"An Experimental Study of the Effect of Prior Market Experience on Annuitization and Equity Allocations"

4/2/2010

Keywords (behavioral finance, annuities, equity allocation, retirement, excessive extrapolation, experimental economics)

Julie R. Agnew (corresponding author), Associate Professor of Economics and Finance, The Mason School of Business, College of William and Mary, P.O. Box 8795, Williamsburg, VA 23187, phone (757) 221-2672, fax (757) 221-2937, e-mail:julie.agnew@mason.wm.edu.

Lisa R. Anderson, Francis T. West Professor of Economics, Department of Economics, College of William and Mary, P.O. Box 8795, Williamsburg, VA 23187, phone (757) 221-2359, fax (757) 221-1175, e-mail: lisa.anderson@wm.edu.

Lisa R. Szykman, Associate Professor of Marketing, The Mason School of Business, College of William and Mary, P.O. Box 8795, Williamsburg, VA 23187, phone (757) 221-2908, fax (757) 221-2937, e-mail: lisa.szykman@mason.wm.edu.

Preliminary Draft: Please do not circulate or cite without the authors' permissions.

This publication was made possible by a generous grant from the FINRA Investor Education Foundation.

I. Introduction

As annuities become an increasingly prevalent distribution option in 401(k) plans, more individuals will be faced with the decision of whether or not to annuitize their retirement savings. Theoretical models have shown that many individuals could benefit from annuitizing their wealth but empirical evidence shows that the actual market for lifetime annuities is much smaller than what is theoretically expected.[1] This fact is known as the "annuity puzzle" and, until recently, most of the efforts to unravel this mystery have focused on models of rational behavior. It has only been in the past few years that academics have looked at the annuitization decision from a behavioral perspective. Initial studies have shown that this is a promising direction for research (see for example, Agnew et al. 2008, Brown 2008, Brown et al.2008 and Hu and Scott 2007) This study adds to this new stream of literature by using experimental methods to investigate how information biases and behavioral biases, such as excessive extrapolation, play into the decision to annuitize. The study also examines whether people who choose to invest their wealth rather than purchase an annuity are influenced by past returns. This paper is an extension of the work by Agnew et al. (2008).

Specifically, participants in our experiment play a retirement game that requires them to make financial decisions that are commonly faced by individuals when they retire from their jobs. The first decision participants make is whether to invest their "retirement savings" in a simulated market or to invest the money in an annuity. We investigate how the sample market returns experienced during a demonstration of how the game is played influence the participants' choice between annuities and investments. For those participants who choose the investment option, we also study how the practice

[1] In this paper, we are referring to single premium, immediate, fixed, lifetime annuities (SPIAs).

returns influence the specific amount of money invested in the market. Because the market returns from our practice rounds are completely independent from the market returns in the actual rounds, the returns during the practice rounds should have no influence on the participant's choice between the investment and the annuity, nor should they influence how much is invested in the market.

We find evidence that if participants experience a series of positive returns in the practice rounds, their probability of choosing the investment significantly increases. For example, if returns in both practice rounds are positive, a participant is 8.6% more likely to choose the investment than a participant that experienced one positive and one negative return (hereafter, mixed returns) during the practice period. Similarly, those participants choosing the investment option invest $3.26 more in the market if they experience two positive practice round returns than others who experience mixed returns. This is a substantial increase, considering that $55 is the maximum amount that can be invested. Likewise, if the participant experiences two negative practice returns, they invest $3.84 less in the market relative to a participant experiencing mixed returns. These results support behavior consistent with excessive extrapolation.

Our findings are consistent with recent empirical work showing a relationship between the probability of annuitization and past returns (Chalmers and Reuter 2009, Previtero 2010). This paper serves as a useful complement to these studies because our novel experimental approach allows us to more cleanly test the role of past market experience by carefully controlling for many factors that may confound the analysis in an empirical study using administrative data.

For example, a finding of a positive relationship between past market performance and the probability of choosing an investment over an annuity could be interpreted in two ways. First, individuals might be erroneously inferring future equity returns based on recent equity market movements. Thus, positive market returns may make the investment choice appear more attractive than the annuity and increase the probability of its selection. For the same reason, conditional on choosing the investment, participants might also purchase more equities than if the returns were negative. Both behaviors would be consistent with excessive extrapolation. A second possible interpretation is that individuals' assets outside their observed retirement accounts are influencing behavior. In this scenario, if individuals have wealth-dependent risk aversion, they will become less risk averse if their outside assets perform well in an up market. This decrease in risk aversion due to the performance of their outside assets will make them less likely to choose an annuity (Mitchell, Poterba, Warshawsky and Brown 1999).

It is difficult to rule out the second interpretation using standard empirical data sets. However, our experimental design allows us to eliminate this explanation. Because each individual starts with the same endowment and no other assets are included in the experiment, wealth dependent risk aversion cannot drive our results. By conducting a controlled laboratory experiment, we are able to cleanly test for the presence of excessive extrapolation, providing support for empirical studies using administrative data that suggest it influences the annuity decision.

Additional advantages of our experimental approach are that we can directly measure risk aversion and financial literacy levels for each individual instead of relying

on indirect proxies (such as demographic variables) that are used in administrative datasets. We are also able to closely control how the financial information is presented, which is not possible with traditional data from administrative sources. Finally, by using dice rolls to calculate market returns, we eliminate any possible correlation between market returns from one round to the next or the potential for participant-specific investment skills to influence decisions.[2] Hence, the returns experienced in the practice rounds should in no way rationally influence investment choices in the actual experiment.

Our findings have real world implications. They suggest that we may be able to make predictions about how people will invest in annuities and whether they will annuitize during different market cycles. Consistent with our findings, LIMRA reports that the annual demand for fixed annuities increased substantially in 2008 following the severe market downturn. The demand for these products had been much lower in the 5 years proceeding.[3] Our findings also have implications for experimental research in general. Specifically, researchers should be cautious in using actual numerical examples in the instructions for an experiment.

