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ABSTRACT

Are Older People Aware of Their Cognitive Decline? Misperception and Financial Decision Making*

We investigate whether older people correctly perceive their own cognitive decline, and the potential financial consequences of misperception. First, we document the fact that older people tend to underestimate their cognitive decline. We then show that those who experienced a severe cognitive decline, but are unaware of it, are more likely to suffer wealth losses compared to those who are aware or did not experience a severe decline. These losses largely reflect decreases in financial wealth and are mainly experienced by wealthier people who were previously active on the stock market. Our findings support the view that financial losses among older people unaware of their cognitive decline are the result of bad financial decisions, not of rational disinvestment strategies.

JEL Classification: J14, J24, C23

Keywords: aging, cognitive ability, household finance, HRS

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1 Introduction

A key feature of the process of human aging is the decline of cognitive ability, a complex phenomenon whose causes and economic consequences are still not well understood. Our insufficient understanding of cognitive decline, and of human capital decumulation more generally, is unfortunate because cognitive functioning influences an individual's ability to process information and to make the right choices. This is becoming even more relevant in the light of the recent trend to scale back publicly-provided safety nets that require relatively little individual decision-making – such as public social security and healthcare systems – and to rely more on private providers that require much higher decision-making skills. For instance, the pension landscape in the U.S. and many other countries has changed dramatically in the last three decades with a major shift away from defined benefit systems towards defined contribution systems. At the same time, the cohorts currently near retirement are expected to live longer and to hold larger amounts of wealth after retirement than previous cohorts. As a result, they will need to make more complex financial decisions, and these decisions will crucially affect their lifetime resources and welfare.

If older people lack the skills required to properly manage their wealth, they are more likely to make mistakes that lower their own welfare. In the aggregate, this can have broader consequences for the whole economy (Campbell, 2016). Because of the significant amount of assets they hold, older people are also more likely to be victimized by investment fraud (Kim et al., 2018; Egan et al., 2019). These observations motivate a growing body of research in economics on the causes and consequences of financial (il)literacy (Agarwal and Mazumder, 2013) and its relationship with the process of cognitive aging (Agarwal et al., 2009; Korniotis and Kumar, 2011; Finke et al., 2016). They also raise fundamental questions about the optimal policy response.

Although financial education is clearly important for younger cohorts, it is unclear whether it is an appropriate policy in the case of older people facing an increasing risk of cognitive decline. Perhaps more important in this case are the largely neglected issues of whether people recognize their cognitive decline and how they protect themselves. For example, those who perceive or are able to predict their own decline may delegate financial decisions to someone they trust, such as their spouse (Hsu and Willis, 2013), another family member, or a financial advisor. On the contrary, those who are unaware of their decline may be overconfident about their ability and may incur financial losses or be subject to financial frauds. The consequences of cognitive decline may be even worse for those with high initial levels of cognitive ability, who tend to manage directly their finances and do not seek advice due to a higher level of confidence (von Gaudecker, 2015; Kim et al., 2018).

In this paper we use data from the Health and Retirement Study (HRS), a representative panel of the U.S. population aged 50+, to study the relationships between self-ratings of memory changes, assessed changes in memory performance, and wealth changes across waves of the survey. To avoid selection issues arising from institutionalization, mortality or proxy interviewing, we restrict the sample to people aged 80 years or less, so most of our respondents do not experience the extreme cognitive decline typical of neurological pathologies. Since wealth changes are defined at the household level, we further restrict attention to the household member who is most knowledgeable about the household finances.

We establish three important facts, some of which are new. First, consistent with the evidence from other studies (see, e.g., Gamble et al. 2015), we show that older people tend to be unaware of their cognitive decline. Second, we analyze the financial consequences of this underestimation by focusing on individuals who experienced a severe cognitive decline – as measured by the change in their memory score across survey waves – and we show that unaware respondents are more likely to suffer large wealth losses compared to respondents who are aware or did not experience a severe decline. Third, we show that wealth losses across waves are mainly reported by people in the fourth quartile of the distribution of total wealth, are concentrated among respondents who are unaware of their declining memory performance, mainly reflect large decreases – equal to about 10% on average – in the real value of financial wealth (particularly in the value of stocks, mutual funds and investment trusts owned), and are much larger among respondents who were active on the stock market in the previous two years.

To help interpreting these findings, we estimate a multi-period difference-in-differences (DiD) model of wealth changes for individuals who experienced at least one memory loss event during the observation window, thus focusing on the different wealth profiles of aware and unaware respondents. Despite the substantially reduced sample size, our results show that being unaware of own memory loss helps predict future wealth changes, whereas past wealth changes do not help predict future memory losses or awareness of these events. Reverse causality concerns may still arise if, in the 2-year window between survey waves, wealth shocks negatively affect health and cognition, via increasing stress (Schwandt, 2018). We address this concern by constructing an arguably exogenous measure of wealth shock that only depends on the initial portfolio composition of each household and on exogenous stock market fluctuations. Although our measure strongly predicts wealth changes, it does not significantly affect the probability of experiencing a memory loss or of being aware of it. Additionally, we find no evidence of depression or stress driven by financial concerns among unaware respondents.

Our results suggest a causal role of unawareness of own cognitive decline for wealth losses. Since wealth losses among unaware respondents mainly reflect a decrease in the value of riskier assets, they might result from bad financial decisions. We find no comparable wealth losses among respondents who are aware of their declining memory, or among respondents who are unaware but are less likely to make financial decisions in the household. We also find that wealthier unaware respondents tend to display better memory performance before the occurrence of the memory loss. All this suggests an interpretation based on overconfidence. As argued by Barber and Odean (2001), overconfident investors incur larger return losses because they trade too much, hold unrealistic expectations about their investments and the accuracy of their estimates, and invest too much on information acquisition. This interpretation is in line with the evidence in von Gaudecker (2015) showing that the largest deviations from efficient portfolio strategies occur among those who appear to overestimate their capabilities and do not seek external help with their investments.

To provide further evidence for our overconfidence interpretation, we ask whether differences in health or other personal characteristics might provide alternative explanations for the observed differences in wealth profiles between people aware and unaware of their cognitive decline. For example, if unaware respondents have lower subjective life expectancy, they might optimally decide to disinvest more, which would explain their different wealth profiles. In fact, we find that unaware respondents are on average in better physical health. Unlike aware respondents, they also show no negative change in their subjective assessment of life expectancy. For them, the standard life-cycle model would therefore predict smaller disinvestment, which is just the opposite of what we observe. Further, we find no differences between the aware and the unaware in financial transfers to children or, using additional data from the HRS Consumption and Activities Mail Survey (HRS-CAMS), in their consumption patterns. Finally, we cannot explain our results with differences between the aware and the unaware in portfolio composition or differential misreporting of wealth.

Our paper is related to a growing literature that investigates the determinants of the large wealth dispersion observed in the U.S. and other developed economies (see Campbell, 2016 for a review), especially around the age of retirement. While earlier works attempt to explain the large cross-sectional wealth inequality through heterogeneity in saving rates (Dynan et al., 2004) or risk aversion (Calvet et al., 2009), recently attention has been devoted to cross-sectional heterogeneity in the rates of returns (Fagereng et al., 2016), possibly arising from differences in financial knowledge (Lusardi et al., 2017). We contribute to this line of research by proposing yet another channel that may affect the longitudinal variation in wealth, namely differences in cognitive deterioration and in awareness of own declining skills. While the existing literature provides clear evidence of a U-shaped age-profile of financial mistakes (Agarwal et al., 2009; Korniotis and Kumar, 2011), to the best of our knowledge we are the first to use nationally-representative longitudinal data to explore the link between age-related cognitive decline, awareness of this decline, and financial performance. The policy implications are also novel because, instead of pointing to interventions aimed at improving the degree of financial literacy of older people, our findings point to interventions aimed at moderating overconfidence among older wealth owners unaware of the fact that their previously good skills are rapidly deteriorating.

The remainder of this paper is organized as follows. Section 2 reviews the literature on cognitive aging and decision making and outlines our theoretical framework. Section 3 describes our data and presents some descriptive statistics. Section 4 describes our modeling strategy. Section 5 presents our empirical results and discusses some alternative explanations. Finally, Section 6 concludes.

2 Cognitive aging and decision making

2.1 Literature review

Cognitive ability is the ability to perform the mental processes required in a variety of tasks, so it is generally regarded as a multidimensional latent trait, only imperfectly measured by different types of performance test. As people get older, their cognitive ability tends to gradually deteriorate, though there is large variation across individuals at all ages (see for example Schaie, 1996). This age-related decline ranges from what may be considered as normal cognitive aging to large drops in cognitive performance due to neurological pathologies, such as Alzheimer's disease or other forms of dementia.

The psychological literature usually draws a distinction between two different forms of intelligence, fluid and crystallized. Fluid intelligence comprises fundamental skills, such as memory, executive functioning, abstract reasoning and processing speed (Salthouse, 1996), which are more closely related to biological factors. It is generally related to the performance on new tasks and is characterized by a steady decline over one's adult life starting already from the age of 20. Crystallized intelligence, which consists of the knowledge and experience acquired during the life, shows instead little age-related decline and partially compensates the large decline in fluid intelligence. Most day-to-day tasks rely on a different mix of these two forms of intelligence. Therefore, our ability to perform a specific task may decline over time at different rates (or even improve) depending on the tasks considered. For most tasks we can assume that cognitive performance is hump shaped with respect to age, with a peak reached around 50 years of age (for a recent review, see Mazzonna and Peracchi, 2018).

A rich literature, mainly in psychology, has investigated how age-related cognitive decline affects individuals' decision-making (see Carpenter and Yoon, 2011 for a review), showing that older adults are more likely to use biased heuristic strategies because aging increases the cost of engaging in effortful cognitive activities (Hess, 2014). Older adults may in fact choose to limit both the quantity and complexity of the information they use. As in the macroeconomic literature on rational inattention, this may in fact be perfectly rational given their increasingly limited capacity for processing information (Kim et al., 2016). Consistent with this view, Abaluck and Gruber (2011) find that elderly choices under Medicare Part D tend to focus on a narrow range of dimensions, which is inconsistent with a fully informed rational decision process with no limit on information-processing capacity.

Given the fundamental role of preferences in economic modeling, economists have recently focused their attention on the relationship between cognition and risk aversion (see Dohmen et al., 2018 for a review) and the effects of aging on this relationship. For instance, Bonsang and Dohmen (2015) find that the association between aging and risk aversion is mediated by numerical ability. Recent experimental evidence in psychology (e.g., Koscielniak et al., 2016) also confirms the positive correlation between aging and risk aversion and the mediating effect of the age-related decline in processing speed and memory. More generally, Christelis et al. (2010) show that cognitive ability is strongly related to portfolio choices. They find that the propensity to invest in stocks is strongly associated with cognitive ability. Further, this relationship persists after controlling for differences in health conditions, which are also related to the likelihood of investing in risky assets (Rosen and Wu, 2004).

