 - \theta_j)^2 \sigma_c^2 \right]. \quad (6)$$

Individual variations in preferences appear in the risk parameter, η_i.

In the investment choice experiment which we explain in detail in section 4, each subject completes an internet survey where they are asked to allocate their retirement saving (pension) contribution to one of six investment options. Five of the options differ by the proportion of equities and cash (ranging from 100 percent cash/0 percent equities to 75/25, 50/50, 25/75 and 0/100) while the sixth is a retirement savings account. Each portfolio differs by (gross) return, fees and risk. In the choice sets offered to participants in our survey, the fees ϕ_j and risk which is proxied by range, vary over four levels for each option.[6] Rates of return μ are fixed at the median for each portfolio and expressed as a dollar amount. Subjects are asked to nominate which investment option they would be most likely to choose, and which they would be least likely to choose. Subjects are also asked to answer a number of questions about personal circumstances and demographics.

[5] More specifically portfolio option $j = 6$.

[6] It is possible that investors view fee risk and investment risk differently. Our set up tests for investment risk aversion but does not include a test of aversion to fee uncertainty. Although varying between options and levels, the fee percentage is fixed.

4 Experimental design

We tested the model in equation (4) using a choice experiment. In the experiment, each respondent is given (an hypothetical) \$1000 to invest towards their retirement via one of five mutual funds comprised of cash and Australian shares, or a retirement savings account. We commenced by explaining the background of the investment experiment to the respondent.[7] We then presented the respondent with 16 tables of the six investment options. The characteristics of each investment option were summarized in three key features - the expected (average) accumulation after 10 years, the range of the final accumulation after 10 years and the investment management fee (% pa). We used a fractional factorial design for the choice sets, based on the L^MA approach in Louviere, Hensher and Swait (2000). Table 1 shows an example of a choice set.

Table 1:
Choice set template.

Which of the following options are you most likely to choose when considering investment options?
Please tick ONE BOX for most likely and ONE BOX for least likely

	Investment options for you to consider for a \$1000 contribution					
Key Features after 10 years	100% cash	75% cash 25% shares	50% cash 50% shares	25% cash 75% shares	100% shares	Retirem't Savings Account
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 (% pa)	1.75%	1.95%	2.20%	2.40%	2.20%	0%
1.Which investment option would you be most likely to chose? (tick one)	☐	☐	☐	☐	☐	☐
2.Which investment option would you be least likely to chose? (tick one)	☐	☐	☐	☐	☐	☐

Note: Table shows one example of an investment choice set offered to survey participants. Each participant chose most and least likely choices from 16 of these tables where the levels of investment management fees and likely 'worst' and 'best' accumulation after 10 years varied over four levels for each option apart from the retirement savings account.

Each choice set has two attributes varying over four levels. Attribute levels are specific to each investment option, as illustrated below in Table 2. We compute the expected return and range data from bootstrapped total real returns to benchmark cash and stock indices (see

[7] The text of the survey introduction is reproduced in Appendix B.

Appendix C for a description of the bootstrap and data sources) and survey Product Disclosure Statements (PDS) [8] from major Australian retail superannuation funds for representative fees.

Table 2:
Attribute levels.

Key Features		100% Cash	75% Cash 25% Shares	50% Cash 50% Shares	25% Cash 75% Shares	100% Shares	Retirem't Savings Account
Risk	1	1450-2000	1300-3050	1100-4000	800-8400	600-15800	1140
Range of terminal	2	1500-1850	1500-2450	1350-3400	1200-4700	1000-6250	1140
wealth values	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% pa)	1950 (6.9%pa)	2250 (8.4%pa)	2550 (9.8%pa)	2800 (10.8%pa)	1140 (1.3%pa)
Investment	1	1.75%pa	1.90%pa	1.85%pa	2.25%pa	2.20%pa	0%
management	2	2.00%pa	1.95%pa	2.00%pa	2.30%pa	2.30%pa	0%
fees	3	2.10%pa	2.10%pa	2.20%pa	2.35%pa	2.40%pa	0%
	4	2.20%pa	2.15%pa	2.30%pa	2.40%pa	2.60%pa	0%

Note: Returns and ranges are inflation-adjusted. For the retirement savings account (RSA), the return is the compound average % p.a. return from the Commonwealth Bank Retirement Savings Account PDS, adjusted for taxes and inflation. The figure relates to an account balance $1000<$5000, and the terminal value has zero risk. Risk levels are taken from a bootstrap of historical returns and are the range of final values of $1000 investment after 10 years, min-max, 5-95th, 10-90th and 20-80th quantile ranges rounded to the nearest $50. The 'average' outcomes are the 50th quantiles for each option.

As discussed, we present risk to respondents as 'likely worst case accumulation after 10 years' and 'likely best case accumulation after 10 years'. These are ranges of final values of the $1000 investment after 10 years: the extreme minimum and maximum of the bootstrapped distribution, 5-95th, 10-90th and 20-80th quantile ranges. This is not typical of presentations of risk in Product Disclosure Statements, where there is no universally accepted method for representing risk to retirement savers. Providers of retirement savings funds do not present standard deviations, which might be regarded as conventional for more informed investors, although a typical PDS 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 use in the experiment, on the other hand, shows extreme upside as well as downside outcomes.[9]

[8] Australian superannuation funds are required by law to prepare Financial Product Disclosure Statements, which present the main features of financial products to potential investors.

[9] In future work we plan to conduct an experiment to investigate how retirement savers respond to different representations of risk.

In addition, presenting respondents with ranges of outcomes implies that non-normality in the data (skewness and kurtosis) is not removed. The bootstrapped distribution of returns to stocks does display some negative skewness and excess kurtosis.

Actual fee structures in Australian retail retirement saving products are generally very complex, often decrease as account balances rise and are frequently negotiable between the superannuation provider or their agent and the customer. We use a single 'Investment management fee' calibrated to the level of fees charged by retail providers of managed funds, with four levels for each of the six types of portfolios. This structure captures the higher fees charged by managers of growth assets.[10]

Table 3 shows the impact of fees on real net returns (see equation 5) for each investment option.

Table 3:
Portfolio net returns.

	Investment option				
	100% cash	**75:25**	**50:50**	**25:75**	**100% equities**
10 yr value in dollars	$1675	$1950	$2250	$2550	$2800
rate of return p.a.	5.3%	6.9%	8.4%	9.8%	10.8%
less return on RSA	4.0%	5.6%	7.1%	8.5%	9.5%
net of fees					
0	2.25%	3.70%	5.20%	6.25%	7.30%
1	2.00%	3.65%	5.10%	6.20%	7.20%
2	1.90%	3.50%	4.90%	6.15%	7.10%
3	1.80%	3.45%	4.80%	6.10%	6.90%

Note: Table shows the median investment outcomes for each option in dollars, as a real annualized percentage, and net of the 1.3% fixed return on the constant option (retirement savings account). The last four rows show the implicit levels of net returns when management fees for each investment option are deducted. Median investment outcomes and the related annualized rate of return are taken from the bootstrapped distribution of 10 year terminal wealth values for an initial investment of $1000 using the historical returns series described in Appendix C.

For estimation purposes, portfolio variance can be inferred from the range information used

[10] The major types of fees on accumulation accounts could include: 1) Contribution fees (4-4.5% of all contributions), charged to open the account and on all later contributions. (It is worth noting that this fee combined with the government's contribution tax of 15% cuts close to 20% from contributions before they earn anything. In some cases a reduction can be negotiated with the financial adviser who is arranging the account.) This is a large amount, but tends to be the same fixed percentage for all accounts, so we did not include these in the experiment. 2) Management or investment fees, linked to chosen investments and varying from manager to manager. They may include additional performance fees, and/or rebates on larger accounts (e.g. reducing management fees when an account balance increases above $100,000 or $500,000). 3) Administration or member fees, charged as a percentage of the account balance or as a fixed fee but sometimes bundled with investment management fees. 4) Switching investment options or other transactions by members, sometimes including a fee on the termination of the account. 5) Ongoing payments to advisers as part of the investment agreement.

in the choice sets. To compute the portfolio variance associated with each range we take the 5000 bootstrap draws and delete any observation that falls outside the specified range, computing the variance of each truncated distribution. The annualized standard deviations calculated using this method are set out in Table 4 below.

Table 4:
Portfolio volatility.

