Are people aware of their cognitive decline? Misperception and financial decision making*

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Abstract

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

Keywords: Aging; cognitive ability; household finance; HRS.

JEL codes: J14, J24, C23.

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1 Introduction

A key aspect 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 make the right choices. This has become 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 (see e.g. Poterba et al., 2007). At the same time, people are living longer, which implies saving more before retirement and holding larger amounts of wealth after retirement. As a result, older people are now asked to make complex decisions that 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 and, in the aggregate, 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 (Kieffer and Mottola, 2017; 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; Lusardi et al., 2014) 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 also a cost-effective policy in the case of older people facing an increasing risk of cognitive decline. Perhaps more important in this case is the largely neglected issue of whether people recognize their cognitive decline and are able to protect themselves. For example, those who perceive or are able to predict their own decline might delegate financial decisions to someone they trust, such as a 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 or scams (Lusardi et al., 2014). 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 not seek advice due to a higher level of confidence (von Gaudecker, 2015; Kim et al., 2018).

Using panel data from the Health and Retirement Study (HRS), we study the relationships between self-ratings of memory changes, assessed changes in memory performance, and wealth changes across waves of the survey. We establish three important facts. First, consistent with the evidence from other studies (see, e.g., Gamble et al. 2015), we show that older people tend to be unaware or grossly underestimate their own 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 experience 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 quartiles of the distribution of total wealth, are concentrated among respondents who are unaware of their declining memory performance, and are mainly driven by large decreases in the real value of financial wealth (about 10% on average across waves), 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 but past wealth changes do not help predict future memory losses or awareness of these events. The reverse causality concerns may still arise if, in the 2-year windows between two waves, a 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 – driven by stock market fluctuations and linked to the portfolio composition of each household. Although our measure of wealth shock strongly predicts wealth changes, it does not significantly affect the probability of experiencing a memory loss or of being aware of it. Additionally, we do find any evidence of depression or stress driven by financial concerns among unaware respondents.

Our results suggests 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. This suggests an interpretation based on overconfidence, defined as the case when individuals "overestimate their performance in tasks requiring ability, including the precision of their information" (Della Vigna, 2009). 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 with negative spillovers on market efficiency (Odean, 1998). This interpretation is in line with the evidence in von Gaudecker (2015), who shows 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. Moreover, unlike aware respondents, they do not show any negative change in their subjective assessment of life expectancy. Given their better health conditions and longer subjective time horizon, the standard life-cycle model would predict larger disinvestments for respondents aware of their cognitive decline, which is just the opposite of what we observe. We also find no differences in financial transfers to children between aware and unaware respondents or, using additional data from the HRS Consumption and Activities Mail Survey (HRS-CAMS), in their consumption patterns. Finally, we find no evidence that our results are driven by differences 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 cohorts, 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 describe 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 diseases or other forms of dementia (Leshner et al., 2017).

The psychological literature usually draws a distinction between two different forms of intelligence, fluid and crystallized (Horn and Cattell, 1967). 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 (see, e.g., Sims, 2003), 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 (Dohmen et al., 2010; Benjamin et al., 2013; Dohmen et al., 2018) 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 (Henninger et al., 2010; 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; Bogan and Fertig, 2013).

2.2 Conceptual framework

To illustrate how cognitive decline might affect 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 just provide the main intuitions and offer more details in Appendix A.

As in LMM, we consider a simple two-period model with no bequest in which a consumer maximizes her life-time utility over consumption in the two periods by deciding how to allocate her income y between initial consumption c_1, savings s, and cognitive investment i aimed at raising the return R on savings, so she can consume $c_2 = Rs$ in the second period. The cognitive investment consists of time, effort, and costly information, and requires both computational and memory skills. Departing from the original LMM formulation, we assume that $R = \gamma + \delta i$, 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 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. consumers aware of their negative cognitive shock or low-income consumers ($y \leq \bar{y}$) unaffected by a 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.

Figures A.1–A.3 illustrate the main predictions of our model for the three investor types.[1] For sufficiently high income ($y > \bar{y}$), the model predicts lower lifetime income and lower wealth changes 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 a higher return 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.[2] To avoid potential selection issues arising from mortality and institutionalization, we further restrict the sample to people aged 80 years or less. Since our dependent variable is at household level, we restrict attention to financial respondents, who answer financial questions on

[1] As described in the Appendix, the prediction are based on a log linear utility function and calibrating the model assuming $\beta = .90$, $\gamma = 1.10$, and $\delta = .05$.

[2] 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 (see e.g. Weir et al., 2014). 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.

behalf of the household. Given the higher correlation between financial respondent cognition and household wealth, and the specialization in financial decision making of older household, Smith et al. (2010) argue that the financial respondent is likely the most informed about the financial wealth of the family and the chief financial decision maker. However, to avoid the potential selection issue 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.

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 partially 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.

[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. In the Appendix we also present the results obtained using the absolute definition or alternative thresholds and test for ceiling and floor effects.

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 or other forms of dementia. 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. In the Appendix (Figure B.1) we show that our measure of relative memory decline is strongly correlated with three other such tests, 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.[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.

[5] 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 respondents ability to provide definitions of five given words.

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 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 more 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 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 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

[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%. Similarly, Meijer et al. (2013) show that the autoregressive coefficient of a simple dynamic model jumps from 0.1 to 0.4 after taking this procedure into account.

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 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. Interesting, the first profile is much steeper than the second. This result is not affected by cohort effects, as confirmed by Figure B.2, which separately analyzes the longitudinal profiles of the first three HRS cohorts,[11] and

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

[9] This prevents us from using the log transformation, which would be natural given the skewness of the wealth distribution. As robustness check, we show that the results 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 having a negative wealth value is close to 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.

[11] Although the HRS includes six birth cohorts, here we only consider the four for which we have a longer observation window, namely the original HRS cohort born 1931–1941 entering in 1992, the Study of Assets and Health Dynamics (AHEAD) cohort born in 1923 or earlier and entering in 1993, and the Children of Depression (CODA) cohort born 1924–1930 and the War Baby (WB) cohort born 1942–1947, both entering in 1998. We do not include the Early Baby Boomers (EBB) cohort born 1948–1953 and the Mid Baby Boomers (MBB) cohort born 1954-1959.

by Figure B.3, which plots the mean residuals by age from a fixed effect regression.