2.2 Perceived cognitive decline and financial decision making

To illustrate the effect of perceived cognitive decline on financial decision making, and the consequences of misperception, we present a simple conceptual framework that builds on the life-cycle model proposed by Lusardi et al. (2017), hereafter LMM. Here we provide the main intuitions and offer more details in Appendix A.

As in LMM, we consider a simple two-period model in which a consumer maximizes life-time utility – defined over consumption in the two periods with no bequest – by deciding how to allocate income y between initial consumption c_1, savings s, and cognitive investment i aimed at raising the return on savings. This cognitive investment consists of time, effort, and costly information, and requires both computational and memory skills to produce its effects. We assume that consumption in the second period is given by $c_2 = Rs$ where, departing from the original LMM formulation, $R = \gamma + \delta i$, with $\gamma \geq 1$ and $\delta \geq 0$. This allows us to distinguish between passive investors ($i = 0$) who are happy with the basic return γ, and active investors ($i > 0$) who make a costly cognitive investment i seeking to raise their return. It is easy to show that optimal savings and investment are both linear in income (as in the original LMM model), and that below some income level $\bar{y}$ it is optimal to be a passive investor.

We model cognitive decline as an exogenous random shock that may hit the consumer before she chooses c_1, s, and i, and turns the productivity δ of cognitive investments from positive to negative. In this case, it is crucial whether the consumer is aware of her own cognitive decline. If she is aware, her best choice is to make no cognitive investment and just earn the basic return γ. If she is not aware, she makes a positive investment and obtains a lower return than a passive investor – unless she makes no cognitive investment because her income is too low anyway.

Our simple conceptual framework involves three types of investors: (i) normal investors, i.e. consumers unaffected by a cognitive shock who make costly cognitive investments to raise their returns on savings; (ii) passive investors, i.e. low-income consumers ($y \leq \bar{y}$) or high-income consumers ($y > \bar{y}$) aware of their negative cognitive shock; and (iii) overconfident investors, i.e. consumers unaware of their negative cognitive shock who make costly cognitive investments but earn a lower return than passive investors. For high-income consumers, the model predicts lower lifetime utility for the overconfident investor compared to both passive and normal investors. Our model does not consider the possibility of delegation. However, if a consumer is overconfident, absent mandatory advanced directives or a financial "driving licence" (Agarwal et al., 2009), it is not clear why she would delegate her financial decisions to others. Net of the agency issues that may arise, delegation is actually more likely to benefit consumers hit by a cognitive shock but aware of it, as it may help them obtain higher returns on their savings.

3 Data

This section describes our data, in particular our measures of memory and wealth, and presents some descriptive statistics.

3.1 The HRS

The HRS is a household panel survey that collects rich and detailed information on nationally representative samples of approximately 20,000 Americans aged 50 or older and their partners. The survey began in 1992 and is fielded biennially in even-numbered years. Interviews are conducted in-person and by telephone, with supplemental information collected via mail.

We use data from the RAND HRS files, a cleaned, easy-to-use, and streamlined version of the data from the original HRS core interviews, with derived variables covering a large range of measures and RAND imputations of missing values on income, assets, and medical expenditures. These files have been used extensively in the economic literature because they are consistent and comparable across waves. We confine attention to the nine survey waves from 1998 (wave 4) to 2014 (wave 11) because the cognitive tasks and the questions on self-rating of memory changed in 1996 and full information on total wealth is available only from 1998.

Our initial sample includes all respondents aged 50 and older with non-missing information on our variables of interest, namely household wealth and self-rated and assessed memory.[1] To avoid potential selection issues arising from institutionalization, mortality or proxy interviewing, we further restrict the sample to people aged 80 years or less. Since wealth changes are defined at the household

[1] To minimize the effects of attrition and nonresponse due to aging and aging-related conditions, the HRS makes extensive use of proxy interviews, which are programmed and worded separately. For most questions, the proxy interview only involves wording changes (e.g., from "you" to "her"), but some questions that are considered inappropriate to ask proxies (e.g., cognitive performance tests) are omitted entirely. In what follows we drop proxy interviews because they do not contain the cognitive performance tests.

level, we only consider the financial respondents.[2] However, to avoid potential selection issues arising from a change of the financial respondent after a memory loss, we focus on the designated financial respondent in the previous wave, before the memory loss event. Nonetheless, just like Hsu and Willis (2013), we find no evidence of switching in financial management shortly after an episode of cognitive decline.

In our robustness checks we also employ data from the HRS-CAMS, a paper-and-pencil survey fielded biennially in odd-numbered years. In particular, we employ data on total household expenditure and household expenditure on four categories of goods, namely durables, non-durables, housing and transportation.

All sample statistics presented in the remainder of this section are computed using the HRS household-level weights, which adjust for differences in the composition of the sample and the population in terms of age, marital status, race and cohort of entry.

3.2 Self-rated and assessed memory

The HRS asks respondents to rate their memory at the time of the interview as either "Excellent", "Very good", "Good", "Fair", or "Poor". It also asks them to rate their current memory compared to their memory in the previous interview (about two years earlier) as either "better now", "about the same", or "worse now".

The HRS assesses memory performance using two word recall tasks designed as follows.[3] The interviewer reads a list of ten words to the respondent and then asks to recall as many words as possible from the list in any order. The respondent hears the list only once and is asked to recall the words two times, immediately after the encoding phase (immediate recall) and after a few minutes (delayed recall). We sum up the scores in the two tests, so our memory score ranges from 0 to 20.[4] Figure 1 shows the distribution of the memory score, both in levels and in differences across waves of the survey. On average, the memory score is equal to 9.78, while the difference in the score between two waves is only slightly negative (-.37), suggesting that many respondents actually improve their score from one wave to the next. This may partly reflect retesting effects (Salthouse et al., 2004). These arise because, although respondents are exposed to a different list of words in each wave, repeated exposure to the same test format may induce some learning. If attrition across waves is correlated with cognitive functioning, sample selection may also partially explain the observed distribution of changes in the memory score.

[2] The financial respondent is the household member designated by each household to answer all household-level financial questions. Smith et al. (2010) argue that the financial respondent is the most knowledgeable person about the financial assets of the household and the chief financial decision maker.

[3] As argued by Dohmen et al. (2018), these tests only capture memory performance if other factors that might affect test performance are held constant. For example, distractions on the day of the test or personality traits that determine task motivation could play an important role.

[4] More information on the cognitive measures in the HRS can be found in Ofstedal et al. (2005).

To simplify the comparison between self-rated and assessed memory changes, we dichotomize both variables. As for self-rated changes, we distinguish between declining memory ("worse now") and non-declining memory ("about the same" or "better now"). As for assessed performance, we first define a threshold – absolute or relative – that allows us to distinguish respondents who experience a severe memory loss across waves from those who do not. Following the neuropsychological literature (see e.g. Nasreddine et al., 2005), a memory loss may be regarded as severe if it exceeds one standard deviation, corresponding in our case to a loss of three or more words. Such "absolute" definition may understate cognitive declines among respondents with poor memory scores already in the baseline year (floor effect). Therefore, in what follows we present the results obtained using a "relative" definition that regards a memory loss as severe if it corresponds to a decline of the memory score by 20% or more. This corresponds to the first quintile of the distribution of the changes in the memory score and to an average decline of almost four words, starting from an initial score of 11.7 words on average.

Notice that, as a consequence of our sample selection criteria described in Section 3.1, these definitions of memory loss capture cognitive declines that occur at an earlier age and are likely to be much milder than those associated with Alzheimer's disease and other forms of dementia investigated in Hsu and Willis, 2013. Indeed, more than 60% of the individuals in our sample experienced at least one memory loss event during the observation window.

The HRS also includes cognitive tasks aimed at assessing other cognitive dimensions, such as basic skills of reasoning, orientation, calculation, language, and knowledge.[5] On average, our definition of memory loss is associated with a decline of 10% of a standard deviation in the other test scores. This indicates that it captures the overall deterioration of an individual's cognitive performance.

Finally, it is worth noting that the order of the questions is always the same. The respondents are first asked to self-rate their memory and then follow the cognitive testing, which eliminates the risk that answers about self-rated memory are biased by the test outcome.

3.3 Household wealth

The HRS collects detailed information on household wealth and its individual components, distinguishing between 13 asset categories: the net value of primary residence; the net value of secondary residence; the net value of real estate (not primary or secondary residence); the net value of vehicles; the net value of farm or business; the net value of individual retirement accounts (IRA or Keogh

[5] Our measure of relative memory decline is strongly correlated with three other tests included in the HRS, namely backward counting and serial 7, which involve simple numerical calculations, and the total mental status score, which sums the scores from the counting, naming and vocabulary tests. The serial 7 test asks the respondent to subtract 7 from 100, and continue subtracting 7 from each subsequent number for a total of five times. The vocabulary task scores the respondent's ability to provide definitions of five given words. Having a severe relative memory loss is associated with a statistically significant decline in serial 7 of .10 of a standard deviation (SD), in backward counting of .05 of a SD, and in total mental status of .15 of a SD.

plans); the net value of stocks, mutual funds and investment trusts; the value of checking, savings, or money market accounts; the value of certificates of deposit (CDs), government savings bonds and Treasury bills (T-bills); the net value of bonds and bond funds; the net value of all other savings or assets; the value of all mortgages/land contracts (primary residence); the value of other home loans (primary residence); the value of all mortgages/land contracts (secondary residence); and the value of all other debt (credit card balances, medical debts, life insurance policy loans, loans from relatives, etc.). This information is obtained from the designated financial respondent, one in each household, namely the person that is most knowledgeable about financial issues. Notice that the RAND HRS files do not encompass all components of total wealth, as they only contain fragmentary information on 401k, 403(b) and other employer-sponsored retirement plan balances, and no direct measure of Social Security wealth. Including the value of these other wealth components would complicate matters considerably – as they can only be estimated indirectly, for example using the data and the procedure described in Barth et al. (2018)[6] – but is unlikely to substantially modify our results – as it is implausible that changes in these unmeasured components would offset those observed for the measured components, and do so in ways that differ across respondents' types.

We are primarily interested in the net value of total household wealth, computed as the sum of all assets and liabilities recorded in the HRS, and in the net value of total household financial wealth, computed as the sum of all financial wealth components recorded in the HRS (excluding the net value of individual retirement accounts) less the value of all debt components except mortgages. We convert all monetary amounts to 2014 U.S. dollars using the average consumer price index (CPI) as deflator. Although the information on household wealth is self-reported, it is important to note that the HRS interview includes an asset verification procedure in which respondents are asked to verify or correct the asset values reported in the previous and the current waves whenever there is a large discrepancy (more than 50,000 U.S. dollars) in the reported values.[7]

Unfortunately, missing or incomplete information (e.g. bracketed amounts in an unfolding bracket sequence) on some wealth components represents a serious challenge. The RAND HRS files provide imputed values for these cases.[8] To limit the impact of the imputation procedures on our results, we restrict the sample to the observations for which the imputations represent less than 20% of the value of all asset and debt categories. To limit the impact of outliers we also trim all observations with total wealth below the 1st percentile or above the 99th percentile. The resulting working sample consists of 16,243 individuals (9,009 males and 7,234 females), observed on average for 3.5 waves. As expected, wealth distribution is heavily skewed to the right and, in the case of financial wealth, a

[6] Barth et al. (2018) compute Social Security wealth by exploiting the link between individuals in the HRS and income data available through the Master Earnings File maintained by the U.S. Social Security Administration.

