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MILESTONE BIRTHDAY EVENTS AND RETIREMENT INVESTMENT BEHAVIOUR

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ABSTRACT

This paper investigates individuals' investment behaviour in their retirement savings surrounding milestone ages. Age is expected to play a key role in influencing investment choices, primarily through the risk of the investment strategy reflected in the asset allocation. Less clear is what particular age this occurs at or whether it is a smooth, incremental adjustment. We investigate whether milestone ages, that is those ending in "0" or "5", play a role in the propensity to make investment changes. We utilise a large Australia retirement savings fund which provides the history of investment changes of a diverse sample of workers. We do find a clear role for age in the propensity to make investment changes. Pervasive milestone effects are not observed but we do observe some ages suggestive of milestone effects which are otherwise inconsistent with the expected age relationship. We also find a difference between genders surrounding the 50th milestone age.

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Milestone Birthday Events and Retirement Investment Behaviour

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Abstract

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JEL Codes: J26, D91, G11, D14, G23, E21

Keywords: Milestone age, life-cycle, retirement savings, consumer finance, household finance, birthdays

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1 Introduction

Age retains a central role in the modelling of individual savings, and the consideration of retirement savings specifically, including the related concepts of age, age-structuring, and the life-course (Settersten & Mayer, 1997). Most commonly age has been employed as a measure of development, for example the maturing worker/investor/saver such as in the life-cycle hypothesis (LCH) (Modigliani, Brumberg and Ando, see Abel (1990)). The LCH casts the individual as forward looking, borrowing when young, saving when employed and in middle-ages, and dissaving when retired as they seek to smooth consumption and maximise utility. The stylised profile of wealth accumulation that accompanies this model has event markers of commencing work, retirement, and death. We investigate whether, rather than a smooth passing of years some ages act as *milestones* when it comes to retirement savings decisions. Milestone ages have been defined as "ages ending in 0; e.g. 40, 50, etc." (Miron-Shatz, Bhargave, & Doniger, 2015) which suggest "10-year epochs" (Alter & Hershfield, 2014, p. 17066). These ages can act as "temporal landmarks [which] can change people's outlook and lead to an evaluative mode of thinking about one's life" (Miron-Shatz et al., 2015, p. 1). Milestone ages can be seen directly as the interaction of age as a biological, psychological, and social marker.[1] For example, psychological components, such as changes to risk tolerance with age can interact with social aspects such as the social norms of accepted risky behaviours for particular ages.

Our interest is in age as a milestone within a retirement savings context and specifically in respect of retirement savings investment strategy activity. We investigate three research questions. First, are milestone ages marked by elevated investment activity out of step with any prevailing age-based trend? Second, do individuals act in *anticipation* of these milestones or, instead, in *reaction* to their occurrence? That is, is investment activity elevated before a milestone age, during, or after a milestone age? Third, are gender differences evident in investment activity associated with milestone ages?

[1] Settersten and Mayer (1997) identify these aspects, collectively, as one of three different debates in the social sciences. The others relate age, age structuring and the life course to: 1) how individuals are connected to others and history; and 2) the social construction of time.

The transition to defined contribution (DC) retirement savings plans, as a means of private savings for retirement, has been observed worldwide. DC plans place the responsibility on the individual to choose both the appropriate savings level and investment strategy for those savings. That the majority, in fact, remain with designated defaults is well known reflecting a status quo bias (W. Samuelson & Zeckhauser, 1988); inertia (Madrian & Shea, 2001); inattentiveness (Mitchell, Mottola, Utkus, & Yamaguchi, 2006); or a "path of least resistance" (Choi, Laibson, Madrian, & Metrick, 2002). Even during the turmoil of the global financial crisis relatively few moved from default options (Gerrans, 2012). This low level of activity behaviour is not without possible negative consequences (Yamaguchi, Mitchell, Mottola, & Utkus, 2006).

Empirical research into DC plan behaviour, including that noted above, has typically focussed on the factors that can explain the key retirement savings behaviours, how much to save and how to invest those savings. Factors typically include individual demographics (e.g. age, gender, income), psychological factors (e.g. risk tolerance, financial literacy, propensity to plan), psychosocial factors (e.g. social norms), and how the DC savings decisions are framed (e.g. defaults, opt-in). Our focus on the role of age beyond its information as a demographic characteristic alone is inspired from empirical literature which has highlighted the significance of birthdays and milestones in explaining changes in health (eg. morbidity and mortality: Ajdacic-Gross et al., 2012; Phillips, Van Voorhees, & Ruth, 1992; Saposnik, Baibergenova, Dang, & Hachinski, 2006; Shimizu & Pelham, 2008), and health-related behaviours (eg. consulting a GP: Handysides, 2011).

We investigate the investment choice activity of members of a large Australian superannuation plan[2] with a specific focus on member investment activity levels surrounding key milestone ages. This focus can also be related to an individual's "decision horizon" rather than the "planning horizon" (Bodie, 2003). The latter is the remaining period a portfolio will be invested which changes with age. The life-

[2] "Superannuation" is the name given to tax-advantaged retirement savings products in Australia, comparable to employment based 401(k)'s and 403(b)'s in the US, and the more recently introduced NEST in the UK.

cycle hypothesis is more explicitly concerned with the planning horizon: the time between the current age, retirement, and death over which consumption and savings are to be optimised. Within a retirement savings context this is a function of current age and life expectancy. The decision horizon is the time between decisions to revise a portfolio allocation which may be influenced by the calendar (e.g. end of month/year), or financial events (payslip, tax return) (Bodie, 2003). Bodie (2003) also suggests events such as marriage may also trigger a revision and we explore a milestone birthday as another trigger event that alters the decision horizon.

The next section reviews different conceptions of age, the empirical evidence of milestone age related behaviours, and the relevance to retirement savings. The third section reviews the data used for the empirical analysis. Section four presents the modelling and empirical results. The final section provides a discussion of results and identifies areas of future analysis.

2 Literature

Neugarten and Datan (1996) suggest three dimensions of time: life time; social time; and historical time. Life time, or chronological age, is the most commonly used and retirement savings systems are generally life time based. For example, in the Australian system, contributions have been age-limited, eligibility for social security is restricted presently to those aged 65[3], and superannuation savings are preserved until nominated ages given date of birth, ranging from 55 years to 60 years. Social time refers to "age-grades" or "unitary age-categories" which have specific characteristics and can be seen as part of a series which may differ by sex (Eisenstadt, 1956). For example, youth, adult, elder. Historical time refers to the dynamic nature of social time reflecting that age-grades or norms change over time, which can then identify cohort effects.

[3] Increasing to 67 years by 2023.

2.1 Milestone Ages and Birthday Effects

Miron-Shatz et al. (2015) find a significant effect of milestone ages, defined as ages-ending in zero, on life-satisfaction which they isolate to a heightened evaluative perspective rather than emotional or experiential perspective. Their empirical design, classifies those in a particular age-milestone as including those up to six-months prior to the milestone birthday or up to six months after the milestone birthday[4]. Alter and Hershfield (2014) focus on the approaching milestone or "9-ending ages" (e.g. 49, 59) positing that it is the *pending* milestone that prompts heightened evaluation. Consistent with this they find, in survey responses, that those with 9-ending ages considered the meaning of life more often; were more likely to register on dating sites catering to those seeking extra-marital affairs; and had higher suicide rates than those with any other age-ending digit. Additionally they find that marathon runners with 9-ending ages run faster times than those in the bracket two-years younger, and 9-ending ages were more likely to enrol in a marathon race for the first time.[5] Phillips and Smith (1991) also report a higher suicide rate for milestone ages, isolated this to married males[6], focusing on ages ending in zero.

Others have examined the significance of birthday events per se rather than specific ages. Phillips et al. (1992) find that women are more likely to die in the week following their birthday than any other week, attributed to a birthday as a lifeline. In contrast, the peak in male deaths is the week prior to a birthday, attributed to birthday as deadline. Collectively the results suggest that individuals "do not experience time as an even, homogenous process" (Phillips et al., 1992, p. 539).

Shimizu and Pelham (2008) take a more granular approach and examine five days: the two days before, the two days after; and the birthday itself. They also separately consider Christmas, New Year's Day, and Thanksgiving (being a US sample) using the same five-day event window. Consistent with a deferral

[4] As we utilise the actual birthday we can distinguish between these groups

[5] The latter two analyses sought to counter the concern with the result from the dating website where age may not be accurately reported, specifically under-reported. They argue that for comparative purposes it is better to overstate age for marathon ages.

[6] Phillips et al. (1992) use a Californian sample 1965-1985 whereas Alter and Hershfield (2014) use a whole of US sample 2000-2011. Phillips et al. (1992) compares the zero ending rate with the average for those two years below and older. Alter and Hershfield (2014) compare the difference of each age hence the methodology and sample may explain the different conclusions.

effect, death rates were higher in the two days after Thanksgiving and Christmas compared with the two days before. Further the death rate on the actual day was lower than all four days consistent with an expectation of wanting to experience the day with family. Similarly there were more deaths after New Year's Day than the days before, but a larger number of deaths on New Year's Day than any of the other four days surrounding, again consistent with deferral until the ceremonial date without the accompanying desire for the celebration on the day. Finally, a significantly larger number of deaths were found on the birth day rather than the four surrounding days with no deferral effect post the birthday found. Similarly, when extended to months, the likelihood of death is highest in the birth month and lowest in the month preceding. Ajdacic-Gross et al. (2012), however, reject the deferral hypothesis and argue it is a "birthday blues" or "anniversary reaction" utilising cause of death (e.g. cardiovascular). Their results estimate a peak in deaths on birthdays with no "anticipatory or aftereffects" (Ajdacic-Gross et al., 2012, p. 605).

2.2 Age and Retirement Savings

Whether viewed as a positive or normative model of savings behaviour (Deaton, 2005), the life-cycle hypothesis (LCH) (Modigliani, Brumberg and Ando, see Abel (1990)) has been the workhorse model for consideration of the structure of savings by age. The LCH casts the broad savings/consumption decision as fundamentally linked to time in, and retreat from, the workforce either voluntarily, as in retirement, or more permanently, as in death. Specific ages *per se* have less of a role in the LCH than the length of time between them. That is, the length of earning years and retirement years. Within the context of investment portfolios, age has largely been considered through the lens of its impact on time in or out of the workforce, human capital, and the associated risk contribution to the total portfolio of assets. Levinson (1986, p.4) argues that the idea of the life cycle is "metaphorical, not descriptive or conceptual … [but] suggests that there is an underlying order". Levinson (1986, p.5) proposes that the life cycle contains age-linked "eras" with their own "biopsychological character", and while "age-linked phases goes against conventional wisdom … [it] now has the status of an empirically grounded hypothesis that needs further testing in various cultures" (Levinson, 1986, p.5).

Age can be seen as having direct and indirect effects on investment activity. A direct effect may arise via greater experience providing confidence in making an investment strategy change. This age-related activity would not be expected to be associated with specific milestone ages. An indirect effect may arise due to a mediating effect via asset allocation. Given the predominantly fixed default investment strategy of superannuation funds, and given age can be taken as a risk tolerance proxy, it may be expected, absent costs, that those at either end of the age distribution would be more likely to make a change.[7] P. A. Samuelson (1989) reviews the theoretical literature's view on the role of age in managing financial risk over planning horizons, reconciling the conventional wisdom that investors should be more risk tolerant when young and progressively decrease exposure to relatively risky equities in favour of lower risk cash and fixed interest securities. Milevsky (2011) argues that in addition to age-related financial risk aversion, longevity risk aversion (the fear of outliving financial resources in retirement) is influential to retirement asset allocation and this may also be age-related.

Lifecycle funds, at least in their implementation, take a milestone age approach to investment strategy. Chant, Mohankumar, and Warren (2014) review of the asset allocations of default investment options in the Australian superannuation market indicates that the 50th and 55th birthdays see significant adjustments to equity exposures, with median equity allocation dropping eight and nine percentage points respectively. The empirical literature which has examined the risk levels of individuals' retirement savings portfolios (e.g. Agnew, Balduzzi, & Sundén, 2003; Gerrans, Clark-Murphy, & Speelman, 2010; Guiso, Jappelli, & Haliassos, 2000) is not unequivocal but generally supports a humped shape risk versus age profile: increasing risky asset class allocation to a peak and subsequent decline. Other empirical literature has focussed on the role of age in explaining participation in financial markets (e.g. Campbell, 2006; Guiso et al., 2000; Reserve Bank of Australia, 2003). Elsewhere, age related decision making quality has been considered (Agarwal, et al., 2009) taking its cue from medical and psychological

[7] Implicit in this is the assumption that superannuation funds incorporate membership age profile as a factor when formulating an investment strategy, which the regulators guidance to trustees confirms (Australian Prudention Regulation Authority, 2006).

evidence on cognitive functioning. The latter pinpoints an "Age of Reason" of peak performance in regards financial decision making at age 53 years. However, this age focus is related to quality, not necessarily the predisposition to make a financial decision.

What is unexplored in this investment literature is the specific role of milestone ages, or milestone birthday events, in either focussing attention on the planning horizon or as key decision horizon markers. Here the theoretical literature is less clear in terms of when exactly a change should occur other than the broad expectation from Modern Portfolio Theory that changes will be precipitated by risk preference changes, or changes in risk/return expectations of underlying assets.

This is a significant question within the context of retirement savings given that it has been suggested "Many participants in self-directed retirement plans … do not know enough about investing to choose rationally among alternatives" (Bodie and Treussard, 2007). In response life-cycle options have been developed which automate the management of the investment strategy by reducing risk exposures at nominated ages. An alternative, or complementary, approach is to better target members to engage them in this decision making when they are most receptive to making such a change. Therefore, what key ages appear as milestone ages to members themselves and provide age related behaviour norms?

3 Data

This paper uses administrative data from Mercer Australia which through the Mercer Super Trust offers management and administration of retirement savings for approximately 200 employers, 220,000 active members and AUD$20 billion in assets under management in 2015. Employees are drawn from a broad section of employers and industries. Importantly, the data offers a longitudinal view of individual member investment behaviour which allows examination of behaviours preceding, during, and after milestone ages.

The unit of analysis is a member financial year. The data period extends from 2003/04 through 2011/12. The administrative database identifies a member's gender, age, annual employer contributions, and year

ending balance. To be included in the analysis a member is required to be observed for a full financial year, have a balance record, a contributions record, date of birth and gender record. This provided 120,004 members drawn from 177 sub-plans.[8] The average membership length a member is observed is 3.6 years. On average a member is 47.9 years of age in the last financial year they are observed in the data. Similarly in the last year a member is observed the average annual employer contribution is $6195 and the average end of year balance is $92984.

Our focus is both the propensity of members to make a change to their investment strategy as well as the change in risk level of the investment change. Members are able to make a change to their accumulated balance and separately make a change to where future contributions are directed. We consider these Balance and Contributions changes separately. In the next section, we discuss the methodology to assess the propensity to change investment strategy of Balances and Contributions considering members' age, gender and whether the investment switch involves more or less growth assets.

4 Estimations

Our focus is whether investment behaviour is significantly different in the period prior to, or after, a member reaches a milestone age. We use ages 40, 45, 50, 55, and 60 years for this purpose. Before examining investment activity surrounding the various milestone ages we first examine the role of age overall.

