Self-assessed cognitive ability and financial wealth: Are people aware of their cognitive decline?*

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Abstract

We investigate whether people correctly perceive their own cognitive decline and the potential financial consequences of misperception. Using longitudinal data from the Health and Retirement Survey, we examine the relationship between self-ratings of memory ability and assessed memory performance and show that older people tend to underestimate their own cognitive decline. We then investigate the financial consequences of this underestimation. We show that respondents who experience a severe cognitive decline across waves, but are unaware of it, are more likely to experience financial losses. Finally, we examine potential explanations for the patterns of wealth changes observed among respondents who are unaware of their cognitive decline. Our findings support the view that financial losses among unaware respondents reflect bad financial decisions, not rational disinvestment strategies.

Keywords: Aging; cognitive ability; financial decisions; HRS.

JEL codes: J14, J24, C23.

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1 Introduction

Population aging is one of the fundamental trends observed in developed countries and, increasingly, in developing countries as well. A key aspect of the aging process 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 the ability of an individual to process information and make the right choices, and is therefore crucial for task performance and decision making. The role of cognitive functioning is even more important in the light of the recent tendency 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 substantially 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). Irrespective of the precise nature of this shift (which in each country reflects a different mix of legislated changes, changes in the patterns of participation behavior, and changes in the level and composition of pension portfolios), the result is that older adults are now asked to make complex decisions which 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 with broader consequences for the whole economy (Campbell, 2016). This observation motivates the growing body of research in economics on the cause and consequences of financial (il)literacy (see Lusardi et al., 2014 for a review) and its relationship with the age related process of cognitive decline (Agarwal and Mazumder, 2013; Korniotis and Kumar, 2011; Finke et al., 2016).

These issues are particularly relevant for countries – like the U.S. – where the older population holds a substantial share of total wealth[1] and raise fundamental questions about the optimal policy response (Agarwal et al., 2009). In particular, it is important to understand whether people recognize their own cognitive decline and whether they are able to protect themselves from it. For example, if people perceive or predict their own cognitive decline, they may delegate financial decisions to someone they trust – another family members or to a financial advisor – without incurring any financial loss. On the contrary, if people are unaware of their cognitive decline, they may incur financial losses or may be subject to financial frauds or scams (Lusardi et al., 2014). The consequences of cognitive decline may be even worse for people with high initial levels of cognitive ability who tend to manage directly their finances and not seek advice due to their higher level of confidence (Kim et al., 2018).

Using data from the Health and Retirement Survey (HRS), we study the relationship between self-

[1] According to the 2016 Survey of Consumer Finance of the Federal Reserve Bank, the highest value of the median family net worth in the U.S., roughly 265,000 U.S. dollars, is found among families whose head is 75+.

ratings of memory ability and assessed memory performances (measured by the total score in the word recall tests) and show that older people tend to grossly underestimate their own cognitive decline. We then 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 waves of the survey. We show that respondents who are unaware of their cognitive decline are more likely to experience large wealth losses, that is, substantial negative wealth changes across waves, compared to respondents who are aware of their cognitive decline and, more generally, compared to all other respondents who do not experience a similar decline. Substantial wealth losses across waves are mainly reported by people in the third and fourth quartiles of the distribution of total wealth and amount to an average decline of 3% in mean total wealth across waves. The wealth losses for respondents who are unaware of their declining memory performance are mainly driven by large decreases in the real value of their financial wealth (about 8% on average across waves), and particularly in the value of stocks, mutual funds and investment trusts owned.

Since these wealth losses mainly reflect a decrease in the value of the financial assets held by wealthier respondents who are unaware of their declining memory, such losses might be the result of bad financial decisions. In fact, we do not find similar wealth losses among respondents who are aware of their declining memory performance or among respondents who are unaware but are less likely to take financial decisions in the household (non-financial respondents). We show that these people are actually more likely to show better memory performance before the occurrence of memory losses. This suggests an overconfidence interpretation which seems to be consistent with Korniotis and Kumar (2011), who show that older investors lose their investment skills as their cognitive ability declines and with recent evidence from a special HRS module on financial advice (Kim et al., 2018), which shows that people with higher levels of cognitive ability are less likely to avoid financial advice or help due to self-confidence.

Differences in health or other unobserved individual characteristics may provide alternative "rational" explanations for observed differences in the wealth trajectories, especially between people aware and unaware of their cognitive decline. For instance, if people unaware of their cognitive decline have lower subjective life expectancy, they might optimally decide to disinvest more and this would explain their different wealth trajectories. We find, however, that respondents who are unaware of their cognitive decline are on average in better physical health. Moreover, unlike respondents who are aware of their declining memory performance, 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 life-cycle hypothesis would predict larger disinvestments for respondents aware of their cognitive decline, which is just the opposite of what we observe. