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Aging, Financial Literacy, and Fraud

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by

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Abstract

This study examines how cognitive changes associated with aging impact the financial decision making capability of older Americans. We find that a decrease in cognition is associated with a decrease in financial literacy. Decreases in episodic memory, perceptual speed, and visuospatial ability are associated with a decrease in numeracy, and decreases in episodic and semantic memory are associated with a decrease in financial knowledge. A decrease in cognition also predicts a drop in self-confidence in general, but importantly, it is not associated with a drop in confidence in managing one's own finances. Participants experiencing decreases in cognition do show an increased likelihood of getting help with financial decisions; however, many participants experiencing significant drops in cognition still do not get help. This study also examines the risk factors for an older American being victimized by financial fraud. We find that overconfidence in one's financial knowledge is a significant predictor of the odds of falling victim.

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1. Introduction

There are concerns that financial decision making in the older population is compromised by the presence of cognitive decline in advanced age. These concerns combined with demographic changes resulting in an increasingly larger older population have sparked several recent studies on aging and financial decision making.[1] Recent studies find that older individuals are prone to worse financial decision making. For example, Korniotis and Kumar (2011) find that older investors exhibit less investment skill, and Agarwal et al. (2010) find that suboptimal credit behavior increases past age 53. Finke, Howe, and Huston (2011) suspect that financial decision making ability declines with age as financial literacy declines; indeed, they show that average financial literacy scores are lower by about 1% for each year after age 60. These existing studies indirectly examine the effects of cognitive aging on financial ability by comparing across individuals of different ages. Such comparisons confound the effect of cognitive decline with other differences, such as cohort effects. For example, Malmendier and Nagel (2011) find the cohort effect of early-life economic conditions on risk taking decades later. Direct measures of cognition collected repeatedly from the same individuals are needed in order to identify the effect of a decrease in cognition on financial ability.

We use longitudinal data from the Rush Memory and Aging Project, a large cohort study of aging, to identify, within individuals, the impact of decreases in cognition on financial literacy, financial confidence, and self-participation in financial decisions. In analyses restricted to persons without dementia based on a detailed clinical evaluation, we find that a decrease in cognition is a significant predictor of a decrease in financial literacy among older Americans. A

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[1] For example, see the articles collected in Li, Ridderinkhof, and Samanez-Larkin (2011) and Samanez-Larkin (2011). Also, Samanez-Larkin and Knutson (2013) provide a recent summary of much of this work.

decrease in cognition also predicts a drop in self-confidence in general, but importantly, it does not predict a decrease in confidence in managing one's own finances nor a decrease in confidence in one's financial knowledge.

The detrimental effects of cognitive aging on the financial choices of older Americans can potentially be mitigated with help for financial decisions provided within or outside of the household. We find that individuals who experience a decrease in cognition are more likely to stop managing their own finances and pass on this responsibility to their spouse, and they are more likely to get financial help from outside their household. However, there are still many participants who are experiencing cognitive decreases who are not getting help with their financial decisions. Even among the participants experiencing statistically significant decreases in cognition, about half are not getting help with their financial decisions. While these participants are likely to benefit from trustworthy, knowledgeable advice, knowing who to trust in financial matters can be problematic.

Older Americans have to be very careful in selecting who helps them with their financial decisions especially in light of the growing problem of financial fraud. In this study we also examine the risk factors for falling victim to financial fraud. Blanton (2012) reports striking statistics highlighting the rise of financial fraud in the United Sates. According to the Federal Trade Commission, fraud complaints have increased fivefold in the past decade, to more than a million in 2010. The number of enforcement actions filed by the Security and Exchange Commission against investment advisors and companies reached 146 in 2011, a new record. The problem of financial fraud is particularly important for older Americans, who are the most commonly victimized segment of the population. The FINRA foundation conducted a fraud

survey in 2012 among a representative sample of Americans aged 40 and over, and the results show that those age 65 and older are targeted more often and more likely to lose money when targeted than those respondents in their 40s.[2] The types of financial fraud revealed in this study included "419" frauds (Nigerian email fraud), lottery scams, penny stock scams, boiler room calls, pyramid schemes, and free lunch seminars that are actually sales pitches. In addition, the 2012 Senior Financial Exploitation Study[3] conducted by the Certified Financial Planner (CFP) Board of Standards, Inc., found that 56% of CFP professionals had an older client who had been exploited financially, and the average estimated loss was $50,000 per victim.

Seniors are particularly at risk for fraud. After decades of saving for retirement, many have reached their peak level of wealth, which attracts scammers. Furthermore, the shift from pension plans to individual retirement accounts puts individuals in charge of managing more of their own financial assets, thus enabling bigger frauds. The problem of fraud therefore is likely to increase dramatically as the baby boom generation of Americans retires in record numbers.

We hypothesize that overconfidence in one's financial knowledge is a significant risk factor for being victimized by financial fraud. Our main measure of overconfidence combines a participant's answers to a set of standard financial literacy questions with her confidence rating for each answer. Overconfidence in financial knowledge is defined as getting the literacy questions wrong *while* thinking that the answers are correct. Overconfidence is particularly concerning for household financial decision making. Overconfidence is known to be a significant factor in explaining poor investment decisions of households. For example, Barber and Odean

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[2] Results available for download at
http://www.finra.org/web/groups/sai/@sai/documents/sai_original_content/p337731.pdf
[3] Results available for download at http://www.cfp.net/downloads/CFPBoard_Senior_Financial_Study_2012-08-20.pdf

(2000) show that households lose money by frequently trading stocks, and Barber and Odean (2001) connect this behavior to overconfidence. Goetzmann and Kumar (2008) show that investors who are overconfident diversify their investment portfolio less, thus taking on more risk than is necessary to achieve the same level of expected return.

We add to this literature with the novel finding that overconfidence is a significant risk factor for being victimized by financial fraud, an understudied and growing problem among the burgeoning population of retirees. We find that a one standard deviation increase in overconfidence in financial knowledge increases the odds of falling victim to fraud by 36%. Financial knowledge, not just general knowledge, protects against fraud: years of education is not a significant predictor of the likelihood of being victimized by fraud.

Building on Goetzmann and Kumar (2008), we employ failure to diversify when investing as a secondary measure of overconfidence. We measure failure to diversify as holding a concentrated investment, specifically investing more than 25% of one's total wealth in the stock of a single company. Failure to diversify is not only evidence of low financial literacy, but also evidence of overconfidence because the investment is held despite a poor financial understanding. Someone with low literacy but no confidence would not commit to such risky investments. We rule out the alternative hypothesis that our participants who fail to diversify have a greater propensity to take on risk by controlling for risk preferences when employing having a concentrated investment in one stock as a secondary measure of overconfidence.

Having a concentrated investment increases the odds of fraud victimization by a remarkable 154%. This result is not explained by risk preferences; fraud victims do not exhibit significantly higher propensity to take risk in either of our two measures. These participants

with a concentrated stock investment may be getting inadequate financial advice, which may help explain their higher incidence of fraud victimization. Many of these participants with a concentrated stock investment get help with financial decisions from someone outside the household. Since holding a concentrated stock investment unnecessarily exposes one's portfolio to high risk, the quality of the advice these participants are getting is questionable.

2. Data Description and Construction of Measures

Our data come from the Rush Memory and Aging Project (MAP), an ongoing longitudinal study of aging (Bennett et al. (2012)). Since beginning in 1997, MAP has enrolled older participants from throughout the Chicago metropolitan area. Participants undergo yearly interviews and detailed clinical evaluations, including medical history, neurological, and neuropsychological examinations. The MAP data include demographic information for each participant, such as age, sex, and education. In 2010, a decision making assessment was added to MAP. The Institutional Review Board of Rush University Medical Center approved MAP and the decision making substudy.

We exclude data from the 71 participants who were diagnosed with dementia at the time of their first decision making assessment. For these participants even completing the decision making assessment is rare; only 19 of these participants provided answers to each of our outcomes of interest. Our conclusions are robust to including these participants, but we exclude them to avoid any selection bias due to the participants who could not complete the survey. Dementia is diagnosed in accordance with the standards set by the National Institute of Neurologic and Communicative Disorders and Stroke and the Alzheimer's Disease and Related

Disorders Association (Bennett et al. (2005)). At the time of these analyses, 575 participants without dementia at the initial decision making assessment had completed at least two decision making assessments. Two decision making assessments are required to observe increases and decreases in decision making measures over time. For our sample analyzing the risk factors for financial fraud victimization, we extend the sample to include all 731 participants without dementia who have completed at least one decision making assessment.

Since its beginning, MAP has collected yearly cognitive test scores for each participant. Cognition is assessed with 19 tests, which are listed in the appendix by the 5 cognitive domains assessed in the battery: episodic memory, perceptual speed, semantic memory, visuospatial ability, and working memory. Episodic memory captures the memory of specific events whereas semantic memory captures the knowledge of concepts. Working memory captures the ability to store and process transitory information. Perceptual speed involves the ability to process information quickly and make mental comparisons. Visuospatial ability involves understanding visual representations and the spatial relationships among objects. The raw scores of each of the 19 cognitive tests are converted to z-scores using the baseline mean and standard deviation of the entire MAP cohort on that test. These 19 z-scores are averaged to compute the global cognitive function score. The z-scores within each domain are averaged to compute each cognitive domain score. We calculate each participant's change in cognition from the first decision making assessment to the most recent decision making assessment.

We connect each participant's change in cognition to the concurrent change in a variety of measures related to financial decision making capability. The exact wording of each decision making question used in this study is provided in the appendix. The decision making

questionnaire includes 18 standard financial literacy questions including 9 to test numeracy and 9 to test financial knowledge. We measure financial literacy, numeracy, and knowledge by adding the number of correct answers in each category of questions. Participants may respond that they do not know the answer, and they can refuse to answer any question. Participants are aware of these possibilities: 26% of participants refused or said do not know to at least one financial literacy question during the decision making study. Typically, these participants refused or said do not know only rarely. Among the participants who used these options at least once, the average number is 1.65 refusals or do-not-knows per survey. These responses are treated the same as incorrect answers in this analysis.

Each financial knowledge question includes a follow up question immediately after to assess the participant's confidence in her answer to the preceding knowledge question using a four-point scale from extremely confident to not at all confident. We score an extremely confident answer as a 3, fairly confident as a 2, a little confident as a 1, and not at all confident as a 0. We measure each participant's confidence in her financial knowledge by summing the confidence scores to these 9 questions. We measure overconfidence in financial knowledge by summing the scores to the confidence questions for which the participant got the associated financial knowledge question wrong. Thus, overconfidence is measured as a combination of poor financial knowledge and an unawareness of this lack of knowledge. A participant who scores low on financial knowledge is not overconfident in her financial knowledge if she reports being not at all confident in her answers.

We also use two additional measures of confidence. We assess self-confidence using a single question that asks participants to report their general level of confidence on a ten-point

scale with 1 indicating that they are not at all confident and 10 indicating that they are completely confident. We assess financial confidence with a single question that asks participants to report to what extent they agree with the statement: "I am good at managing day to day financial matters such as keeping up with checking accounts, credit cards, payments, and budgeting." Responses are reported on a seven-point scale from strongly agree indicating the highest level of financial confidence (6) to strongly disagree indicating the lowest level of financial confidence (0).

Participants are also asked who are primarily responsible for making their financial decisions. They are asked explicitly if they, their spouse, their child, or someone else is responsible, and they are asked to specify the relationship for a response that includes someone else. Thus, we can identify participants who make their own financial decisions, households who make their own financial decisions (participant or spouse), participants that get help with financial decisions (spouse or other person is specified, possibly in addition to self), and participants that get help from outside of the household (someone other than the participant or spouse is included as primarily responsible).

The decision making questionnaire includes a question asking participants if in the past year they were a victim of financial fraud or have been told they were a victim of financial fraud. We use this self report to identify fraud victims as those participants who answered this question affirmatively during any one of their yearly evaluations. We use the data from each participant's first decision making questionnaire to predict which participants will report being recently victimized by financial fraud at the first or any future yearly evaluation.

Participants are asked if more than 25% of their total wealth is invested in the stock of a single company, which we use as our measure of investment concentration. The decision making questionnaire includes two types of questions for assessing each participant's risk preferences. The first assessment of risk preferences uses a standard procedure for estimating risk aversion using a set of 10 questions asking participants if they would prefer a certain amount of money or a coin toss to win a larger amount. The exact amounts of money are provided in the appendix. We measure risk aversion using the procedure specified by Boyle et al. (2011), who find the best fit coefficient of relative risk aversion for each participant's choices in the ten risk aversion questions. The second assessment of risk preferences uses each participant's report of her lifetime willingness to take financial risks on a ten-point scale from not at all willing to completely willing.

3. Cognition Change

3.1. Procedure for Cognition Change Sample

We use simple regressions to identify the effect of a change in cognition on these decision making variables. Each regression is of the following form:

$$\Delta y_i = a * \Delta Cognition_i + b + \varepsilon_i$$

In each regression the dependent variable is the change in the decision making variable (y) from the participant i's first decision making assessment to her most recent (Δy_i). When this dependent variable is binary, we use the logistic form for the regression.

The right-hand side includes participant i's change in cognitive function score ($\Delta Cognition_i$) and a constant. The coefficient of the first term (a) captures the effect of a one

unit change in cognitive score. The error term is ε_i. The coefficient a captures the effect of both increases and decreases in cognition collectively. Since the focus of this study is on understanding the impact of decreases in cognition on financial decision making, we also run the previous regression using only the subset of participants who experience a decrease in cognition. For this subset the coefficient a only captures the association of decreases in cognition with the dependent variable.