4.1 Age and the overall propensity to make changes

A first regression estimates the probability that a member makes an investment change in a financial year. This is a preliminary step to estimate the role of key variables, including the expected overall positive age association. A random effects logit estimator using an unbalanced panel of members is

[8] Since July 2014 the SG rate has been 9.5 percent.

utilised for making a Balance Investment Change and separately a Contributions Investment Change in a financial year as specified in equation 1.

$$\log\left(\frac{\Pr(y_{it}=1)}{1-\Pr(y_{it}=1)}\right) = \alpha + \boldsymbol{\beta x_{it}} + \boldsymbol{\delta f_t} + \mu_i + \varepsilon_{it} \quad (1)$$

where $\boldsymbol{x_{it}}$ is a vector of member characteristics, $\boldsymbol{f_t}$ is a vector of financial year indicators, μ_i is an individual specific random effect, and ε_{it} is a time varying error term. $\boldsymbol{x_{it}}$ includes a member's age category from a set of five-year groups centred on a milestone birthday. An indicator for gender (Female) is included, a measure of the member's financial year employer contributions, and a member's annual balance. The latter two are included as standardised values from within the five-year age group in the respective financial year. Heteroskedastic robust standard errors are estimated which allow for clustering at the individual member level. Table 1 presents the odds-ratio estimates from these estimations along with unconditional probability estimates for sub-groups across the sample period.

<Insert Table 1>

The unconditional probability that a member makes a change in a financial year is 3.5% for their accumulated balance and 4.0% for future contributions. Both the estimated odds that a member makes a balance or contributions change increase monotonically with age. In terms of making a balance investment change, being in the 40 years and 45 years age groups reduces the odds a member makes a change relative to a member in the 50 years age group by 37.6% and 25.4% respectively. Conversely the odds increase by 65% and 168% for a member in the 55 years and 60 years group, respectively. The same pattern is observed for contributions changes though in each case the relative odds are lower. Being a female member reduces the odds of a balance change by 67% for balance changes and 61% for contributions. A one standard deviation increase in balance increases the odds of a balance change by 67% whereas a one standard deviation increase in annual contributions increases the odds of a balance change by 14%. For the same changes the odds of making a contributions change are 41% and 24%. In

short a member's accumulated balance appears relatively more influential for making a balance change and contributions more influential for making a contributions change.

4.2 The role of milestone ages

Given the monotonic relationship between age and the probability of making and investment strategy change we next explore the role of milestone ages by examining a balanced panel of members who are observed for a full five-year age cohort group using equation 2. In this estimation the age group indicators are not included but a set of indicators m_t for the two individual years preceding a milestone birthday and the two individual years after a milestone birthday are included in place.

$$\log\left(\frac{\Pr(y_{it}=1)}{1-\Pr(y_{it}=1)}\right) = \alpha + \boldsymbol{\beta x_{it}} + \sum_{t=-2}^{+2} \gamma m_t \quad + \delta \boldsymbol{f_t} + \mu_i + \varepsilon_{it} \qquad (2)$$

A significant milestone age effect could emerge in several ways. Given the results in Table 1 a positive age-choice relationship is identified. Consistent with a milestone effect, this positive relationship may result from the probability of making a choice increasing only during the milestone birthday year. We may also see a reduction in the probability of making a choice in the year immediately after a milestone birthday but the net effect of the five years around and including the milestone birthday is positive. It could also be that choice is reduced in the milestone age but is either in the two years before and/or after the milestone birthday.

Table 2 presents the estimates from equation 2 again separately for balance changes and contributions changes. First, for balance changes, none of the odds estimates are significantly higher in the two years prior to the respective milestones relative to the milestone age itself and none of the odds ratios for the years after a milestone age are significantly lower. In the case where an odds ratio is significantly different from a milestone it is for the 55th milestone where the two years preceding are significantly lower than the 55th milestone, which is consistent with the positive age relationship indicated in Table 1. However, focusing on the size and pattern of odds estimates suggests some differing behaviour around milestones. For example, while there is no significant difference in the odds of a change in the two years

prior to the milestone or the first year after the 40th milestone a significant increase is only observed between the first and second year after the milestone (χ^2 7.88 p-value 0.0050). For the 45th milestone the odds ratios are in fact significantly *higher* two-years prior to the 45th compared with the year after (χ^2 2.67 p-value 0.1020). Whether this peak in activity in the early 40s is in reaction to the 40th milestone or a 45th milestone is not obvious. Similarly while the odds of a change aren't significantly evident in the year preceding the 50th milestone, there is a difference between the spike in activity in the year preceding the 50th milestone relative to the activity two years prior to the 50th milestone (χ^2 3.65 p-value 0.0562). This could be taken as suggesting that members don't wait until the looming milestone, rather they respond earlier and then maintain an elevated level of activity. The elevated level of activity continues into the 55th milestone age-bracket but the 55th milestone sees activity spike again relative to each of the two years prior to the milestone years before stabilizing.

For contributions changes the patterns for the 40th milestone group is somewhat U-shaped. The odds ratio two years prior to the 40th milestone is significantly higher than the year preceding the 40th milestone (χ^2 3.65 p-value 0.0562) and the year after the milestone (χ^2 3.65 p-value 0.0562) against expectations of a positive age-choice relationship. In the 45th milestone a similar U-shape is observed. The odds-ratio is significantly higher two-years prior to the 45th milestone relative to the year-preceding (χ^2 7.29 p-value 0.0069), the milestone itself and the year after the milestone (χ^2 6.53 p-value 0.0106), but not significantly different to that two years after (χ^2 2.53 p-value 0.1115). For the 50th milestone the elevated contributions activity only appears in the second year after the 50th milestone relative to the preceding year (χ^2 7.51 p-value 0.0061). Within the 60th milestone group no significant differences are observed.

Collectively these results suggest differences in activity relative to a specific milestone age itself are not common. However, activity level differences that can be attributed to milestones are estimated more consistently for contributions changes where higher activity is observed prior to milestones.

4.2.1 Differences by gender

Table 3 and Table 4 present re-estimations of equation 2 separately by gender for balances changes and contributions changes. Here the purpose is to compare the relative pattern of the odds-ratios within each milestone age by gender, given that we know the overall lower odds that female members make either change.

4.2.2 Balance changes

For the 40th milestone age group the previously identified relatively higher activity after the 40th milestone is evident for both genders. In the 45th milestone age group the drop-off in activity after the 45th milestone is also evident for both genders. For males there are significantly reduced odds of a change the year after the 45th milestone relative to two years before the milestone. For female members, the reduced odds are isolated to each of the two years after the 45th milestone. In both cases this is opposite to the general expectation of *increased* activity with age as suggested in Table 1. Collectively these results suggest that a delayed increase in activity post the 40th milestone carries into the 45th milestone but then dissipates.

Differences are evident in the relative pattern of activity around the 50th milestone. For female members the odds-ratios suggest a humped activity profile, peaking at the 50th milestone, though the differences in odds-ratios relative to the milestone are not significant. For males there is not a consistent pattern evident but the pattern suggests higher odds of activity the year before and the year after the 50th milestone, but again neither is significant. It is only the odds for the second year after the 50th milestone which is significantly higher than the milestone year. However, a test for the differences between male and female members' odds ratios supports a relative difference in activity around the 50th milestone. While males are overall more likely to make a change across the 50th milestone group (and any other milestone age group) the distribution of this activity is different to female members. Relative to males, female member's activity is more likely to be during the 50th Milestone with the odds reducing after. This is borne out when comparing the odds by gender, again noting that this comparison is not of the overall

odds of making a change for which males are more likely. But, given this, female members are significantly more likely to make a change in the 50th milestone year relative to each of the years preceding compared with males (χ^2 4.80 p-value 0.0265, χ^2 4.69 p-value 0.0303).

4.2.3 Contributions changes by gender

The apparent U-shaped activity relative to the 40th milestone is evident for both genders for contributions. That is, higher odds two-years prior and two years after the 40th milestone. For females, the odds are significantly higher two years prior to the milestone relative to one year prior (χ^2 2.94 p-value 0.0864) and for males the odds two years prior are higher than one year after the milestone (χ^2 3.87 p-value 0.0490). In both cases this is against the overall prevailing positive age trend. The elevated odds after the 40th milestone, significant for females, carry over to the 45th milestone. The odds a male makes a contributions change is significantly higher two-years prior to the 45th milestone compared to the milestone year and year after the milestone (χ^2 3.97 p-value 0.0462). Female members also have a significantly higher odds of making a change two years prior to the 45th milestone compared with one year after the milestone (χ^2 4.76 p-value 0.0306). This behaviour in the early 40s is consistent with the previously discussed balances activity.