Portfolio standard deviations									
100% cash		75:25		50:50		25:75		100% equities	
range $	%p.a.	range $	%p.a.	range $	%p.a.	range $	%p.a.	range $	%p.a.
1450-2000	1.72	1300-3050	5.06	1100-4000	8.21	800-8400	12.66	600-15800	17.39
1500-1850	1.49	1500-2450	3.74	1350-3400	6.95	1200-4700	10.33	1000-6250	13.87
1550-1800	1.19	1600-2350	3.17	1550-3150	5.79	1400-4100	8.75	1300-5350	11.51
1600-1750	0.78	1700-2200	2.25	1750-2800	4.08	1700-3500	6.33	1700-4300	7.96

Note: Table shows the ranges of investment outcomes for each option presented to survey participants, and the related annualized standard deviation, both in real terms. Ranges were chosen from the bootstrapped distribution of 10 year terminal wealth values for an initial investment of $1000 using the historical returns series described in Appendix C. The four range levels are the most extreme, 5%-95%, 10%-90% and 20%-80% empirical quantiles from the bootstrapped distribution. Standard deviations were computed by truncating each bootstrapped empirical distribution at the required range, and then computing the annualized standard deviation for the truncated distribution.

4.1 Subject profile

We presented choice sets to 819 individuals in March 2007 and 919 in October 2008 using the internet survey provider PureProfile who maintain a representative panel of households. As well as completing the investment choice experiment, the individuals were asked to score a risk survey previously used by AMP - one of Australia's largest financial services providers - to enable retirement savers to self assess their taste for risk, and to answer a range of personal and demographic questions. In this section we summarize the aggregate responses of the people who took part in the 2007 experiment and note any differences for 2008 only where relevant. A complete inventory of the demographic and risk survey is given in Appendix D.

4.1.1 Age, gender and family

The sample was evenly divided by gender and all geographical regions were represented approximately proportionally to population. We limited the survey ages to 18-65 years, since this is the group most likely to be contributing to retirement savings - in Australia individual retirement savings coverage is mandatory for all employees aged 18-65 who earn at least $A450 per month. Figure 2 shows the distribution of the 2007 survey respondents by age group: around half the sample are aged 25-44 years. In the 2008 survey where the sample was larger, the age groups were slightly more even, with more than 150 respondents in the 55-64 years group. We found that the age profile by gender was fairly evenly spread between men and women, with slightly more younger females and older males in the 2008 survey.

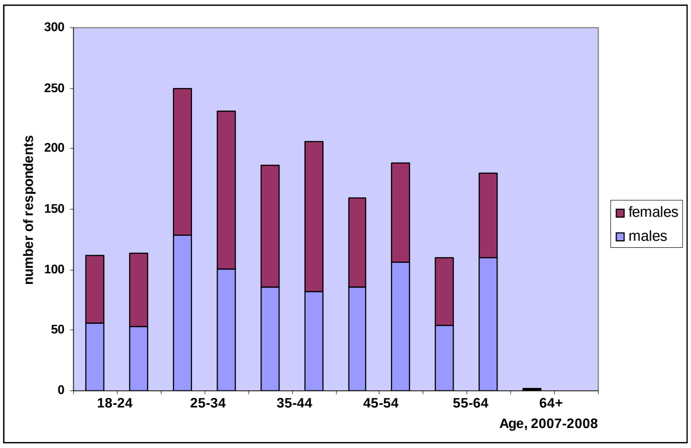


Figure 2: Age and gender of respondents, 2007-08.

More than 60% of both samples were partnered (married/defacto or living with a partner), while around 25% were single and around 10% were either widowed or divorced. Similarly 41% of both groups of respondents have children up to 18 years of age evenly spread across ages.

As shown in Figure 3, the majority of respondents have a tertiary education and the largest group (27%) have an undergraduate degree, although almost one fifth have not completed high school. Group 1 'some HS' have complete fewer than 11 years of schooling; group 2 'SC' have been awarded a School Certificate, equivalent to 11 years of schooling; group 3 have graduated High School; group 4 have completed some tertiary training at a technical college offering trade and skill-based awards; group 5 have completed an undergraduate degree at a university and group 6 have some other tertiary college training, whereas group 7 have a postgraduate university degree. The 2008 sample had a sightly higher representation of technical college graduates, but was otherwise very similar.

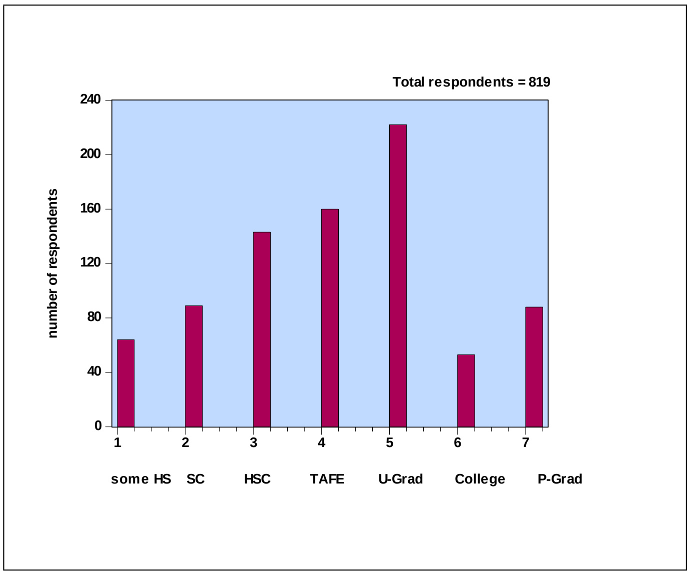


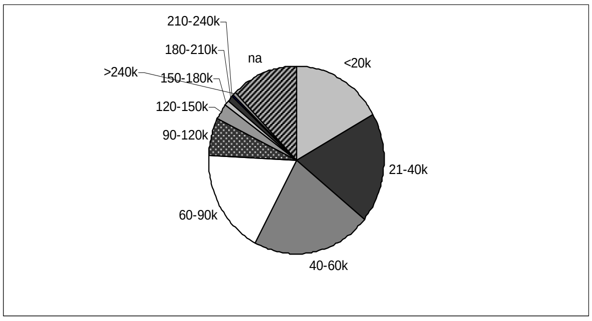
Figure 3: Education of Respondents, 2007.

4.1.2 Employment and income

Around 57% of respondents were either full-time workers (52%) or full-time students (5%), with around 20% working part time or not currently working. Almost a third classified their employment as professional (24%) or management (10%). Around 12% named 'home duties' as their occupation and similar numbers were clerical or service industry workers. Around 5% were unemployed and 7% were retired. The smallest occupational representations were from tradespersons (4%) and transport workers (2%).

Reported personal and household income is graphed in Figure 4. More than 12% of respondents did not report an amount for personal income, but the majority of reported incomes were at or below current average weekly earnings (about $55k p.a.). Household incomes are on average much higher as we would expect, but the non-response rate for this question was still higher at more than 14%.

Personal income



Household income

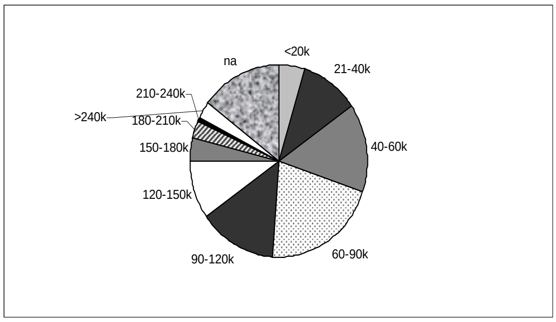


Figure 4: Respondent personal and households income, 2007.

4.1.3 Housing, vehicles, and investments

More than 75% of respondents lived in detached houses, a large minority in apartments (around 15%), and far fewer in other types of housing. The proportion of home owners outweighed non-home owners 56% to 44%, whereas around 87% of the sample owned their own car. Investment properties are owned by less than one fifth of the respondents, and the median value of these properties was reported at $A300k in 2007 and $A342k in 2008.

Most people owned non-retirement financial investments or savings (68%) and most of the remainder were considering investing (25%). In 2007, 43% of respondents said that they owned stocks or shares, and more than 40% were considering purchasing them. In 2008, only 30% said they were considering purchasing shares, a drop of 10 percentage points between surveys, although the actual ownership proportion had not decreased despite a very severe fall in stock prices over the preceding months. Figure 5 shows the number of respondents who owned assets of different classes. Savings accounts are held by almost everyone, and large minorities invest in shares, property and managed funds, whereas the more sophisticated securities and derivatives are held by only a few. This pattern was consistent across both samples.

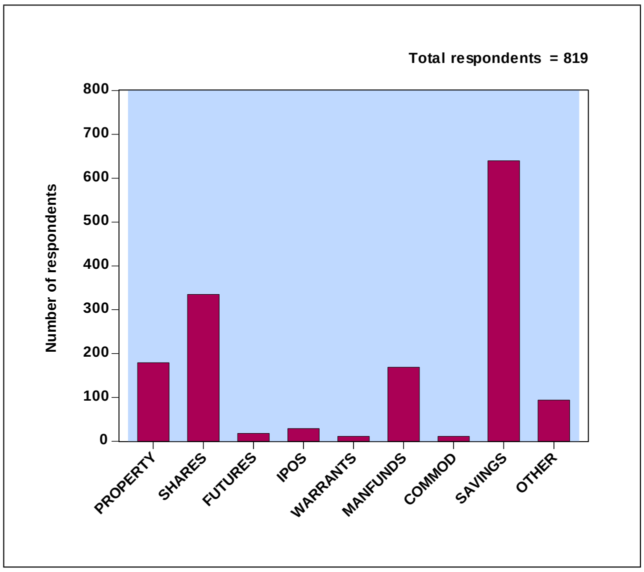


Figure 5: Respondents owning assets, 2007.