[7] In an experiment included in the 2001 HRS, Hill (2006) shows that incorporating the corrections from this call-back procedure leads to a drop in the variance of the change in the net worth by about 50%.

[8] Detailed information on the imputation procedure can be found in Hurd et al. (2016).

large fraction of respondents (about 25%) report zero or negative values.[9]

We use the information on the composition of financial wealth by asset category in any given wave to predict total financial wealth in the following wave using monthly information on market returns by asset category obtained from the Thomson Reuters Datastream database. Specifically, for stocks we use the difference in the S&P 500 Composite Index; for long-term bonds we use the U.S. Treasury 10 Year Government Bond Yield; for CDs, government savings bonds and T-bills we use the interest rate on 3-month CDs; for debt we use the 24-month personal consumer credit interest rate; and for checking and savings accounts we use estimates obtained from Statista.[10] Suppose that respondent i is interviewed in month t and re-interviewed m months later. Given the respondent's initial wealth W_{ijt} in asset category j, we compute the predicted wealth $W^*_{ij,t+m}$ in that category at the time of the next interview by the formula:

$$W^*_{ij,t+m} = W_{ijt} \prod_{s=t+1}^{m} (1 + r_{js}),$$

where r_{js} is the return on asset category j between month $s-1$ and month s. The predicted value of total financial wealth is then computed by summing the predicted wealth in all asset categories.

3.4 Descriptive statistics

Figure 2 shows the age profiles of the mean value of the memory score (the sum of the scores in the immediate and delayed word recall tasks) and of the self-rated memory level. Interestingly, the first profile is much steeper than the second. This result is not due to cohort effects and also holds if we take individual fixed effects into account.

We find similar evidence when comparing changes in the memory score with self-rated memory changes across waves. Table 1 shows that, depending on the definition of severe memory loss (either a relative decline of 20% or more in the memory score, or an absolute decline of one standard deviation or more), between 77 and 80% of those who experience a severe memory loss between adjacent waves actually rate their memory as stable or improved. On the other hand, between 19 and 20% of those who do not experience a severe memory loss between adjacent waves rate their memory as worse. Figure 3 shows that, as expected, the proportion of respondents who experience a severe memory loss increases with age, but the age-profiles for aware and unaware respondents are roughly parallel.

Figure 4 shows the distribution of the assessed memory performance in the wave before the occurrence of a severe memory loss. Although we use the relative definition of severe loss (a 20%

[9] This prevents us from using the log transformation, which would be natural given the skewness of the wealth distribution. In a robustness check, we show that the results obtained using the log transformation are very similar to those reported in the main text when focusing on the richest respondents for whom the probability of negative wealth is essentially zero (Section 5.4).

[10] http://www.statista.com/statistics/325600/average-interest-rate-checking-account-usa/. We assume that for the missing years (before 1998 and after 2014) the time profile of the interest rate is the same as the FED Federal Funds target rate, which we again obtain from Datastream.

decline of the initial memory score), respondents who experienced a severe loss (both aware and unaware) still show on average higher initial memory performance than those who did not experience a severe loss. If we only consider the subset of respondents with a severe memory loss, the distributions of their memory performance in the previous wave is much more similar for aware and unaware respondents, and is actually slightly better for unaware respondents.

In Table 2 we investigate the characteristics of those who are more likely to experience a severe memory decline and to be unaware of it. Specifically, we report the estimated marginal effects from probit models for the probability of experiencing a relative memory loss as defined above (Columns 1 and 2) and for the probability of being unaware conditional on having a memory loss (Columns 3 to 4). For both outcomes, we initially control only for basic socio-demographic characteristics, wealth quartiles, and memory score in the previous wave (Columns 1 and 3). We then include additional controls for self-rated health and the number of limitations in the activities of daily living (ADL) in the previous wave (Columns 2 and 4). Consistent with Figure 3, age is strongly positively associated with the probability of experiencing a memory loss but only weakly associated with the probability of being unaware. As expected, education, wealth and health are all negatively associated with the probability of experiencing a severe memory loss. However, most of these "protective" factors are only weakly associated with the probability of being unaware, or even increase that probability. In particular, respondents with higher initial memory scores or initially in very good health are more likely to be unaware of their memory decline. In other words, the unaware appear to have better initial health and memory, and this may be the reason why they remain confident about their skills. It is worth noting that having children does not affect the probability of experiencing a memory decline but is negatively associated with the probability of being unaware. Finally, females have both a higher probability of experiencing a memory loss and of being unaware of it.

4 Empirical modeling

The regression models we fit to the data are meant to reveal possible associations between wealth changes across waves and severe declines in memory performance, and whether the nature of this association depends on the respondents' awareness of their cognitive decline.

Although HRS respondents are asked to self-rate both their memory performance in the current wave and changes in memory performance across waves, we focus on the latter for two reasons. First, since we want to investigate whether wealth changes differ on average for respondents with a severe memory loss, we are more interested in their perceived changes in memory performance over time than in their perceived memory performance at a given point in time. Second, among respondents whose test scores reveal a severe memory loss, we want to distinguish between those who self-rate their memory as declining and those who do not. This is easier than defining a threshold for the self-rated memory level in a given wave (e.g., poor or fair) and comparing it with the assessed memory performance.

4.1 The basic model

Our basic model for the individual wealth changes is of the form:

$$\Delta W_{it} = \alpha + \beta_1 Aware_{it} + \beta_2 Unaware_{it} + \beta_3 Pessimist_{it} + \boldsymbol{\gamma}^\top \boldsymbol{X}_i + \boldsymbol{\delta}^\top \boldsymbol{Z}_{it} + \psi_t + U_{it}, \tag{1}$$

where ΔW_{it} is the change in wealth (total, financial, or their subcomponents) of individual i between waves $t-1$ and t, $Aware_{it}$ is a binary indicator equal to one if individual i presents a severe memory decline between the two waves and self-rates own memory as declining, $Unaware_{it}$ is a binary indicator equal to one if individual i presents a severe memory decline between the two waves but self-rates own memory as stable or improving, $Pessimist_{it}$ is a binary indicator for not presenting a memory decline but self-rating own memory as worse, $\boldsymbol{X}_i$ is a vector of time-invariant regressors including sex, race, and years of education, $\boldsymbol{Z}_{it}$ is a vector of time-varying regressors including a quadratic age term and a set of indicators for marital status, labor force status, and geographical region (census division), ψ_t is a survey-wave fixed effect common across individuals, U_{it} is an unobservable error term assumed to be mean independent of the observable regressors, and α, β_1, β_2, β_3, $\boldsymbol{\delta}$, and $\boldsymbol{\gamma}$ are parameters to be estimated. The intercept α may be interpreted as the expected wealth change for an individual who does not present a cognitive decline and does not self-rate own memory as worse.

The fact that (1) is a model for wealth changes has two important implications. First, the contrast $\beta_1 - \beta_2$ measures the difference in the expected value of wealth changes, not of wealth levels, for two individuals with the same values of $\boldsymbol{X}_i$ and $\boldsymbol{Z}_{it}$, one aware of own memory decline and the other unaware. Whether $\beta_1 - \beta_2$ may also be given a causal interpretation is an important question that we leave to the next section. Second, since wealth is self-reported, wealth changes across waves may be subject to a substantial amount of measurement error, which is likely to significantly increase the variability of the error term in (1) relative to a model for the wealth levels.

To guarantee that we are comparing individuals with similar observable characteristics, in Section 5.1 we also consider a more general specification that includes initial wealth and memory scores as additional time-varying regressors. This is because wealth changes may be expected to be larger for people with larger initial wealth and because wealthier respondents may be less likely to experience a severe memory loss but more likely to be unaware. Further, we investigate the heterogeneity of the results across quartiles of the initial wealth distribution.

As a robustness check, in Section 5.4 we consider two alternative model specifications. One exploits the full support of the assessed memory change and its interaction with the self-rated memory decline (Table B.8 in the appendix). The other adds to model (1) a set of individual fixed effects to account for unobserved heterogeneity in wealth changes, not only in wealth levels.

4.2 The DiD model

To investigate the different profile of wealth for the aware and the unaware, and help interpret our findings, we also estimate a multi-period DiD model for all individuals who experienced at least one memory loss event during the observation window, with the "treatment group" consisting of those who are unaware of their memory loss ($Unaware_i$) and the control group consisting of those who are aware.[11] Specifically, we consider the following model:

$$\Delta W_{it} = \alpha + \beta \, Unaware_i + \sum_{s \geq -S}^{S} (\gamma_{1s} + \gamma_{2s} \, Unaware_i) \, 1[\tau_{it} = s] + \boldsymbol{\delta}^\top \boldsymbol{Z}_{it} + \psi_t + V_{it}. \tag{2}$$

where $1[A]$ is the indicator function of the event A and τ_{it} denotes the "event year", defined so that $\tau_{it} = 0$ for the year in which we observe the first severe memory loss event for individual i. The coefficients of interest are the γ_{2s}, which represent the sequence of DiD coefficients for the unaware individuals. Estimating this model requires a sample of individuals who are observed continuously for at least $S + 1$ periods before and S periods after the memory loss event. In our data respondents are observed on average for 3.5 periods (less than 8 years), so this requirement severely restricts the available sample size, which leads to higher standard errors and possible bias due to sample selection. To minimize the problem, we set $S = 1$, so the coefficients measure differences relative to the omitted coefficient corresponding to $\tau_{it} = -2$. This results in a sample of 2,125 individuals observed for at least 8 years (from $\tau_{it} = -2$ to $\tau_{it} = 1$), who experienced at least one severe memory loss event during this period. Because of the small sample size, we use model (2) mainly as a robustness check and do not investigate heterogeneity across individuals with different (initial) wealth or across stock owners, as we do for the basic model.

5 Results

We begin by examining the relationship between changes in total wealth and the occurrence of severe memory losses (defined here as a decline of 20% or more in the memory score) using various versions of the first-difference model (1) and the multiple-period DiD model (2). We then discuss alternative interpretations of our empirical findings and present a number of robustness checks.

5.1 Memory loss awareness and wealth changes

Table 3 presents the results from the first-difference model (1). The first three columns of the table only use information on financial respondents (FR). Columns (1) and (2) are for a restricted version of the model that only includes an indicator for a severe memory loss without distinguishing between

[11] Since some individuals experienced more than one memory loss event we focus on the first such event to assign these individuals to one of the two groups.

aware, unaware and pessimist respondents (this corresponds to the restrictions that $\beta_1 = \beta_2$ and $\beta_3 = 0$). When we do not condition on initial wealth and memory levels (Column 1), we see little evidence of systematic differences in wealth changes between people with and without severe memory losses. After controlling for initial wealth and memory levels (Column 2), the coefficient associated with the memory loss indicator becomes statistically significant, negative, and quantitatively large – corresponding to a loss of almost 6% of mean wealth. Column (3) removes the restrictions that $\beta_1 = \beta_2$ and $\beta_3 = 0$, and shows that wealth losses are on average much larger for respondents who are unaware of their memory decline. The estimate of the contrast $\beta_1 - \beta_2$ is economically relevant, corresponding to a loss of roughly 6% of mean wealth over a two-year period. The coefficient on pessimist respondents (those who did not present a memory decline but self-rate their memory as worse) is small and not statistically different from zero. Thus, to save space, we no longer report it in the remaining tables.

The last two columns of Table 3 focus on those who experienced a severe memory decline and compare financial respondents (Column 4) with non-financial respondents (Column 5). The comparison of the two columns shows that the expected wealth losses are economically relevant (about 20 thousands dollars) and statistically different from zero only for the financial respondents, which suggests that the lack of awareness of own cognitive decline has much more serious consequences for those who actually make financial decisions in a household.

Table 4 presents the results for the DiD model (2). This allows us to directly compare the wealth changes of aware and unaware before and after their first memory loss event. As expected, the large reduction in the number of observations leads to large standard errors, but the point estimates for both total and financial wealth confirm that the wealth drop around a memory loss event is larger for the unaware respondents regardless of the controls we include in the model (the basic set of controls for age and survey year fixed effects or the full set of controls). Further, the size of the drop is larger than that estimated from model (1) although not statistically different given the large standard errors. The table also shows little evidence that past wealth changes help predict subsequent memory loss events. At the same time, wealth losses do not seem to increase after the first memory loss event. Consistent with the evidence reported in the next section, when we focus on financial respondents with positive financial wealth (columns 3 and 6) the estimated wealth drop around the memory loss event substantially increases and becomes statistically significant. As a robustness check, we also estimate a modified version of model (1), which includes leads and lags of the regressors of interest (i.e., aware and unaware). The results in Table B.1 confirm the absence of any anticipation or lagged effects.

Because of the loss of precision due to the smaller sample size available for the DiD model, we shall henceforth focus on extensions of our basic specification (1), leaving aside the DiD model.

Table 5 presents the results of fitting model (1) separately by quartile of the distribution of initial wealth to account for heterogeneous effects depending on the position in the initial wealth distribution. The table shows that the wealth losses observed for respondents who are unaware of their own memory decline are concentrated among those in the top half (third and fourth quartiles) of the initial wealth distribution and represent roughly a 4% decline in their mean wealth. Furthermore, the difference $\beta_1 - \beta_2$ between aware and unaware respondents is particularly large (almost 7% of mean wealth) and statistically significant only for the wealthiest respondents. All these findings are consistent with our conceptual framework in Section 2.2. Table B.6 in the appendix shows that wealth losses mainly involve respondents who are still employed or are under age 70, and therefore likely to be in a phase of their lives where they are still saving for retirement.

5.2 Potential mechanisms

So far we only investigated the relationship between severe memory changes (self-rated or assessed) and total wealth changes. To explore potential mechanisms behind the observed relationship, Table 6 presents the results obtained by fitting model (1) for total wealth changes (Column 1 is the same as Column 3 of Table 3) and then separately for changes in the value of five broad wealth categories, namely financial wealth, individual retirement accounts, housing, other real estate, and farm/business.[12] The table shows that the wealth losses for respondents who are unaware of their declining memory are mainly due to a decrease in the value of their financial wealth and, to a lesser extent, of their individual retirement accounts. Changes in the value of the other wealth categories (other real estate, and farm/business) are much smaller and not statistically significant. Using the RAND HRS definition of financial wealth, which excludes individual retirement accounts, we account for about 65% of the total wealth losses reported in the first column of Table 6. If we also include individual retirement accounts, we account for almost 85%. It is worth noting, however, that the difference between aware and unaware, measured by $\beta_1 - \beta_2$, is large (more than 15 thousands dollars) and statistically different from zero only for financial wealth.

Table 7 presents the results of fitting model (1) separately for people with and without financial wealth in the initial wave, and for respondents in the third and fourth quartiles of the distribution of initial wealth. The table shows that the effect is concentrated among those who initially hold positive financial wealth and among those with initial wealth above the median. More specifically, people in the third and fourth quartiles of the initial wealth distribution who are unaware of their memory decline suffer substantial financial losses across waves, the magnitude of which corresponds to roughly

[12] Financial wealth consists of the net value of stocks, mutual funds and investment trusts, the net value of checking, savings or money market accounts, the value of CDs, government savings bonds or T-bills, the net value of bonds and bonds funds, and the net value of all other savings or assets; individual retirement accounts consist of the net value of IRA/Keogh plans; housing consists of the net value of the primary residence; other real estate consists of the net value of the secondary residence and other real estate; and farm/business consists of the net value of farm or business.

10% of their mean financial wealth.

Since financial losses are observed only for respondents who hold positive financial wealth in the previous wave and are unaware of their cognitive decline, we concentrate on this group. Table 8 shows that more than half of the average loss in financial wealth (which, from Table 7, is equal to about 22 thousand U.S. dollars at 2014 prices) reflects a decrease in the net value of stocks, mutual funds, and investment trusts owned (Column 1). The rest is due to a decrease in the net value of certificates of deposit, checking and savings accounts, and in the net value of other savings or assets (Columns 4–6). We instead observe hardly any changes in the value of bonds and bond funds (Column 2) and in the value of financial debt (Column 3).

These results show that wealth losses are concentrated among wealthier respondents who are unaware of their cognitive decline, and the losses mainly involve financial assets. Since wealth losses are concentrated among the financial respondents, who are more likely to make financial decisions, it is possible that these people may have made poor financial investments because they were unaware of their falling cognitive performance. We also know that respondents who experienced a severe memory loss show better cognitive performance at the baseline (Table 2 and Figure 4) and were therefore likely to be more confident about their ability. This interpretation is confirmed by our investigation of the information from Section R (Asset Change) of the HRS. This module asks financial respondents who report owning (or having previously owned) stocks or shares in mutual funds about their stock market activity in the last two years (namely whether they sold or bought stocks or mutual funds shares including automatic reinvestments).[13] Table 9 shows that the wealth losses in financial wealth are mainly observed among unaware respondents who reported to be active on the financial markets in the last two years (Column 1). Losses are also observed among unaware respondents who were inactive (Columns 2) or were inactive and did not own stocks (Columns 3), but these losses are much smaller than for unaware respondents active on the financial markets (16% vs. 6%). It is worth noting that being unaware does not affect the probability of being active on the stock market, which suggests that overconfidence does not lead people to be more active on the stock market (as shown by Barber and Odean, 2001) but mainly causes them to perform worse on familiar tasks.

5.3 Alternative interpretations

The evidence reported so far is consistent with our "bad investment" interpretation. However, we cannot a priori exclude alternative interpretations of our findings that stress differences in observable or unobservable characteristics between respondents aware and unaware of their declining memory.

[13] The high frequency of bracket responses, and of item nonresponse to questions on the amount of stocks sold or bought in the last period, does not allow to calculate meaningful monetary amounts for these financial transactions.

Reverse causality

One possibility is that financial losses set individuals under stress and lead them to perform poorly on cognitive test scores. This would be consistent with Schwandt (2018) who shows that exogenous wealth shocks driven by stock market fluctuations may negatively affect health via increasing stress. Although we do not find evidence of pre-trends in wealth changes in the DiD model, the 2-year windows between two waves does not allow us to rule out this possibility. It is worth noting, that this alternative explanation should also explain the observed differences across aware and unaware respondents. We performed two different tests that lead us to exclude this possibility.

First, as in Schwandt (2018), we employ an arguably exogenous measure of wealth shock, based on the predicted difference in financial wealth, constructed by capitalizing the value of each asset category owned in the previous wave by its average market return across waves (as described in Section 3.3). Reassuringly, Columns (1) and (2) of Table 12 show that this measure is essentially unrelated to the probability of experiencing a memory loss and of being aware of it. Further, although this measure strongly predicts wealth changes – a dollar increase in predicted wealth is associated with an increase of 59 cents in actual wealth between waves – the last three columns of Table 12 show that it does not substantially change our main estimates when included in equation (1) as an additional regressor.

Second, we evaluate the stress channel by testing whether there are differences between aware and unaware respondents in depression symptoms, life satisfaction, the probability of declaring themselves in financial strain, having control over their financial situation, and having difficulties managing money.[14] Not surprisingly, we find that the aware respondents are those who are more likely to be depressed and less satisfied with their life (Table B.11 in the appendix).

Rational disinvestment

Another possibility is that the negative wealth changes observed for unaware respondents do not represent losses but rational disinvestments arising for a variety of reasons.

As already noted when discussing Table 2, among the respondents who experienced a severe memory loss, those who were unaware were also more likely to be in better health or to perceive themselves as in better health. However, since we are investigating the sources of differential wealth changes, what matters is whether memory losses induce changes in subjective life expectancy and how individuals react to these changes. This is investigated in the first two columns of Table 10, where we regress changes in subjective life expectancy on the occurrence of severe memory losses[15] using a

[14] Hsu and Willis (2013) use the variable experiencing difficulties in managing money as a measure of self-awareness of financial capacity, correlated with severe cognitive decline and dementia.

[15] The HRS asks respondents what is the percentage chance that they will reach a certain target age, varying from 75 to 95 years depending on the age of the respondent at the time of the interview.

specification similar to model (1) for wealth changes. The only case for which we find evidence of a negative association between severe memory losses and changes in subjective life expectancy is when we consider respondents who are aware of their cognitive decline.

The last two columns of Table 10 instead show no evidence that severe memory losses are associated with statistically significant changes in out-of-pocket medical expenditure, neither for the aware nor for the unaware respondents. This allows us to reject another possible interpretation, namely that people unaware of their cognitive decline face higher medical expenses which negatively affect their wealth profiles. Table B.7 in the appendix, based on the HRS-CAMS data, shows that relative memory losses are associated neither with increases in total consumption nor with increases in particular consumption categories, and this is true for both aware and unaware respondents. All these findings lead us to reject the rational disinvestment explanation.

We also find no evidence of an association between severe memory losses and changes in financial transfers to children, neither in their probability nor in the expected total amount if they occur (Table B.5 in the appendix). These findings allow us to reject yet another interpretation, namely that the children, having noted the declining memory of their parents, take control of their parents' finances or anticipate bequests.

Differences in portfolios

Given the well-know relationship between cognitive ability, health and stockholding, Table 11 investigates whether respondents (un)aware of their cognitive decline change the composition of their financial portfolio between risky assets (stocks, mutual funds and investment trusts, but not IRAs) and safe assets (all other financial assets) distinguishing between changes in the probability of holding risky assets (the extensive margin) and changes in the expected share of risky assets (the intensive margin). Our results indicate that both aware and unaware respondents with wealth levels above the median appear to slightly change their portfolio towards less risky assets, but only at the extensive margin.