3.2. Summary Statistics for Cognition Change Sample

Table 1 presents summary statistics for the 575 participants in the cognitive change sample. They are mostly female, well-educated, older Americans. The average age is 82.23 years, and only 23% are male. The participants average 15.11 years of education. About two-thirds (377 participants) of the sample experience a decrease in their global cognition z-score from their first decision making assessment to the most recent. The average decrease in measured cognition among this group is -0.29. Many participants (34%) increase their cognition score. The same questions are repeated each year, and participants benefit from the effect of practice. The average increase is smaller in size at 0.19.

Studies around the world find low levels of financial literacy (Lusardi and Mitchell (2011a)). Participants in this study perform similarly. Participants answer on average 12.69 of the 18 financial literacy questions correctly in their initial decision making assessment. They answer a similar number of numeracy questions (6.32) and financial literacy questions (6.37) correctly on average. These averages do not change by much overall from first assessment to the most recent. Lusardi and Mitchell (2011b) analyze a three-question financial literacy module included in the 2004 Health and Retirement study. They find that only 50% of

respondents answered both the questions about inflation and compound interest correctly, and only 33% of respondents answered an additional question about diversification correctly as well. In contrast, 65% of our respondents answered the same questions about inflation and compound interest both correctly, while 45% answered the additional question about diversification correctly as well.[4]

 Participants display a high level of self-confidence: their self-confidence averages 7.17 on the 10 point scale with a 10 meaning completely confident. Confidence in managing finances is similarly high on average (4.98 out of 6), meaning that most participants agree with the statement that they are good at managing their day to day financial matters. Confidence in financial knowledge averages 18.93 out of a maximum of 27, which is a little higher than the score for a participant who indicates they are fairly confident for each question (18). Average overconfidence in their financial knowledge is fairly low at 4.19, indicating that on average participants are aware when they do not know the answer to a financial knowledge question.

Consistent with their high confidence in their ability to manage finances and their high confidence in their financial knowledge, the vast majority of participants (88%) are primarily or jointly responsible for their financial decisions at the time of their first decision making assessment. About 41% get help with financial decisions, including from a spouse, child, or outside advisor. Just 25% get help with financial decisions from someone other than a spouse. Over time fewer participants make their own financial decisions and more get help. At time of

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[4] The overlapping financial literacy questions are provided in the appendix as numeracy question 9 (inflation), numeracy question 7 (compound interest), and knowledge question 5 (diversification). Note that there is a slight difference in the wording of the diversification question ("better" as opposed to "safer").

the most recent decision making assessment, the percentage of participants making their own financial decisions dropped by 13%, and 11% more got help with financial decisions.

3.3. Cognition Changes and Literacy

In this subsection we examine the impact of decreases in cognition on financial literacy and its components (numeracy and financial knowledge). Table 2 presents results of six regressions following the form specified in the procedures section of this paper. Changes in cognition are associated with changes in financial literacy and its components. A one unit change in cognition is associated with a literacy change of 1.149, which comes from a 0.648 change in numeracy and a 0.501 change in financial knowledge. Each association is statistically significant at the 1% level.

We rule out the possibility that the positive association between cognition changes and literacy changes in this regression could be driven by those participants with improvements in their cognition score improving their financial literacy scores as well and not from those with decreases in their cognition score getting worse on literacy. Since the impact of decreases in cognition is the focus of this study, we rule out the previous possibility by running the same regression only for the subset of participants whose global cognition score dropped. Decreases in cognition are associated with decreases in financial literacy and its components. A one unit decrease in cognition is associated with a financial literacy decrease of 1.183, which comes primarily from a 0.765 decrease in numeracy. These associations are also statistically significant at the 1% level. A one unit decrease in cognition is associated with a trend toward a decrease in financial knowledge of 0.419; its p-value is 0.12.

The size of these effects of cognitive changes on financial literacy are modest, but it is important to consider that the changes in cognition we are measuring during the decision making assessment period occurs over just two to three years. Individuals experiencing cognitive decreases are likely to experience further decreases over time. Thus, the impact of decreases in cognition on financial literacy is expected to accumulate over time.

3.4. Breakdown by Cognitive Domain

The association of drops in cognition with drops in financial literacy and its components can be separated into the five domains of cognition tested. Table 3 presents summary statistics for these five domain-specific cognitive measures. As with the global cognition score, participants' average score has dropped over time. The changes in these domain-specific cognitive measures are positively correlated; however, there is a lot of independent variation in these measures. The correlations range from a low of 6% between visuospatial ability and working memory to a high of 34% between episodic memory and semantic memory.

Table 4 also presents regression results for how decreases in these cognitive domain scores are associated with changes in the components of financial literacy. Numeracy changes are most strongly predicted by a drop in episodic memory; a one unit decrease in episodic memory is associated with a 0.725 decrease in numeracy, which is statistically significant at the 1% level. Numeracy changes are also associated with visuospatial ability (p=.03) and perceptual speed (p=.09). Knowledge changes are most strongly predicted by a drop in semantic memory; a one unit decrease in semantic memory is associated with a 0.562 decrease in the participant's financial knowledge, which is statistically significant at the 5% level. A statistically significant

association with financial knowledge changes is only also found with episodic memory decreases (p=.09).

3.5. Cognition Changes and Confidence

We next examine the effect of changes in global cognition on a variety of confidence measures. First, we examine the effect of a decrease in cognition on general self-confidence. Table 4 shows that a one unit change in cognition is associated with a 0.416 change in self-confidence on a ten-point scale. This weak association in changes is driven by a strong association among the subset of those participants experiencing declining cognition. A one unit decrease in cognition is associated with a 0.968 decrease in self-confidence, which is statistically significant at the 5% level. However, we find a very different result for the effect of a decrease in cognition on one's confidence for managing financial matters. Neither changes in cognition or decreases in cognition are associated with changes in confidence in managing one's finances. Despite the drop in self-confidence associated with a decrease in cognition, participants who have a decrease in cognition do not reduce their confidence for managing their own finances.

Similarly, participants who experience a decrease in cognition do not significantly reduce their confidence in their financial knowledge. Although we find that a one unit change in cognition is significantly associated with a 1.23 change in participants' confidence in their financial knowledge, this result is not driven by those with a decrease in cognition. In this case those increasing their cognition score are also increasing their confidence in their financial knowledge. Among those participants experiencing a decrease in cognition, there is not

statistical significance in the association between decreases in cognition in the change in confidence in their financial knowledge.

In the previous subsection of this paper, we document that financial knowledge does drop with decreases in cognitive score; thus, these participants do not appear to recognize fully the detrimental effect of decreased cognition on their financial ability despite their decrease in self-confidence in general. However, when we assess the relationship between participants' changes in cognition and their changes in our overconfidence measure, we find no statistically significant association.