4.1.4 Attitudes to risk

As a preliminary to the choice experiments, we scored the risk attitude of respondents using a screening questionnaire. This questionnaire, developed by AMP, a major provider of financial services, scores respondents' risk tolerance from 1 to 5 with a higher score matched to higher risk tolerance. In 2007, no respondents scored 5 ('aggressive' investors), 4% were rated 'moderately aggressive', 76% scored 3 ('balanced'), 18% were rated 'moderately conservative' (scoring 2) and 2% were labelled 'conservative'. The 2008 crisis sampling was virtually identical, although the 'conservative' group was one percentage point higher at 3%, and two respondents rated as 'aggressive'.

We also asked respondents some further questions to gauge their attitude to risk. For example, they were asked to indicate whether they purchased home insurance (around 70% said yes) and/or car insurance (more than 90% did) and 83% said that they had some no-claim bonus on their car insurance. About 10% of respondents used internet gambling facilities, compared with more than half of respondents who used on line auction sites, close to 70% who shopped on the internet and more than 85% who used internet banking services.

We used this information on demographics to model preference classes and innate variability and results are reported in the next section.

5 Estimated models and results

Conventional conditional logit models in the style of McFadden (1974), restrict the preferences of individuals to be homogeneous over the sample, subject to i.i.d. random errors. However it is well known that unobserved heterogeneity among individuals may bias the estimated coefficients of the model, and so a series of alternative and less restrictive approaches have been proposed in the literature (see for example, Louviere, Hensher and Swait 2000; Train 2003). Here we apply a recent development in latent class estimation, a type of finite mixture model, in which preference parameters differ for discrete but unobserved (latent) classes of participants. In addition, we allow the underlying variability of the random errors to switch between a number of discrete latent values; in other words, the degree of variation in responses is not restricted to be a fixed value over the whole population. Until recently, most latent class models allowed preference parameters to change from class to class, but restricted the scale parameter of utility to be fixed at one for all classes, creating a potential confound between true underlying preference variability and differences in the variance of the error distribution. What appeared to be significant differences between preference parameters may have been caused by changes in underlying scale (Louviere and Eagle 2006). With the work of Magidson and Vermunt (2005), embodied in the software Latent GOLD, it is now possible to relax the restriction that the scale parameter is fixed across the whole population and separately estimate the class preferences and scale variables.

Further, using this technology, we can estimate latent classes in preferences and scale as functions of demographic covariates. As a result we can identify the types of people most likely to exhibit the tastes of a particular class or who show more or less overall variation in response. It turns out that preference classes in our estimated models identify some interesting distinctions based on age and income, and that general variation in response may be linked to underlying risk tolerance and age.

5.1 Latent class model

In a McFadden-style conditional logit model, the random utility of choosing investment option j for individual i is

$$U_{ij}^* = V_{ij} + \varepsilon_{ij}^* \tag{7}$$

where ε_{ij}^* is i.i.d. extreme value with variance $\frac{\pi^2}{6\lambda^2}$. The probability that individual i chooses investment option j is

$$\begin{aligned} P_{ij} &= \Pr\left(V_{ij} + \varepsilon_{ij}^* > V_{ik} + \varepsilon_{ik}^*, \forall j \neq k\right) \\ &= \Pr\left(\varepsilon_{ik}^* < \varepsilon_{ij}^* + V_{ij} - V_{ik}, \forall j \neq k\right) \end{aligned} \tag{8}$$

and

$$P_{ij} = \frac{\exp\left(\beta_j^{*\prime} x_{ij}\right)}{\sum_j \exp\left(\beta_j^{*\prime} x_{ij}\right)} \tag{9}$$

where x_{ij} is a vector comprised of a constant for option j, log net portfolio return and log variance for option j. Since the model depends on comparisons of $U_{ij}^* s$ and choices are therefore invariant to the scale of utility, it is conventional to reweight utility by λ so as to set the variance of the unobserved component of utility to $var(\varepsilon_{ij}^*) = \lambda^2 \left(\frac{\pi^2}{6\lambda^2}\right) = \frac{\pi^2}{6}$, and

$$P_{ij} = \frac{\exp\left(\lambda\beta_j^{*\prime} x_{ij}\right)}{\sum_j \exp\left(\lambda\beta_j^{*\prime} x_{ij}\right)} = \frac{\exp\left(\beta_j^{\prime} x_{ij}\right)}{\sum_j \exp\left(\beta_j^{\prime} x_{ij}\right)}, \tag{10}$$

where $\beta = \lambda\beta^*$. The variance scaling factor λ and preference parameter vector β^* are always jointly estimated, so interpretation depends on the normalization chosen. In a finite mixture model such as we estimate here, if we allow the preference parameters β^* to vary between latent classes of investors, but restrict $\lambda = 1$ for all classes, then there is always a danger of interpreting differences in β by class as due to β^* when they are caused by differences in λ.

Here,[11] the random utility of option j for individual i is dependent on the latent preference class $q = 1, ..., Q$ and the unobserved scale parameter class λ_d, $d = 1, ..., D$ inhabited by individual i. (We normalize one scale parameter to one and interpret the others as ratios to the normalized value.) The probability of choice j by individual i in choice situation t, conditioning on class q and scale factor class d is

$$P\left(i, t, j | q, d\right) = \frac{\exp\left(\lambda_d \beta_{q,j}^{\prime} x_{it,j}\right)}{\sum_j \exp\left(\lambda_d \beta_{q,j}^{\prime} x_{it,j}\right)}, \tag{11}$$

and $\lambda_d = 1 | d = 1$,

$$P\left(i, t, j | q, d = 1\right) = \frac{\exp\left(\beta_{q,j}^{\prime} x_{it,j}\right)}{\sum_j \exp\left(\beta_{q,j}^{\prime} x_{it,j}\right)}. \tag{12}$$

[11] In some respects this description follows Greene and Hensher (2003).

For simplicity we write

$$P_{it|q,d} = \Pr[y_{it} = j|\text{class} = q,\ \text{scale} = d].$$

If each of the $t = 1, ..., T$ choice events are independent, then the contribution of the individual i to the overall likelihood, conditioning on class and scale is

$$P_{i|q,d} = \prod_{t=1}^{T} P_{it|q,d}. \tag{13}$$

In the model of utility in equation (4) we measure utility relative to the reference option, the retirement savings account, so our model is estimated using the attributes in equations (5) and (6) so $x_{it,j}$ is a vector of length $m = 3$ comprised of the logarithms of net returns and portfolio variance, and a constant term. We present each participant with 16 choice sets ($T = 16$).

We assume that there are Q discrete latent classes and D scale groupings, but that class membership is hidden. The best estimated models (section 5.3) have $Q = 7$ latent preference classes and $D = 2$ scale groups, and we allow for the classes to be determined using a set of observable characteristics or demographics. If $H_{iq|d}$ is the prior probability for class q for individual i and $G_{i|d}$ is the prior probability for scale group d, then the multinomial logit model suggested by Greene and Hensher (2003) can be used to estimate each prior as:

$$H_{iq|d} = \frac{\exp\left(\theta'_q z_i\right)}{\sum_q \exp\left(\theta'_q z_i\right)} \text{ and } G_{id} = \frac{\exp\left(\gamma'_d z_i\right)}{\sum_d \exp\left(\gamma'_d z_i\right)}. \tag{14}$$

The vector z_i includes $k = 1, ..., K$ relevant covariates and/or demographic characteristics of individual i including a constant. In our estimated models, the set of demographics (z_i) is comprised of indicators for the age and household income of respondents, and their risk score from the AMP risk survey. These demographics decide the composition of the 7 latent preference and 2 scale classes, but in the final models reported in Tables 7 and 8 below not all of these demographic variables are selected.

To ensure complete allocation of all individuals to a preference and scale class, we have $\sum_q \theta_{k,q} = 0$ and $\sum_d \gamma_{k,d} = 0$. If none of the variables in z_i are relevant, then the $H_{q|d}$ and G_d reduce to a $Q(D)$-vector of constants which sum to one. Combining these together, the overall log likelihood is

$$\ln L = \sum_{i=1}^{N} \ln P_i = \sum_{i=1}^{N} \ln \left[\sum_{d=1}^{D} \sum_{q=1}^{Q} G_{id} H_{iq|d} P_{i|q,d} \right] = \sum_{i=1}^{N} \ln \left[\sum_{d=1}^{D} \sum_{q=1}^{Q} G_{id} H_{iq|d} \prod_{t=1}^{T} P_{it|q,d} \right]. \quad (15)$$

Estimation of the (up to) $[(D-1)+(Q-1)]K+QMJ$ parameters of the model is by numerical maximization of the log likelihood. Following the Latent GOLD default estimation process, we use 10 randomized sets of starting values and small Bayes constants to try to ensure that an identified global maximum is reached. We choose the number of preference and scale classes by comparison of the Bayesian Information Criterion, $BIC = \ln L + \frac{\text{model size} \ln N}{\ln N}$.

The posterior probability that an individual belongs to preference class q can be inferred from Bayes theorem and the estimated parameters where

$$\hat{H}_{q|i} = \frac{\sum_d \hat{P}_{i|q,d} \hat{H}_{iq|d} \hat{G}_{id}}{\sum_q \sum_d \hat{P}_{i|q,d} \hat{H}_{iq|d} \hat{G}_{id}}, \quad (16)$$

and similarly for scale class d where

$$\hat{G}_{d|i} = \frac{\sum_q \hat{P}_{i|q,d} \hat{H}_{iq|d} \hat{G}_{id}}{\sum_d \sum_q \hat{P}_{i|q,d} \hat{H}_{iq|d} \hat{G}_{id}}. \quad (17)$$

Another restriction of the conventional conditional logit model is that of the independence of irrelevant alternatives (IIA) where an increase in the odds of choosing a particular option j implies a proportional decrease in all other probabilities, so that odds ratios not directly impacted by the changes for option j stay constant. In other words the model treats all alternatives as proportionately substitutable, and does not allow for different degrees of substitutability and complementarity. This seems unlikely where the alternatives include choices that are close substitutes as is the case in our experiment (McFadden 1974). Consequently a real advantage of the latent class model here is that IIA does not hold: in equations (15) all variables appear in the probability $P_{it|q,d}$, including those of different alternatives.

The marginal effect on individual i's choice probability for option j in choice situation t due to a change in attribute m in option w is

$$\hat{\sigma}_{it,m,j,w|q,d} = \frac{\partial \ln P(i,t,j|q,d)}{\partial x_{it,m,w}} = [\mathbf{1}(w=j) - P(i,t,j|q,d)] \beta_{m,w|q,d} \quad (18)$$

which can be averaged across individuals and choice sets as

$$\bar{\sigma}_{m,w,j|q,d} = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T}\sum_{t=1}^{T}\hat{\sigma}_{it,m,j,w|q,d}. \tag{19}$$

In our estimated model below, where $x_{it,m,w}$ is the logarithm of net return or the logarithm of portfolio variance for investment option w, equation (18) can be interpreted as the $w-$net return elasticity or $w-$variance elasticity of the probability of choosing option j. We report estimated average own-elasticities $\bar{\sigma}_{m,j,j|q,d}$ in Table 10 and cross-elasticites in Table 11 below.

5.2 Observed choices

We ask subjects to nominate the options they would be 'most likely' and 'least likely' to choose from 16 choice sets generating 13104 (14699) best and worst choices in 2007(2008). The results of most likely and least likely choices in the survey are set out in Table 5.

For 2007, the higher the equity weighting, the more likely an option is chosen as 'most likely'. The RSA and 100% cash options account for less than 5% of best choices, whereas more than 60% are allocated to the options with 75% or more in shares. However while the RSA is also the most common 'worst' choice, accounting for about 60% of least likely investments, the 100% cash and share portfolios are least likely choices in 12-15% of observations. In other words dislike of portfolios is not uniformly decreasing as equity shares rise, and so different considerations appear to be determining best and worst selections. Observed worst choices indicate that undiversified portfolios are least preferred by investors.

The 2008 survey was taken between 17-24 October soon after the failure of Lehman Brothers and following a 30% decline in the benchmark equity index (ASX200) over less than two months. The Australian dollar had also depreciated very rapidly (around 30% against the USD over the course of a few weeks) and news media were dominated by reports of financial and economic crisis. Despite the gloomy environment, preferences for high equity allocations were only slightly moderated. The 100% shares choices drop by eight percentage points to around 25% of the sample, in favour of higher cash weightings, particularly the 50:50 allocation, which increases by four percentage points to 23% of best selections.[12] The 100% shares option also attracts 6 percentage points more worst choices, rising from 12 to 18 per cent. The savings account and 100% cash options are chosen as worst less frequently. Nonetheless, the investments with more

[12] This type of allocation is sometime chosen to minimize regret, see Michenaud and Solnik 2005; Bell 1982; Loomes and Sugden 1982.

than 75% in equities are still the most popular choices.

Table 5:
Observed choices of most likely (best) and least likely (worst) options.

2007				option			
best	**100% cash**	**75:25**	**50:50**	**25:75**	**100% shares**	**RSA**	**total**
choices	700	1411	2536	3920	4300	237	13104
proportions	0.05	0.11	0.19	0.30	0.33	0.02	
odds ratio RSA	2.95	5.5	9.5	15	16.5		
worst							
choices	1904	533	588	753	1630	7696	13104
proportions	0.15	0.04	0.05	0.06	0.12	0.59	
odds ratio RSA	0.25	0.07	0.08	0.10	0.20		
2008				option			
best	**100% cash**	**75:25**	**50:50**	**25:75**	**100% shares**	**RSA**	**total**
choices	1097	1896	3448	4014	3798	446	14699
proportions	0.07	0.13	0.23	0.27	0.26	0.03	
odds ratio RSA	2.46	4.25	7.73	9.00	8.52		
worst							
choices	1852	528	606	866	2574	8273	14699
proportions	0.13	0.04	0.04	0.06	0.18	0.56	
odds ratio RSA	0.22	0.06	0.07	0.10	0.31		

Note: Upper rows show the observed number and proportion of best/worst investment choices for each option from the raw survey data along with the observed odds ratio relative to option 6, the retirement savings account, for 2007 survey. Lower rows show the same for 2008 survey. The 819 (919) respondents made selections from 16 choice sets generating 13104 (14699) observations each of 'most likely' and 'least likely' investments.

5.3 Fitted model

We fitted the latent class model described in section 5.1 (Latent GOLD software version 4.5; Magidson and Vermunt 2005) to the 'most likely' choices, using demographic information to select classes for variance heterogeneity and preferences. We estimated models for increasing numbers of latent scale and preference classes, selecting the preferred model using the Bayesian Schwartz information criteria (BIC): this criterion rewards improved fit but penalizes additional parameters. Fit is good, but both models slightly underpredict the probability of choose the 50:50 portfolio. Table 6 sets out a comparison between observed and predicted frequencies of choice.

Table 6:
Observed and predicted choices of most likely (best) investment options.

2007	option					
observed	**100% cash**	**75:25**	**50:50**	**25:75**	**100% shares**	**RSA**
proportions	0.05	0.11	0.19	0.30	0.33	0.02
predicted						
proportions	0.04	0.16	0.16	0.28	0.34	0.02
2008	option					
observed	**100% cash**	**75:25**	**50:50**	**25:75**	**100% shares**	**RSA**
proportions	0.07	0.13	0.23	0.27	0.26	0.03
predicted						
proportions	0.07	0.14	0.19	0.29	0.28	0.03

Note: Table shows the observed and predicted proportions of best investment choices for each option from the raw survey data and the preferred models.

5.3.1 Scale Factor - variance heterogeneity

Variance heterogeneity in the estimated model is explained by age and risk tolerance in the 2007 sample and by age only in 2008. The BIC indicated two scale factor groupings where $\lambda_1 = 1$ (by normalization) and $\hat{\lambda}_{2,2007} = 3.44, \hat{\lambda}_{2,2008} = 4.13$, implying that the first group show three or four times more variability in underlying response than the second group. We estimated the scale factors using the multinomial logit model of equation (14) where the vector of covariates z_i is comprised of an indicator for age and the individual's score from the risk questionnaire.[13] Results are set out in Table 7 showing that the high variability group are more likely to be younger (and more risk tolerant in 2007), whereas the low variability group were older. Interestingly, risk score is irrelevant to scale class groupings in the crisis period sample, demonstrating a weaker connection between prior preference and choice consistency during financial stress.

Of the total survey participants in 2007 (2008), 53% (57%) are most likely to be members of scale class one and 47% (43%) are likely to be members of scale class two, indicating an increase in variability in the crisis sample.

5.3.2 Latent Classes - preference heterogeneity

Preference heterogeneity in the model is explained by age and household income. We estimate seven latent classes in our model where class membership is a function of a constant, an indicator

[13] We tested down to this model from the full set of demographic covariates.