We find similar evidence when we compare changes in the memory score with self-rated memory changes across waves. Table 1 shows that most respondents who experienced a severe memory loss between successive waves (defined as a either a relative decline of 20% or more in the memory score or an absolute decline of one standard deviation or more) actually rate their memory as stable or improved. 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% 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 1–3) and for the probability of being unaware conditional on having a memory loss (Columns 4–6). For both outcomes, we initially control only for basic socio-demographic characteristics and wealth quartiles (Columns 1 and 3). We then include additional controls for memory score (Columns 2 and 4) and health conditions in the previous wave (Columns 3 and 6). Consistent with Figure 3, age positively affects the likelihood of experiencing a memory loss but only weakly affects that of being unaware. As expected, education, wealth and health are negatively associated with severe memory declines. However, most of these "protective" factors only weakly affect the probability of being unaware or even increase that probability. In particular, respondents who have higher memory scores or are in better health conditions are more likely to be unaware of their memory decline in the next wave (Columns 5–6). Contrary to what one might expect, among those who experience a severe memory decline, the unaware are not retired people living alone with low education and poor health and cognitive functioning. Instead, they appear to have better initial health and memory capacity, and therefore are more likely to remain confident about their skills. It is worth noting that having children does not affect the probability of experiencing a memory decline but does lower 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 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 individual wealth changes is the following:

$$\Delta W_{it} = \beta_0 + \beta_1 Aware_{it} + \beta_2 Unaware_{it} + \boldsymbol{\beta}_3^\top \boldsymbol{X}_i + \boldsymbol{\beta}_4^\top \boldsymbol{Z}_{it} + \delta_t + \epsilon_{it} \tag{1}$$

where ΔW_{it} is the change in wealth (total, financial or their subcomponents) of individual i between wave $t-1$ and wave t, $Aware_{it}$ is a binary indicator equal to one if individual i experiences 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 experiences a severe memory decline between the two waves but self-rates won memory as stable or improving (hence, absence of severe memory decline is the "reference category"), $\boldsymbol{X}_i$ 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, geographical region (census division), and for respondents who do not experience a memory decline but self-rate their memory as worse now, δ_t is a survey-wave fixed effect common across individuals, ϵ_{it} is an unobservable error term assumed to be mean independent of the observable regressors, and β_0, β_1, β_2, $\boldsymbol{\beta}_3$ and $\boldsymbol{\beta}_4$ are parameters to be estimated.

The fact that model (1) is in first differences has two important implications. First, its parameters have a different interpretation than for a model in levels. For example, the difference $\beta_1 - \beta_2$ measures the difference in the predicted value of ΔW_{it} 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 the difference $\beta_1 - \beta_2$ 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 levels of wealth.

To guarantee that we are comparing individuals who are otherwise similar in terms of observable characteristics, we present the results of a more general model that also controls for differences in initial wealth and memory levels by including the wealth and memory scores in the previous wave as additional time-varying regressors. This is because wealth changes may be expected to be larger for people with a larger initial amount of wealth. Moreover, wealthier respondents are 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 and we implement a series of robustness checks.

In the robustness checks we consider alternative model specifications. First, we consider specifications that exploit the full support of the assessed memory change and its interaction with the self-rated memory decline (Table B.10). Second, we add to model (1) an individual fixed effects to account for the unobserved heterogeneity affecting wealth changes and not only wealth levels. Although the results are consistent with those reported in the main text (Table B.11 and B.12), the already mentioned issues of the substantial amount of measurement error in wealth changes is exacerbated by the likely measurement error in regressors of interest leading to attenuation bias.

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.[12] More specifically we consider the following model:

$$\Delta W_{it} = \gamma_0 + \gamma_1 \, Unaware_i + \sum_{s \geq -S}^{S} (\gamma_{2s} + \gamma_{3s} \, Unaware_i) \, 1[\tau_{it} = s] + \boldsymbol{\gamma}_4^\top \boldsymbol{Z}_{it} + \delta_t + U_{it}. \tag{2}$$

where $1[\cdot]$ is the usual indicator function 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_{3s}, 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 period after the memory loss event. Since in our data respondents are observed on average for 3.5 periods (less than 8 years), this requirement severely restricts the sample available to estimate the model, which leads to higher standard errors and possible bias due to sample

[12] 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.

selection. To minimize these problems, we set $S = 1$, so the coefficients measure differences relative to the omitted coefficient corresponding to $\tau_{it} = -2$. Even with this choice of S, we end up with a small sample of individuals (2,125) who were observed for at least 8 years, from $\tau_{it} = -2$ to $\tau_{it} = 1$, and experienced at least one severe memory loss event during this period. For this reason, we use model (2) mainly as a robustness check to investigate mean changes in total and financial wealth, but we do not investigate heterogeneity of our results across individuals from different (initial) wealth groups or only among 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

The first two columns of Table 3 show the results obtained when we do not distinguish between aware and unaware respondents, and only include an indicator for a severe memory loss, that is, we impose the restriction that $\beta_1 = \beta_2$ in model (1). When we do not condition on the respondents' initial wealth or memory levels (Column 1), we see little evidence of systematic differences in wealth changes between people with and without severe memory losses. After we condition on the 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 restriction that $\beta_1 = \beta_2$ and shows that wealth losses are on average much larger for respondents who are unaware of their memory decline. The estimated difference $\beta_1 - \beta_2$ is economically relevant, corresponding to a loss of roughly 6% of mean wealth. Notice that the coefficient on respondents who do not experience a memory decline but self-rate their memory as decling (not reported to save space) is always small and never statistically different from zero.

The last two columns of Table 3 focus on the subset of respondents who experienced a severe memory decline and comparing financial respondents with non financial respondents, so far excluded by our sample selection. 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 being unaware of one's own cognitive decline has much more serious consequences for those who actually make financial decisions in a household. This is also reassuring regarding our decision of focusing only on financial respondents.

Table 4 shows the results of the DiD model (2), which allows us to directly compare the wealth changes of aware and unaware before and after their first memory loss event. As expected, the dramatic 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 the memory loss event is larger for the unaware respondents regardless of the controls we include in the model (the basic model only controls for age and survey year fixed effects). 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 of causality (in Granger's sense) from past wealth changes to subsequent memory loss events. At the same time, wealth losses do not seem to increase after the initial memory loss event. Consistent with the evident reported in the next section, when we focus on financial respondents with positive financial wealth (column (3) and (6)) the estimated wealth drop around the memory loss substantially increases and becomes statistically significant. As a robustness check, we also estimate a modified version of model (1), which include leads and lags of the regressors of interest (i.e., aware and unaware), that confirms the absence of any anticipation or lagged effects (see Table B.1). 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).

Table 5 presents the results of fitting (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 their 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 shows that wealth losses mainly involve respondents who are still employed or under age 70, and therefore probably 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.[13] The table shows that the wealth losses for respondents who are unaware of their

[13] 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

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 experience substantial financial losses across waves, the magnitude of which corresponds to roughly 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

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.

shares including automatic reinvestments).[14] 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 (Columns 1 and 4). 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.