3.6. Cognitive Changes and Seeking Financial Help

Having shown that decreases in cognition are associated with a decrease in financial literacy but not one's financial confidence, we now examine to what extent those participants who experience a decrease in their cognitive score get help with their financial decision making. Because the dependent variables in this subsection are binary, we alter our regression to the logistic form; otherwise, the explanatory variables are the same. Table 5 presents these logistic regression results. A one unit decrease in cognition results in an increase in the odds that a participant stops making her own financial decisions by $e^{1.098} - 1 = 203\%$. This relationship is statistically significant at the 1% level. Similarly, a one unit decrease in measured cognition results in an increase in the odds that both participant and spouse (a household) stop making their own financial decisions by $e^{1.290} - 1 = 263\%$. Again, this relationship is statistically significant at the 1% level.

Participants who experience a decrease in their cognition are more likely to obtain help with making financial decisions. A one unit decrease in measured cognition results in an

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increase in the odds that a participant obtained help for her financial decisions by $e^{0.864} - 1 = 137\%$. This result is statistically significant at the 5% level. It includes obtaining help from a spouse as well as anyone outside the household. Similarly, a one unit decrease in measured cognition results in an increase in the odds that a participant obtained help for her financial decisions from outside her household by $e^{0.878} - 1 = 141\%$, which is statistically significant at the 5% level. Typically, help from outside the household is provided by a son, a daughter, or a professional financial advisor.

Despite the strong association between decreases in cognition and seeking help with financial decisions, there are still many participants who experience significant declines in their cognition who are not getting help. We use each participant's complete history of cognitive scores, including those prior to the start of the Decision Making assessment, to determine the long-term cognitive trajectory of each individual. The number of annual cognition scores for participants in our sample ranges from 2 for the most recent enrollees to 15 for long-time participants. On average participants have 6.6 cognitive scores with median of 7. Thus, we have a long history of cognitive function scores to determine which participants are experiencing a decline in cognition during their time in MAP. For each participant we determine the slope of her cognitive ability by running a simple linear regression of cognition scores on age and a constant. There are 146 participants who have experienced both decreased cognition during the decision making assessment and a statistically significant cognitive decline during their participation in MAP. Of these 146 participants only about half (76) get help with their financial decision making.

4. Financial Fraud

4.1. Procedure for Fraud Sample

We use logistic regressions to identify the effect of overconfidence on the odds of being victimized by financial fraud. The logistic regression with overconfidence in financial knowledge as the explanatory variable takes the form:

$$\log\left[\frac{\pi(Fraud_i)}{1 - \pi(Fraud_i)}\right] = a * Over_i + b * Male_i + c * Age_i + d * Educ_i + e * Cog_i + f + \varepsilon_i$$

$Fraud_i$ is an indicator variable that equals 1 when participant *i* reported being the victim of a financial fraud during the decision making assessment period. $Over_i$ is participant *i*'s overconfidence in financial knowledge score from her first decision making assessment. We include the following control variables. $Male_i$ is an indicator that equals 1 when the participant is a man. Age_i is participant *i*'s age in years at the time of the first decision making assessment. These controls are included because prior studies show that men tend to be more overconfident than women and that older individuals are more susceptible to falling victim to fraud. $Educ_i$ is the participant's years of education. Cog_i is participant *i*'s global cognition z-score at the time of her first decision making assessment. These additional controls are included to test if they provide protection from falling victim to financial fraud. The constant term is f, and ε_i is the error term for participant *i*. In this regression the coefficient a captures the effect of a 1 unit increase in overconfidence on the log odds of being victimized by financial fraud. This coefficient is the focus of the fraud section of this study.

We use investment concentration as a secondary measure of overconfidence. The logistic regression with investment concentration as the explanatory variable takes the form:

$$\log\left[\frac{\pi(Fraud_i)}{1 - \pi(Fraud_i)}\right] = g * CI_i + h * Risk_i + i * Male_i + j * Age_i + k * Educ_i + l * Cog_i + m + \varepsilon_i$$

CI_i is an indicator variable that equals 1 when participant *i* owns a concentrated investment. $Risk_i$ is a measure of participant *i*'s risk preferences. We use two measures of risk preferences. The first is an estimated coefficient of relative risk aversion. The second is a self-reported financial risk taking propensity on a ten-point scale. The reason for including a risk measure as a control in this regression is that holding a concentrated investment could in theory be driven by the respondents' risk preferences rather than overconfidence. We include it to rule out this risk-based explanation. The other control variables are defined as in the previous regression. The constant term is now *m*. In this regression the coefficient *g* captures the effect of having a concentrated investment on the log odds of being victimized by financial fraud.

4.2. Summary Statistics for Fraud Sample

Table 6 presents summary statistics for the fraud sample. This sample adds 156 participants to the cognition change sample who have completed just one decision making assessment. These participants were not included in the cognitive change sample since they have not been in the study long enough to calculate changes over time. Like the cognitive change sample, the participants in this extended sample are again mostly female and well educated on average. The average age for the fraud sample is 82.22 years, which is almost identical to the average age of 82.23 in the cognitive change sample. The average years of education is 15.13 in the fraud sample, which is also almost identical to the average years of education of 15.11 in the cognitive change sample. Again, participants diagnosed with dementia are excluded from the sample. In both samples only 23% are male.

Of the 731 participants, 70 report being recently victimized by fraud, just under 10% of the fraud sample. The demographic characteristics of the fraud victims and those not victimized are similar. The percentage of female fraud victims is identical to the percentage of females among those not victimized. Fraud victims average 0.45 years less of education, but this difference is not significant. The average global cognition z-score is also not significantly different. The only statistically significant demographic difference between the two groups is in age, but the difference in age is small in magnitude with the fraud victims averaging 3.19 years less of age. This result could be due to older participants being less likely to report fraud victimization even when it actually happens.

Fraud victims exhibit greater overconfidence in their financial knowledge. Fraud victims average an overconfidence score of 5.21 compared to 4.11 for those not victimized. This difference in means is statistically significant at the 5% level. Further evidence of overconfidence predicting fraud victimization is revealed in the significant difference between the percentage of fraud victims who hold concentrated investments (10%) and the percentage of those not victimized who do so (5%): 7 out of 70 fraud victims answering the question reveal that they have a concentrated investment whereas 33 out of 661 not victimized have concentrated investments. Holding a concentrated investment does not by itself imply that the participant is overconfident in her financial knowledge. Alternatively, the participant could be choosing to concentrate her portfolio in one stock to increase the risk in her investment portfolio. We rule out this risk-based explanation by testing if fraud victims demonstrate a greater propensity to take on risk in general using two measures: the estimated coefficient of risk aversion and a risk taking propensity score. The average values of these measures are

similar across groups indicating that a difference in the propensity to take on risk does not drive the result that fraud victims are more likely to hold concentrated investments.