Table 7:
Multinomial logit estimation of scale factor groups ($D = 2$)**.**

	2007		2008	
	Class 1, $\lambda = 1$	Class 2, $\lambda = 3.44$	Class 1, $\lambda = 1$	Class 2, $\lambda = 4.13$
	coef	coef	coef	coef
Intercept	-0.443*	0.443*	0.282	-0.282
age: under 24	0.162*	-0.162*	0.259*	-0.259*
age: 25-44	-0.037	0.037	-0.090	0.090
age: 45-65	-0.124*	0.124*	-0.169*	0.169*
Risk Score (/100)	1.697*	-1.697*	-0.149	0.149
% of sample	53	47	57	43

Note: Table shows estimation results of the probability $G_{id} = \frac{\exp(\gamma'_d z_i)}{\sum_d \exp(\gamma'_d z_i)}$ that an individual i is a member of scale class d for $d = 1, 2$, and $\sum_d \gamma_{k,d} = 0$. Significance is at 10% or higher is indicated by an asterisk.

for age and an indicator for low household income (<40K) and the number of classes was determined by BIC as discussed in section 5.1. In the 2008 estimation we also included an indicator for failure to report income (around 14% of the respondents). Other demographic and experience covariates were not significant when included as explanators in the latent class estimation. Estimation results for the multinomial logit latent class model is set out in Table 8.

For 2007, members of class 1 are more likely to be under 25 years of age and not in the middle age range, and members of class 2 are also likely to be under 25 years but not in the oldest age group (45-65). People over 45 years are significantly more often members of classes 3 and 5. Respondents aged 25-44 are significantly more likely to appear in class 5, and class 3 also includes people with incomes over $40K. Age influences are not significant for classes 4 and 6, but household income is relevant: high incomes are prevalent in class 4 and low incomes in class 6. Neither age nor income is significant in explaining the membership of class 7. In summary, classes 1 and 2 are younger, but not necessarily of higher or lower income, classes 3 and 5 are older, with higher incomes in class 3. Class 4 are higher income and class 6 are lower income with no significant age grouping.

In 2008 we can describe class 1 and class 7 as predominantly made up of people under 25 years, and class 1 are also of low income. Unlike the 2007 model, members of class 2 are more likely over 45 years and of higher income, and class 5 are similar, but more of the middle age bracket. Classes 3, 4 and 6 have few significant demographic parameters, though class 3 may be of lower income.

Posterior prediction of preference and scale class membership is shown in Figure 6 for both

Table 8:
Multinomial logit estimation of preference classes ($Q = 7$).

	Class 1	*Class 2*	*Class 3*	*Class 4*	*Class 5*	*Class 6*	*Class 7*
2007							
% of sample (posterior)	16	10	20	33	15	2	4
Intercept	0.54*	-0.05	0.42*	1.04*	0.16*	-1.34*	-0.79*
age: under 24	0.33*	0.64*	-0.42*	-0.22	-0.57*	0.20	0.05
age: 25-44	-0.36*	-0.13	0.04	0.05	0.28*	-0.08	0.19
age: 45-65	0.03	-0.51*	0.38*	0.17	0.29*	-0.12	-0.24
income≤40k	-0.07	-0.14	-0.24*	-0.20*	-0.10	0.48*	0.27
income>40k	0.07	0.14	0.24*	0.20*	0.10	-0.48*	-0.27
2008							
% of sample (posterior)	14	13	17	28	18	3	7
Intercept	0.35*	0.13	-1.01*	-0.61*	0.65*	0.38*	0.12
age: under 24	0.41*	-0.19	0.02	-0.41	-0.16	-0.11	0.44*
age: 25-44	-0.13	-0.16	-0.17	0.13	0.18*	-0.02	0.17
age: 45-65	-0.28*	0.35*	0.15	0.28	-0.02	0.13	-0.61*
income≤40k	0.28*	-0.42*	0.35	0.07	-0.32*	0.39	-0.00
income>40k	-0.07	0.39*	-0.80*	-0.11	0.36*	0.05	0.17
income unrep.	-0.21	0.03	0.45*	0.03	-0.41	-0.09	-0.17

Note: Table shows estimation results of the probability $H_{iq|d} = \frac{\exp(\theta_q' z_i)}{\sum_q \exp(\theta_q' z_i)}$ that an individual i is a member of preference class q for $q = 1, ..., 7$ and $\sum_q \theta_{k,q} = 0$. Significance is at 10% or higher is indicated by an asterisk.

surveys. The smallest preference group is class 6 with 15 (29) members and the largest is class 4 with 277 (259) members. High and low variance groups are fairly evenly distributed across the preference groupings, though the proportion of high variability respondents increases in the 2008 sample, particularly in class 4, where the proportion of high variability respondents rises to 58% compared with 44% in 2007. This increase in variability may be coming from an increase in uncertainty during the crisis.

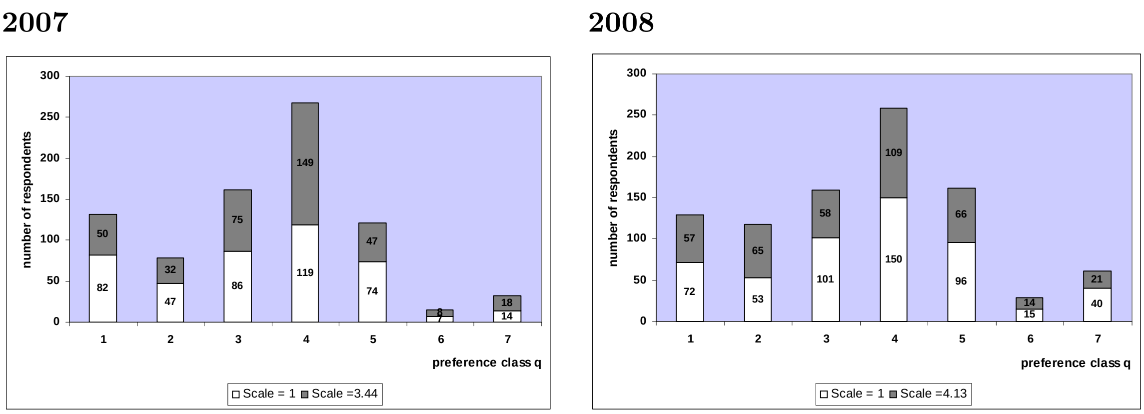


Figure 6: Posterior prediction of scale and preference class membership.

5.3.3 Estimated preferences

The latent class model allows us to separately estimate preferences of each underlying class in that sample, conditioning on variance heterogeneity. Preference parameters can be used to compute the estimated probability that the member of a particular preference and variance grouping will select options 1-6 where the conditioning information is the natural log of the net return of the portfolio and the natural log of the portfolio variance for each option. The log transformation suggests that individuals respond to proportional rather than absolute changes in returns and risk. The conventional mean-variance objective function equation (1) in the levels of net returns and variance is consistent with constant absolute risk aversion preferences if returns are normally distributed and utility is exponential, or with quadratic preferences if returns take any elliptical distribution, but the utility function in logs of net returns and variances estimated here assumes constant relative risk aversion preferences.[14]

Attributes of all options are relevant to the probability of choosing any of each of the five non-RSA options and consequently marginal effects include cross- as well as own- elasticities. Table 9 shows estimated preference parameters by class. Significance at the 10 per cent level or higher is indicated by an asterisk.

The graphs in Figure 7 show the implied choice probabilities for each investment option conditioning on preference (variance scale class with $\lambda = 1$) for the tranquil and crisis period surveys.

Each class, tends to choose one particular investment option, except class 2, which is likely to choose options 4 or 5, marginally preferring 5 in 2007 and 4 in 2008. In 2007, income effects on choice are most pronounced: the high income class (4) is most likely to prefer the 100% shares investment, and the low income class (6) is most likely to choose the retirement savings account. The older-age high income class (3) prefers option 4 which has 25:75 cash to shares mix and members of class 5, who are older but have no income bias, prefer the 50:50 mix. Classes which include more young respondents divide into a conservative group (class 1) who prefer mainly cash (75:25 mix) and a more risk tolerant group (2) who weakly prefer equity weights above 50%.

In 2008 some of these patterns remain. Classes 1 and 7 which are dominated by younger respondents prefer cash allocations at 75% or higher. Classes 2 and 5 are dominated by older

[14] For example, if we rewrite the utility function from section 3 in terms of logs rather than levels, $G = \ln(Z) - \gamma \ln(Z^2) = \ln(Z)(1 - 2\gamma)$, then we have a scaling of log utility and the coefficient of relative risk aversion reduces to one.