Our paper is laid out as follows. In the next section we provide a brief overview of the past literature. In Section III we describe our experimental design. In Section IV we describe our data. Sections V and VI are devoted to an econometric analysis of the annuity decision and the equity allocation decision, respectively. Section VII concludes.

[2] Choi et al. (2009) test whether there is empirical support in their data for return chasing being driven by rational learning about one's own investing skill and find no support. It is possible that a positive relationship between personal performance and annuitization could be generated by differences in the participants' investment skills. In this case, it would be expected that the participants who exhibit superior investment skills would generate relatively higher portfolio performance than others. It would also be expected that those with superior skills would be more likely to prefer the investment option. Our experiment eliminates the possibility of superior investment skills.

[3] We thank LIMRA International for providing data that we will report in the next working draft of this paper.

II. Brief Literature Review

There is growing evidence that information in the marketplace can influence an individual's decision in seemingly irrational ways. For example, excessive extrapolation is a theory suggesting that individuals can erroneously extrapolate from past returns. In other words, even though stock returns are largely unpredictable, individuals might view abnormal past stock performance as representing future stock performance. This view may lead to ill-informed financial decisions.

Very recently, Previtero (2010) finds evidence of excessive extrapolation using administrative data. He examines the payout decisions of more than 103,000 US employees from 112 defined benefit plans over the 2002-2008 period and finds that the likelihood of purchasing an annuity decreases with positive past stock market returns. Similarly, using a separate dataset provided by LIMRA International over the 1985-2009 timeframe, he finds that a one standard deviation increase in stock market returns decreases the sales of total fixed annuities by more than 25 percent after controlling for interest rates and business cycles. Chalmers and Reuter (2009) also find that individuals participating in the Oregon Public Employees Retirement System demand partial lump sum payouts over life annuity payouts more when equity market returns over the 12 preceding months are higher.

There are several possible explanations for the observed negative relationship between returns and annuitization. Previtero (2010) discusses several of them in his paper and discusses the challenges of testing these explanations using empirical data. One explanation is that retirees infer future equity returns based on recent market

performance, which is consistent with excessive extrapolation.[4] In other words, the investment option becomes increasingly more attractive when the expected returns in the market are higher and vice versa. A second theory is that higher recent equity market returns cause the participants' other sources of income to produce retirement benefits that are greater than expected. This could lead them to be less likely to annuitize because they have wealth-dependent risk aversion. Neither Previtero (2010) nor Chalmers and Reuter (2009) can definitively rule out the second theory because neither use data that include information about other potential income sources. Our experiment addresses this issue and thus, provides a cleaner test of excessive extrapolation.

We also test for evidence of excessive extrapolation in portfolio allocations, as has been observed in 401(k) plans. Several authors find that individuals tend to invest more in their own company's stock when the past performance is strong (Benartzi 2001, Choi et al. 2004, Huberman and Sengmueller 2004, Agnew 2006, Brown et al. 2007). In addition, Benartzi and Thaler (2007) find that individuals make asset allocation choices in 401(k) plans based on past performance. Finally, Agnew and Balduzzi (2009) find that of the limited individuals that trade in 401(k) plans, the asset transfers into and out of assets at the aggregate level follow returns. This is known as positive feedback trading. While this evidence exists, there are no studies to our knowledge that look at the combined annuitization and allocation decision, and this paper helps fill this gap.

III. Experimental Design

[4] This could also be consistent with a naive learning heuristic. Choi et al. (2009) find that 401(k) savings rates increase more when investors experience high average and/or low variance returns relative to others who do not experience the same returns.

This experiment differs from the typical economics experiment in several ways. First, we deliberately introduce context into the design through the use of PowerPoint slide shows, since one focus of the main study is how information biases influence choice.[5] Another unique feature of the design is that we capture individual-specific measures of risk tolerance and financial literacy. Additionally, other distinguishing features of this study are the large number of participants and the wide age range of the subjects. For this study, we recruited over 790 female and male non-student subjects from the greater Williamsburg, Virginia area, ranging in age from 19 to 89. The average age was 55. We also recruited subjects from a wide distribution of incomes and education.

As participants arrived for the session, they were assigned to one experimental assistant who sat beside them in the room. Each assistant worked with two participants per session, and we averaged a total of ten participants per session. Given the wide age distribution of our subject pool, all of the experiments and surveys were conducted with pen, paper and dice. For record keeping purposes, assistants used laptop computers with Excel spreadsheets designed specifically for the investment choice experiment. Assistants recorded subject decisions and die throws on the spreadsheet, which calculated earnings each round. Participants had the option of using a calculator to double-check earnings and subjects also recorded earnings on a record sheet.

Each session of the experiment began with subjects completing the lottery choice experiment from Holt and Laury (2002). We used this lottery choice experiment to measure risk tolerance. The participants made a series of ten choices between two options (one being riskier than the other). For each choice, the probability of payout

[5] For more detail about our message framing, please refer to Agnew et al. (2008).

between the two options (determined by a die roll) varied. Once they completed all ten choices, one decision was randomly selected for payment by the throw of a 10-sided die. Then another die throw was used to determine subject earnings, which were paid in cash. We used payoffs that were three times the low (baseline) condition in Holt and Laury (2002). Earnings for the lottery choice experiments averaged $6.87.

Once subjects completed this experiment, they worked independently on the ten question financial literacy quiz adapted from several literacy tests used in previous studies (Agnew and Szykman 2005, Hilgert, Hogart and Beverly 2003, Wilcox 2003, John Hancock Financial Services 2002). The quiz tested basic financial concepts, such as understanding the importance of saving early, specifics about financial instruments and more advanced topics like the definition of beta. The quiz was designed to achieve a wide distribution of scores in order to separate individuals into high literacy and low literacy groups.