Absent a preference for high risk, holding a concentrated position in one stock is an investment mistake. Diversifying one's investments reduces risk without necessarily decreasing expected return of the portfolio. Giving up this potential risk reduction by holding a concentrated investment demonstrates a lack of understanding of the value of diversification, a financial literacy mistake. However, holding a concentrated position in one stock is not just a secondary measure of low financial literacy. It also demonstrates the participant's confidence in her financial knowledge because she has chosen to hold the stock. A participant who does not understand diversification but does not have the confidence in her understanding to invest in the stock market would not be considered overconfident by this investment concentration measure. Like our main measure of overconfidence in one's financial knowledge, this investment concentration measure combines both a lack of financial literacy with a mistaken confidence in one's understanding.

4.3. Overconfidence in Financial Knowledge

We now test if overconfidence in financial knowledge remains a significant predictor of fraud victimization while controlling for sex, age, education, and cognition. Table 7 presents results of a logistic regression with fraud victimization as the binary dependent variable. Overconfidence in financial knowledge remains a significant predictor. The coefficient on overconfidence is 0.084 with a p-value of 0.01 indicating strong statistical significance of this result. To examine the economic significance of this coefficient, consider a one standard deviation increase in overconfidence (3.65). This increase in overconfidence increases the

estimated odds of fraud victimization by $e^{3.65(0.084)} - 1 = 36\%$. The unconditional odds of recent fraud victimization in our sample is $\frac{70}{661} = 0.106$; a one standard deviation increase in overconfidence increases these odds to 0.144. Among the demographic control variables, only age is statistically significant. Age is negatively associated with self-reported fraud victimization. This result could be due to older individuals being less likely to report fraud even when it happens. This result corresponds with the small, but statistically significant difference in mean ages between fraud victims and those not victimized. The results of this logistic regression reveal that the age difference does not drive the significant difference in overconfidence between the two groups.

The negative association between age and self-reported fraud victimization in this regression is robust to controls for who is primarily responsible for making financial decisions. Increased age is associated with letting someone else manage one's finances, but this fact does not appear to drive the negative association between age and reporting being a fraud victim. The negative association is robust to including in the fraud regression an indicator variable of whether or not the participant is primarily responsible for making her own financial decisions. The negative association also holds among the subset of those participants who make their own financial decisions.

In the second and third regressions in Table 7, we test if overconfidence is a significant risk factor for financial fraud victimization only because it is also an indicator of low financial knowledge or high confidence in one's financial knowledge. Low financial knowledge alone is not a significant risk factor, nor is high confidence alone. Neither measure is statistically significant in a logistic regression when replacing overconfidence as the independent variable of

interest. That low financial knowledge alone is not a significant predictor of financial fraud victimization is not surprising. A participant with low financial knowledge who is aware of her low level of financial understanding is likely to be more cautious when making financial choices. That high confidence in one's financial knowledge alone is not a significant predictor is also not surprising. High confidence is warranted when the participant does have a high level of financial knowledge. Our overconfidence measure captures an important combination of lacking financial knowledge while being mistakenly confident in those areas of financial misunderstanding. This particular combination of low knowledge and high confidence is what puts older Americans at greater risk for financial fraud victimization.

4.4. Investment Concentration

We next test if having a concentrated investment remains a significant predictor of fraud when controlling for sex, age, education, and cognition. Table 8 presents the results of three logistic regressions with recent fraud victimization as the binary dependent variable. The results of the first regression reveal that having a concentrated investment does remain a significant predictor of fraud victimization. The coefficient on the binary variable indicating the participant holds a concentrated investment is 0.934 with a p-value of 0.04 indicating the result is statistically significant. Having a concentrated investment increases the odds of fraud victimization by an astounding $e^{0.934} - 1 = 154\%$. Again, the unconditional odds of recent fraud victimization in the sample are 0.104. An increase of 154% boosts these odds to 0.264.

The second and third regressions in the table include an additional control variable capturing the risk preferences of the participant to test if these preferences explain the relationship between having a concentrated investment and fraud victimization. The second

regression includes the estimated coefficient of risk aversion for each participant. This additional control variable fails to be of statistical significance while the coefficient on the binary variable indicating the participant holds a concentrated investment is unchanged at 0.934, again with a p-value of 0.04. As a robustness test, we use an alternative measure of risk taking propensity in the third logistic regression in the table. Again, the additional control variable capturing risk preferences fails to be significant while the significance of having a concentrated investment remains. These results indicate that having a concentrated investment is not due to risk preferences; instead, it is likely driven by the participant overestimating the potential return of the concentrated investment relative to its risk, a form of overconfidence. Further, having a concentrated investment is positively correlated with our measure of overconfidence in financial knowledge. Participants who hold a concentrated investment have a 1.29 higher overconfidence score than participants who do not; this difference in average overconfidence is statistically significant with a p-value of 0.04.

We cannot rule out the possibility that those participants with a concentrated stock investment may be getting bad financial advice, which alternatively may be responsible for their higher incidence of fraud victimization. Of those participants with a concentrated stock investment, 38% (15 of 40) get help with financial decisions from someone outside the household. Holding a concentrated stock investment is unwise from a risk management perspective, which calls into question the quality of the advice these participants are getting. Our data do not allow us to determine who exactly is responsible for making that specific financial decision of holding a concentrated investment, so we cannot pin the responsibility on the participant or the advisor completely.

5. Conclusion

We utilize the data from the Rush Memory and Aging Project and the Decision Making substudy to identify the detrimental impact of decreases in cognition associated with aging on the financial decision making ability of older Americans. We find that decreases in cognition are associated with decreases in financial literacy. We provide evidence that participants do not recognize this decrease. Despite showing significant drops in their self confidence in general, their confidence in their ability to manage their own finances and their confidence in their financial knowledge do not decrease with drops in measured cognition. Similarly, Holland and Rabbitt (1992) find that individuals in their 70s do not rate their sensory abilities as poor any more so than individuals in their 50s despite significant declines in their measured ability. Importantly, they find that those older individuals who recognize their decline in sensory ability adjust their road-use behavior and have fewer accidents. Perhaps there is an analogy between driving and financial choices, and older Americans who have a drop in cognition would be more likely to take precautions in their financial decision making if made aware of the connection. Whether it is sought out or unsolicited, participants who experience a decrease in their cognitive score are more likely to obtain help with their financial decisions, though perhaps not as many get assistance as need it and bad advice may be a problem.