We also investigate whether the observed differences in wealth changes reflect differences in the initial portfolio composition that lead to lower returns. Table B.3 in the appendix presents estimates of model (1) where ΔW_{it} is now the difference between a respondent's total financial wealth in wave t and the financial wealth predicted by capitalizing the value of each asset category owned in wave $t-1$ by its average market return, as described in Section 3.3. We present separate estimates for all respondents with positive financial wealth (Columns 1–2) and the subsample with a severe memory loss (Columns 3–4). Our results show that even taking into account the initial composition of financial portfolios, respondents unaware of their cognitive decline appear to largely underperform relative to the other respondents. Again, the largest difference is found among the wealthier respondents.

Misreporting and measurement error

People who experience a severe memory decline may find it hard to remember the value of their assets and make large errors across waves. These errors would appear as large wealth changes. The issue is whether this problem affects aware and unaware respondents differently. For example, a survey participant who is aware of her memory loss may ask a family member or a caregiver to provide the necessary information. In this case, the wealth changes among people with poor memory may be attenuated or even eliminated for those who recognize the problem and take corrective actions. In fact, no evidence on the patterns of misreporting is possible without a linkage of HRS to administrative data. Nonetheless, our tests for differential misreporting (Table B.4 in the appendix) reject such hypothesis. In particular, we find no indication that people unaware of their cognitive decline are characterized by higher levels of financial wealth imputation or, when restricting attention to stockholders, by a higher frequency of missing or incomplete values. Furthermore, by exploiting the HRS asset verification procedure, we find no evidence of differential asset misreporting between aware and unaware respondents. Since a large level of misreporting would be needed to explain the observed difference in expected wealth changes between aware and unaware respondents, its is hard to believe that it would not not show up in our tests, especially that based on the HRS asset verification procedure that has been proved to be very effective in reducing the measurement error in wealth changes (see, e.g., Hill, 2006).

5.4 Robustness checks

We first consider the sensitivity of our results to alternative definitions of memory loss. Our general conclusions do not change when we adopt the absolute definition of memory loss typically used in the neuropsychological literature, namely a one standard deviation decline in memory score. Moreover, they remain essentially unchanged when we vary the threshold for the relative definition of severe memory loss by considering either a lower threshold of 15% or a higher threshold of 25%. Unsurprisingly, the difference between aware and unaware respondents is smaller when using the lower threshold and larger when using the higher threshold.

Given the right-skewed distribution of wealth, we also considered using the log transformation. Unfortunately, the non-negligible number of negative or null wealth values (especially in the case of financial wealth) prevents us from following this approach for the full sample. However, when focusing on respondents in the third or fourth quartile of the initial wealth distribution, the results obtained using the log transformation are very similar to those reported in the main text (Table B.2).

A number of tables in Appendix B test the robustness of model (1) to alternative specifications. Table B.8 presents the results of estimating a simple model that regresses changes in total wealth on changes in memory test scores, self-rated memory decline and their interaction using both an absolute and a relative definition of memory changes. While memory changes are strongly correlated with wealth changes, there is no statistically significant association between wealth changes, self-rated memory decline and its interaction with changes in test scores. However, when we consider a nonlinear association between memory changes (using quintiles) and wealth changes, self-rated memory decline turns out to be positively (and strongly) correlated with wealth changes only for people at the bottom of the memory change distribution, thus confirming the results of our baseline model. Tables B.1, B.9, and B.10 – where we include leads and lags of the main regressors, or replicate our analyses adding individual fixed effects – also confirm the robustness of our main specification.

Another concern that might arise is that people may experience more than one severe memory loss event, of which they may not have been aware. This implies that they may repeatedly switch states (e.g., from aware to unaware, and viceversa) across waves. It turns out that 67% of the respondents experience zero or only one severe memory loss event, and even when they experience more than one, only a small fraction of individuals (9.8%) alternate between states. Furthermore, it is reassuring that if we exclude people alternating between states, or only those who declared a memory decline in the previous wave, our results remain quantitatively similar to those reported in the main text.

6 Conclusions

Using data from the HRS, a large representative panel survey of elderly Americans, we show that people tend to substantially underestimate their cognitive decline and we document the financial consequences of misperception. We find that respondents who are unaware of their cognitive decline are likely to experience larger financial wealth losses compared to those who are aware or did not experience a severe decline. We investigate alternative explanations for our results that stress differences in observable or unobservable characteristics between aware and unaware respondents. We find no differences in health conditions, subjective life expectancy, transfers to children, or consumption patterns between the two types of respondents. This rules out explanations based on rational disinvestment and leaves our proposed explanation, namely that unaware respondents are more likely to make bad financial decisions which negatively affect their wealth. Since wealth losses are concentrated among financial respondents in the highest wealth quartiles, who scored better on the initial memory tests, this is consistent with an overconfidence interpretation.

After the recent financial crisis, much attention has been devoted to financial literacy and how to raise its level, especially among younger people. Our overconfidence interpretation suggests that in the case of older investors, who hold a large fraction of national wealth, what really matters is whether they are aware of their cognitive decline and are able to modify their financial behavior accordingly. Our results do not imply that older people should be prevented from making independent financial decisions. Rather they serve as a warning that unrestricted freedom of choice – coupled with the rising complexity of financial products – may have very negative consequences for people unable to promptly recognize a severe cognitive decline and take appropriate actions.

Incentivizing financial delegation might not solve the problem, because delegation itself requires non-trivial cognitive skills. Further, the presence of asymmetric information gives rise to a serious principal-agent problem, as the agent – a family member or a financial consultant – might choose to maximize her own welfare exploiting the poor decision-making skills of the principal. Policy interventions aimed at incentivizing the annuity market – for example through default options or financial incentives – appear to be more consistent with our results, but would require a stricter regulation of this market.

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Table 1: Self-rated vs. assessed memory.

	Severe relative mem. loss		
Self-rated memory change	No	Yes	Total
Stable or improved	.608	.187	.796
Worse	.149	.055	.204
Total	.757	.243	1.00

	Severe absolute mem. loss		
Self-rated memory change	No	Yes	Total
Stable or improved	.618	.178	.796
Worse	.154	.050	.204
Total	.773	.228	1.00

Notes: This table compares self-rated memory changes across waves with two different measures of memory loss: 1) severe "relative" memory loss is defined as a decline of 20% or more in the memory score (first quintile); severe "absolute" memory loss is defined as a memory score change of one standard deviation or more.

Table 2: Probit estimates of the probability of having a severe relative memory loss and of being unaware conditional on having a severe relative memory loss

	Having a severe memory loss		Unaware (conditional on severe memory loss)	
	(1)	(2)	(3)	(4)
Age	.002 ***	.003 ***	-.002	-.002 *
	(.001)	(.001)	(.001)	(.001)
Age^2	.000 ***	.000 ***	.000	.000
	(.000)	(.000)	(.000)	(.000)
Alone$_{t-1}$	-.006	-.005	-.016	-.019 **
	(.004)	(.004)	(.010)	(.010)
Female	.077 ***	.077 ***	.045 ***	.043 ***
	(.004)	(.004)	(.008)	(.008)
Children	-.001	-.001	-.005 **	-.004 **
	(.001)	(.001)	(.002)	(.002)
Education	-.017 ***	-.016 ***	-.004 **	-.006 ***
	(.001)	(.001)	(.001)	(.001)
Working$_{t-1}$	-.036 ***	-.030 ***	.046 ***	.019 **
	(.004)	(.004)	(.009)	(.009)
Q2 wealth$_{t-1}$	-.032 ***	-.028 ***	.019	.003
	(.006)	(.006)	(.011)	(.011)
Q3 wealth$_{t-1}$	-.048 ***	-.041 ***	.010	-.016
	(.006)	(.006)	(.012)	(.012)
Q4 wealth$_{t-1}$	-.063 ***	-.053 ***	.004	-.033 **
	(.006)	(.006)	(.014)	(.014)
Recall$_{t-1}$	.095 ***	.096 ***	.023 ***	.019 ***
	(.002)	(.002)	(.003)	(.003)
Very good health$_{t-1}$		-.026 ***		.100 ***
		(.004)		(.008)
ADL limitations$_{t-1}$		.023 ***		-.085 ***
		(.006)		(.011)
Obs.	80895	80895	19545	19545
N	22454	22454	13585	13585
Mean	.24	.24	.76	.76
Pseudo R^2	.083	.085	.016	.043

Notes: This table shows marginal effects from probit estimates of the probability of being aware conditional on experiencing a severe relative memory loss. Column (1) and (3) includes socio-demographic controls, survey year fixed effects (not reported) and the initial memory score. Column (2) and (4) also includes, as controls for initial health, whether the respondent has at least one limitation with activities of daily living (ADL) and self-rated own health as very good or excellent. The inclusion of health variables slightly reduces the number of observations. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 3: Changes in total wealth (thousands of U.S. dollars at 2014 prices)

	All financial respondents (FR)			Resp. w/severe mem. loss	
				FR	Non FR
	(1)	(2)	(3)	(4)	(5)
Memory loss	-7.327	-22.660 ***			
	(5.008)	(5.089)			
Pessimist			1.232		
			(6.258)		
Aware			-5.262		
			(9.018)		
Unaware			-27.227 ***	-20.001 **	-6.508
			(5.541)	(9.099)	(13.143)
$\beta_1 - \beta_2$			-21.965 **		
			(9.578)		
Obs.	57011	57011	57011	13912	6265
Mean W	380.435	380.435	380.435	344.523	481.868
Mean ΔW	7.485	7.485	7.485	-.281	9.376
N	16243	16243	16243	9695	4526
Initial wealth and memory	No	Yes	Yes	Yes	Yes

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), and a dummy for people who declare a decline in their memory but did not experience a severe memory loss. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 4: Changes in total and financial wealth for aware and unaware respondents (DiD model)

	Total wealth			Financial wealth		
	Basic controls	All controls	Financial wealth>0	Basic controls	All controls	Financial wealth>0
	(1)	(2)	(3)	(4)	(5)	(6)
$\tau = -1$	20.652	15.017	4.759	6.405	-3.792	-14.184
	(43.231)	(30.355)	(37.602)	(27.692)	(16.316)	(17.912)
$\tau = 0$	-45.234	-36.743	-64.113 **	-26.905	-28.585	-46.208 *
	(28.390)	(25.401)	(31.990)	(22.103)	(19.321)	(24.993)
$\tau = 1$	8.048	8.366	-1.369	20.220	8.507	2.511
	(30.339)	(24.039)	(30.318)	(23.333)	(14.672)	(18.326)
Obs.	8500	8500	6268	8500	8500	6268
N	2125	2125	1567	2125	2125	1567
Mean W	425.143	425.311	531.914	104.957	105.014	139.004
Mean ΔW	12.583	12.633	11.187	-1.185	-1.159	-3.772