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, this measure does not significantly affect the probability of experiencing a memory loss and of being aware of it (columns (1) and (2) of Table 12). Further, although this measure strongly predicts wealth changes – a dollar increase in predicted wealth is associated with a 53 cents increase in wealth between waves – it does not substantially change our main estimates when included in equation (1) as an additional regressor (last three columns of Table 12).

Second, we evaluate the stress channel by testing whether there are differences between aware and unaware respondents in depression symptoms, life satisfaction, in the probability of declaring theirselves in financial strain or to have control over their financial situation. Not surprisingly, we

[14] The high number of brackets responses and missing values on the amount of stocks sold or bought in the last period do not allow to calculate meaningful monetary amounts for these financial transactions.

find that the aware respondents are those who are more likely to be depressed and less satisfied with their life (see Table B.15).

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 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 allow 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, 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.

Table B.5 also shows no evidence of an association between severe memory losses and changes in financial transfers to children. This finding allows 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 the children's 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 assets 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

[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 of the age of the respondent at the time of the interview.

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 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 harder to remember the value of their assets and make larger errors across waves. These errors would appear as large wealth changes. The issue is whether such problem affects aware and unaware respondents differently. For example, a survey participant who is aware of 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, all our tests for differential misreporting (Table B.4) 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, exploiting the HRS asset verification procedure, we find no evidence of differential asset misreporting between aware and unaware respondents. We believe that the level of misreporting needed to explain our main results, would be too large to not show up in our tests, especially when based on the asset verification procedure of HRS, which has been proved to be very effective in reducing the measurement error in wealth changes (e.g., Hill, 2006).

5.4 Robustness checks

In this section we present some robustness checks carried out mainly to assess the sensitivity of our results to alternative definitions of memory loss. As already mentioned, 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. Table B.8 shows that the results obtained in this case are quantitatively and qualitatively similar to those reported in Table 3. The table also shows that our results remain essentially unchanged when we vary the threshold for the relative definition of severe memory loss by considering a lower threshold of 15% and 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.

Although we use a relative definition of memory loss, ceiling and floor effects in the memory score may still affect the probability of observing a severe memory loss. Table B.9 addresses this issue and shows that our results are substantially unaffected if we exclude the first or last quintiles of the initial memory score distribution.

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).

We already mention in Section 4.1 that we test the robustness of model (1) to alternative specifications. In Table B.10 we first estimate 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 (Δ memory score$_t$) 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. The evidence in Tables B.1, B.11, and B.12 – where we include leads and a lags of the main regressors or replicate our main analyses using a fixed effect strategy – also confirms 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. To address the identification concerns that might arise, we show that 70% of the respondents experienced zero or only one severe memory loss event, and even when they experienced more than one, only a small share of our sample (8.7%) alternated between states (see Table B.13). 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 are again quantitatively similar to those reported in the main text (available upon request).

Finally, Table B.14 presents the results obtained when we add controls for initial health status – self-rated health (SRH), activities of daily living (ADL), and instrumental activities of daily living (IADL) – or for changes in health status across waves. Ignoring health status may give rise to an omitted variables problem because health levels or health changes may be correlated with both wealth and memory changes. It turns out that including these additional regressors does not alter our main results.

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 a rational disinvestment argument. Hence, the more natural explanation is that unaware respondents are more likely to make bad financial decisions that negatively affect their wealth. As 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 what really matters, at least in the case of older investors, 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. They serve instead 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 taking advantage of the poor decision-making skills of the principal. Policy interventions aimed at incentivizing the annuity market (e.g., through default option or financial incentives) appear to be more consistent with our results, but would require a stricter regulation of this market.

References

Abaluck, J., Gruber, J., 2011. Choice inconsistencies among the elderly: Evidence from plan choice in the Medicare Part D program. American Economic Review 101 (4), 1180–1210.

Agarwal, S., Driscoll, J. C., Gabaix, X., Laibson, D., 2009. The age of reason: Financial decisions over the life cycle and implications for regulation. Brookings Papers on Economic Activity 2009 (2), 51–117.

Agarwal, S., Mazumder, B., 2013. Cognitive abilities and household financial decision making. American Economic Journal: Applied Economics 5 (1), 193–207.

Barber, B. M., Odean, T., 2001. Boys will be boys: Gender, overconfidence, and common stock investment. Quarterly Journal of Economics 116 (1), 261–292.

Barth, D., Papageorge, N. W., Thom, K., 2018. Genetic endowments and wealth inequality. NBER Working Paper 24642.

Benjamin, D. J., Brown, S. A., Shapiro, J. M., 2013. Who is 'behavioral'? Cognitive ability and anomalous preferences. Journal of the European Economic Association 11 (6), 1231–1255.

Bogan, V. L., Fertig, A. R., 2013. Portfolio choice and mental health. Review of Finance 17 (3), 955–992.

Bonsang, E., Dohmen, T., 2015. Risk attitude and cognitive aging. Journal of Economic Behavior & Organization 112, 112–126.

Calvet, L. E., Campbell, J. Y., Sodini, P., 2009. Fight or flight? portfolio rebalancing by individual investors. Quarterly Journal of Economics 124 (1), 301–348.

Campbell, J. Y., 2016. Restoring rational choice: The challenge of consumer financial regulation. American Economic Review 106 (5), 1–30.

Carpenter, S. M., Yoon, C., 2011. Aging and consumer decision making. Annals of the New York Academy of Sciences 1235 (1).

Christelis, D., Jappelli, T., Padula, M., 2010. Cognitive abilities and portfolio choice. European Economic Review 54 (1), 18–38.

Della Vigna, S., 2009. Psychology and economics: Evidence from the field. Journal of Economic Literature 47 (2), 315–372.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2010. Are risk aversion and impatience related to cognitive ability? American Economic Review 100 (3), 1238–1260.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2018. On the relationship between cognitive ability and risk preference. Journal of Economic Perspectives 32 (2), 115–134.

Dynan, K. E., Skinner, J., Zeldes, S. P., 2004. Do the rich save more? Journal of Political Economy 112 (2), 397–444.

Egan, M., Matvos, G., Seru, A., 2019. The market for financial adviser misconduct. Journal of Political Economy 127 (1), 233–295.

Fagereng, A., Guiso, L., Malacrino, D., Pistaferri, L., 2016. Heterogeneity in returns to wealth and the measurement of wealth inequality. American Economic Review 106 (5), 651–55.

Finke, M. S., Howe, J. S., Huston, S. J., 2016. Old age and the decline in financial literacy. Management Science 63 (1), 213–230.