Table 9:
Conditional logit estimation of choice parameters

2007

	Class 1	*Class 2*	*Class 3*	*Class 4*	*Class 5*	*Class 6*	*Class 7*
Attribute	coef	coef	coef	coef	coef	coef	coef
ln ret 1	1.87*	6.24	1.85	-11.95*	0.22	-4.44	-2.77*
ln ret 2	2.13*	1.81	-15.07*	-8.28	8.47*	-4.41*	-6.21*
ln ret 3	2.58*	2.36	3.05*	10.31*	2.23*	12.58*	-5.15
ln ret 4	-5.01	11.16*	-0.22	19.70*	-5.57	-10.23	-8.49
ln ret 5	6.04	1.54	0.79	0.61	22.42*	0.28	10.22
ln var 1	-0.12	-0.48	0.76	0.57	0.30	0.25	0.12
ln var 2	-0.08*	0.05	0.68*	-0.87	0.24*	-0.36	-0.09*
ln var 3	-0.05*	-0.39*	0.55*	0.57	0.04	-0.36*	0.09
ln var 4	-0.26*	-0.79*	0.28*	1.53*	-0.13	-0.04	-0.13
ln var 5	-0.18	-1.09*	0.60*	0.59*	-0.17	-0.66*	-0.39
asc 1	7.65*	20.82	18.92*	-42.41*	5.83	-16.63	-7.30*
asc 2	8.68*	9.00	-38.87	-33.24	34.77*	-18.26	-19.85*
asc 3	0.13*	8.05*	20.85	36.46*	13.17*	34.51*	-13.82
asc 4	-14.07	30.81*	10.45	66.21*	-10.74	-29.87	-23.35
asc 5	15.83	3.12	13.36	9.09*	62.56*	-0.47	25.41

Note: Estimated coefficients $\beta_{m,j,q}$, $m = 1, ...3$, $j = 1, ..., 5, q = 1, ...7$. Significance is at 10% or higher is indicated by an asterisk.

and higher income investors and most likely choose share allocations above 50%. Classes 3 and 4 choose share weights above 50% most often, but their demographics are not clear.

Our model also allows estimation of elasticities of choice probabilities with respect to changes in net return and portfolio variance (see equation 18). Table 10 shows the return j and variance j elasticity of the probability of choosing option j. In other words, each cell in the first row gives the percentage response of the probability of choosing option one given a one percent change in the net return to option one. The upper cells of the table report these elasticities for the 2007 survey and the lower cells for the 2008 survey setting scale class at the highest variability, $\lambda = 1$.[15] Significant elasticities are reported, with own elasticities relating to the most probable investment option for each preference class in bold typeface.

The classes populated by respondents of higher income and older age (3&5 in 2007 and 2&5 in 2008) respond positively to both higher net returns and higher variance, whereas the classes associated with younger ages (1 & 2 in 2007, and 1 & 7 in 2008) are more consistent with standard mean-variance objectives, with positive response to return and negative response to risk. The low income groups (6 in 2007 and 7 in 2008) also respond negatively to risk. Class 5,

[15] Results for the low variability classes are not substantially different, and are available from the authors on request.

Table 9 **continued**

2008

Attribute	*Class 1* coef	*Class 2* coef	*Class 3* coef	*Class 4* coef	*Class 5* coef	*Class 6* coef	*Class 7* coef
ln ret 1	1.23*	-3.16	-3.86*	-1.18	-5.86*	1.39	-2.33
ln ret 2	0.97	3.94	-4.49	-5.21*	7.70	2.09	-0.71
ln ret 3	1.55*	1.57*	2.74	-7.96	10.38*	5.75*	1.41*
ln ret 4	6.33	4.00	13.73	-0.37	15.73*	7.20	-2.23
ln ret 5	-3.61	0.12	-30.44*	-8.75	3.44*	24.83*	3.53*
ln var 1	-0.02	-0.24	0.18	0.04	0.42	-1.44*	0.02
ln var 2	-0.65	0.29	-0.01	-0.36*	0.63*	0.06	0.01
ln var 3	-0.10*	0.25*	-0.29	0.48	0.83*	-0.09	-0.17*
ln var 4	-0.14	0.23*	-0.03	-0.75*	1.23*	-0.16	-0.34*
ln var 5	0.14	1.34*	0.25	-0.48	0.52*	-0.55*	-0.51*
asc 1	5.96	-8.86	-14.79*	-0.93	-19.29	-6.23	-8.24
asc 2	4.85*	22.46	-16.41	-17.59*	30.73	10.82*	-0.27
asc 3	5.53*	15.72	5.55	-20.29	38.01*	21.28*	5.68*
asc 4	17.9	22.58*	36.47	-3.80	53.40*	22.58	-5.21
asc 5	-8.35	14.47	-81.25*	-24.36	15.74*	64.90*	9.71*

Note: Estimated coefficients $\beta_{m,j,q}$, $m = 1, ...3$, $j = 1, ..., 5, q = 1, ...7$. Significance is at 10% or higher is indicated by an asterisk.

which in both surveys is comprised of middle-older ages and higher incomes, favors the 50:50 portfolio, but has a high positive return elasticity and risk elasticity in both models. However class four, which tends to choose the 100% share portfolio switches from positive to negative risk elasticities between the tranquil-period and crisis-period surveys.

The structure of the latent class model also allows us to estimate cross-elasticities, that is to measure the percentage change in the probability of choosing option j given a change in the net return or variance displayed for option w. Table 11 sets out a subset of these cross elasticities: those relating to the investment option that is most commonly chosen by each preference class, which is marked in the table by the double asterisks.

On inspection, we see some evidence that respondents treated side-by-side options as substitutes. For example, we noted that members of preference class 1 (mainly young respondents) tended to prefer higher returns and less risk, and were more likely to choose the 75:25 cash to shares weighting than other options. Looking down the relevant column in Table 11 shows that members of class 1 regard the 50:50 portfolio as a substitute, lowering their probability of choosing the 75:25 portfolio when the 50:50 portfolio net return increases (-0.91 cross elasticity), and increasing the probability of choosing the 75:25 portfolio when the 50:50 portfolio variance increases (0.02 cross elasticity). For return cross-elasticities in 2007, this substitution effect with

2007 **2008**

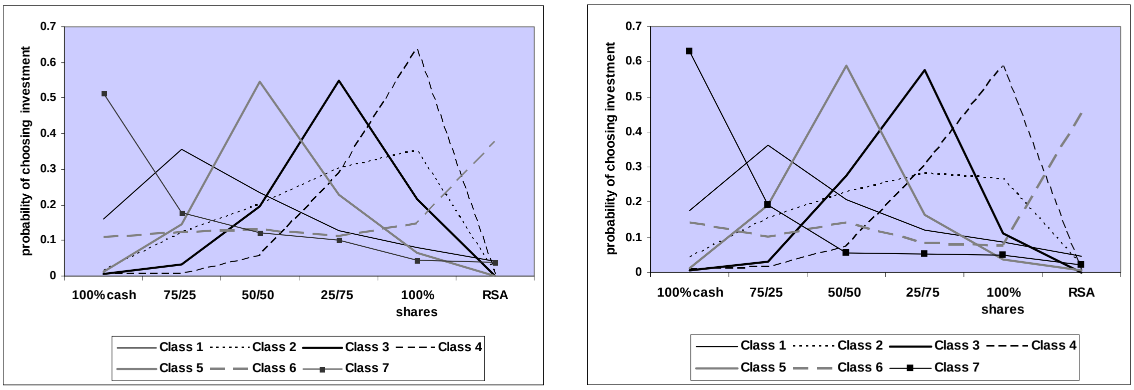


Figure 7: Investment choice probabilities by preference class.

Note: Graphs show estimated average probability $P\left(j|q,d\right)$ of choice of investment option j for each preference class where scale parameter $\lambda = 1$.

the next-nearest portfolio is evident for preference classes 1-5, although the sign is unexpected for class 7. The link is weaker for 2008, showing up for classes 1, 2 and 5.

A similar comparison applies to variance cross-elasticities, but this time the sign of the elasticity is conditional on whether the preference class is risk averse or risk loving. In the 2007 survey, there are significant positive variance cross-elasticities with the next-nearest portfolio for classes 1,2 and 7, which display risk aversion, so that if the nearby portfolio is riskier, the respondent substitutes toward the asterisked option. There are significant negative variance cross-elasticities for classes 3, 4 and 5, showing that these respondents are more likely to move away from the asterisked option if the variance of the nearby portfolios rise. The 2008 model shows consistently-signed nearby variance cross-elasticities for classes 1, 2, 4 and 5.

6 Conclusion

We designed and implemented a choice experiment to investigate the extent to which retirement savers follow standard finance theory - that is mean-variance analysis - when choosing from a menu of investment options.

Overall we found that the extent to which retirement savers behaved as mean-variance investors differed by age and income level. Using the scale-adjusted version of the latent class choice model, we estimated latent classes in preference and scale as functions of personal and demographic variables. Age and income level were found to be important determinants of preference class while variability (scale) was determined largely by underlying risk tolerance and age. Further, estimation via conditional logit models to assess the marginal effects of variations in

Table 10:
Estimated own elasticities by preference class.