We also find that overconfidence in one's financial knowledge is a significant risk factor for seniors becoming a victim of financial fraud. Our results make an important contribution to existing research connecting overconfidence with poor investment decision making. Increasing the financial knowledge of older Americans is likely to help protect them from becoming victims of financial fraud. In cases where increasing financial knowledge is not possible, increasing

awareness of one's limitations may help protect against the harmful effects of overconfidence. The Elderly Investment Fraud and Financial Exploitation Study[5] conducted in 2010 by the Investor Protection Trust found that that only 2% of seniors reported that their health care provider had asked them about their ability to manage money. Among adult children of senior parents who were in touch with their parent's health care provider, 19% had raised concerns about mental comprehension, but only 5% had raised concerns about the handling of money. Financial victimization of seniors is a large and growing problem, and more research is needed to better understand the factors that predict fraud victimization in order to design effective solutions.

The importance of studying financial decision making in the older population has never been greater. Prior to 1980, retirees relied on a combination of employer-sponsored defined benefit pensions and Social Security for monthly income. For these retirees institutions shouldered the responsibility and the risk of investing contributions and managing payouts. Since 1980, many defined benefits plans have been replaced by defined contribution plans, which leave the responsibility of managing investments and withdrawals to the individual retiree. Poterba, Venti, and Wise (2008) document that in 2000, 87% of personal retirement contributions went to individual accounts with the largest proportion of these going to 401(k) accounts. The next generation of retirees will have the responsibility and risk of managing the money in these individual accounts sensibly. As the baby boom generation of Americans begins to retire, there will be an ever larger portion of the population shouldering this great financial responsibility of managing their own retirement wealth.

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[5] Study results available at
http://www.investorprotection.org/downloads/pdf/learn/research/EIFFE_Survey_Report.pdf

After the massive shift from defined benefit pensions to self-directed defined contribution retirement accounts, economists documented the many heuristics and biases of these new retirement savers (Benartzi and Thaler (2007)). Research also helped to reveal solutions such as automatic enrollment and default investment portfolios (Choi et al. 2004) that have greatly increased retirement savings. As this generation of workers begins to retire, we believe that research on the financial decision making of older Americans will be equally as important in revealing the heuristics, biases, and behaviors of this new generation of retirees. This information is essential to developing the innovations that will help them to maximize their well-being during this last period of their lives when many important and influential financial decisions are made.

References

Agarwal, Sumit, John C. Driscoll, Xavier Gabaix, and David Laibson, 2009, "The Age of Reason: Financial Decisions over the Life-Cycle and Implications for Regulation." *Brookings Papers on Economic Activity* 2:51–117.

Barber, Brad M., and Terrance Odean, 2000, "Trading is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors," *Journal of Finance* 55: 773–806.

Barber, Brad M., and Terrance Odean, 2001, "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment," *Quarterly Journal of Economics* 116:261–292.

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

Bennett, David A., Julie A. Schneider, Aron S. Buchman, Lisa L. Barnes, Patricia A. Boyle, and Robert S. Wilson, 2012, "Overview and Findings from the Rush Memory and Aging Project," *Current Alzheimer Research* 9: 646–663.

Bennett, David A., Julie A. Schneider, Aron S. Buchman, Carlos Mendes de Leon, Julia L. Bienais, and Robert S. Wilson, 2005, "The Rush Memory and Aging Project: Study Design and Baseline Characteristics of the Study Cohort," *Neuroepidemiology* 25: 163–175.

Blanton, Kimberly, 2012, "The Rise of Financial Fraud: Scams Never Change but Disguises Do," Center for Retirement Research working paper.

Boyle, Patricia A., Lei Yu, Aron S. Buchman, David I. Laibson, David A. Bennett, 2011, "Cognitive function is associated with risk aversion in community-based older persons, " *BMC Geriatrics* 11: 53.

Choi, James J., Brigitte C. Madrian, and David Laibson, 2004, "Plan Design and 401(k) Savings Outcomes," *National Tax Journal* 62: 275–298.

Finke, Michael S., John Howe, and Sandra J. Huston, 2011, "Old Age and the Decline in Financial Literacy, working paper, Available at SSRN: http://ssrn.com/abstract=1948627.

Goetzmann, William N., and Alok Kumar, 2008, "Equity Portfolio Diversification," *Review of Finance* 12: 433–463.

Holland, Carol A., and Patrick M. A. Rabbitt, 1992, "People's Awareness of Their Age-Related Sensory and Cognitive Deficits and the Implications for Road Safety," *Applied Cognitive Psychology* 6: 217–231.

Korniotis, George M., and Alok Kumar, 2011, "Do Older Investors Make Better Investment Decisions?" *Review of Economics and Statistics* 93: 244–265.

Li, Shu-Chen, K. Richard Ridderinkhof, and Gregory R. Samanez-Larkin, eds. 2011. *Frontiers of Neuroscience*. Volume 5. *Decision Making Across the Life Span.*

Lusardi, Annamaria, and Olivia S. Mitchell, 2011, "Financial Literacy Around the World: An Overview," *Journal of Pension Economics and Finance* 10: 497–508.

Lusardi, Annamaria, and Olivia S. Mitchell, 2011, "Financial Literacy and Planning: Implications for Retirement Wellbeing," NBER working paper 17078.

Malmendier, Ulrike, and Stefan Nagel, 2010, "Depression Babies: Do Macroeconomic Experiences Affect Risk Taking?" *Quarterly Journal of Economics* 126: 373–416.

Poterba, James, Steven Venti, and David Wise, 2008, "The Changing Landscape of Pensions in the United States," in Annamaria Lusardi, editor, *Overcoming the Saving Slump: How to Increase the Effectiveness of Financial Education and Savings Programs*. Chicago, IL: University of Chicago Press.

Samanez-Larkin, Gregory R., ed. 2011. *Decision Making Over the Life Span.* Volume *1235.* New York: Annals of the New York Academy of Sciences.

Samanez-Larkin, Gregory R., and Brian Knutson, forthcoming 2014, Reward Processing and Risky Decision Making in the Aging Brain, in Valerie F. Reyna and Vivian Zayas, eds.: *The Neuroscience of Risky Decision Making.* Washington, DC: American Psychological Association.

Table 1: Summary Statistics for Cognition Change Sample

This table presents summary statistics for the cognition change sample and the subsample of participants who experienced a decrease in cognition score during the Decision Making assessment. Age and Education are stated in years. Cognition is a z-score scaled to all participants in the Memory and Aging Project at baseline. Values are reported as means (standard deviation) or percentages.