Gamble, K., Boyle, P., Yu, L., Bennett, D., 2015. Aging and financial decision making. Management Science 61, 2603–2610.

Henninger, D. E., Madden, D. J., Huettel, S. A., 2010. Processing speed and memory mediate age-related differences in decision making. Psychology and Aging 25 (2), 262.

Hess, T. M., 2014. Selective engagement of cognitive resources: Motivational influences on older adults' cognitive functioning. Perspectives on Psychological Science 9 (4), 388–407.

Hill, D. H., 2006. Wealth dynamics: Reducing noise in panel data. Journal of Applied Econometrics 21 (6), 845–860.

Horn, J. L., Cattell, R. B., 1967. Age differences in fluid and crystallized intelligence. Acta Psychologica.

Hurd, M. D., Meijer, E., Moldoff, M., Rohwedder, S., 2016. Improved wealth measures in the Health and Retirement Study: Asset reconciliation and cross-wave imputation. RAND Corporation Working Paper WR-1150.

Kieffer, C. N., Mottola, G. R., 2017. Understanding and combating investment fraud. Financial Decision Making and Retirement Security in an Aging World, 185.

Kim, H. H., Maurer, R., Mitchell, O. S., 2016. Time is money: Rational life cycle inertia and the delegation of investment management. Journal of Financial Economics 121, 427–447.

Kim, H. H., Maurer, R., Mitchell, O. S., 2018. Cognitive ability and the demand for financial advice at older ages: Findings from the Health and Retirement Survey. Pension Research Council Working Paper.

Korniotis, G. M., Kumar, A., 2011. Do older investors make better investment decisions? Review of Economics and Statistics 93 (1), 244–265.

Koscielniak, M., Rydzewska, K., Sedek, G., 2016. Effects of age and initial risk perception on balloon analog risk task: the mediating role of processing speed and need for cognitive closure. Frontiers in Psychology 7, Article 659.

Leshner, A., Landis, S., Stroud, C., Downey, A., et al., 2017. Preventing Cognitive Decline and Dementia: A Way Forward. National Academies Press.

Lusardi, A., Michaud, P.-C., Mitchell, O. S., 2017. Optimal financial knowledge and wealth inequality. Journal of Political Economy 125 (2), 431–477.

Lusardi, A., Mitchell, O. S., Curto, V., 2014. Financial literacy and financial sophistication in the older population. Journal of Pension Economics & Finance 13 (4), 347–366.

Mazzonna, F., Peracchi, F., 2018. The economics of cognitive aging. In: Oxford Encyclopedia of Economics and Finance. Oxford University Press, Oxford.

Meijer, E., Spierdijk, L., Wansbeek, T., 2013. Measurement error in the linear dynamic panel data model. In: ISS-2012 Proceedings Volume On Longitudinal Data Analysis Subject to Measurement Errors, Missing Values, and/or Outliers. Springer, pp. 77–92.

Nasreddine, Z. S., Phillips, N. A., Bédirian, V., Charbonneau, S., Whitehead, V., Collin, I., Cummings, J. L., Chertkow, H., 2005. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. Journal of the American Geriatrics Society 53 (4), 695–699.

Odean, T., 1998. Volume, volatility, price, and profit when all traders are above average. Journal of Finance 53 (6), 1887–1934.

Ofstedal, M. B., Fisher, G. G., Herzog, A. R., 2005. Documentation of cognitive functioning measures in the Health and Retirement Study. HRS Documentation Report DR-006.

Poterba, J., Venti, S., Wise, D. A., 2007. The changing landscape of pensions in the United States. NBER Working Paper 13381.

Rosen, H. S., Wu, S., 2004. Portfolio choice and health status. Journal of Financial Economics 72 (3), 457–484.

Salthouse, T. A., 1996. The processing-speed theory of adult age differences in cognition. Psychological Review 103 (3), 403–428.

Salthouse, T. A., Schroeder, D. H., Ferrer, E., 2004. Estimating retest effects in longitudinal assessments of cognitive functioning in adults between 18 and 60 years of age. Developmental Psychology 40 (5), 813.

Schaie, K. W., 1996. Intellectual Development in Adulthood: The Seattle Longitudinal Study. Cambridge University Press.

Schwandt, H., 2018. Wealth shocks and health outcomes: Evidence from stock market fluctuations. American Economic Journal: Applied Economics 10 (4), 349–77.

Sims, C. A., 2003. Implications of rational inattention. Journal of Monetary Economics 50, 665–690.

Smith, J. P., McArdle, J. J., Willis, R., 2010. Financial decision making and cognition in a family context. The Economic Journal 120 (548), F363–F380.

von Gaudecker, H.-M., 2015. How does household portfolio diversification vary with financial literacy and financial advice? Journal of Finance 70 (2), 489–507.

Weir, D., Faul, J., Langa, K., 2014. Proxy interview and bias in the distribution of cognitive abilities due to non-response in longitudinal studies: A comparison of HRS and ELSA. Longitudinal and Life Course Studies 2 (2), 170–184.

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 memory loss			Unaware (conditional on memory loss)		
	(1)	(2)	(3)	(4)	(5)	(6)
Age	.002 ***	.002 ***	.003 ***	-.002	-.002	-.002 *
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Age^2	.000 ***	.000 ***	.000 ***	-.000	.000	.000
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$Alone_{t-1}$	-.007 *	-.006	-.005	-.015	-.016	-.019 **
	(.004)	(.004)	(.004)	(.010)	(.010)	(.010)
Female	.030 ***	.077 ***	.077 ***	.033 ***	.045 ***	.044 ***
	(.003)	(.004)	(.004)	(.008)	(.008)	(.008)
Children	-.000	-.001	-.001	-.004 **	-.005 **	-.004 **
	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)
Education	-.005 ***	-.017 ***	-.016 ***	-.001	-.004 **	-.006 ***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
$Working_{t-1}$	-.020 ***	-.036 ***	-.030 ***	.051 ***	.046 ***	.019 **
	(.004)	(.004)	(.004)	(.009)	(.009)	(.009)
Q2 $wealth_{t-1}$	-.012 **	-.032 ***	-.028 ***	.024 **	.019	.003
	(.005)	(.006)	(.006)	(.012)	(.011)	(.011)
Q3 $wealth_{t-1}$	-.016 ***	-.048 ***	-.041 ***	.018	.010	-.016
	(.005)	(.006)	(.006)	(.013)	(.012)	(.012)
Q4 $wealth_{t-1}$	-.025 ***	-.064 ***	-.051 ***	.017	.007	-.042 ***
	(.006)	(.006)	(.006)	(.014)	(.014)	(.013)
$Recall_{t-1}$		.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	80895	19545	19545	19545
N	22454	22454	22454	13740	13585	13585
Mean	.24	.24	.24	.24	.24	.24
Pseudo R^2	.012	.083	.085	.012	.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) includes only socio-demographic controls and survey year fixed effects (not reported). Column (2) adds the initial memory score. Column (3) 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 2014 U.S. dollars)