After all subjects completed the financial literacy quiz, we made a five-minute PowerPoint presentation about the investment choice experiment. The presentations were framed either to favor the annuity choice, favor the investment choice or favor neither choice.[6]

After the PowerPoint presentation, we distributed the instructions (see Appendix 1, available online) for the investment choice experiment called the retirement game. To ensure all the participants fully understood the game, the instructions were read aloud and we completed two practice rounds that demonstrated how the game is played for both the investment and annuity choice.

[6] Please refer to Agnew et al. 2008 for a complete description of stimulus development and content.

In the retirement game, participants were given $60 to either purchase an annuity or invest in a simulated market. Subjects who chose the annuity option received a fixed payment of $16.77 for each round of their simulated life, up to a maximum of 6 payments totaling $100.62. The annuity did not have survivor benefits, so once a subject "died" this part of the experiment ended. Lifespan was determined by dice rolls. All participants faced the same probability of continuing in the game each period and were made aware of these probabilities upfront, so adverse selection was not a concern. Each round corresponded to one month in real time, and subjects were paid using post-dated checks. Subjects were told in advance that they would receive all of their checks at the end of the experimental session.

Subjects who chose the investment option decided how much to withdraw from their account each round (i.e., how much to allocate to their check for that round) and how much to invest in a simulated market, with returns that ranged from negative 38% to positive 54%. These returns were based on the distribution of annual returns net the risk-free rate from the overall stock market from 1926 to 2005. The return for each period was determined by the sum of the rolls of two six-sided dice. Each sum was associated with one market return. Any money not withdrawn or invested carried over from round to round on a dollar for dollar basis (i.e., earned a risk free rate of return of zero). At a minimum, subjects had to withdraw $5, which represented basic living expenses for the period. As described above, subjects were paid with post-dated checks, so there were real time delays associated with choosing future over present consumption in the lab. Whether subjects progressed to the next period was determined in the same manner as in the annuity option. If subjects ran out of money before the game was over, they were

charged a monetary penalty that was deducted from their earnings. The penalty was charged each period they had an insufficient balance. We simulated a bequest in the investment option by paying subjects 20% of their balance when they "died." Overall, subjects earned an average of $50 in the game.

As mentioned earlier, two practice rounds of the investment decision were completed prior to playing the game. The only difference from the real round was that the market die rolls in the practice round were thrown by the person reading the instructions at the front of the room and applied to everyone in the room. In the actual rounds, the assistant threw the die for each participant separately. Thus, each individual in the session had a different die roll each round.

Finally, we implemented a subtle default option. Near the beginning of the instructions (found in the section labeled "Your Decisions" in the instructions available in Appendix 1 online) we added the following sentence: "If you do not make a decision, you will automatically receive the annuity (or investment)." In addition, at the end of the instructions we added the following statement: "The annuity (investment) record sheet is on the next page. If you want the annuity (investment), please turn the page to begin. If you prefer to choose the investment (annuity) option, please ask your assistant for an investment (annuity) record sheet."

The session ended with subjects completing a survey. Select questions can be found in the online Appendix. While subjects completed this survey, we printed the checks earned in the experiments. Once a subject completed the survey, they were given their checks and dismissed from the session. Sessions lasted about one and a half hours on average.

IV. Data

For this paper we use the same dataset described in Agnew et al. (2008). Table 1 provides the demographic characteristics, as well as additional individual measures that capture risk tolerance (mid-CRRA, gamble indicator), financial literacy levels, actual asset holdings (own annuity indicator, own stock indicator), past practice round market experience (cumulative practice returns, two positive practice round returns, two negative practice round returns) and actual past market experience (lost money in past indicator) of the participants.

As in Agnew et al. (2008), we limit our study sample to individuals for which we can calculate an accurate measure of the Holt and Laury (2002) coefficient of relative risk aversion (CRRA). As a result, we exclude from this original sample 46 subjects who chose a certain payoff of $6.00 over a certain payoff of $11.55 in the lottery experiment, and 52 subjects who made two or more switches between the safe lottery and the risky lottery, because we interpret these choices as indicating that these subjects did not understand the experiment. We discuss the risk measure in more detail below. New to this study is that we also exclude participants (46 individuals) with missing practice round return data. This was possible if during the first practice round, the participant "died" and the instructor did not continue with the example. In some cases, even when the participant "died" in the first practice round, the instructor continued with an example of the second round and a market roll. These individuals were included in this sample because they experienced two practice rounds. All tables report results from this reduced sample.

As mentioned in the Introduction, we use the returns generated from the two practice rounds conducted during the reading of the instructions for the game. It is made clear to the participants that these rolls have no influence on the outcome of the actual experiment. Therefore, they should rationally have no influence on subsequent decisions during the actual rounds. We calculate two past market performance measures from these returns that we use in the subsequent analysis. The first is the cumulative return over the two practice rounds, which is calculated as follows:

$$\text{cumulative return} = ((1+r_1) * (1 + r_2)) * 100 \quad (1)$$

where r_i is the "market" return in round i of the practice rounds

Table 1 reports that the average cumulative market return was 16 percent over the two practice periods. We also create two indicator variables intended to capture the possibility that individuals might perceive a trend in the returns that could lead to excessive extrapolation. If both practice round returns were positive, our indicator variable “Two Positive Practice Round Returns” equals one. If not, it equals zero. The same logic is used to create the indicator variable “Two Negative Practice Round Returns.” Thirty one percent of the sample experienced two positive returns, while 6 % experienced two negative returns.

We include indicator variables to control for the bias and default treatments. Individuals were broken down relatively evenly among the different treatments.

As mentioned earlier, our measure of risk tolerance is based on the Holt and Laury (2002) lottery choice survey. In our analysis, we use the midpoint of the range of the coefficient of relative risk aversion (CRRA) for each subject following the Harrison, List and Towe (2007) methodology. We also include an indicator variable called “gamble

indicator" that is one if they indicated they gambled or purchased lottery tickets in the last year three or more times. This is meant to be an additional measure of risk taking.