The relative differences in activity between genders observed for balances around the 50th milestone is not observed for contributions. For both males and females activity around the 50th milestone appears U-shaped though it is only the odds two years after the milestone that is significantly different to the milestone. Similarly, activity around the 55th and 60th milestones do not significantly differ by gender.

4.2.4 Direction of change

We next consider the direction of the change in investment strategy for both balance and contributions by considering the proportion of growth assets (equity and property) in the investment options selected. The strategic asset allocation of each investment option on the member's investment menu is weighted by the member's dollar allocation to the unit. Members may combine single asset class options together

(e.g. Australian Equity, Cash) or pre-mixed options (e.g. Balanced), or both. The effective asset allocations are then divided into three categories: Neutral (a change which is plus or minus five percentage points in growth assets); Increase (a greater than five percentage points increase in growth assets); and Decrease (a more than five percentage points decrease in growth assets). In the sub-sample of those that make a change Decrease is the largest group (43%) followed by Increase (34%) and Neutral (23%). For the sub-sample of contributions changes Decrease is the largest group (42%) followed by Increase (37%) and Neutral (20%). This noticeably differs by financial year. For example, in 2006/07 the proportions for balances are Increase (50%), Neutral (30%), and Decrease (20%) whereas for 2008/09 the proportions are Increase (15%), Neutral (18%), and Decrease (66%).

We next estimate a multinomial logit model with individual random effects utilising the three categories plus and a fourth category which includes those who make no change in the financial year. We utilise the same set of explanatory variables as previous and estimate equation 3 plus we also control for the beginning of year growth asset allocation given that we are considering change in allocations.

$$\Pr(y_{ijt} = 1) = \frac{\exp(\alpha+\beta_j \boldsymbol{x_{jit}}+\delta \boldsymbol{f_t}+\mu_{ij}+\varepsilon_{jit})}{\sum_{j=1}^{J} \exp(\alpha+\beta_{kj} \boldsymbol{x_{jit}}+\delta \boldsymbol{f_t}+\mu_{ij}+\varepsilon_{jit})} \quad (3)$$

where, additionally, *j* represent the different choice categories.

4.2.5 Balance direction changes

The results reported in Table 5 identify that the reduced odds for female members making a change is prevalent across each of the choice types. It is strongest when it comes to changes that increase growth assets but nonetheless is evident in changes which reduce growth or are growth neutral. By disaggregating the choice types by change in growth assets, the results also help explain some of the previous results. The increased odds of making a change before the 45th milestone relative to the year after or two years after, is only identified for neutral growth assets changes or increases in growth assets. This accords with the expectation of reduced growth asset allocation with age. Hence, a possible explanation for the unexpected result of an increased likelihood of making a change earlier in the 45th age

milestone is in part being driven by age related willingness to take risk. Whether this is appetite to take risk is heightened due to the recent 40th milestone or the looming 45th milestone is not clear. A similar result is observed in the 55th milestone group. A reduced odds of making a change the year after the 55th milestone is only observed in the Increase group. Again this is consistent with the expected negative age-growth assets relationship. While we expect overall that the odds of a change to increase with age, this is not expected for changes that increase growth assets allocations.

Examining contributions changes the results presented in Table 6 are consistent with the previous discussion. First female members have lower odds of being in any of the change categories. Second, the increased odds of making a change prior to the 40th and 45th milestone is again isolated to the Increase and Neutral growth category.

5 Discussion

The investigation of age-related milestone effects on investment behaviour is prompted by empirical evidence in medical literature which identifies the significance of milestone ages. Age is expected to play a significant role in the characteristics of investment behaviours, particularly asset allocation given a declining appetite for risk with age. Further, investment performance may have a more consequential impact for individuals as they age and deplete human capital.

We investigate age related investment behaviours with a focus on milestone ages/years: 40th, 45th, 50th, 55th, and 60th. Our results support the view of a positive relationship between age and investment activity relating to both the investment strategy applied to accumulated savings (balances) and future savings (contributions). The odds that a member makes an investment change increases monotonically with age, where age is measured in five year groups surrounding a milestone age.

To investigate the role of milestone ages we next investigate relative investment activity for those members that are observed for a full milestone age cohort. That is, those observed over a five year period commencing two years prior to a milestone age and ending two years after the milestone age.

Our overall finding is that milestone effects are not as strong as found in the empirical medical literature. Within each of the five-year milestone age groups a positive age-change relationship is the most common of activity. However, there are two notable cases where behaviour is contrary to this which may be attributed to milestone effects.

First, in the case of changes to how balances are invested there is an increased odds of a change after/before the 40^{th}/45^{th} relative to the 45^{th} milestone and the two years after. For contributions there is also some evidence of increased change activity preceding the 40^{th} birthday. In both cases this is observed form males and females. A disaggregation of the type of investment change, characterised by the change in growth assets allocation suggests this pattern is only observed among those increasing the allocation to growth assets and to a lesser extent these make more neutral changes in terms of growth assets.

The second milestone age related behaviour is a gender difference surrounding the 50^{th} milestone. While males remain more likely to make an investment change within the five years around the 50^{th} milestone (and each of the other milestone ages), by gender female members are relatively more likely during their 50^{th} year compared with the two preceding years relative to males.

Table 1 Likelihood of Making Investment Change: Balances and Contributions Overall

This table presents odds-ratio estimates from an individual random effects regression of Balance and Contributions investment changes in a financial year. An unbalanced panel of members with at least a whole year of membership is used. Age is included using indicators for the five-year bands around and including the 40th, 45th, 50th, 55th and 60th birthday. Balance and Employer Contributions are based on standardised values within each financial year's 5-year age-cohort. Financial year indicators are also included. Robust errors clustered at sub-plan level are reported in parentheses with significance indicated at 99%***, 95%**, and 90%* level. In addition to odds-ratio estimates, the unconditional annual probability of making each type of change is reported for the various groupings along with standard deviations.

	Annual Balance Changes		Annual Contributions Changes		
	Odds Ratio	Unconditional Probability (SD)	Odds Ratio	Unconditional Probability (SD)	Obs.
Age 38-42 years	0.6239***	0.0238	0.7776***	0.0305	128,110
	(0.0342)	(0.1526)	(0.0339)	(0.1719)	
Age 43-47 years	0.7458***	0.0284	0.8577***	0.0342	112,922
	(0.0279)	(0.1662)	(0.0286)	(0.1818)	
Age: Base 48-52 years		0.0359		0.0398	93,675
		(0.1861)		(0.1954)	
Age 53-57 years	1.6532***	0.0495	1.5207***	0.0530	67,527
	(0.0742)	(0.2169)	(0.0586)	(0.2240)	
Age 58-62 years	2.6827***	0.0643	2.3829***	0.0677	39,943
	(0.2089)	(0.2453)	(0.1580)	(0.2513)	
Female	0.3301***	0.0189	0.3948***	0.0236	146,745
	(0.0209)	(0.1362)	(0.0233)	(0.1518)	
Gender: Male Base		0.0432		0.0484	295,432
		(0.2034)		(0.2147)	
Balance	1.6711***		1.4080***		
	(0.0442)		(0.0358)		
Contributions	1.1367***		1.2414***		
	(0.0246)		(0.0354)		
Year: Base 2003/04		0.0278		0.0377	24,096
		(0.1645)		(0.1904)	
2004/05	0.9801	0.0272	0.9579	0.0363	24,656
	(0.0915)	(0.1627)	(0.0669)	(0.1869)	
2005/06	1.0736	0.0294	0.9686	0.0372	39,567
	(0.0932)	(0.1688)	(0.0746)	(0.1891)	
2006/07	1.0106	0.0280	0.7713***	0.0311	45,180
	(0.0961)	(0.1650)	(0.0573)	(0.1735)	
2007/08	1.6224***	0.0397	0.9921	0.0380	52,622
	(0.1342)	(0.1952)	(0.0702)	(0.1913)	
2008/09	1.8427***	0.0434	1.4623***	0.0506	55,325
	(0.1421)	(0.2038)	(0.0969)	(0.2193)	
2009/10	1.5478***	0.0382	1.2597***	0.0456	62,050
	(0.1321)	(0.1918)	(0.0863)	(0.2086)	
2010/11	1.1975**	0.0316	0.8620**	0.0345	64,092
	(0.0971)	(0.1749)	(0.0639)	(0.1825)	
2011/12	1.7244***	0.0405	1.2368**	0.0448	64,589
	(0.1623)	(0.1971)	(0.1028)	(0.2068)	
Constant	0.0048***	0.0352	0.0091***	0.0402	
	(0.0005)	(0.1842)	(0.0009)	(0.1964)	
Observations	442,177		442,177		442,177
Number of members	120,004		120,004		
Number of Sub-plans	177		177		
Log-Likelihood Constant	-63078		-70992		
Log-Likelihood Final	-56043		-64578		
Wald χ^2	2783		1293		
df	15		15		
rho	0.593		0.556		