	All financial respondents (FR)			Resp. w/severe mem. loss	
				FR	No FR
	(1)	(2)	(3)	(4)	(5)
Memory loss	-7.327	-22.660 ***			
	(5.008)	(5.089)			
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 Δ W	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	Full controls	Financial wealth>0	Basic controls	Full 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	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. 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	26.855	130.917	360.175	1160.615
Mean Δ	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	380.435	96.698	58.734	150.088	32.514	26.713
Mean Δ	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 Δ	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	66.007	8.987	2.971	15.832	34.090	15.613
Mean Δ	-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	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

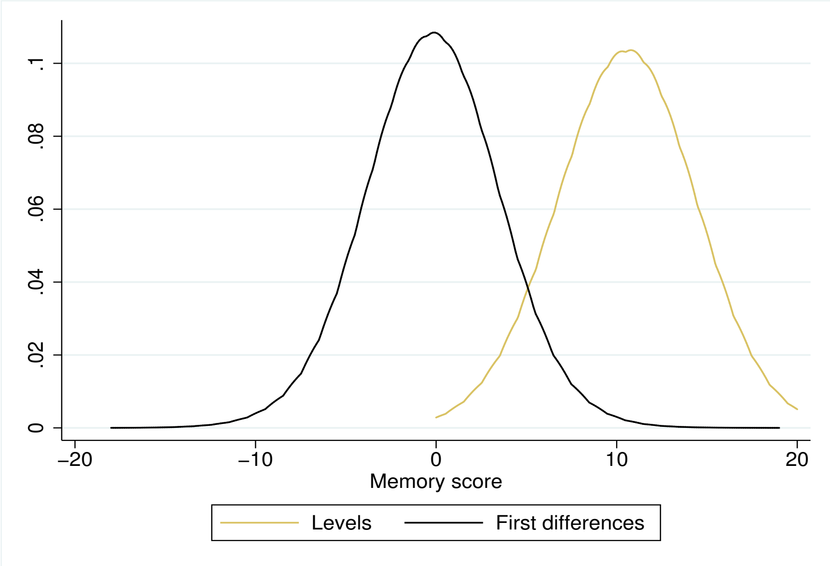
Notes: In Columns (1) and (2), the dependent variable is a dummy variable which indicates whether the respondent owns any risky financial asset (extensive margin), while in Columns (3) and (4) the share invested in risky asset conditional on owning risky assets (intensive margin). All regressions include 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

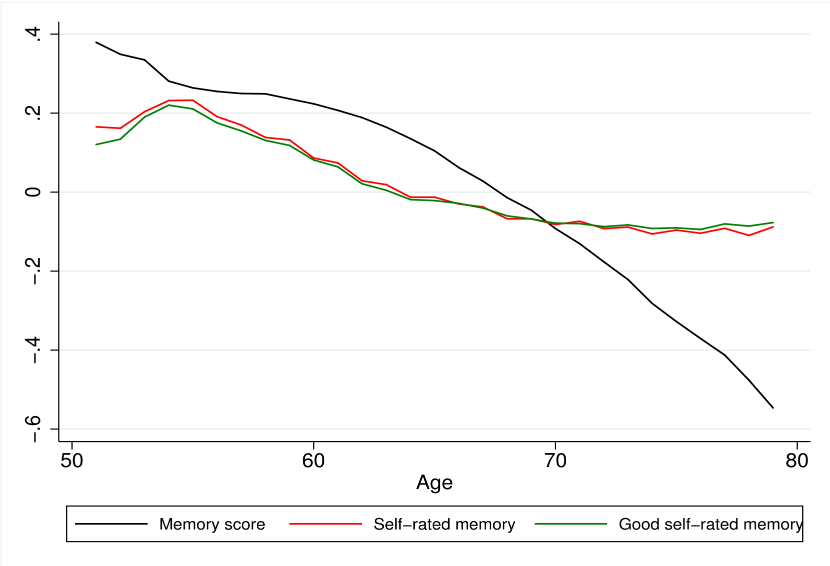
Notes: In Columns (1) the dependent variable is a dummy variable which indicates whether the respondent experience a severe memory decline, while in column (2) whether she is unaware conditional on experiencing a severe memory decline. In Columns (3) (4) and (5) the dependent variable is the change in 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



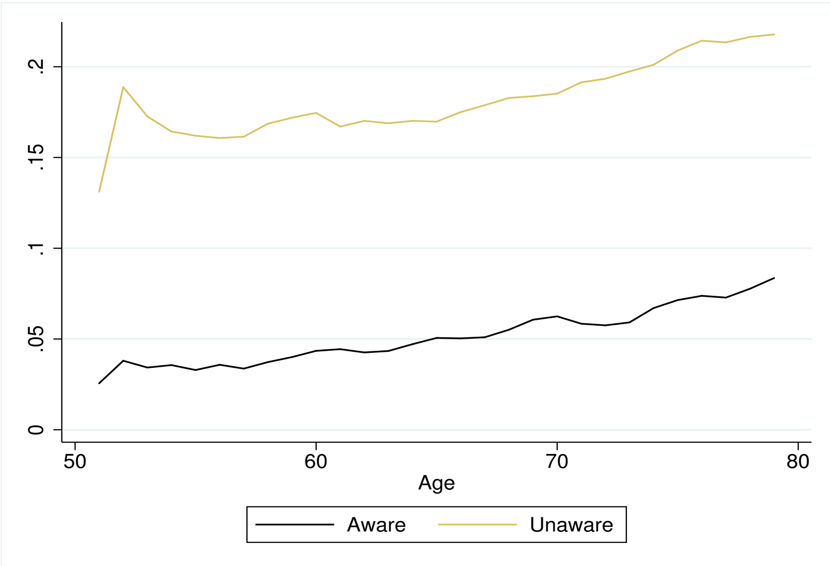
Notes: The figure show the univariate kernel density estimation of the memory score in levels and first differences using the Epanechnikov kernel and a bandwidth of 2.