In addition, we use several measures to capture actual investment experience. "Own Annuity Indicator" is a variable that equals one if a participant indicated they actually own an annuity. Similarly, "Own Stock Indicator" is a variable that equals one if they own stocks. "Lost Money in the Past Indicator" equals one if the individual answered yes to the question "In any given year have you lost what you consider to be a large amount of money in the stock market?" While not directly related to the experiment, these personal experiences may influence participants' decisions in the game. For example, a person who actually owns an annuity may be more likely to choose the annuity option because they are more familiar with annuities than someone who does not own an annuity. Similarly, a person who suffered a loss in the stock market may be less likely to choose the investment option in the game in order to avoid another loss.

Finally, our analysis includes several control variables. As documented in much of the 401(k) retirement literature, we know individuals tend to not change their initial investment decisions, a finding commonly called inertia. To control for this in the analysis of the equity decision, we include a variable that equals the dollars invested in equity during the first round of the practice rounds. We use this same variable in our analysis of the annuity decision because it might also proxy for the risk taking nature of the individual. Those who are more risk seeking would be expected to be more likely to choose the investment option. We also control for the demographic characteristics listed in Table 1. Empirical research has shown the role of demographic variables in equity

allocation and annuity decisions (for example, Agnew, Balduzzi and Sunden (2003), Chalmers and Reuter (2009) and Previtero (2010)).

V. Econometric Analysis of the Annuity Decision

Before turning to the econometric analysis, it is useful to look at some basic summary statistics to see if they suggest a relationship between practice round returns and the decision to choose the annuity or the investment in the actual experiment. Table 2 reports the number of individuals that fall into the three practice round return categories: two positive returns, mixed returns and two negative returns. These simple figures do not control for any of the variables that may influence their decision. Caution must also be taken when interpreting the results because the sample sizes are not equal and we are not testing significance. That said, these numbers are consistent with excessive extrapolation. Of those 250 participants who experienced two positive practice round returns, 72% chose the investment. For those 498 who experienced mixed returns, 66% chose the investment and of the small group of 48 who experienced two negative returns, 47% chose the investment. These very simple statistics suggest that further analysis is warranted.

To examine this further in Table 3 we present the results from a probit regression based on three different specifications that control for the variables we discussed earlier. We report the marginal effects from a probit analysis with robust standard errors. The dependent variable equals one if the participant chose the investment, and zero if not. The note section at the bottom of the table provides more details about the analysis and how the marginal effects are calculated. Consistent with our simple statistics, the results suggest that the gains and losses from the sample period influence the decision to

purchase an annuity. Our results demonstrate a significant relationship between cumulative past returns in Model 1 but not in the other two models. Our alternative specification for returns, which should reveal if individuals are following trends in returns, is significant across all three models. In our most complete specification, Model 3, a participant earning two positive returns is 8.6% more likely to choose the investment. Thus, it appears that individuals are influenced the most by past trends in the performance.

Our results also reveal that even when controlling for past returns, the influence of information biases is strong and significant. Based on Model 3, an individual in the annuity bias condition is 14% less likely to choose the investment relative to the neutral condition, while an individual in the investment bias condition is 16.4% more likely to choose the investment versus the neutral.

Not surprisingly, more risk averse participants are less likely individuals to choose the investment. Individuals considered more financially literate are also more likely to choose the investment option. It is not clear why this would be a factor because the choice is actuarially fair. One explanation could be that those who are more financial literate are more familiar with investment options. They may be exhibiting a familiarity bias. Alternatively, those who are less financially literate may be choosing the annuity option because it requires less decision-making and is less overwhelming given their limited knowledge.

Interestingly, personal experience also has an influence on a person's decision. Those who own annuities are 14% less likely to choose the investment, while those who

own stock are 10% more likely to choose the investment option. Thus, once again a familiarity bias may be in play.

VI. Econometric Analysis of the Equity Allocation Decision

The next step in our analysis investigates whether the amount of money invested in the market was influenced by the outcome of the practice rounds.[7] Similar to the previous section, we look at some basic summary statistics using our three categories of past returns. Simply looking at the levels of equity allocation in the first round, we find that the average dollars invested in equity was highest ($33.37) when two positive practice returns were observed. This amount decreased to $30.07 for mixed returns and $28.74 for two negative returns. Thus, it appears that the level of investment changes as we would expect.

Given the documented inertia in 401(k) plans, we expected that several individuals might not change the dollars they commit to equity from the practice to real rounds.[8] As you can see in Table 4, 44% of the sample maintained the same dollar amount in equities in the first round of the experiment compared to the first round of the practice rounds. Additionally, we also want to see if the changes in equity investment from the first round of the practice round to the first actual round moved in the direction consistent with excessive extrapolation. Once again we have not tested for significance nor controlled for important factors that might influence this decision. That said, the

[7] This analysis was limited to only participants who chose the investment option since the annuity option did not include any further decisions.

[8] We also tried different measures for equity allocations such as the percent of the investable assets (equity holding account) put in equity and the percent of the maximum possible dollars ($55 in the first round assuming the minimum $5 withdrawal) put in equity. Our findings related to prior returns were qualitatively the same and are available upon request.

overall pattern is consistent with a behavioral explanation. When there are two positive practice returns, the percent increasing their allocation (46%) is higher than the percent decreasing it (10%). When returns are mixed, 28% of participants increased their investment and 28% decreased their investment from the practice rounds. In the case of two negative returns, the reverse holds. Those increasing equity (14%) are less than those decreasing equity (38%)

The simple statistics once again suggest that further analysis is necessary. Therefore, to control for other factors that may influence this decision, we estimated a tobit regression of the dollars invested in equity in Table 5 and found that for a 10 percent increase in returns, the amount invested in equities increased by 42 cents based on the full specification. In addition, we found that two positive (two negative) practice returns amounted to a $3.26 increase ($3.84 decrease) in equity investment from the mixed case. Given that the absolute maximum amount that can be invested in equity is $55, this is a substantial increase.