Table 2 Investment Change in Milestone Age Groups: Balances and Contributions

This table reports the odds-ratio for the likelihood of making an investment strategy change within a financial year estimated from an individual member random effects logit model. Each column reports an estimation for a five-year milestone age cohort with indicators included for the individual years prior to and after the nominated milestone age. The Balance and Employer Contributions coefficients are based on standardised values of each variable across each financial year's 5-year age-cohort. Financial year indicators are also included. The first five columns report for a Balance Change and the following five columns report for a Contributions Change. Robust errors are clustered at sub-plan level with significance indicated at 99%***, 95%**, and 90%* level.

	Balance Change					Contributions Change				
	40th	45th	50th	55th	60th	40th	45th	50th	55th	60th
- 2 years	0.8859	1.1958	0.8600	0.6069***	0.7640	1.3094	1.3556**	1.1290	0.7228**	0.8003
	(0.1457)	(0.1683)	(0.1543)	(0.0942)	(0.1937)	(0.2175)	(0.2081)	(0.1967)	(0.1084)	(0.1961)
- 1 year	0.8399	1.0730	1.1037	0.7460**	0.7335	0.9794	0.9738	1.0967	0.7808*	0.8258
	(0.1057)	(0.1483)	(0.2002)	(0.0971)	(0.1860)	(0.1047)	(0.1318)	(0.1840)	(0.1016)	(0.1600)
+ 1 year	0.8208	0.8585	1.0602	0.9291	0.9789	0.8817	0.8122	1.1660	1.1460	0.9433
	(0.1197)	(0.1146)	(0.1202)	(0.1190)	(0.2451)	(0.1247)	(0.1105)	(0.1203)	(0.1633)	(0.2168)
+2 years	1.1463	0.8779	1.1660	1.1833	0.8328	1.2510	0.9472	1.4986***	1.3557*	0.7648
	(0.1947)	(0.1435)	(0.1300)	(0.1829)	(0.1886)	(0.2055)	(0.1358)	(0.1889)	(0.2181)	(0.1771)
Female	0.2499***	0.2734***	0.2670***	0.4460***	0.4052***	0.2673***	0.3375***	0.2799***	0.4674***	0.4185***
	(0.0433)	(0.0534)	(0.0452)	(0.0619)	(0.0645)	(0.0423)	(0.0641)	(0.0476)	(0.0614)	(0.0675)
Balance	1.5302***	1.5793***	1.7324***	1.5877***	1.4293***	1.4150***	1.4541***	1.6817***	1.5938***	1.4057***
	(0.1265)	(0.1224)	(0.0994)	(0.1064)	(0.0995)	(0.1058)	(0.0974)	(0.0816)	(0.1178)	(0.0962)
Conts.	1.1907**	1.1108*	1.2805***	1.1153*	1.1469**	1.2736***	1.1930**	1.3849***	1.1845	1.2289***
	(0.0826)	(0.0696)	(0.0905)	(0.0725)	(0.0631)	(0.0918)	(0.0837)	(0.0781)	(0.1312)	(0.0600)
2004/05	1.0048	1.3876	1.1272	0.8058	0.8717	0.8514	1.5876	0.8080	0.5526*	0.7398
	(0.2621)	(0.5087)	(0.3436)	(0.2713)	(0.4160)	(0.2345)	(0.5245)	(0.2143)	(0.1710)	(0.3427)
2005/06	1.1555	1.3663	1.0261	0.7360	0.8484	1.0562	1.4486	0.6693	0.5118**	0.5342
	(0.3254)	(0.4433)	(0.3678)	(0.2728)	(0.3967)	(0.3061)	(0.4493)	(0.2199)	(0.1662)	(0.2452)
2006/07	0.7915	1.4177	0.9334	0.7197	0.9497	0.7355	1.2789	0.4987**	0.4532**	0.6046
	(0.2202)	(0.5214)	(0.3301)	(0.2854)	(0.5076)	(0.2011)	(0.4442)	(0.1457)	(0.1523)	(0.2918)
2007/08	1.6145*	2.0834**	1.2910	1.1193	1.6651	1.2305	1.7821*	0.5654**	0.6122*	1.0563
	(0.4464)	(0.7223)	(0.4248)	(0.4086)	(0.8950)	(0.3445)	(0.5615)	(0.1600)	(0.1819)	(0.5353)
2008/09	1.2062	2.6632***	1.2288	1.5515	3.6989**	1.0566	2.5194***	0.9200	1.1351	3.3121**
	(0.3900)	(0.9637)	(0.4404)	(0.6294)	(2.0992)	(0.3439)	(0.8176)	(0.2944)	(0.4067)	(1.7272)
2009/10	1.0637	2.6869**	1.1903	1.1804	2.2256	1.0284	2.6305***	0.9304	0.9085	1.9661
	(0.3956)	(1.0655)	(0.4468)	(0.5212)	(1.3957)	(0.3530)	(0.8625)	(0.3396)	(0.3518)	(1.1571)
2010/11	0.7807	2.0405*	0.8003	0.9459	2.2155	0.7557	2.1369**	0.4782*	0.5425	1.9876
	(0.3117)	(0.8218)	(0.3269)	(0.4526)	(1.3521)	(0.2639)	(0.7567)	(0.1845)	(0.2322)	(1.1750)
2011/12	0.9560	2.6851**	1.7035	1.6204	3.5190*	1.0126	2.3524**	0.8257	0.9726	3.0985*
	(0.4190)	(1.2330)	(0.7284)	(0.7866)	(2.2961)	(0.4076)	(0.9611)	(0.3525)	(0.4290)	(1.8799)
Constant	0.0038***	0.0021***	0.0053***	0.0121***	0.0122***	0.0049***	0.0027***	0.0075***	0.0171***	0.0155***
	(0.0014)	(0.0008)	(0.0019)	(0.0050)	(0.0087)	(0.0019)	(0.0010)	(0.0025)	(0.0061)	(0.0094)
Obs.	33,710	33,430	28,565	20,150	10,985	33,710	33,430	28,565	20,150	10,985
Members	6,742	6,686	5,713	4,030	2,197	6,742	6,686	5,713	4,030	2,197
Sub-plans	154	149	148	143	133	154	149	148	143	133
LL Base	-3877	-4715	-4593	-3939	-2415	-4070	-4823	-4520	-3972	-2401
LL Final	-3472	-4051	-3995	-3486	-2180	-3686	-4241	-3932	-3526	-2177
Wald χ^2	311.0	164.0	342.8	364.0	266.1	284.3	183.3	391.6	493.7	325.0
(df)	15	15	15	15	15	15	15	15	15	15
rho	0.604	0.647	0.617	0.573	0.530	0.575	0.616	0.614	0.566	0.523