2007	$\lambda = 1$						
Attribute	*Class 1*	*Class 2*	*Class 3*	*Class 4*	*Class 5*	*Class 6*	*Class 7*
net return							
100% cash	1.57			-11.89			**-1.34**
75:25 c/s	**1.37**		-14.59		7.24	-3.86	-5.11
50:50 c/s	1.97		2.46	9.73	**1.01**	10.96	
25:75 c/s		7.79		14.01			
100% shares					20.97		
variance							
100% cash							
75:25 c/s	**-0.05**		0.66		0.21		-0.08
50:50 c/s	-0.04	-0.31	0.44			-0.31	
25:75 c/s	-0.22	-0.55	**0.13**	1.09			
100% shares		**-0.71**	0.47	**0.22**		-0.06	
2008	$\lambda = 1$						
net return							
100% cash	1.02		-3.84		-5.79		
75:25 c/s				2.05			
50:50 c/s	1.23	1.21			**4.26**	-6.83	1.46
25:75 c/s					13.17		
100% shares			-27.02		3.32	-8.06	-3.44
variance							
100% cash						0.03	
75:25 c/s				0.06	0.51		
50:50 c/s	-0.08	0.20			**0.34**		-0.10
25:75 c/s		**0.16**		-0.11	1.03		-0.14
100% shares		0.99			0.50	-0.44	-0.49

Note: Table shows the percentage change average probability $P(j|q,d)$ of choice of investment option j for each preference class, where scale $\lambda = 1$,given a one percent change in net return j or variance j.. Estimated parameters with p-values of 0.1 or less are reported and elasticities relating to the most likely option for each preference class is in bold font.

net expected returns (gross returns less fees) and risk (portfolio volatilities) on investment choice, by class, highlighted the importance of age and income level. In addition, we find evidence that respondents compare the characteristics of nearby investment options when deciding on their most-preferred choice, and display cross-elasticities consistent with their taste for net returns and risk tolerance. Dissimilar portfolios were less likely to have significant cross-elasticities.

Classes (defined over scale and preference) populated by young and low income retirement savers were found more likely to respond positively to net expected returns and negatively to risk, as predicted by standard mean-variance analysis. However, classes populated by older and higher income retirement savers, were found more likely to behave contrary to standard mean-variance analysis by reacting positively to increasing variance in returns when risk is presented

Table 11:
Estimated cross-elasticities by preference class.

2007	$\lambda = 1$						
Attribute	*Class 1*	*Class 2*	*Class 3*	*Class 4*	*Class 5*	*Class 6*	*Class 7*
net return							
100% cash	-0.66			7.63			**
75:25 c/s	**		8.28		-4.63	1.65	3.20
50:50 c/s	-0.91		-1.68	-6.58	**	-4.72	
25:75 c/s		-3.93	**	-12.58			
100% shares		**		**	-12.27		
variance							
100% cash							**
75:25 c/s	**		-0.37		-0.13		0.05
50:50 c/s	0.02	0.14	-0.30		**	0.13	
25:75 c/s	0.09	0.28	**	-0.98			
100% shares		**	-0.33	**		0.02	
2008	$\lambda = 1$						
net return							
100% cash	-0.45		2.22		3.45		**
75:25 c/s	**			3.07			
50:50 c/s	-0.56	-0.44			**	-2.59	-0.89
25:75 c/s		**	**		-9.28		
100% shares			17.53	**	-2.03	-11.20	-2.23
variance							
100% cash						0.65	**
75:25 c/s	**			0.21	-0.37		
50:50 c/s	0.04	-0.07			**		0.11
25:75 c/s		**	**	0.44	-0.72		0.21
100% shares		-0.38		**	-0.30	0.25	0.32

Note: Table shows cross elasticities for the most preferred investment for each scale class, i.e., the percentage change in average probability $P(j|q,d)$ of choice of investment option j where j is the most probable investment option for each scale class, given a one percent change in net return w or variance w. The most probable choice for each preference class is indicated by two asterisks. Results for scale class $\lambda = 1$ and estimated cross elasticities with p-values of 0.1 or less are reported.

as a widening range of possible investment outcomes. This is of particular concern when the retirement welfare of older contributors to accumulation funds is highly susceptible to large negative shocks around the end of working life and early in retirement. It appears that people are willing to accept large risks at a time when more caution typically is needed.

Comparing results between the relatively tranquil asset market conditions of early 2007, and the full-blown financial crisis of October 2008 suggests a mild moderating of risk tolerance. Portfolios with higher cash weightings were chosen more often, but share allocations above 75% stayed the most popular. Patterns of returns and risk elasticities associated with age and income groups were consistent between both surveys, though the estimates from the crisis-period model were less precise.

Our aim was to ask some fundamental questions about the role of standard finance theory in the choice of investment option by retirement savers. In future work we plan to design and implement choice experiments to investigate further the impact of choice menu design on choice using a large panel of respondents. Here we have characterized risk as a range defined in terms of the 'worst' and 'best' case accumulations after 10 years. Alternatives could include standard definitions such as 'variance', graphical representations or qualitative explanations. An important issue for analysis is the presentation and explanation of the concept of portfolio risk to retirement savers.

Appendix A: Derivation of equation (3)

From equation (2), the difference in utility between option k and option j is:

$$\begin{aligned}
V_k - V_j &= \left\{\mu_s\theta_k + \mu_c(1-\theta_k) - \phi_k - \eta\left[\theta_k^2\sigma_s^2 + 2\theta_k(1-\theta_k)\sigma_{sc} + (1-\theta_k)^2\sigma_c^2\right]\right\} \\
&\quad - \left\{\mu_s\theta_j + \mu_c(1-\theta_j) - \phi_j - \eta\left[\theta_j^2\sigma_s^2 + 2\theta_j(1-\theta_j)\sigma_{sc} + (1-\theta_j)^2\sigma_c^2\right]\right\} \\
&= (\theta_k-\theta_j)(\mu_s-\mu_c) - (\phi_k-\phi_j) \\
&\quad -\eta\left[\begin{array}{c} \left(\theta_k^2-\theta_j^2\right)\sigma_s^2 + 2\left\{\theta_k(1-\theta_k) - \theta_j(1-\theta_j)\right\}\sigma_{sc} \\ +\left\{(1-\theta_k)^2 - (1-\theta_j)^2\right\}\sigma_c^2 \end{array}\right] \\
&= (\theta_k-\theta_j)(\mu_s-\mu_c) - (\phi_k-\phi_j) \\
&\quad -\eta\left[\begin{array}{c} \left\{(\theta_k-\theta_j)(\theta_k+\theta_j)\right\}\sigma_s^2 + 2\left\{(\theta_k-\theta_j) + \left(\theta_j^2-\theta_k^2\right)\right\}\sigma_{sc} \\ +\left\{\left(1-2\theta_k+\theta_k^2\right) - \left(1-2\theta_j+\theta_j^2\right)\right\}\sigma_c^2 \end{array}\right] \\
&= (\theta_k-\theta_j)(\mu_s-\mu_c) - (\phi_k-\phi_j) \\
&\quad -\eta\left[\begin{array}{c} \left\{(\theta_k-\theta_j)(\theta_k+\theta_j)\right\}\sigma_s^2 + 2\left\{(\theta_k-\theta_j) - (\theta_k-\theta_j)(\theta_k+\theta_j)\right\}\sigma_{sc} \\ +\left\{-2(\theta_k-\theta_j) + (\theta_k-\theta_j)(\theta_k+\theta_j)\right\}\sigma_c^2 \end{array}\right] \\
&= (\theta_k-\theta_j)(\mu_s-\mu_c) - (\phi_k-\phi_j) \\
&\quad -\eta(\theta_k-\theta_j)\left[\begin{array}{c} \left\{(\theta_k+\theta_j)\right\}\sigma_s^2 - 2\left\{1-(\theta_k+\theta_j)\right\}\sigma_{sc} \\ +\left\{-2+(\theta_k+\theta_j)\right\}\sigma_c^2 \end{array}\right] \\
&= \left(\phi_j-\phi_k\right) + (\theta_k-\theta_j)\left\{(\mu_s-\mu_c) + 2\eta\sigma_c^2 - 2\eta\sigma_{sc} - \eta(\theta_k+\theta_j)\left[\sigma_s^2 - 2\sigma_{sc} + \sigma_c^2\right]\right\}
\end{aligned}$$

Appendix B: Survey introduction

We would like you to think about having \$1000 to invest in your superannuation fund. The \$1000 might come to you as a tax refund, a bonus, an inheritance, a small lottery prize, or perhaps you find an envelope with cash in it. You are required to choose the way your money is invested from a menu of investment options. We are going to show you 16 scenarios for your superannuation investment. The scenarios differ by the range of possible returns on your investment in each option and the fees you have to pay to the people managing your investment.