The biases had no influence on the subsequent equity allocation, but interestingly, if the individual had gambled or bought lottery tickets more than three times in the previous year, they were expected to allocate close to $3.00 more to equities than others.

Finally, we estimate a multinomial logit model to investigate how the probabilities of three outcomes (increasing, decreasing or not changing equity investment from the sample round) are influenced by the practice round returns.[9] To properly estimate the model, we must eliminate participants that in the sample round were invested

[9] We initially estimated an ordered logit to investigate how the probabilities of the three outcomes are influenced by the practice round returns. We chose the ordered logit model because of the ordered nature of the data. However, we tested the parallel regression assumption for this model using an approximate LR test initiated with the omodel command in Stata and found that we had to reject that assumption (for more information, see Long and Freese 2006)

at the extremes, meaning either an investment of nothing in equity or the maximum of $55 in equity. This eliminated 85 participants. Table 6 reports the main results for the full specification (Model 3 in previous tables). In the first specification with the cumulative sample returns we find both coefficients significant. The coefficients are calculated relative to the base category, which is the no change in equity allocation category. We also conduct a Likelihood Ratio test and Wald test on the cumulative sample return and in both cases the hypothesis that all the coefficients associated with this variable are simultaneously equal to zero can be rejected at the .01 level. To help interpret our results in Figure 1 we plot the predicted probabilities of each outcome relative to a range of prior practice returns. If past returns do not matter, the probabilities of each outcome should be unchanged relative to the cumulative returns from the practice period. In other words, all the lines should be horizontal. We find that the predicted probability of the individual being in the "increasing equity" outcome increases with cumulative returns. In the opposite fashion, the predicted probability of the "decreasing equity" outcome falls with increases in sample returns. The probability of not changing the equity allocation falls slightly as the returns increase. Thus, this suggests that past returns influence changes in equity investment in our experiments.

We also run a multinomial logit using the return indicator variables. Referring back to Table 6, it is only the two positive returns that influence the outcomes. The Likelihood Ratio Test and the Wald Test both reject the null hypothesis, suggesting that positive returns do matter. Table 7 reports the marginal effects from this specification and show that individuals experiencing two positive returns are 22.8% more likely to increase equity versus individuals experiencing mixed returns and 17.3% less likely to

decrease equity from the same relative group. While not significantly different from zero at the 95% level, the signs of the changes in probabilities is as expected for those experiencing the two negative returns.

VII. Conclusion

The annuity puzzle is a research topic that only recently has been approached from the behavioral standpoint. Recent research has shown that information framing can influence whether individuals annuitize or not (Brown et al. 2008, Agnew et al. 2008). This paper provides further support for research in this area by providing evidence that another behavioral bias, excessive extrapolation, can also influence this decision. Recent empirical work using novel datasets provide evidence supporting excessive extrapolation but cannot definitively rule out the possibility that wealth effects are driving the results. By controlling for wealth effects in this experiment, our findings provide further evidence that excessive extrapolation influences the annuity choice. This paper also contributes to the literature by demonstrating how excessive extrapolation may play into the subsequent equity allocation decision if the lump sum payout is chosen. To our knowledge, this is the first paper to test this subsequent allocation decision (either experimentally or with survey data) and we find significant effects. Given the importance of these allocation decisions to individuals' well being in retirement it is useful to understand what factors influence choices. Our findings should be tested with administrative data and, if significant results are found, plan sponsors and financial educators should consider effective ways to communicate the drawbacks of this type of investment approach.

As Previtero (2010) points out in his conclusion, much of the research in retirement has focused on the accumulation phase and a better understanding of financial decisions after people retire is needed. The annuity decision and subsequent asset allocation decisions are an important part of this post-retirement decumulation phase. In fact, Planadvisor (2009) reports that a recent Watson Wyatt survey found that nearly a quarter (22%) of defined contribution plans now offer an annuity as a distribution option, and that figure is expected to increase. Specifically, they report that 10 percent of the plans not offering this option are considering it. Furthermore, a December 2009 press release from the Department of Labor states that the agency is looking into ways to encourage defined contribution plans to offer lifetime annuities (Planadvisor 2009). As a result, it is becoming increasingly important to understand which factors influence participants' financial decisions related to annuities and investments during the decumulation phase of retirement.

References

Agnew, Julie R. 2006. "Do Behavioral Biases Vary Across Individuals? Evidence from Individual Level 401(k) Data." *Journal of Financial and Quantitative Analysis*, 41(4): 939-961.

Agnew, Julie R. and Lisa R. Szykman. 2005. "Asset Allocation and Information Overload: The Influence of Information Display, Asset Choice, and Investor Experience." *The Journal of Behavioral Finance*, 6(2): 57-70.

Agnew, Julie R., and Pierluigi Balduzzi. 2009. "The Response of Aggregate 401(k) Trading to Asset Returns." Working Paper.

Agnew, Julie R., Lisa R. Anderson, Jeffrey R. Gerlach and Lisa R. Szykman. 2008. "Who Chooses Annuities? An Experimental Investigation of the Role of Gender, Framing and Defaults." *American Economic Review: Papers & Proceedings*, 98(2): 418-422.

Agnew, Julie R., Pierluigi Balduzzi, and Annika Sundén. 2003. "Portfolio Choice and Trading in a Large 401(k) Plan." *American Economic Review*, 93(1): 193-215.

Benartzi, Shlomo. 2001. "Excessive Extrapolation and the Allocation of 401(k) Accounts to Company Stock." *Journal of Finance*, 56(5): 1747-1764.