Table 3 Likelihood of Making Balance Investment Change by Gender

This table reports the odds-ratio for the likelihood of making a Balance Investment Change within a financial year estimated from an individual member random effects logit model. Each column reports an estimation for a five-year milestone age cohort with indicators included for the individual years prior to and after the nominated milestone age. The Balance and Employer Contributions coefficients are based on standardised values of each variable across each financial year's 5-year age-cohort. Financial year indicators are also included. The first five columns report for a Balance Investment Change (BIC) and the following five columns report for a Contributions Investment Change. Robust errors are clustered at sub-plan level with significance indicated at 99%***, 95%**, and 90%* level

	Females					Males				
	40th	45th	50th	55th	60th	40th	45th	50th	55th	60th
- 2 years	0.5159*	1.0973	0.5011**	0.9056	0.8380	1.0018	1.2201	0.9520	0.5488***	0.7506
	(0.1751)	(0.4270)	(0.1657)	(0.2802)	(0.5181)	(0.1833)	(0.1819)	(0.1812)	(0.0939)	(0.2065)
- 1 year	0.4808**	0.9000	0.6121	0.9992	0.4496	0.9385	1.1118	1.2396	0.6888***	0.8506
	(0.1404)	(0.3049)	(0.2021)	(0.2635)	(0.2840)	(0.1325)	(0.1545)	(0.2428)	(0.0973)	(0.1591)
+ 1 year	0.7027	0.5310*	0.7919	1.2848	0.6886	0.8457	0.9370	1.1256	0.8401	1.0791
	(0.2699)	(0.1901)	(0.2351)	(0.3478)	(0.3789)	(0.1245)	(0.1392)	(0.1489)	(0.1217)	(0.2175)
+2 years	1.4380	0.4834*	0.8378	1.4681	0.5665	1.0884	0.9780	1.2493*	1.1137	0.9307
	(0.5355)	(0.2021)	(0.2387)	(0.4124)	(0.3258)	(0.1982)	(0.1768)	(0.1690)	(0.1995)	(0.1966)
Balance	1.2988**	1.6475***	1.8322***	1.4236***	1.3654***	1.5954***	1.5722***	1.7130***	1.6484***	1.4734***
	(0.1659)	(0.2252)	(0.2516)	(0.1192)	(0.1278)	(0.1444)	(0.1366)	(0.0998)	(0.1095)	(0.1160)
Conts.	1.3662*	1.0494	1.0406	1.4780***	1.0696	1.1501**	1.1200*	1.3544***	1.0669	1.1813**
	(0.2260)	(0.1470)	(0.1701)	(0.1302)	(0.0890)	(0.0731)	(0.0710)	(0.0798)	(0.0506)	(0.0859)
2004/05	1.0966	0.3704	8.0551**	0.7949	0.9769	0.9866	1.8155*	0.9003	0.8029	0.8306
	(0.8563)	(0.3481)	(8.2272)	(0.4750)	(1.1883)	(0.3033)	(0.6155)	(0.2942)	(0.2976)	(0.3898)
2005/06	0.4054	0.6693	4.2112	0.9052	1.1413	1.3830	1.6296	0.9137	0.6862	0.7393
	(0.3713)	(0.5030)	(4.8799)	(0.4896)	(0.9933)	(0.4223)	(0.5185)	(0.3545)	(0.2571)	(0.3955)
2006/07	0.7275	0.7476	3.2452	1.0341	0.7963	0.8069	1.6679	0.8541	0.6515	0.9791
	(0.5574)	(0.7104)	(3.5258)	(0.6557)	(0.8432)	(0.2515)	(0.5366)	(0.3219)	(0.2608)	(0.5566)
2007/08	0.9545	0.6636	6.2761*	0.8544	1.0782	1.8256*	2.6630***	1.1122	1.1981	1.8453
	(0.7823)	(0.6014)	(6.8684)	(0.5432)	(1.0267)	(0.6194)	(0.8087)	(0.4058)	(0.4308)	(1.0602)
2008/09	0.3940	1.2894	5.7886	1.9078	4.0007	1.5145	3.1797***	1.0553	1.4638	3.5802**
	(0.3613)	(1.1216)	(6.8647)	(1.2907)	(3.8466)	(0.5726)	(1.0550)	(0.4094)	(0.5948)	(2.2912)
2009/10	0.4331	1.5399	5.4293	1.5371	1.3875	1.2994	3.0919***	1.0244	1.1125	2.5785
	(0.4017)	(1.5363)	(6.5981)	(1.0850)	(1.4690)	(0.5299)	(1.0498)	(0.4259)	(0.4985)	(1.7533)
2010/11	0.4083	1.1752	2.8053	1.2451	1.8597	0.9075	2.3677**	0.7242	0.8729	2.3577
	(0.3677)	(1.2984)	(3.4746)	(0.8546)	(2.0323)	(0.3984)	(0.8436)	(0.3352)	(0.4329)	(1.5189)
2011/12	0.2983	2.5458	7.5663	1.8716	3.6830	1.2446	2.7986**	1.4797	1.5862	3.4803*
	(0.3484)	(2.8672)	(9.6324)	(1.5864)	(3.9467)	(0.5842)	(1.2872)	(0.7365)	(0.7658)	(2.4342)
Constant	0.0021***	0.0011***	0.0002***	0.0049***	0.0096***	0.0031***	0.0017***	0.0061***	0.0121***	0.0100***
	(0.0019)	(0.0010)	(0.0003)	(0.0031)	(0.0115)	(0.0013)	(0.0006)	(0.0024)	(0.0052)	(0.0077)
Obs.	10,790	10,085	8,670	6,445	3,625	22,920	23,345	19,895	13,705	7,360
Members	2,158	2,017	1,734	1,289	725	4,584	4,669	3,979	2,741	1,472
Sub-plans	133	135	130	120	103	149	147	145	139	122
LL Base	-646.2	-832.1	-830.8	-902.5	-566.4	-3224	-3877	-3754	-3026	-1841
LL Final	-595.6	-722.1	-715.6	-837.1	-530.8	-2868	-3323	-3270	-2637	-1640
Wald χ^2	74.69	37.93	122.7	82.47	83.69	112.3	98.35	236.4	327.5	165.8
(df)	14	14	14	14	14	14	14	14	14	14
rho	0.613	0.682	0.694	0.503	0.462	0.606	0.642	0.603	0.594	0.552

Table 4 Likelihood of Making a Contributions Investment Change by Gender

This table reports the odds-ratio for the likelihood of making a Contributions Investment Change within a financial year estimated from an individual member random effects logit model. Each column reports an estimation for a five-year milestone age cohort with indicators included for the individual years prior to and after the nominated milestone age. The Balance and Employer Contributions coefficients are based on standardised values of each variable across each financial year's 5-year age-cohort. Financial year indicators are also included. The first five columns report for a Balance Investment Change (BIC) and the following five columns report for a Contributions Investment Change. Robust errors are clustered at sub-plan level with significance indicated at 99%***, 95%**, and 90%* level