Notes: The table shows the results of DiD model which compares the changes in wealth of aware and unaware around the the first severe memory loss event. The basic controls include a quadratic age term and survey year dummies. The full controls also include dummies for labor force status, marital status, race, gender, education, financial respondent status and census division, and the initial wealth and memory levels. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 5: Changes in total wealth (thousands 2014 U.S. dollars) by quartile of initial wealth, only financial respondents

	1st quartile	2nd quartile	3rd quartile	4th quartile
	(1)	(2)	(3)	(4)
Aware	-5.074 *	-.215	-5.579	35.536
	(2.919)	(5.180)	(10.329)	(31.562)
Unaware	-2.795	-2.815	-15.992 ***	-43.748 **
	(1.978)	(2.809)	(5.623)	(18.067)
$\beta_1 - \beta_2$	2.280	-2.600	-10.413	-79.284 **
	(3.180)	(5.617)	(11.136)	(33.646)
Obs.	16680	14434	13374	12523
N	6721	6365	5761	4311
Mean W	26.855	130.917	360.175	1160.615
Mean ΔW	20.396	22.391	45.213	-59.534

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 6: Changes in wealth components (thousands 2014 U.S. dollars), only financial respondents

	Total	Financial	IRAs	Housing	Real estate	Business
	(1)	(2)	(3)	(4)	(5)	(6)
Aware	-5.262	-2.360	-2.655	-2.141	.003	.004
	(9.018)	(5.216)	(2.687)	(2.308)	(.003)	(.004)
Unaware	-27.227 ***	-17.528 ***	-5.138 ***	-1.908	-.002	.002
	(5.541)	(2.945)	(1.534)	(1.715)	(.002)	(.002)
$\beta_1 - \beta_2$	-21.965 **	-15.168 ***	-2.483	.233	-.005	-.002
	(9.578)	(5.349)	(2.779)	(2.569)	(.004)	(.004)
Obs.	57011	57011	57011	57011	57011	57011
N	16243	16243	16243	16243	16243	16243
Mean W	380.435	96.698	58.734	150.088	32.514	26.713
Mean ΔW	7.485	-1.549	2.923	11.413	-.003	-.003

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss , and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 7: Changes in financial wealth (thousands 2014 U.S. dollars) by initial financial wealth ownership and initial financial wealth quartile, only financial respondents

	No financial wealth	Positive financial wealth	3rd wealth quartile	4th wealth quartile
	(1)	(2)	(3)	(4)
Aware	-3.559 ***	1.999	-3.583	15.571
	(1.215)	(7.178)	(5.795)	(19.868)
Unaware	1.053	-21.565 ***	-10.313 ***	-34.672 ***
	(1.409)	(3.788)	(3.512)	(10.500)
$\beta_1 - \beta_2$	4.612 ***	-23.564 ***	-6.731	-50.243 **
	(1.482)	(7.396)	(6.247)	(20.213)
Obs.	17265	39746	11868	12039
N	8011	12963	5280	4200
Mean W	2.636	137.557	85.118	345.956
Mean ΔW	12.729	-6.898	12.569	-37.741

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 8: Changes in the value of financial wealth components (thousands 2014 U.S. dollars) for respondents with positive initial financial wealth, only financial respondents

	Stocks	Bonds	Debt	CDs	Checking/ savings	Other assets
	(1)	(2)	(3)	(4)	(5)	(6)
Aware	-1.909	.053	-.102	.956	-1.357	3.958 *
	(5.401)	(1.194)	(.256)	(1.463)	(2.091)	(2.378)
Unaware	-11.887 ***	.281	-.148	-1.483 **	-4.106 ***	-4.063 ***
	(2.581)	(1.003)	(.210)	(.650)	(1.063)	(1.230)
$\beta_1 - \beta_2$	-9.978 *	.228	-.045	-2.439	-2.749	-8.021 ***
	(5.350)	(1.433)	(.295)	(1.535)	(2.180)	(2.469)
Obs.	39746	39746	39746	39746	39746	39746
N	12963	12963	12963	12963	12963	12963
Mean W	66.007	8.987	2.971	15.832	34.090	15.613
Mean ΔW	-4.337	-.155	1.195	.295	.657	-2.164

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 9: Changes in the value of financial wealth (thousands 2014 U.S. dollars) by stock market activity, only financial respondents

	Financial wealth		
	Active	Inactive	Inactive + no stocks
	(1)	(2)	(3)
Aware	15.703	5.584	-2.543
	(32.508)	(15.708)	(6.350)
Unaware	-54.981 ***	-10.550	-9.640 **
	(20.293)	(11.779)	(4.262)
$\beta_1 - \beta_2$	-70.684 **	-16.134	-7.098
	(35.579)	(17.917)	(7.208)
Obs.	5498	7421	44092
N	2908	4100	14434
Mean W	342.636	168.370	53.968
Mean ΔW	1.959	-9.141	-.635

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Activity on the stock markets is based on the assets change module of HRS where respondents are asked about their activity on the stock market (whether they sold or bought stocks in the last two years) conditional on stock holding at time $t-1$ or at time t stocks. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 10: Differences in subjective life expectancy and in out-of-pocket health expenditure, only financial respondents

	Subj. life expectancy		Out-of-pocket exp.	
	(1)	(2)	(3)	(4)
Mem. loss	-.369		.038	
	(.412)		(.155)	
Aware		-1.474 *		.161
		(.764)		(.487)
Unaware		.106		.023
		(.448)		(.140)
Obs.	42804	42804	47493	47493
N	13376	13376	14927	14927
Mean	48.763	48.763	3.218	3.218

Notes: In Columns (1) and (2), the dependent variable is variable indicating the self-assessed individual probability of living for 10 or more years while in (3) and (4) the out-of-pocket expenditure in thousand dollars. All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table 11: Differences in ownership and share of risky assets, only financial respondents

	Risky assets ownership		Risky assets share	
	(1)	(2)	(3)	(4)
Aware	-.009	-.016	.002	-.005
	(.008)	(.014)	(.018)	(.019)
Unaware	-.005	-.011	.015	.006
	(.005)	(.009)	(.011)	(.011)
$\beta_1 - \beta_2$	.004	.005	.013	.011
	(.009)	(.015)	(.020)	(.021)
Obs.	57011	25897	14176	11696
N	16243	8132	5365	4347
Mean	.261	.452	.440	.563
3rd-4th wealth quartile	No	Yes	No	Yes

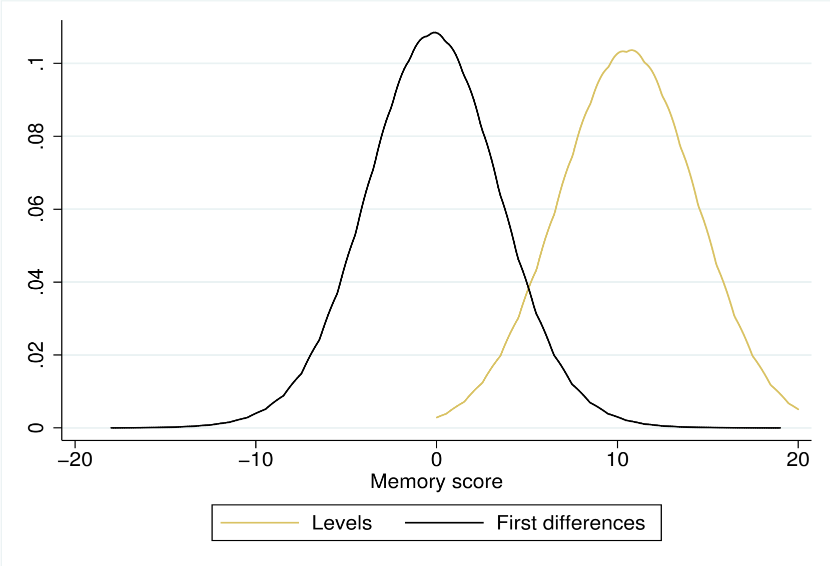
Notes: In Columns (1) and (2), the dependent variable is a dummy variable which indicates whether the respondent owns any risky financial asset (extensive margin), while in Columns (3) and (4) the share of financial wealth invested in risky asset conditional on owning risky assets (intensive margin). All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. Standard errors are robust and clustered at the household level. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 12: Actual and predicted wealth changes, cognitive decline and awareness

	Memory loss	Unaware	Dependent variable: Δ Wealth		
	(1)	(2)	(3)	(4)	(5)
Predicted Δ Wealth	.000	-.000	.593***		.593***
	(.000)	(.000)	(.025)		(.025)
Unaware				-27.227***	-23.394***
				(5.541)	(4.839)
Aware				-5.262	-6.416
				(9.018)	(7.983)
Obs.	57011	13912	57011	57011	57011
N	16243	9695	16243	16243	16243
Mean	.244	.765	380.435	380.435	2.720

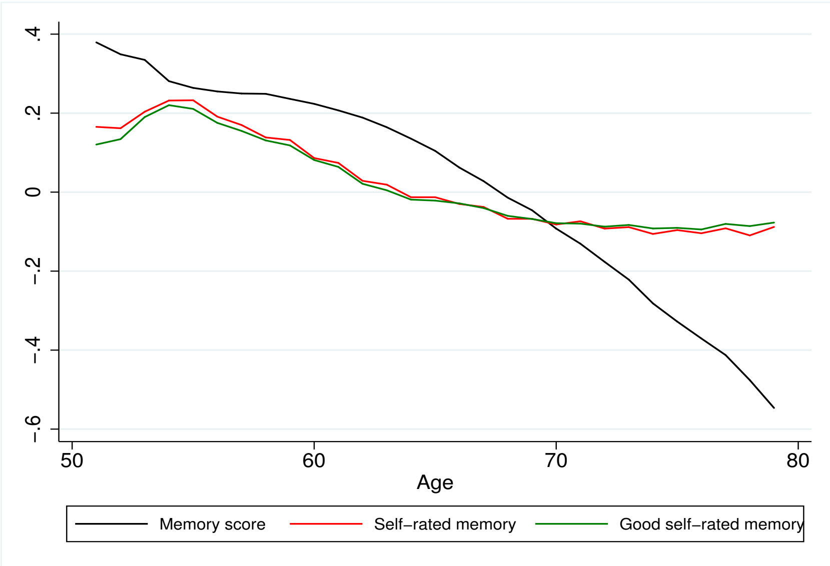
Notes: In Columns (1) the dependent variable is a dummy variable which indicates whether the respondent experience a severe memory decline, while in column (2) whether she is unaware conditional on experiencing a severe memory decline. In Columns (3) (4) and (5) the dependent variable is the change in total wealth. All regressions also include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. Standard errors are robust and clustered at the household level. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Figure 1: Density of memory scores in levels and first differences



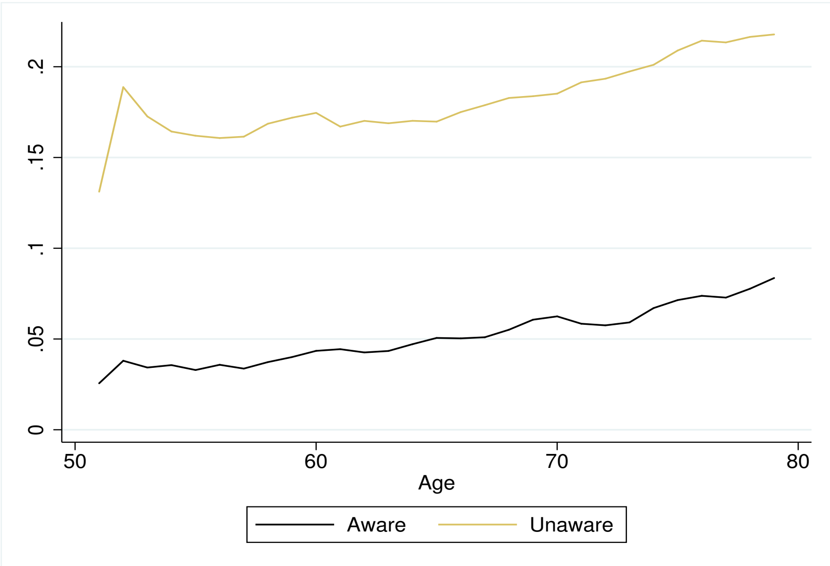
Notes: The figure show the univariate kernel density estimation of the memory score in levels and first differences using the Epanechnikov kernel and a bandwidth of 2.