Benartzi, Shlomo and Richard Thaler. 2007. "Heuristics and Biases in Retirement Savings Behavior." *Journal of Economic Perspectives*, 21(3): 81-104.

Brown, Jeffrey R. 2008. "Understanding the Role of Annuities in Retirement Planning." In Annamaria Lusardi (ed.), *Overcoming the Saving Slump: How to Increase the Effectiveness of Financial Education and Savings Programs*, 178-208. Chicago: University of Chicago Press.

Brown, Jeffrey R., Jeffrey R. Kling, Sendhil Mullainathan, and Marian V. Wrobel. 2008. "Why Don't People Insure Late-Life Consumption? A Framing Explanation of the Under-Annuitization Puzzle." *American Economic Review* 98(2), 304-309.

Brown, Jeffrey R., Nellie Liang, and Scott Weisbenner. 2007. "Individual Account Investment Options and Portfolio Choice: Behavioral Lessons from 401 (k) Plans." *Journal of Public Economics* 91:10, 1992-2013.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2004. "For Better or For Worse: Default Effects and 401(k) Savings Behavior." In David A. Wise (ed.), Perspectives on the Economics of Aging, 81-121. Chicago: University of Chicago Press.

Choi, James J., David Laibson, Brigitte C. Madrian and Andrew Metrick. 2009. "Reinforcement Learning and Savings Behavior." *Journal of Finance*, LXIV (6), 2515-2534.

Chalmers, John and Jonathan Reuter. 2009. "How Do Retirees Value Life Annuities? Evidence from Public Employees." Working paper.

Harrison, Glenn W., John A. List and Charles Towe. 2007. "Naturally Occurring Preferences Exogenous Laboratory Experiments: A Case Study of Risk Aversion." *Econometrica*, 75(2): 433-458.

Hilgert, Marianne A., Jeanne M. Hogarth and Sondra G. Beverly. 2003. "Household Financial Management: The Connection between Knowledge and Behavior." *Federal Reserve Bulletin*: 310-322.

Holt, Charles A. and Susan K. Laury. 2002. "Risk Aversion and Incentive Effects." *American Economic Review*, 92(5): 1644-1655.

Hu, Wei-Yin, and Jason S. Scott. 2007. "Behavioral Obstacles to the Annuity Market." *Financial Analysts Journal* 63(3), 71-82.

Huberman, Gur, and Paul Sengmueller. 2004. "Performance and Employer Stock in 401(k) Plans." *Review of Finance* 8(3), 403-443.

John Hancock Financial Services. 2002. "Insight into Participant Investment, Knowledge and Behavior." Eighth Defined Contribution Survey.

Long, J. Scott and Jeremy Freese, 2006. Regression Models for Categorical Dependent Variables Using Stata. A Stata Press Publication, College Station, Texas.

Previtero, Alessandro. 2010. "Stock Market Returns and Annuitization." Working Paper, UCLA Anderson School of Management.

Planadvisor website. December 17, 2009. http://www.planadviser.com/More_Employers_Considering_Annuities_in_DC_Plans.aspx

Mitchell, Olivia, James Poterba, Mark Warshawsky and Jeffrey R. Brown. 1999. "New Evidence on the Money's Worth of Individual Annuities." *American Economic Review*, 89(5): 1299-1318.

Wilcox, R.T. 2003. "Bargain Hunting or Star Gazing? Investors' Preferences for Stock Mutual Funds." *Journal of Business*, 76(4): 645-655.

Table 1: Descriptive Statistics

N	799	**% Considered High Financial Literacy**[1]	44%
Average (Median) Age	55 (58)	**Avg. Midpoint of the Range of CRRA**	0.26
Race		**Personal Investments**	
% Black	10%	% Own Investments	59%
% Non-Black	89%	% Own One Annuity or More	28%
% Missing	1%		
Marital Status		**Gambling Habits**	
% Married	70%	% Who Gamble or Buy	27%
% Not Married	30%	Lottery Tickets More	
% Missing	0%	than 3 times a year	
Education		**Lost Money in the Stock Market**	
% High School or Less	8%	% Who Lost Money	42%
% Some College	20%	in the stock market	
% College	34%		
% Graduate Work	37%	**Returns from Practice Rounds**	
% Missing	0%	Mean Cumulative Return	16%
		Std. Dev. Cumulative Return	34%
Household Income			
Less than $20,000	4%	% Individuals Experiencing:	
$20,000 to $40,000	12%	Two Positive Returns	31%
$40,001 to $60,000	16%	Two Negative Returns	6%
$60,001 to $80,000	16%	Mixed Returns	63%
$80,001 to $100,000	15%		
$100,001 to $150,000	17%		
More than $150,000	11%		
% Missing	8%		

[1] Score of 8 or above on ten question exam

Table 2: Breakdown of Investment Decision Based on Practice Round Returns

Category	Number Choose Investment	Total Number in Category	% Choose Investment
Two Positive Practice Round Returns	180	250	72%
Mix of Positive and Negative Practice Round Returns	329	498	66%
Two Negative Practice Round Returns	23	48	47%
Total	532	796	67%