	Females					Males				
	40th	45th	50th	55th	60th	40th	45th	50th	55th	60th
- 2 years	1.3999	1.4325	0.6288	1.0463	1.2233	1.3002	1.3442*	1.2697	0.6508***	0.7077
	(0.4818)	(0.5173)	(0.2289)	(0.3106)	(0.7033)	(0.2287)	(0.2101)	(0.2401)	(0.1051)	(0.2012)
- 1 year	0.7810	1.0283	0.5832	0.7512	0.8283	1.0244	0.9705	1.2424	0.7932	0.8168
	(0.2595)	(0.3391)	(0.2143)	(0.1910)	(0.3560)	(0.1185)	(0.1281)	(0.2206)	(0.1182)	(0.1521)
+ 1 year	0.7532	0.5053*	1.1771	1.2796	0.8085	0.9003	0.8879	1.1630	1.1044	0.9691
	(0.2574)	(0.1801)	(0.3270)	(0.2971)	(0.3922)	(0.1358)	(0.1324)	(0.1466)	(0.1754)	(0.1954)
+2 years	2.0409***	0.8435	1.2451	1.4654	0.6422	1.1236	0.9694	1.5596***	1.3187	0.8010
	(0.5644)	(0.2937)	(0.3598)	(0.4013)	(0.3861)	(0.2073)	(0.1560)	(0.2288)	(0.2336)	(0.1573)
Balance	1.3054**	1.4613***	1.7487***	1.4093***	1.3842***	1.4444***	1.4483***	1.6613***	1.6681***	1.4295***
	(0.1742)	(0.1824)	(0.2238)	(0.1364)	(0.1108)	(0.1130)	(0.1118)	(0.0831)	(0.1098)	(0.1183)
Conts.	1.2275	1.2450*	1.2225*	1.5259***	1.1649*	1.2903***	1.1859**	1.4427***	1.1271	1.2561***
	(0.1624)	(0.1394)	(0.1453)	(0.1602)	(0.0909)	(0.0955)	(0.0854)	(0.0760)	(0.0883)	(0.0694)
2004/05	1.3928	1.0535	1.2486	0.4286**	1.2351	0.7717	1.7506*	0.7334	0.5780	0.6334
	(1.3533)	(0.7667)	(0.8526)	(0.1731)	(1.4541)	(0.2258)	(0.5891)	(0.2201)	(0.1971)	(0.2854)
2005/06	1.0994	1.6540	0.5692	0.6393	1.0377	1.0502	1.4000	0.6839	0.4660**	0.4203*
	(1.0383)	(1.1669)	(0.4464)	(0.2980)	(0.9416)	(0.3129)	(0.4467)	(0.2327)	(0.1573)	(0.2186)
2006/07	0.9859	0.7986	0.3462	0.5873	0.9097	0.7005	1.4216	0.5316**	0.4123**	0.5253
	(0.8827)	(0.6705)	(0.2435)	(0.3499)	(0.9706)	(0.2022)	(0.4554)	(0.1662)	(0.1444)	(0.2644)
2007/08	1.2577	1.1414	0.4563	0.5596	0.7670	1.2407	1.9732**	0.5854*	0.6176	1.1001
	(1.0473)	(0.8644)	(0.3051)	(0.2689)	(0.7783)	(0.3791)	(0.5723)	(0.1775)	(0.2106)	(0.5946)
2008/09	0.8783	1.8061	0.7478	1.2542	5.9844*	1.1061	2.7408***	0.9495	1.0963	2.7247*
	(0.8025)	(1.5124)	(0.5533)	(0.6811)	(5.6567)	(0.3928)	(0.8611)	(0.3207)	(0.4263)	(1.6046)
2009/10	0.8985	2.5236	0.7748	1.2423	2.2549	1.0695	2.6826***	0.9501	0.8200	1.9018
	(0.8281)	(2.2548)	(0.6468)	(0.6668)	(2.3848)	(0.3947)	(0.8213)	(0.3738)	(0.3571)	(1.2221)
2010/11	0.8027	1.8242	0.2822	0.6680	2.8314	0.7606	2.2611**	0.5276	0.5073	1.8014
	(0.8047)	(1.7403)	(0.2491)	(0.3876)	(3.2037)	(0.3035)	(0.7715)	(0.2244)	(0.2392)	(1.1355)
2011/12	0.4998	2.3028	0.4722	1.1251	5.2432	1.1928	2.3894**	0.9169	0.9385	2.6335
	(0.5344)	(2.3590)	(0.4123)	(0.7690)	(5.5106)	(0.5137)	(1.0148)	(0.4223)	(0.4354)	(1.7602)
Constant	0.0011***	0.0011***	0.0025***	0.0093***	0.0062***	0.0049***	0.0025***	0.0071***	0.0163***	0.0157***
	(0.0011)	(0.0010)	(0.0018)	(0.0046)	(0.0068)	(0.0020)	(0.0009)	(0.0026)	(0.0066)	(0.0106)
Obs.	10,790	10,085	8,670	6,445	3,625	22,920	23,345	19,895	13,705	7,360
Members	2,158	2,017	1,734	1,289	725	4,584	4,669	3,979	2,741	1,472
Sub-plans	133	135	130	120	103	149	147	145	139	122
LL Base	-704.7	-913.9	-823.7	-921.3	-568.8	-3360	-3904	-3690	-3040	-1824
LL Final	-646.1	-816.2	-721.5	-865.4	-538.2	-3034	-3419	-3204	-2649	-1629
Wald χ^2	55.3	62.0	112.1	104.2	175.7	149.3	111.6	286.6	384.3	233.2
(df)	14	14	14	14	14	14	14	14	14	14
rho	0.604	0.627	0.656	0.468	0.451	0.570	0.614	0.606	0.593	0.545

Table 5 Likelihood of Making a Balance Investment Change

This table reports the odds-ratios of making a Balance Investment Changes in a financial year broken down by the direction of the change in growth assets: Neutral (+ or - 5 percent change growth assets); Increase in growth assets; or Decrease in growth assets relative to a No Change as the base category. The results are estimated within a financial year estimated from an individual member random effects multinomial logit model. Each column reports an estimation for a five-year milestone age cohort with indicators included for the individual years prior to and after the nominated milestone age. The Balance and Employer Contributions coefficients are based on standardised values of each variable across each financial year's 5-year age-cohort. Financial year indicators are also included. Robust errors are clustered at sub-plan level with significance indicated at 99%***, 95%**, and 90%* level.

	40th	45th	50th	55th	60th
			Change – Neutral Growth		
- 2 years	0.8002	1.3330	0.9534	0.9722	0.6314
	(0.2194)	(0.4332)	(0.2515)	(0.2817)	(0.2463)
- 1 year	0.9184	1.3637	1.1504	0.9327	0.4964**
	(0.1780)	(0.3228)	(0.2166)	(0.2416)	(0.1577)
+ 1 year	0.8138	0.7828	1.2152	1.0384	0.9809
	(0.2151)	(0.1865)	(0.2156)	(0.2688)	(0.2300)
+2 years	1.0348	1.3119	1.2938	1.0426	
	(0.2768)	(0.3798)	(0.2989)	(0.2486)	
Female	0.3672***	0.2387***	0.2562***	0.5216***	0.3444***
	(0.1000)	(0.0578)	(0.0548)	(0.0823)	(0.0938)
Balance	1.6043***	1.6185***	1.5706***	1.4586***	1.4025***
	(0.1387)	(0.1494)	(0.1069)	(0.1170)	(0.0975)
Conts.	1.1775**	1.0872	1.2681***	1.0988	1.1452**
	(0.0948)	(0.1221)	(0.1013)	(0.0918)	(0.0665)
Beg. Growth Allocation	1.0309***	1.0173**	0.9780***	1.0067	0.9935
	(0.0103)	(0.0084)	(0.0041)	(0.0024)	(0.0054)
Constant	0.0000***	0.0029***	0.0007***	0.0048***	0.0152***
	(0.0000)	(0.0016)	(0.0040)	(0.0036)	(0.0112)
			Change – Increase Growth		
- 2 years	0.9301	1.3004	0.8854	0.7391	1.5810
	(0.1550)	(0.2134)	(0.1824)	(0.1369)	(0.4630)
- 1 year	0.7672	1.0374	1.1900	0.9842	1.2899
	(0.1453)	(0.1790)	(0.2838)	(0.1549)	(0.3407)
+ 1 year	0.7149*	0.9531	0.7759*	0.6788**	1.1735
	(0.1347)	(0.1613)	(0.1173)	(0.1151)	(0.2304)
+2 years	1.1303	0.7725	0.9310	0.9496	
	(0.2017)	(0.1653)	(0.1435)	(0.2110)	
Female	0.1791***	0.2237***	0.2282***	0.2168***	0.4400***
	(0.0364)	(0.0757)	(0.0695)	(0.0432)	(0.0661)
Balance	1.4401***	1.8743***	1.8397***	1.6118***	1.4366***
	(0.1237)	(0.1644)	(0.1015)	(0.1249)	(0.1380)
Conts.	1.2381***	1.1712**	1.2187***	1.1478*	1.1092
	(0.0960)	(0.0838)	(0.0726)	(0.0685)	(0.0754)
Beg. Growth Allocation	0.9913**	0.9839***	0.9742***	0.9795***	0.9791***
	(0.0034)	(0.0024)	(0.0030)	(0.0072)	(0.0040)
Constant	0.0029***	0.0039***	0.0111***	0.0010***	0.0000
	(0.0016)	(0.0022)	(0.0007)	(0.0010)	(0.0000)
			Change – Reduce Growth		
- 2 years	0.7795	1.0165	0.7784	0.4268***	0.5223**
	(0.2461)	(0.2696)	(0.1696)	(0.0807)	(0.1652)
- 1 year	0.8956	1.1199	1.0186	0.5844***	0.7561
	(0.2209)	(0.2098)	(0.2483)	(0.1031)	(0.2197)
+ 1 year	0.9422	0.7919	1.2479	1.0082	1.0846
	(0.2160)	(0.1778)	(0.2308)	(0.1941)	(0.2932)
+2 years	1.1646	0.8131	1.2226	1.1788	
	(0.3139)	(0.1883)	(0.2351)	(0.2066)	
Female	0.2782***	0.2798***	0.2389***	0.3934***	0.3503***
	(0.0598)	(0.0550)	(0.0422)	(0.0764)	(0.0726)
Balance	1.5955***	1.4618***	1.7769***	1.6963***	1.3547***
	(0.1468)	(0.1032)	(0.1206)	(0.1141)	(0.1151)
Conts.	1.1528	1.0217	1.3684***	1.0681	1.1912**
	(0.1078)	(0.0744)	(0.1175)	(0.0936)	(0.0976)
Beg. Growth Allocation	0.9842***	0.9800***	1.0086	0.9798***	0.9778***
	(0.0033)	(0.0030)	(0.0095)	(0.0033)	(0.0037)
Constant	0.0069***	0.0001***	0.0056***	0.0394***	0.0316***
	(0.0042)	(0.0001)	(0.0056)	(0.0198)	(0.0280)
Observations	33,631	33,342	28,478	20,114	10,939
Sub-plans	154	149	148	143	133
Log-Likelihood	-4242	-5041	-5007	-4375	-2739