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



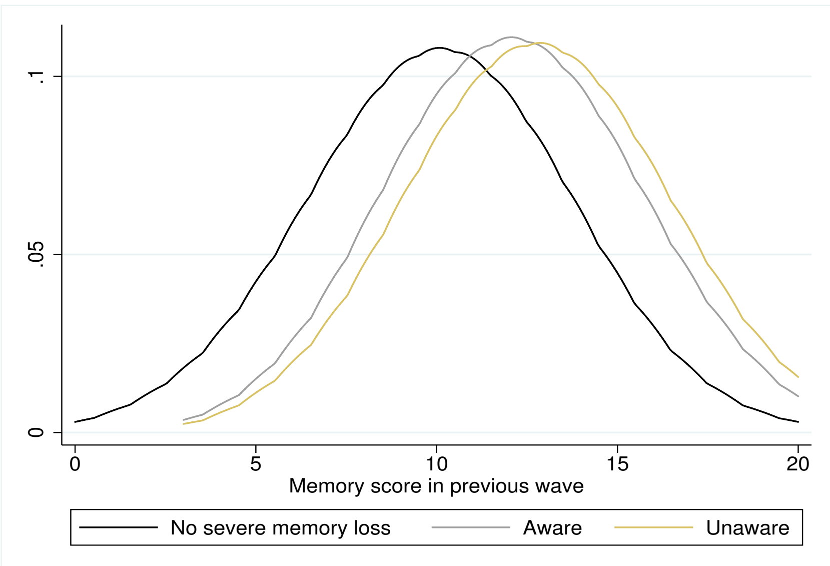
Notes: This figure presents the average age-profile of three indices: the total score in the immediate and delayed recall tasks (in black), the self-rated memory score (in red) and the share of respondents rating their memory as “good” or “very good” (in green). We standardize each index using its mean 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 two-period life-cycle model in LMM, produces predictions that are consistent with the empirical evidence reported 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, subject to the budget constraints

$$c_1 = y - \pi R - s, \quad c_2 = a,$$

where y is income received at the end of the first period, πR 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 $a = Rs$ is final assets (assets at the end of the second period). Substituting through, the consumer chooses a and R to maximize

$$\log(y - \pi R - a/R) + \beta \log(a). \tag{3}$$

LMM distinguish two cases. In the first or "fixed R" case, the consumer only chooses final assets a to maximize

$$\log(y - a/R) + \beta \log(a).$$

The first order condition (FOC) for an internal solution is

$$0 = -\frac{1}{(y - a/R)R} + \frac{\beta}{a} = -\frac{1}{Ry - a} + \frac{\beta}{a},$$

so the optimal level of final assets is proportional to income,

$$a^* = \frac{R\beta}{1+\beta}\, y,$$

or equivalently the ratio of final assets to income, $a^*/y = R\beta/(1+\beta)$, does not depend on income.

In the second case, the consumer chooses a and R to maximize (3). The FOCs for this problem are

$$0 = -\frac{1}{(y - \pi R - a/R)R} + \frac{\beta}{a} \tag{4}$$

and

$$0 = \frac{1}{y - \pi R - a/R}\left(-\pi + \frac{a}{R^2}\right). \tag{5}$$

Since (5) is satisfied whenever $a = R^2\pi$, (4) gives

$$R^2\pi = R\beta y - 2R^2\beta\pi.$$

Solving out for R gives

$$R^* = \frac{y}{\pi[2 + (1/\beta)]}, \quad a^* = \frac{y^2}{\pi[2 + (1/\beta)]^2}, \quad \frac{a^*}{y} = \frac{y}{\pi[2 + (1/\beta)]^2}.$$

that is, final assets are proportional to income square or, equivalently, the ratio of final assets to income is linear in income.

Now consider an equivalent representation of the LMM model, with the budget constraints specified as

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

where $i \geq 0$ is the level of cognitive investment and $R = \gamma + \delta i$ describes how cognitive investment boosts the returns on savings. The intercept γ represents the "basic return" obtained by a "passive investor" with $i = 0$, while the slope δ measures the "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

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

as in LMM. The wealth change between the two periods is equal to

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

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

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

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

$$\frac{\beta\delta}{y + \delta i} = \frac{\beta}{s} = \frac{1}{y - i - s}. \tag{6}$$

The first equality in (6) 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 equal to

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

while the relative wealth change is equal to

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

This simple adaptation of LMM suggests a further modification in which, before choosing s and i, 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 $R = \gamma + \delta di$. 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 equal to

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

while the relative wealth change is equal to

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

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.

Figures A.1–A.3 present the results of a model where $\beta = .90$, $\gamma = 1.10$, and $\delta = .05$. Figure A.1 shows initial consumption (c_1^*), savings (s^*), cognitive investment (i^*), and final consumption ($c_2^* = a^*$) by income (y) and investor type. Figure A.2 shows lifetime utility $u(c_1^*, c_2^*)$ by income and investor type. Finally, Figure A.3 shows the wealth change $a^* - s^*$ by income and investor type.

Figure A.1: Initial consumption (c_1^*), savings (s^*), cognitive investment (i^*), and final consumption (c_2^*) by income (y) and investor type.