Table 3: Probit Regression: Dependent Variable Choose Investment

	Model 1		Model 2		Model 3		X
Dollars invested in Equity Practice Rounds	0.004 ***	0.004 ***	0.003 **	0.003 **	0.003 *	0.003 *	$29
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	
Cumulative Practice Returns	0.001 *		0.001		0.001		16.25
	(0.001)		(0.001)		(0.001)		
Two Positive Practice Round Returns[D]		0.098 **		0.085 *		0.086 *	0
		(0.045)		(0.049)		(0.052)	
Two Negative Practice Round Returns[D]		-0.067		-0.021		-0.055	0
		(0.089)		(0.098)		(0.103)	
Annuity Bias[D]	-0.153 ***	-0.138 ***	-0.160 ***	-0.151 ***	-0.153 ***	-0.140 **	0
	(0.050)	(0.052)	(0.055)	(0.057)	(0.057)	(0.059)	
Investment Bias[D]	0.138 ***	0.149 ***	0.146 ***	0.156 ***	0.155 ***	0.164 ***	0
	(0.049)	(0.051)	(0.053)	(0.055)	(0.057)	(0.059)	
Default Controls	YES	YES	YES	YES	YES	YES	
Mid-CRRA	-0.134 ***	-0.143 ***	-0.165 ***	-0.169 ***	-0.187 ***	-0.192 ***	0.26
	(0.048)	(0.049)	(0.053)	(0.052)	(0.056)	(0.056)	
High Financial Literacy[D]	0.135 ***	0.139 ***	0.130 ***	0.137 ***	0.131 ***	0.136 ***	
	(0.040)	(0.042)	(0.047)	(0.048)	(0.050)	(0.051)	
Demographic Controls	NO	NO	YES	YES	YES	YES	
Own Annuity Indicator[D]					-0.139 **	-0.139 **	0
					(0.055)	(0.055)	
Own Stock Indicator[D]					0.098 **	0.100 **	0
					(0.049)	(0.050)	
Lost Money in Past Indicator[D]					0.040	0.044	0
					(0.051)	(0.052)	
Gamble Indicator[D]					-0.001	-0.003	0
					(0.056)	(0.057)	
Pseudo R-Squared	0.10	0.10	0.13	0.14	0.15	0.15	
N	649	649	583	583	567	567	

Notes: This table reports the marginal effects from a probit analysis using robust standard errors. The dependent variable equals one if the participant chose the investment, and zero if not. The marginal effects are calculated holding the continuous variables (sample dollars gained/lost, age, number of people in the household) at their means for the entire sample and the indicator variables at zero (see X column for values used). The marginal effects for the indicator variables are for discrete changes of the indicator variable from zero to one. Indicator variables are denoted by the superscript D after the variable name. The non-demographic indicator variables are the annuity bias, investment bias, annuity default, investment default, and high financial literacy variables. The demographic control indicator variables include race, marital status, levels of education and household income ranges.

* Significantly different from zero at the 10 percent level.

** Significantly different from zero at the 5 percent level.

*** Significantly different from zero at the 1 percent level.

Table 4: Equity Allocations Summary Statistics

Category	Average Dollars in Equity First Real Round	Decrease Equity from Sample Round		Do Not Change Equity from Sample Round		Increase Equity from Sample Round		Total
		Number	%	Number	%	Number	%	
Two Positive Practice Round Returns	$33.37	14	10%	64	44%	66	46%	144
Mix of Positive and Negative Practice Round Returns	$30.07	80	28%	122	43%	80	28%	282
Two Negative Practice Round Returns	$28.74	8	38%	10	48%	3	14%	21
Total	$31.14	102	23%	196	44%	149	33%	447

Table 5: Tobit Regression: Dependent Variable Dollars Invested in Equity

	Model 1		Model 2		Model 3	
Constant	3.370 **	2.947 *	5.271 **	5.084 *	4.133	4.059
	(1.570)	(1.575)	(2.654)	(2.631)	(2.718)	(2.728)
Dollars invested in Equity Practice Rounds	0.893 ***	0.893 ***	0.885 ***	0.885 ***	0.895 ***	0.894 ***
	(0.034)	(0.034)	(0.036)	(0.035)	(0.035)	(0.035)
Cumulative Practice Returns	0.033 **		0.038 **		0.042 ***	
	(0.016)		(0.015)		(0.015)	
Two Positive Practice Round Returns[D]		2.609 **		3.006 ***		3.264 ***
		(1.070)		(1.101)		(1.100)
Two Negative Practice Round Returns[D]		-4.552 ***		-3.911 **		-3.842 **
		(1.502)		(1.689)		(1.540)
Annuity Bias[D]	-0.216	0.441	-0.545	0.203	0.030	0.745
	(1.258)	(1.275)	(1.338)	(1.357)	(1.347)	(1.370)
Investment Bias[D]	-0.804	-0.412	-1.301	-0.882	-0.988	-0.617
	(1.218)	(1.226)	(1.226)	(1.237)	(1.223)	(1.235)
Default Controls	YES	YES	YES	YES	YES	YES
Mid-CRRA	0.670	0.538	0.078	-0.009	-0.157	-0.255
	(1.059)	(1.063)	(1.040)	(1.027)	(0.987)	(0.975)
High Financial Literacy[D]	1.799 *	1.788 *	0.621	0.757	0.798	0.916
	(1.029)	(1.019)	(1.231)	(1.212)	(1.285)	(1.263)
Demographic Controls	NO	NO	YES	YES	YES	YES
Own Annuity Indicator[D]					0.113	0.202
					(1.320)	(1.317)
Own Stock Indicator[D]					-0.426	-0.316
					(1.212)	(1.211)
Lost Money in Past Indicator[D]					-0.904	-0.961
					(1.085)	(1.082)
Gamble Indicator[D]					2.776 **	2.719 **
					(1.113)	(1.111)
Left-Censored	2	2	2	2	2	2
Right-Censored	67	67	63	63	60	60
Pseudo R-Squared	0.15	0.15	0.16	0.16	0.17	0.17
N	447	447	409	409	398	398

Notes: This table reports the coefficents from a tobit analysis using robust standard errors. The dependent variable equals the dollars invested in the equity market during the first real experimental round. The lower limit is $0 and the upper limit is $55. Indicator variables are denoted by the superscript D after the variable name. The non-demographic indicator variables are the annuity bias, investment bias, annuity default, investment default, high risk and high financial literacy variables. The demographic control indicator variables include race, marital status, levels of education and household income ranges.

* Significantly different from zero at the 10 percent level.
** Significantly different from zero at the 5 percent level.
*** Significantly different from zero at the 1 percent level.