Figure 2: Age profiles of assessed vs. self-rated memory



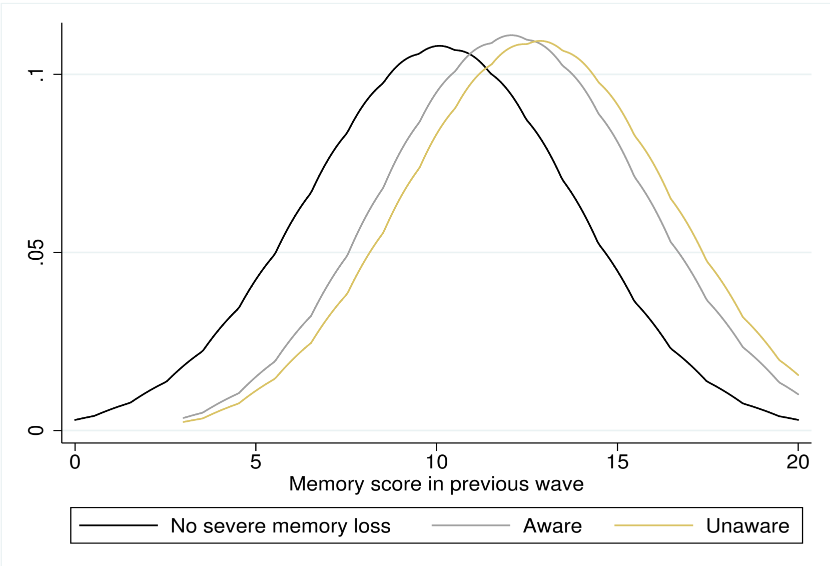
Notes: This figure presents the average age-profile of three indices: the total score in the immediate and delayed recall tasks (in black), the self-rated memory score (in red) and the share of respondents rating their memory as “good” or “very good” (in green). We standardize each index using its mean and standard deviation over the entire period 1996–2014 and compute age-specific averages of the standardized index using the HRS respondent-level weights. We then smooth each profile using a 3-year moving average.

Figure 3: Fraction of respondents aware and unaware of their memory loss



Notes: This figure shows the fraction of respondents aware and unaware of their memory loss (defined as a decline of 20% or more in their word recall test) by age. The figure is constructed by pooling all observations from the HRS (1996–2014) and using the HRS respondent-level weights. We smooth each profile using a 3-year moving average.

Figure 4: Memory score in the previous wave



Notes: This figure compares the density of the memory test score in the previous waves across groups. The top figure compares respondents who experience a severe memory decline with all the other respondents. The bottom figure focuses only on respondents who experience a severe memory decline comparing aware and unaware respondents. Test score densities are based on Epanechnikov kernel density estimations with a bandwidth of 2.

A A two-period life-cycle model with cognitive decline

This appendix shows how a simple modification of the basic model in LMM, produces predictions that are consistent with the empirical evidence presented in this paper.

The basic model in LMM is a simple two-period life-cycle model with no bequest in which a consumer decides consumption at the end of each period, c_1 and c_2, to maximize her lifetime utility function

$$u(c_1, c_2) = \log(c_1) + \beta \log(c_2),$$

where $0 < \beta < 1$ is the discount factor. The budget constraints in the two periods may be written as

$$c_1 = y - i - s, \quad c_2 = Rs,$$

where y is income received at the end of the first period, i is the monetary value of cognitive investment aimed at boosting the returns R on savings s (assets at the end of the first period), and Rs is final assets (assets at the end of the second period). The cognitive investment consists of time, effort, and costly information, and requires both computational and memory skills. Departing from LMM, we assume that $R = \gamma + \delta i$, where the intercept γ represents the "basic return" obtained by a "passive investor" with $i = 0$, while the slope δ measures the expected productivity of cognitive investment for an "active investor" with $i > 0$. It is plausible to assume that $\gamma \geq 1$ and $\delta \geq 0$.

A passive investor only chooses s to maximize

$$\log(y - s) + \beta \log(\gamma s),$$

so her optimal levels of savings and final wealth are

$$s_0^* = \frac{\beta}{1+\beta}\, y, \quad a_0^* = \gamma s_0^* = \frac{\gamma\beta}{1+\beta}\, y,$$

which are both linear in income, as in LMM. The wealth change between the two periods is

$$a_0^* - s_0^* = (\gamma - 1)s_0^* = (\gamma - 1)\frac{\beta}{1+\beta}\, y,$$

which is positive under our assumption that $\gamma \geq 1$, while the relative wealth change is

$$\frac{a_0^*}{s_0^*} - 1 = \gamma - 1,$$

namely the rate of return obtained with no cognitive investment.

If $\delta > 0$, an active investor chooses i and s to maximize

$$\log(y - i - s) + \beta \log((\gamma + \delta i)s).$$

The FOCs for this problem are

$$0 = -\frac{1}{y - i - s} + \frac{\beta\delta}{\gamma + \delta i}$$

and

$$0 = -\frac{1}{y-i-s} + \frac{\beta}{s},$$

from which we obtain

$$\frac{\beta\delta}{y+\delta i} = \frac{\beta}{s} = \frac{1}{y-i-s}. \tag{3}$$

The first equality in (3) gives $\delta s = \gamma + \delta i$, so $i = s - \gamma/\delta$. Substituting into the second equality and rearranging gives

$$s^* = \tau\tilde{y}, \quad i^* = s^* - \frac{\gamma}{\delta} = \tau\tilde{y} - \frac{\gamma}{\delta}, \quad a^* = (\gamma + \delta i^*)s^* = \delta(\tau\tilde{y})^2.$$

where $\tau = \beta/(1+2\beta)$ and $\tilde{y} = y + \gamma/\delta$. Notice that $i^* > 0$ only if $\tau\tilde{y} > \gamma/\delta$, that is, $y > \bar{y}$, where

$$\bar{y} = \frac{(1+\beta)\gamma}{\beta\delta}.$$

The wealth change between the two periods is now

$$a^* - s^* = (\gamma + \delta i^* - 1)s^* = (\delta s^* - 1)s^*,$$

while the relative wealth change is

$$\frac{a^*}{s^*} - 1 = \gamma + \delta i^* - 1 = \delta s^* - 1.$$

This simple adaptation of LMM suggests a further modification in which, before making their savings and investment decisions, consumers are hit by an exogenous cognitive shock d that affects the productivity of their cognitive investment and can be positive or negative, so the returns on savings are described by the random variable $R = \gamma + \delta d i$. If the shock is positive, it is always observed. On the contrary, if the shock is negative, it is observed by some consumers (the "aware") but not by others (the "unaware"). Whether a consumer hit by a negative shock is aware or not is actually irrelevant when income is too low (i.e., $y \leq \bar{y}$), because in this case no cognitive investment would be made anyway.

Suppose, for example, that $d = 1$ with probability p and $d = -1$ with probability $1-p$. If $d = 1$ and $y > \bar{y}$, the best choice for a consumer is to make a positive investment and earn the resulting return of $\gamma + \delta i > \gamma$. If $d = -1$ and $y > \bar{y}$, a positive investment would produce less than the basic return, as $\gamma - \delta i < \gamma$, so the best choice for a consumer is to make no investment and just earn γ. An aware consumer does precisely this. An "overconfident" investor instead makes a positive investment thinking that $d = 1$ and therefore earns $\gamma - \delta i < \gamma$. The main difference with respect to LMM is the explicit consideration of these three different types of investor and the assumption that, for the overconfident investor, $R < \gamma$ despite the fact that $i > 0$.

For the the overconfident investor, the wealth change is

$$a^* - s^* = (\gamma - \delta i^*)s^* - s^* = (2\gamma - \delta s^* - 1)s^*,$$

while the relative wealth change is

$$\frac{a^*}{s^*} - 1 = \gamma - \delta i^* - 1 = 2\gamma - \delta s^* - 1.$$

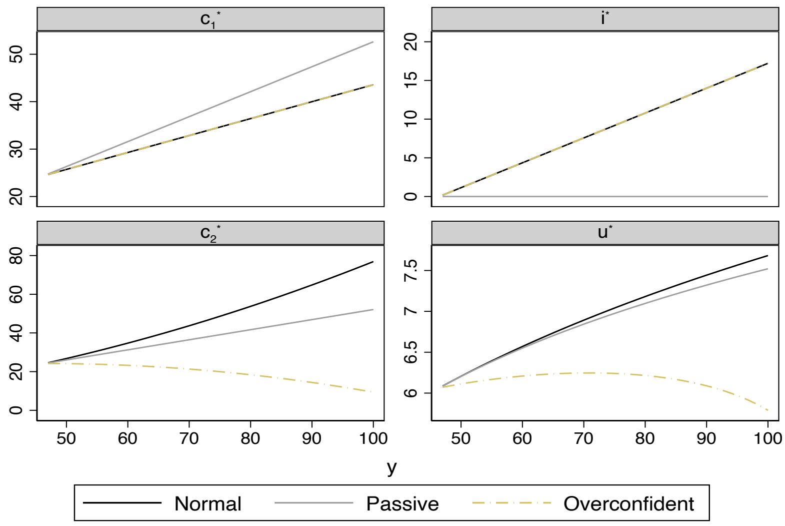
Both are negative if $s^* > (2\gamma - 1)/\delta$. Notice that the difference in relative wealth change between the passive and the overconfident investor is equal to

$$\frac{a_0^*}{s_0^*} - \frac{a^*}{s^*} = \gamma - 2\gamma + \delta s^* = \delta s^* - \gamma,$$

which is positive if $s^* > \gamma/\delta$ or, equivalently, $i^* > 0$. Thus, the overconfident investor always obtains smaller relative wealth changes than the passive investor.