	All Participants		Decrease in Cognition	
Participants	575		377	
Male	23%		22%	
Age	82.23 (7.36)		83.17 (7.19)	
Education	15.11 (2.86)		15.21 (2.93)	
	Initial Level	**Change**	**Initial Level**	**Change**
Cognition	0.22 (0.54)	-0.13 (0.35)	0.22 (0.55)	-0.29 (0.30)
Financial Literacy	12.69 (2.48)	-0.10 (2.21)	12.58 (2.54)	-0.32 (2.32)
Numeracy	6.32 (1.35)	-0.11 (1.54)	6.26 (1.37)	-0.24 (1.58)
Financial Knowledge	6.37 (1.68)	0.02 (1.49)	6.31 (1.69)	-0.08 (1.56)
Self-Confidence	7.17 (1.83)	0.08 (1.94)	7.17 (1.88)	0.06 (2.04)
Confidence in Managing Finances	4.98 (1.38)	-0.03 (1.33)	4.88 (1.45)	-0.12 (1.52)
Confidence in Financial Knowledge	18.93 (5.45)	-0.12 (4.33)	18.62 (5.57)	-0.38 (4.49)
Overconfidence in Financial Knowledge	4.19 (3.58)	0.21 (3.65)	4.18 (3.52)	0.32 (3.82)
Participant Makes Financial Decisions	88%	-13%	87%	-16%
Household Makes Financial Decisions	91%	-10%	91%	-12%
Gets Help with Financial Decisions	41%	12%	45%	12%
Gets Help Outside of Household	25%	11%	29%	12%

Table 2: Decrease in Cognition and Literacy

This table presents regression results of the effect of cognitive changes on financial literacy, and separately on its components, numeracy and knowledge. Cognition Change provides the association between participants' cognition changes and their changes in the specified outcome variable. Cognition Decrease provides the previous association only among the subset of participants who experience a decrease in cognition.

	Literacy Change			Numeracy Change			Knowledge Change		
	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Cognition Change	1.149***	0.262	0.00	0.648***	0.183	0.00	0.501***	0.177	0.00
Intercept	0.049	0.097	0.62	-0.031	0.068	0.64	0.080	0.066	0.22
Cognition Decrease	1.183***	0.395	0.00	0.765***	0.269	0.00	0.419	0.267	0.12
Intercept	0.024	0.166	0.89	-0.017	0.113	0.88	0.041	0.112	0.72

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Table 3: The Components of Global Cognition

This table presents summary statistics and regression results for the effect of cognitive changes within each of the five domains on the components of financial literacy, numeracy and knowledge. Cognition Decrease provides the association of the change in cognitive domain score with the change in the specified component of financial literacy only among the subset of participants who experience a decrease in cognition.

	Decrease in Cognition	
	Initial Level	**Change**
Episodic Memory	0.32 (0.74)	-0.30 (0.42)
Perceptual Speed	0.09 (0.78)	-0.31 (0.46)
Semantic Memory	0.22 (0.62)	-0.21 (0.39)
Visuospatial Ability	0.24 (0.74)	-0.26 (0.61)
Working Memory	0.15 (0.74)	-0.22 (0.49)

	Numeracy Change			Knowledge Change		
	Estimate	**SE**	**p-value**	**Estimate**	**SE**	**p-value**
Episodic Memory Decrease	0.725***	0.242	0.00	0.409*	0.237	0.09
Intercept	0.173	0.130	0.18	0.162	0.127	0.21
Perceptual Speed Decrease	0.369*	0.219	0.09	0.231	0.215	0.28
Intercept	-0.022	0.122	0.86	0.041	0.120	0.73
Semantic Memory Decrease	0.404	0.300	0.17	0.562**	0.270	0.04
Intercept	0.065	0.134	0.63	0.193	0.123	0.12
Visuospatial Ability Decrease	0.472**	0.212	0.03	0.132	0.216	0.54
Intercept	0.136	0.143	0.34	0.014	0.146	0.92
Working Memory Decrease	0.333	0.254	0.19	0.246	0.236	0.30
Intercept	-0.017	0.145	0.68	0.006	0.135	0.97

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Table 4: Decrease in Cognition and Confidence

This table presents regression results of the effect of cognition changes on four different measures of confidence. Cognition Change and Cognition Decrease are defined as in Table 2.

	Change in Self-Confidence			Change in Confidence in Managing Finances		
		SE	p-value	Estimate	SE	p-value
Cognition Change	0.416*	0.234	0.08	0.163	0.168	0.33
Intercept	0.131	0.086	0.13	-0.094	0.061	0.13
Cognition Decrease	0.968***	0.350	0.01	0.098	0.267	0.72
Intercept	0.342**	0.147	0.02	-0.092	0.110	0.40

	Change in Confidence in Financial Knowledge			Change in Overconfidence		
	Estimate	SE	p-value	Estimate	SE	p-value
Cognition Change	1.230**	0.519	0.02	-0.454	0.438	0.30
Intercept	0.040	0.192	0.83	0.150	0.162	0.35
Cognition Decrease	0.977	0.770	0.21	-0.228	0.656	0.73
Intercept	-0.090	0.323	0.78	0.257	0.275	0.35

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Table 5: Decrease in Cognition and Seeking Financial Help

This table presents logistic regression results of the effect of cognitive changes on participants' participation in their own financial decisions. Cognition Change and Cognition Decrease are defined as in Table 2.

	Participant Stopped			**Household Stopped**		
	Estimate	**SE**	**p-value**	**Estimate**	**SE**	**p-value**
Cognition Change	-1.123***	0.323	0.00	-1.119***	0.347	0.00
Intercept	-2.113***	0.145	0.00	-2.414***	0.164	0.00
Cognition Decrease	-1.098***	0.406	0.01	-1.290***	0.432	0.00
Intercept	-2.043***	0.203	0.00	-2.462***	0.232	0.00

	Obtained Help			**Obtained Help Outside Household**		
	Estimate	**SE**	**p-value**	**Estimate**	**SE**	**p-value**
Cognition Change	-0.658**	0.331	0.05	-0.787**	0.341	0.02
Intercept	-2.065***	0.142	0.00	-2.227***	0.151	0.00
Cognition Decrease	-0.864**	0.427	0.04	-0.878**	0.434	0.04
Intercept	-2.205***	0.217	0.00	-2.284***	0.223	0.00

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Table 6: Summary Statistics for Fraud Sample

This table presents summary statistics for the fraud sample as well as for a breakdown of the fraud sample into those participants who experienced fraud and those who did not. Age and Education are stated in years. Cognition is a z-score scaled to all participants in the Memory and Aging Project at baseline. Values are reported as means (standard deviation) or percentages.

	All Participants	Fraud Victims	Not Fraud Victims
Participants	731	70	661
Male	23%	23%	23%
Age	82.22 (7.61)	79.33*** (8.62)	82.52*** (7.44)
Education	15.13 (3.03)	14.73 (2.78)	15.18 (3.06)
Cognition	0.18 (0.59)	0.22 (0.56)	0.17 (0.60)
Overconfidence in Financial Knowledge	4.22 (3.65)	5.21** (3.57)	4.11** (3.65)
Concentrated Investment	6%	10%*	5%*
Financial Knowledge	6.29 (1.76)	6.14 (1.56)	6.31 (1.78)
Confidence in Financial Knowledge	18.64 (5.67)	19.46 (5.05)	18.55 (5.73)
Risk Aversion	0.33 (0.30)	0.32 (0.29)	0.33 (0.30)
Risk Taking	4.92 (2.13)	5.29 (1.93)	4.88 (2.15)

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Table 7: Predicting Fraud with Overconfidence

This table presents the results of a logistic regression with being a fraud victim as the dependent variable.