What we want you to do is simple – in each scenario, tell us:

- Which investment option you would be most likely to choose; and
- Which investment option you would be least likely to choose.

The accumulation in the superannuation fund will be available to you to help fund your retirement once you have reached the age at which government regulations allow you to use money from your superannuation account. This will be somewhere between 55 to 60 years, depending on your current age.

Investment options

We will offer you a menu of six investment options. The six options include five options made up of different combinations of “cash” and “Australian shares”. Australian shares is an investment in the Australian stock market. Cash is an investment in the short term money market. The sixth option is a “Retirement Savings Account”, which is similar to an ordinary bank account.

To help you make your choices we will give you information about past performance and fees for each of the six options.

As you probably are aware, however, past performance does not guarantee future results.

Performance and investment risk

Each investment option has a different expected accumulation (the amount that your $1000 will probably grow to over 10 years), and a different amount of investment risk (variation in the amount your investment grows). Different proportions of Australian shares usually result in different accumulations and risk. Historically, Australian shares have produced a higher return, but more investment risk compared with cash. Some years, share investments gain value rapidly, but some years they lose value. A Retirement Saving Account pays a fixed interest rate that is much lower than you should expect from investing in "cash" without any year by year variation .

In each scenario, for each investment option, you will see the expected (average) accumulation after the next 10 years, based on past experience of the Australian money and share markets. All dollar amounts are quoted in "real terms". That means they are adjusted for inflation and measured in 2007 dollars. The dollar amounts are totals before fees are deducted.

You will also see the likely amount of investment risk for each investment option by the range of the accumulation in your superannuation account after 10 years. The accumulation range is expressed as "likely worst case accumulation value after 10 years" and "likely best case accumulation value after 10 years". As before, these dollar amounts are based on past experience and are in 2007 dollars, without fees deducted.

Investment Management Fees

Fees will be charged for investing your superannuation.

The investment management fee is a fee for managing the investment in your superannuation account. Investment management fees range from 1.75% per year to 2.60% per year and depend on the investment option you choose. There are no investment management fees on the Retirement Savings Account.

Now, we will show you 16 scenarios that contain the six investment options. Please evaluate each scenario carefully before making a choice about where to invest your $1000.

Appendix C: Portfolio data

Portfolios 1–5 comprise proportions of cash and Australian shares. Return and risk attributes for each option are bootstrapped from a sample of monthly time series running from July 1986 to March 2006.

Cash – JP Morgan Australian Cash 12 months total return index (DataStream JPAU12L~A$), end-month.

Shares – Australia-DS Market total return index (DataStream TOTMKAU(RI)), end-month.

Prices – ABS Private Consumption Deflator, quarterly, linearly interpolated to monthly frequency.

Historical portfolio returns were calculated as weighted averages of simple returns, and the inflation rate was subtracted to give a real return

$$R_{p,\mathrm{real}} = (w_1 R_{cash} + w_2 R_{shares}) - R_{prices}.$$

This made 236 real monthly portfolio returns.

Using the Matlab bootstrap function, we drew 480 random draws (with replacement) of each portfolio return, and compounded these into a return for each portfolio at a ten year horizon. We did this 5000 times.

The advantage of using a long run of historical data to compute portfolio returns is that we can model the non-normal features of the data, both negative skewness and excess kurtosis.

Appendix D: Inventory of demographics and personal characteristics and AMP risk tolerance survey.

AMP Risk Tolerance Survey:

A. How familiar are you with investment markets?				
1. Very little understanding or interest	2. Not very familiar	3. Have enough experience to understand the importance of diversification	4. Understand that markets may fluctuate and that different market sectors offer different income, growth and taxation characteristics	5. Experienced with all investment sectors and understand the various factors which may influence performance

B. When you think of the term "investment markets", which one of the following words comes to mind?				
1. Risky	2. Uncertainty	3. Possibility	4. Probability	5. Certainty

C. What level of risk would you be prepared to take in arranging your financial affairs?				
1. Very conservative. I will not take any risks	2. Fairly conservative, but with a view to consistent returns	3. Willing to take some risks to improve returns	4. Willing to take a reasonable amount of risk to improve returns	5. Willing to take more risks than most to improve returns

D. The greatest returns are generally obtained from more volatile investments. Which statement do you feel most comfortable with?				
1. Preferably guaranteed returns	2. Stable, reliable returns	3. Some unpredictability in returns	4. Moderate unpredictability in returns	5. Greatest unpredictability but potentially higher returns

E. How long are you likely to continue with an investment strategy that is not meeting your expectations?				
1. I would change it immediately	2. Up to 6 months	3. Up to 18 months	4. Up to 3 years	5. More than 3 years

F. Generally, when seeking higher long-term returns from your investments you will also increase the likelihood of poor performance from time to time. Which of the following best describes your investment priorities?				
1. Preservation of my current capital is my only objective	2. Security of capital and consistent returns are more important than capital growth	3. A balance of both investment income and capital growth returns expected over the long-term, accepting the possibility of short periods of fluctuating performance from time to time	4. Capital growth is more important than investment income returns over the longer term. I am comfortable with fluctuations in the value of my investments over short periods	5. Growing my assets substantially over the long-term – I do not require income returns to support my living needs and accept that the value of my investment may fluctuate from year to year.

G. Historically, the share market has experienced rapid rises and falls in value. What do you think you would do if your investment experienced a fall by as much as 30% in value in a very short period of time such as a year or less?				
1. Sell the investment immediately	2. Reduce holdings in the investment to limit any loss	3. Do nothing	4. Buy more of the investment	5. Borrow money to buy more of the investment

H. I am willing to experience the ups and downs of the market for the potential of greater returns over the long term.				
1. Strongly disagree	2. Disagree	3. Neither agree or disagree	4. Agree	5. Strongly Agree

I. My main concern is security. Keeping my money safe is more important than earning higher returns.				
1. Strongly agree	2. Agree	3. Neither agree or disagree	4. Disagree	5. Strongly disagree

J. When it comes to investing I would describe myself as:				
1. Inexperienced	2. Somewhat inexperienced	3. Somewhat experienced	4. Experienced	5. Very experienced

K. How do you feel if your investments go down in value?				
1. Extremely concerned	2. Very concerned	3. Concerned	4. Not very concerned	5. Indifferent

L. Which term best describes the way you feel after making a major financial decision?				
1. Apprehensive	2. Concerned	3. Satisfied	4. Optimistic	5. Confident

Notes: AMP Custom Super Investment Options Catalogue, Product Disclosure Statement Part 2, issue 4, September 2006, pp 4-6.

Demographic Survey Question	Response
Gender	M/F
Age	Under 18 years 18-24 years 25-34 years 35-44 years 45-54 years 55-64 years 65+ years
Location	NSW VIC QLD WA SA ACT TAS NT
Do you have children under the age of 18? Age of children 0-2 years Age of children 3-5 years Age of children 6-9 years Age of children 10-14 years Age of children 15-18 years	Y/N
What is your highest level of education?	Some secondary school School certificate Higher School Certificate TAFE University (undergraduate) Other college University (postgraduate)
What is your current employment status?	Full time (more than 30 hours) Working part time Not currently working Full time student
What is your occupation?	Professional Manager Administrator Small business owner Sales Clerical or service worker Transport worker Labourer Tradesperson Home Duties Retired Unemployed

What is your current income?	Under \$20,000 \$21,000-\$40,000 \$40,001-\$60,000 \$60,001-\$90,000 \$90,001-\$120,000 \$120,001-\$150,000 \$150,001-\$180,000 \$180,001-\$210,000 \$210,001-\$240,000 over \$240,000 Prefer not to say.

What is your household income?	Under \$20,000 \$21,000-\$40,000 \$40,001-\$60,000 \$60,001-\$90,000 \$90,001-\$120,000 \$120,001-\$150,000 \$150,001-\$180,000 \$180,001-\$210,000 \$210,001-\$240,000 over \$240,000 Prefer not to say.
Which of the following services do you use?	Internet banking Internet shopping Online auctions Online gambling Other
What type of home do you live in?	House Duplex Semi-detached apartment/unit town house
Do you own your own home?	Y/N
Do you have home insurance?	Y/N
Do you own a car?	Y/N
Do you have vehicle insurance?	Y/N
An do you have a no claims bonus?	Y/N
Do you own an investment property?	Y/N
Value - How much is your investment property worth?	
Do you currently have any investments and savings?	Yes No but considering No not interested

Do you own any stocks and shares?	Yes No but considering No not interested
Do you own any of the following investments?	Property Shares Futures IPOs Warrants Managed funds Commodities Savings accounts Other

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