Table 6 Likelihood of Making a Contributions Investment Change

This table reports the odds-ratios of making types of Contributions Investment Changes in a financial year broken down by the direction of the change in growth assets: Neutral (+ or - 5 percent change growth assets); Increase in growth assets; or Decrease in growth assets relative to a No Change as the base category. The results are estimated within a financial year estimated from an individual member random effects multinomial logit model. Each column reports an estimation for a five-year milestone age cohort with indicators included for the individual years prior to and after the nominated milestone age. The Balance and Employer Contributions coefficients are based on standardised values of each variable across each financial year's 5-year age-cohort. Financial year indicators are also included. Robust errors are clustered at sub-plan level with significance indicated at 99%***, 95%**, and 90%* level.

	40th	45th	50th	55th	60th
			Change – Neutral Growth		
- 2 years	1.2744	1.2573	1.2175	0.7097	1.0494
	(0.4266)	(0.3406)	(0.3186)	(0.1907)	(0.4030)
- 1 year	1.3156	1.0924	1.0941	0.6963*	0.9398
	(0.3537)	(0.2614)	(0.2352)	(0.1479)	(0.2895)
+ 1 year	1.2402	0.7162*	1.3786	1.1917	0.8900
	(0.2985)	(0.1318)	(0.2837)	(0.2682)	(0.2825)
+2 years	2.0113***	1.2570	1.8132***	1.2659	
	(0.4786)	(0.3048)	(0.4021)	(0.3720)	
Female	0.3429***	0.3308***	0.2890***	0.2378***	0.3001***
	(0.0736)	(0.0777)	(0.0481)	(0.0734)	(0.0798)
Balance	1.4695***	1.7006***	1.7538***	1.6976***	1.5533***
	(0.1044)	(0.1012)	(0.0825)	(0.1239)	(0.1000)
Conts.	1.3192***	1.1134	1.3731***	1.1194	1.0548
	(0.0997)	(0.1062)	(0.0864)	(0.1266)	(0.0723)
Beg. Growth Allocation	1.0248***	1.0181***	0.9790***	1.0046	0.9963
	(0.0080)	(0.0029)	(0.0064)	(0.0066)	(0.0032)
Constant	0.0001***	0.0002***	0.0161***	0.0036***	0.0493***
	(0.0001)	(0.0041)	(0.0046)	(0.0026)	(0.0152)
			Change – Increase Growth		
- 2 years	1.3179*	1.6978***	1.2537	1.0914	1.1941
	(0.2189)	(0.3431)	(0.2828)	(0.2156)	(0.3837)
- 1 year	0.8258	0.9960	1.4120	1.2385	0.9636
	(0.1391)	(0.1743)	(0.3702)	(0.2125)	(0.2791)
+ 1 year	0.6678**	0.8937	0.9871	0.9054	1.1024
	(0.1250)	(0.1687)	(0.1415)	(0.1822)	(0.2221)
+2 years	0.8896	0.9606	1.0589	1.2723	
	(0.1838)	(0.1655)	(0.2050)	(0.2917)	
Female	0.2041***	0.3496***	0.3037***	0.5073***	0.4817***
	(0.0341)	(0.0623)	(0.0582)	(0.0842)	(0.0814)
Balance	1.3967***	1.3293***	1.7230***	1.6210***	1.3815***
	(0.1221)	(0.0908)	(0.0830)	(0.1297)	(0.1405)
Conts.	1.3179***	1.2278**	1.3785***	1.2461	1.2352***
	(0.0986)	(0.0987)	(0.0902)	(0.1318)	(0.0907)
Beg. Growth Allocation	0.9859***	0.9800***	0.9795***	0.9818***	0.9832***
	(0.0031)	(0.0030)	(0.0030)	(0.0036)	(0.0064)

Constant	0.0072***	0.0069***	0.0008***	0.0018***	0.0165***
	(0.0042)	(0.0014)	(0.0005)	(0.0015)	(0.0024)
			Change – Reduce Growth		
- 2 years	1.1066	0.8380	0.8911	0.5085***	0.4545**
	(0.3723)	(0.2160)	(0.1900)	(0.0974)	(0.1645)
- 1 year	0.9777	0.9848	0.8734	0.6353**	0.8705
	(0.2020)	(0.1947)	(0.1725)	(0.1198)	(0.2114)
+ 1 year	0.9227	0.8144	1.1170	1.2029	1.1391
	(0.2242)	(0.1671)	(0.1934)	(0.2313)	(0.2614)
+2 years	1.2380	0.7563	1.5853***	1.2245	
	(0.3076)	(0.1648)	(0.2764)	(0.2308)	
Female	0.2923***	0.3006***	0.1516***	0.4940***	0.3416***
	(0.0663)	(0.0853)	(0.0551)	(0.0477)	(0.0856)
Balance	1.4320***	1.4087***	1.5272***	1.4314***	1.2892***
	(0.1242)	(0.1311)	(0.1185)	(0.1315)	(0.1095)
Conts.	1.1844*	1.2402**	1.4471***	1.1730	1.2922***
	(0.1127)	(0.1068)	(0.0823)	(0.2104)	(0.1028)
Beg. Growth Allocation	0.9815***	0.9835***	1.0062	0.9788***	0.9763***
	(0.0038)	(0.0059)	(0.0026)	(0.0025)	(0.0039)
Constant	0.0080***	0.0029***	0.0077***	0.0451***	0.0022***
	(0.0047)	(0.0002)	(0.0065)	(0.0227)	(0.0387)
Observations	33,631	33,342	28,478	20,114	10,939
Sub-plans	154	149	148	143	133
Log-Likelihood	-4512	-5262	-4947	-4424	-2716

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