	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Overconfidence in Financial Knowledge	0.084**	0.034	0.01	-	-	-	-	-	-
Financial Knowledge	-	-	-	-0.109	0.086	0.20	-	-	-
Confidence in Financial Knowledge	-	-	-	-	-	-	0.025	0.027	0.35
Male	0.147	0.308	0.63	0.199	0.320	0.53	-0.017	0.322	0.96
Age	-0.053***	0.017	0.00	-0.056***	0.017	0.00	-0.053***	0.017	0.00
Education	-0.051	0.047	0.27	-0.056	0.047	0.23	-0.066	0.047	0.16
Cognition	0.194	0.263	0.46	0.146	0.263	0.59	-0.052	0.252	0.84
Intercept	2.338	1.545	0.13	3.721**	1.581	0.02	2.573	1.626	0.11

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Table 8: Predicting Fraud with Investment Concentration

This table presents the results of logistic regressions with being a fraud victim as the dependent variable. We use two measures of risk preferences. The first is an estimated coefficient of relative risk aversion. The second is a self reported financial risk taking propensity on a ten-point scale.

	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Concentrated Investment	0.934**	0.452	0.04	0.934**	0.452	0.04	0.943**	0.453	0.04
Risk Aversion	-	-	-	-0.003	0.453	0.99	-	-	-
Risk Taking	-	-	-	-	-	-	0.071	0.063	0.26
Male	0.177	0.310	0.57	0.177	0.313	0.57	0.121	0.317	0.70
Age	-0.058***	0.018	0.00	-0.058***	0.018	0.00	-0.056***	0.018	0.00
Education	-0.048	0.047	0.31	-0.048	0.047	0.31	-0.052	0.048	0.27
Cognition	-0.078	0.255	0.76	-0.078	0.256	0.76	-0.101	0.257	0.69
Intercept	3.082**	1.55	0.05	3.082**	1.55	0.05	2.653	1.640	0.11

*, **, and *** indicate statistically significant at the 10%, 5%, and 1% level respectively

Appendix

Cognition Tests

The global cognition score is calculated by converting raw scores on each of the 19 tests listed below to z scores, using the mean and standard deviation from the full cohort at baseline, and then averaging the z scores to produce the composite measure. The composite measure of each cognitive domain is calculated similarly using only the tests in that domain.

Episodic Memory
1. Logical memory (immediate) Story A from the Logical Memory subset of the Wechsler Memory Scale-Revised;
2. Logical memory (delayed) Story A from the Logical Memory subset of the Wechsler Memory Scale-Revised;
3. CERAD Word list recall (immediate)
4. CERAD Word list recall (delayed)
5. CERAD Word list recognition
6. East Boston Story (immediate)
7. East Boston Story (delayed)

Perceptual Speed
1. Oral version of the Symbol Digit Modalities Test
2. Number Comparison
3. 2 indices from a modified version of the Stroop Neuropsychological Screening test

Semantic Memory
1. Verbal fluency from CERAD;
2. 15 item version of the Boston Naming Test
3. 15-item reading test

Visuospatial Ability
1. 15-item version of Judgment of Line Orientation
2. 16-item version of Standard Progressive Matrices

Working Memory
1. Digit Span subtests-forward of the Wechsler Memory Scale-Revised
2. Digit Span subtests-backward of the Wechsler Memory Scale-Revised
3. Digit Ordering

Survey Questions

Financial Fraud Question
In the past year, were you a victim of financial fraud or have you been told you were a victim of financial fraud?

Numeracy Questions
1. Which of these percentages represents the biggest risk of getting a disease? 1%, 10%, 5%

2. A store is offering 15% off a television that is normally priced at $1000. How much money would you save on the TV during this sale? $15, $150, $1500

3. If a television set is on sale for $899, which is $200 off its normal price, what is the normal price? $699, $1099, $1299

4. If 5 people all have the winning numbers in the lottery and the prize is $2 million, how much will each of them receive? $200,000; $400,000; $600,000

5. If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease? 100, 10, 90, 900

6. In a sale, a shop is selling all items at half price. Before the sale, a sofa costs $300. How much will it cost in the sale? $150, $600, $900

7. Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, or less than $102?

8. Again, suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $110, exactly $110, or less than $110?

9. Imagine that the interest rate on your savings account is 1% per year and inflation is 2% per year. After 1 year, will you be able to buy more than, exactly the same as, or less than today with the money in your account?

Financial Knowledge and Confidence Questions for Overconfidence Measure
Note: Each financial knowledge question is followed by the same confidence question below.

How confident are you that you answered that question correctly?

extremely confident, fairly confident, a little confident, not at all confident

1. What do the initials FDIC stand for?

2. What does the FDIC do?

approves new drugs for clinical use, protects the funds people or depositors place in banks and savings institutions, underwrites mortgages and other loans

3. A mutual fund is an investment that holds what---only stocks, only bonds, or stocks AND bonds?

4. When interest rates go up, what do bond prices do: go down, go up, or stay the same?

5. True or false. Buying a single company stock usually provides a better return than a stock mutual fund.

6. True or False. An older person with $100,000 to invest should hold riskier financial investments than a younger person with $100,000 to invest.

7. True or False. Using money in a bank account to pay off credit card debt is usually wise.

8. True or False. To make money in the stock market, you have to buy and sell stocks often.

9. True or False. Stocks and mutual funds generally produce higher average returns above inflation compared to fixed-income investments such as bonds.

Self-confidence Question

Using a 1-10 point rating scale, where 1 indicates that you are not at all confident and 10 indicates that you are completely confident, how would you rate your general level of confidence?

Financial Confidence Question

Please give a number between 1 and 7 indicating the degree to which you agree or disagree with this statement, with 1 being strongly agree and 7 strongly disagree. I am good at managing day to day financial matters such as keeping up with checking accounts, credit cards, payments, and budgeting.

Question about Who Makes Financial Decisions

Currently, who is (are) primarily responsible for making your financial decisions: you, your spouse/partner, your child, or someone else? If someone else, please specify the other person.

Investment Concentration Question

Is more than 25% of your total wealth invested in the stock of a single company?

Risk Taking Question

Using this 1-10 point rating scale, where 1 indicates that you are not at all willing to take risks and 10 indicates that you are completely willing to take risks, what would you say has been over your lifetime your willingness to take risks in financial matters?

Risk Aversion Questions

Note: The following question is asked 10 times with X replaced successively by:

      65, 45, 90, 150, 20, 300, 35, 110, 230, 30

Would you prefer $15 for sure, OR a coin toss in which you will get $X if you flip heads or nothing if you flip tails?