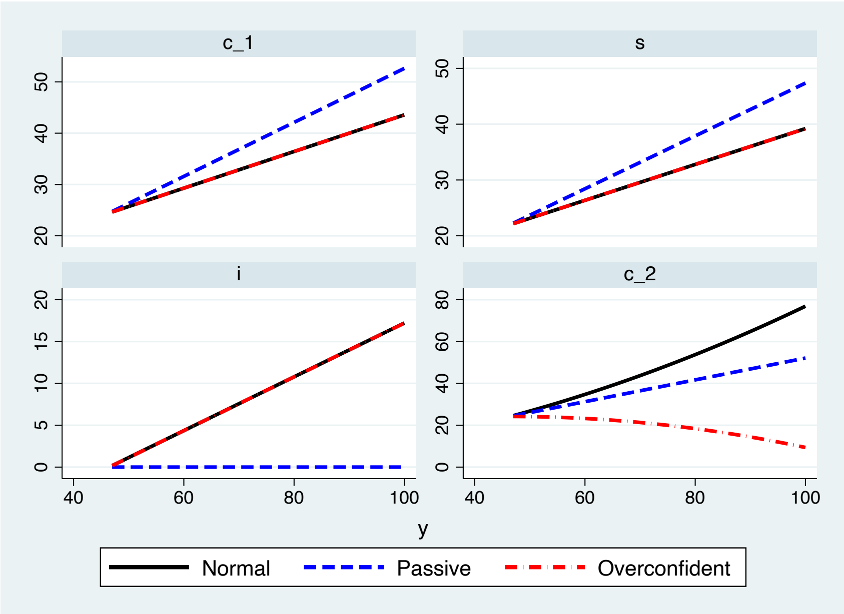


Figure A.2: Lifetime utility $u(c_1^*, c_2^*)$ by income (y) and investor type

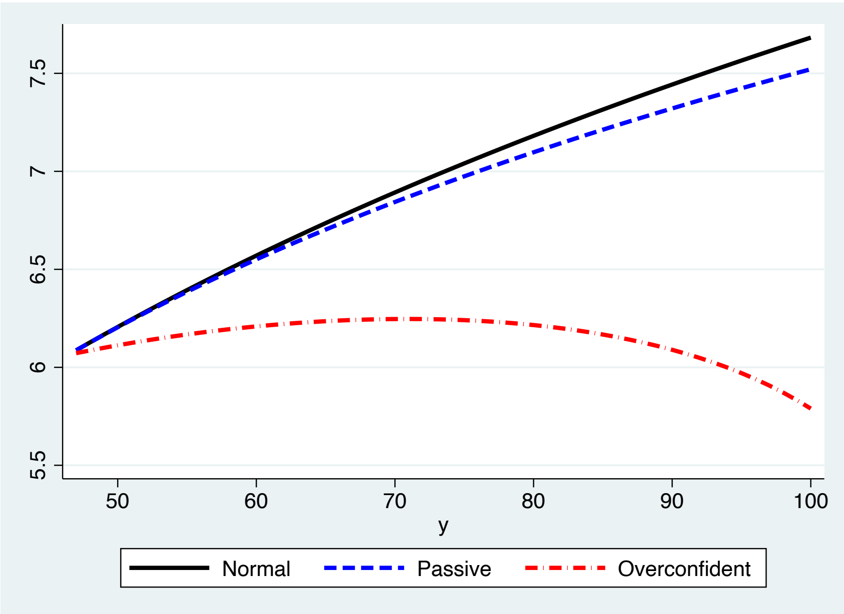
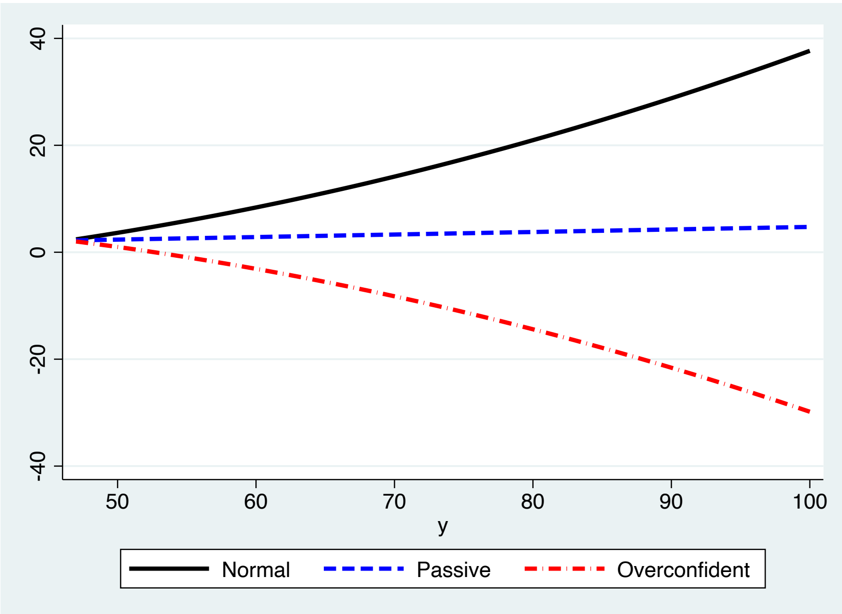


Figure A.3: Wealth change $a^* - s^*$ by income (y) and investor type



B Additional tables and figures

Table B.1: Changes in total wealth, leads and lags (conditional on 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 *
$\beta_1 - \beta_2$	-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: Robustness to alternative definitions of memory loss: changes in total wealth and severe memory loss, only financial respondents

	Relative loss (20%)	Absolute loss	Relative loss (15%)	Relative loss (25%)
	(1)	(2)	(3)	(4)
Aware	-5.672	-7.780	-13.605 *	-1.637
	(8.962)	(10.046)	(8.063)	(10.450)
Unaware	-27.831 ***	-30.075 ***	-27.453 ***	-33.437 ***
	(5.511)	(5.729)	(5.260)	(5.870)
$\beta_1 - \beta_2$	-22.159 **	-22.295 **	-13.848 *	-31.800 ***
	(9.562)	(10.504)	(8.219)	(11.193)
Obs.	56973	57053	56973	56973
N	16284	16301	16284	16284
Mean W	378.991	378.746	378.991	378.991
Mean Δ W	7.517	7.551	7.517	7.517

Notes: This table replicates the estimates in Column (3) of Table 3 except for the use of different definitions of memory loss. In column (1) we include the main definition of relative memory loss, in column (2) we use the absolute definition, in column (3) we use a relative definition based on a decline of 15% or more in the memory score, while in column (4) we use a relative definition based on a decline of 25% or more. Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at individual level. Significance levels: *** < 0.01, ** < 0.05, * < 0.1.

Table B.9: Test for ceiling and floor effects: changes in total wealth (thousands 2014 U.S. dollars) excluding bottom and top quintiles of the initial memory score distribution

	All	No bottom quintile	No top quintile	No bottom and top quintiles
	(1)	(2)	(3)	(4)
Aware	-5.672	-3.459	-9.698	-7.453
	(8.962)	(9.889)	(8.426)	(9.576)
Unaware	-27.831 ***	-27.911 ***	-26.448 ***	-26.965 ***
	(5.511)	(5.937)	(5.185)	(5.802)
$\beta_1 - \beta_2$	-22.159 **	-24.452 **	-16.750 *	-19.512 *
	(9.562)	(10.530)	(9.181)	(10.433)
Obs.	56973	46548	47476	37051
N	16284	14645	15428	13700
Mean	378.991	413.702	350.315	385.854
Mean Δ	7.517	7.753	6.039	5.996

Notes: Columns (1)–(4) correspond to different samples. Column (1) includes all financial respondents; Column (2) excludes people in the bottom quintile of the initial memory score; Column (3) excludes people in the top quintile; Column (4) excludes people in the bottom or in top quintile (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.10: 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)
ΔRecall*SA-loss	-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.11: 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.12: 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.13: Number of respondents by memory loss events experienced

# of memory loss events	Exclusively aware or unaware	
	No	Yes
0	0	5,713
1	0	8,129
2	1,093	3,406
3	631	1,101
4	197	219
5	21	22
6	0	1
Total	1,942	18,591

Notes: The table shows the number of respondents according to the number of severe memory loss events they experienced (first column) and, in case of more than one event, whether they were exclusively aware or unaware (No or Yes).