Figure A.1 presents the results of a model where $\beta = .90$, $\gamma = 1.10$, and $\delta = .05$. The figure shows initial consumption c_1^*, cognitive investment i^*, final consumption $c_2^* = a^*$, and lifetime utility $u^* = u(c_1^*, c_2^*)$ by income y and investor type.

Figure A.1: Initial consumption c_1^*, cognitive investment i^*, final consumption c_2^*, and lifetime utility $u^* = u(c_1^*, c_2^*)$ by income y and investor type.



B Additional tables

Table B.1: Changes in total wealth, leads and lags (conditional on severe memory loss)

	Baseline	Lead	Lead and lag	Baseline restricted
	(1)	(2)	(3)	(4)
Unaware	-20.001 **	-27.535 ***	-22.351 **	-22.638 **
	(9.099)	(10.221)	(9.697)	(9.658)
Unaware_{t+1}		3.226	3.866	
		(12.842)	(13.571)	
Unaware_{t-1}			-11.488	
			(14.513)	
Obs.	13912	9749	8112	8112
N	9695	7119	5880	5880
Mean	344.523	353.935	367.401	367.401
Mean Δ	-.281	2.531	7.858	7.858

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.2: Changes in the logarithm of total wealth (thousands 2014 U.S. dollars) and severe memory losses by quartile of the initial wealth distribution, only financial respondents

	All respondents (1)	1st quartile (2)	2nd quartile (3)	3rd quartile (4)	4th quartile (5)
Aware	-.026	-.151 *	-.007	-.032	.001
	(.022)	(.086)	(.038)	(.028)	(.025)
Unaware	-.039 ***	-.094 *	-.033	-.057 ***	-.042 **
	(.014)	(.051)	(.024)	(.017)	(.017)
$\beta_1 - \beta_2$	-.013	.057	-.026	-.025	-.043
	(.024)	(.090)	(.041)	(.031)	(.028)
Obs.	49133	9346	14058	13288	12441
N	14372	4558	6173	5722	4302
Mean W	438.021	39.595	134.220	361.280	1162.584
Mean Δ	-.017	.290	-.067	-.044	-.133

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.3: Difference between actual and predicted financial wealth in the next wave for respondents with positive initial financial wealth, only financial respondents

	All respondents		Resp. w/severe mem. loss	
	(1)	(2)	(3)	(4)
Aware	-3.306	-3.322		
	(6.846)	(10.083)		
Unaware	-17.101 ***	-23.531 ***	-17.722 **	-25.121 **
	(4.533)	(6.326)	(7.296)	(10.551)
$\beta_1 - \beta_2$	-13.795 *	-20.209 *		
	(7.673)	(11.115)		
Obs.	39746	26463	38021	26393
N	12963	9042	12539	9030
3rd-4th wealth quartiles	No	Yes	No	Yes

Notes: The dependent variable is the absolute difference between the observed financial wealth at time t and expected financial wealth. The latter is constructed as the financial wealth that the respondents would have at time t if the financial assets he owned at time $t-1$ had yielded their average market returns. In Columns (3) and (4) we include only respondents who experience a severe memory loss event between $t-1$ and t. All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.4: Tests for misreporting: imputation of asset values and assessed misreporting of assets, only financial respondents

	Fraction of financial wealth imputed (1)	Incomplete or missing value of stocks (2)	Any asset misreported (3)	Any fin. asset misreported (4)
Aware	-.001	.002	-.008	-.006
	(.002)	(.008)	(.009)	(.006)
Unaware	.000	.006	-.007	-.008 *
	(.001)	(.006)	(.006)	(.004)
Obs.	56973	13256	56973	56973
N	16284	5012	16284	16284
Mean	.060	.111	.090	.051

Notes: The dependent variable in Column (1) is an indicator of the degree of financial wealth imputation (ranging from 0 to 1) for respondents with positive financial wealth, while in Column (2) is an indicator of whether the respondents provided incomplete or missing stock values (conditional on owning stocks). The dependent variable in the last two columns is an indicator of whether the HRS asset verification procedure detected discrepancies in the reported value of any asset (Column (3)) or only of financial assets (Column (4)). All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.5: Changes in transfers to children

	Transfers (Yes/No)		Transfers (Amount)	
	(1)	(2)	(3)	(3)
Memory loss	-.005		1.213	
	(.006)		(.912)	
Aware		-.014		3.195 *
		(.011)		(1.862)
Unaware		-.002		.474
		(.007)		(.951)
Obs.	54114	54114	5661	5661
N	15530	15530	3056	3056
Mean	.214	.214	10.881	10.881
Mean Δ	-.004	-.004	-1.163	-1.163

Notes: The dependent variable in Columns (1) and (2) is an indicator of whether the respondent made any transfers to children, while in Columns (3) and (4) is the amount transferred conditional on a positive transfer. All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.6: Heterogeneity by age and employment status, only financial respondents

	Employed (1)	Not employed (2)	Aged<70 (3)	Aged≥70 (4)
Aware	7.295	-13.485 *	-3.755	-8.404
	(20.746)	(7.750)	(12.912)	(10.633)
Unaware	-31.844 ***	-20.133 ***	-34.461 ***	-11.232 *
	(8.027)	(5.024)	(6.220)	(6.110)
$\beta_1 - \beta_2$	-39.139 *	-6.648	-30.706 **	-2.828
	(20.775)	(8.647)	(13.633)	(11.172)
Obs.	20392	36581	35436	21537
N	8025	12222	12403	8227
Mean	385.126	375.571	354.823	418.756
Mean Δ	19.341	-1.643	12.323	-4.280

Notes: All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.7: Changes in consumption (thousands 2014 U.S. dollars) and severe memory losses

	Total spending (1)	Durables (2)	Non-durables (3)	Household spending (4)	Transport spending (5)
Aware	-2.508	-.008	-.897	-.084	-1.518
	(1.757)	(.054)	(1.164)	(.554)	(.976)
Unaware	.715	-.047	.130	.190	.442
	(1.142)	(.042)	(.629)	(.421)	(.589)
$\beta_1 - \beta_2$	3.223 *	-.039	1.027	.275	1.960 *
	(1.956)	(.062)	(1.252)	(.633)	(1.058)
Obs.	10372	10372	10372	10372	10372
N	4294	4294	4294	4294	4294
Mean	43.832	.374	25.218	9.074	9.166
Mean Δ	-1.153	-.038	-.021	-.525	-.569

Notes: The data are from the HRS-CAMS. All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.8: Change in total wealth and changes in memory

	(1)	(2)	(3)	(4)
	Absolute change definition		Relative change definition	
	Linear	Quintiles	Linear	Quintiles
Memory change	4.418 ***		21.626 ***	
	(0.754)		(4.043)	
Perceived memory loss (PL)	6.554	22.577 **	6.725	24.032 **
	(5.677)	(10.509)	(5.637)	(10.099)
Memory change*PL	-1.474		-9.910	
	(1.317)		(7.903)	
Non linear memory change:				
Quintile #2		22.217 ***		23.040 ***
		(6.584)		(6.871)
Quintile #3		32.473 ***		34.730 ***
		(6.915)		(7.199)
Quintile #4		32.473 ***		35.312 ***
		(8.954)		(6.734)
Quintile #5		38.024 ***		39.032 ***
		(6.980)		(7.643)
Quintile #2*PL		-29.908 **		-30.110 **
		(13.653)		(14.562)
Quintile #3*PL		-16.900		-26.645 *
		(14.701)		(15.181)
Quintile #4*PL		-16.348		-14.632
		(15.931)		(13.541)
Quintile #5*PL		-15.373		-15.483
		(13.741)		(12.790)
Obs.	57053	57053	56973	56973

Notes: Each regression also includes: marital status, years of education, labor force status, gender, race, dummy for financial respondent and census region, a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are robust and clustered at household level. Observations are weighted using the HRS respondent-level sample weights.

Table B.9: Fixed effects models for changes in total and financial wealth

	(1)	(2)	(3)	(4)
	Total wealth		Financial wealth	
	All FR	FR with loss	All FR	FR with loss
Aware	-6.453		-1.152	
	(7.659)		(5.185)	
Unaware	-11.270 ***	-27.169 **	-7.020 ***	-15.810
	(4.072)	(13.106)	(2.213)	(9.975)
$\beta_1 - \beta_2$	-6.083		-5.411	
	(7.741)		(5.023)	
N	57306	14035	57306	14035

Notes: Each regression also includes: marital status, years of education, labor force status, gender, race, dummy for financial respondent and census region a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Significance levels: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$. Standard errors are robust and clustered at household level. Observations are weighted using the HRS respondent-level sample weights.

Table B.10: Changes in total and financial wealth for aware and unaware respondents (DiD model) with individual fixed effects

	Total wealth			Financial wealth		
	Basic controls	Full controls	Financial wealth>0	Basic controls	Full controls	Financial wealth>0
	(1)	(2)	(3)	(4)	(5)	(6)
$\tau = -1$	16.875	8.115	-.485	7.920	-6.814	-15.846
	(39.099)	(15.937)	(18.529)	(26.974)	(11.001)	(11.010)
$\tau = 0$	-46.146	-13.314	-38.149	-23.851	-24.014	-42.742 *
	(28.495)	(24.746)	(30.879)	(22.563)	(20.096)	(25.550)
$\tau = 1$	9.782	10.534	-4.187	25.220	1.388	-9.082
	(30.611)	(19.375)	(22.629)	(24.159)	(11.525)	(12.471)
Obs.	8500	8500	6268	8500	8500	6268
N	2125	2125	1567	2125	2125	1567
Mean	425.143	425.311	531.914	104.957	105.014	139.004
Mean Δ	12.583	12.633	11.187	-1.185	-1.159	-3.772

Notes: The table shows the results of DiD model which compares the changes in wealth of aware and unaware around the the first severe memory loss event. The basic controls include a quadratic age term and survey year dummies. The full controls also include dummies for labor force status, marital status, race, gender, education, financial respondent status and census division, and the initial wealth and memory levels. Significance levels: $*** < 0.01$, $** < 0.05$, $* < 0.1$.

Table B.11: Memory loss, stress and financial control

	Depression (CESD)	Optimism	Life satisfaction	Financial control	Financial strain	Wealth change
	(1)	(2)	(3)	(4)	(5)	(6)
Aware	1.356 ***	-.151 **	-.523 ***	-.573 ***	.163 ***	-19.367
	(.064)	(.059)	(.079)	(.124)	(.047)	(19.241)
Unaware	.286 ***	.027	-.061	.001	.029	-45.898 ***
	(.026)	(.038)	(.049)	(.071)	(.029)	(12.427)
$\beta_1 - \beta_2$	-1.071 ***	.178 ***	.462 ***	.574 ***	-.134 ***	-26.530
	(.066)	(.065)	(.086)	(.133)	(.050)	(21.327)
Obs.	58645	16487	16586	15483	13397	13397
Mean	1.476	4.111	4.919	7.254	1.796	9.973

Notes: Each column represents the outcome of a different OLS regression. In the last column, we replicate the estimates in column (3) of Table 3 in the subsample of respondents who responded to the life satisfaction module. All regressions also include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.