Table 6: Multinomial Logit Model: Dependent Variable Change in Equity from Sample Round 1 to Real Round 1

Model 3	Category (Base Category: No Change)								
Specification One	**Decrease Equity**	**Increase Equity**	**Likelihood Ratio Test**			**Wald Test**			**N**
	Coefficients	Coefficients	Chi-Squared	df	P-value	Chi-Squared	df	P-value	325
Sample Returns	-0.015 ***	0.007 *	15.653	2	0.000	13.4	2	0.001	
	(0.006)	(0.004)							
Specification Two	**Decrease Equity**	**Increase Equity**	**Likelihood Ratio Test**			**Wald Test**			**N**
	Coefficients	Coefficients	Chi-Squared	df	P-value	Chi-Squared	df	P-value	325
Two Positive Sample Returns	-1.438 ***	0.669 **	26.437	2	0.000	21.538	2	0.000	
	(0.463)	(0.302)							
Two Negative Sample Returns	0.344	0.787	1.785	2	0.410	1.584	2	0.453	
	(0.602)	(0.870)							

Notes: The dependent variable has three possible outcomes related to how the equity investment changes from the first sample round to the first real round of the experiment. The three categories are 1) increase equity from sample round 1 2) no change to equity in sample round 1 and 3) decrease equity from sample round 1. The multinomial regression was estimated using variables from Model 3. However, only the coefficients related to returns are reported. The base category is the no change to equity in sample round 1 category. Table 7 and Figure 1 are useful for interpreting the results of these regressions. The Wald and Likelihood Tests test the hypothesis that all the coefficients associated with the independent variable of interest are simultaneously equal to zero.

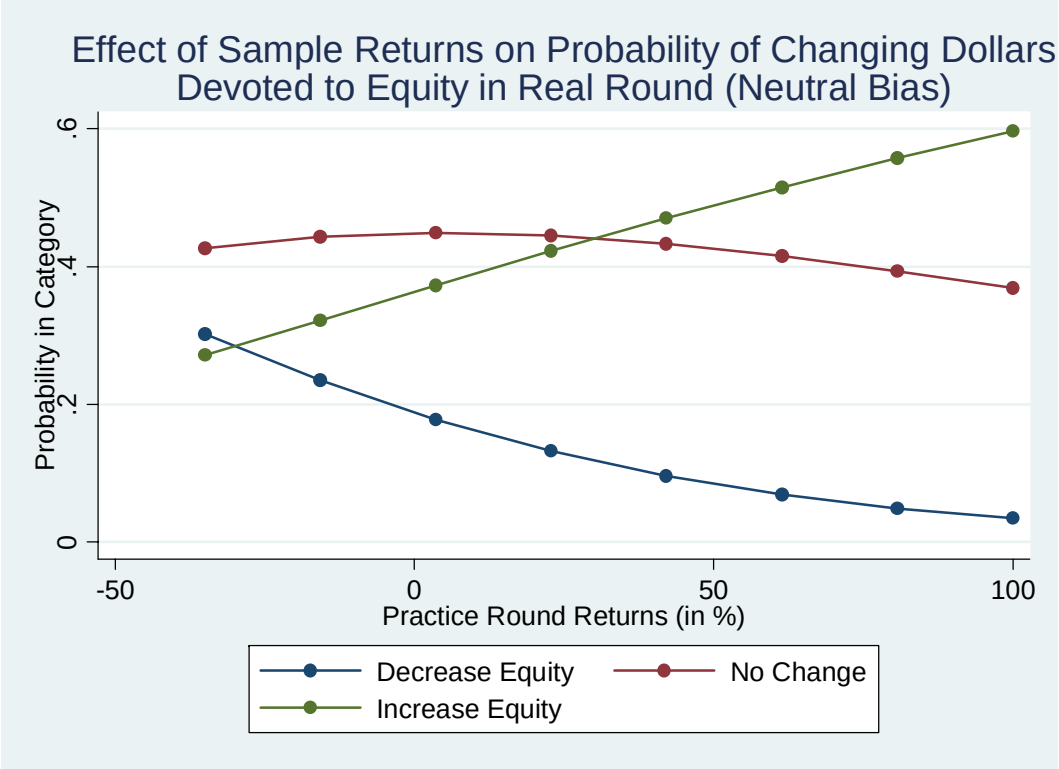
Table 7: Multinomial Logit Model: Change in Predicted Probabilities Based on Changes to Return Indicator Variables

Panel A. Change in Probability for Two Positive Returns				
	Change	95% Confidence Interval		
Decrease Equity	-0.173	[-0.341	to	-0.005]
No Change Equity	-0.055	[-0.233	to	0.123]
Increase Equity	0.228	[-0.079	to	0.376]

Panel B. Change in Probability for Two Negative Returns				
	Change	95% Confidence Interval		
Decrease Equity	0.117	[-0.137	to	0.371]
No Change Equity	0.042	[-0.385	to	0.067]
Increase Equity	-0.159	[-0.260	to	0.344]

Notes: This table reports the changes in predicted probabilities that result from changes to the return indicator variable. The dependent variable has three possible outcomes related to how the participant changes their equity allocation from sample round 1 to the real round 1. These outcomes are decrease equity from sample round 1, do not change equity from sample round 1, and increase equity from sample round 1. In Panel A. the change in market returns is from mixed to two positive returns. In Panel B. the change in market returns is from mixed to two negative returns. In both cases, we hold the continuous variables (sample dollars gained/lost, age, number of people in the household, etc.) at their means for the entire sample and the indicator variables at zero. Refer to the X column in Table 3 for the values used.

Figure 1:


Effect of Sample Returns on Probability of Changing Dollars Devoted to Equity in Real Round (Neutral Bias)
Probability in Category
0
.2
.4
.6
-50
0
50
100
Practice Round Returns (in %)
Decrease Equity
No Change
Increase Equity