Table B.14: Changes in total wealth (thousands 2014 U.S. dollars) and occurrence of memory losses, health controls included

	(1)	(2)	(3)
Aware	-4.346	10.702	-3.370
	(9.099)	(9.298)	(9.097)
Unaware	-27.306 ***	-24.390 ***	-26.984 ***
	(5.490)	(5.263)	(5.477)
$\beta_1 - \beta_2$	-22.960 **	-35.092 ***	-23.614 **
	(9.716)	(10.306)	(9.721)
Obs.	56044	56044	56044
N	16102	16102	16102
Mean	380.501	380.501	380.501
Mean Δ	7.204	7.204	7.204
Initial health	No	Yes	No
Health change	No	No	Yes

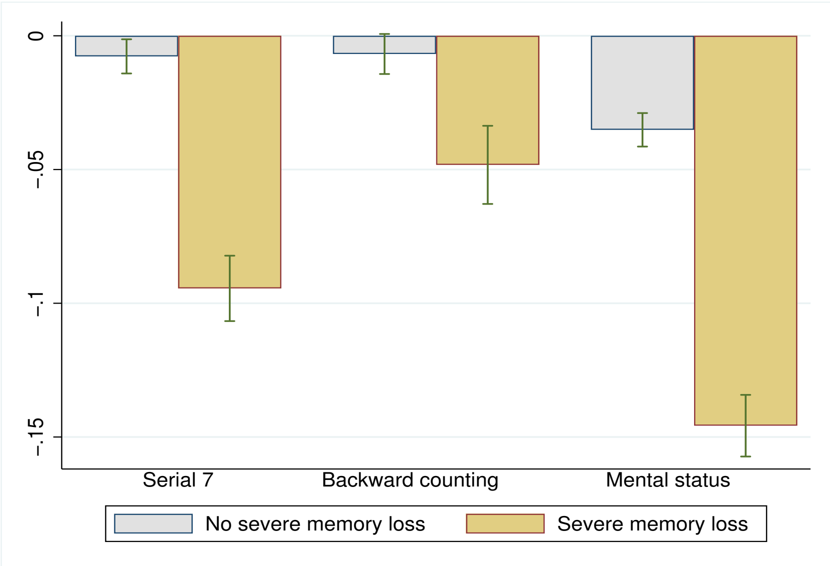
Notes: Columns (1)–(3) correspond to different sets of controls. All regressions include a quadratic age term, survey year dummies, socio-demographic controls (years of education and dummies for marital status, labor force status, gender, race, and census region), a dummy for people who declare a decline in their memory but did not experience a severe memory loss, and the initial levels of wealth and memory. Health controls include self-reported health number of activity of daily living limitations at $t-1$ or changes between t and $t-1$. 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.15: 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

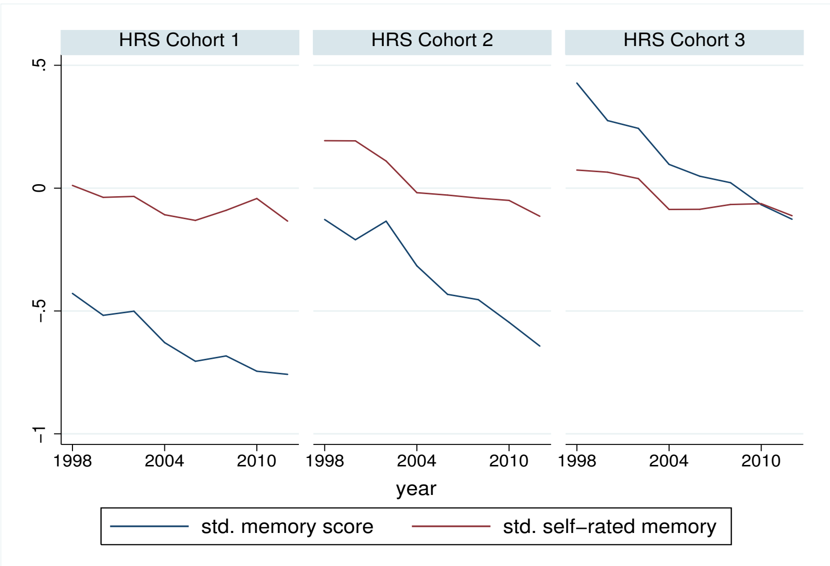
Notes: Each column represents the outcome of a different OLS regression. In the last column, we replicate the estimates in column (3) of Table 3 in the subsample of respondents who responded to the life satisfaction module. All regressions also include a quadratic age term, survey year dummies, socio-demographic 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.

Figure B.1: Average change in other cognitive tests by memory loss



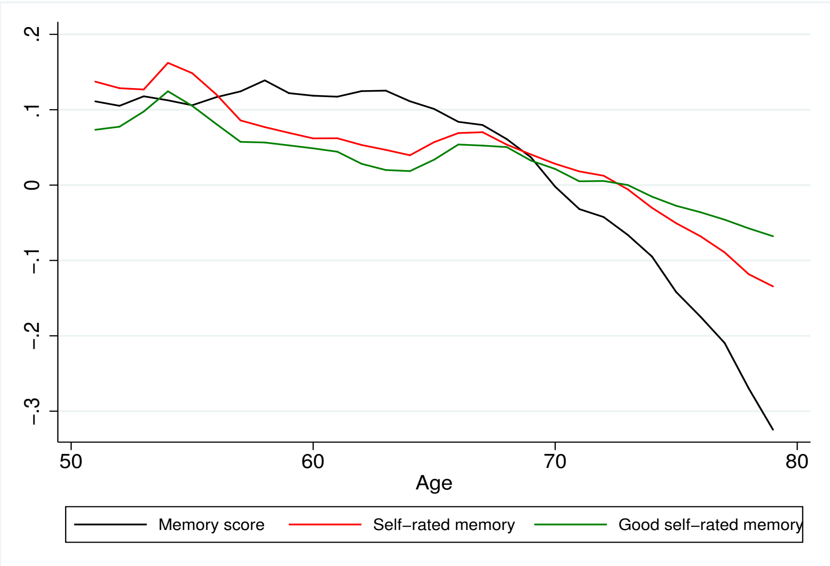
Notes: This figure compares the average changes in other cognitive test scores (serial 7, backward counting and total mental status) for respondents who experience a severe memory loss versus all other respondents.

Figure B.2: Longitudinal profiles of assessed vs. self-rated memory by HRS cohort



Notes: This figure compares the average longitudinal profile of the word recall test (assessed memory) and of the self-rated memory of the first three HRS cohorts.

Figure B.3: Age profiles HRS, fixed effects



Notes: This figure compares the same average age-profile of the three indices presented in Figure 2, namely 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), but uses the residuals from a fixed effect regression without controls.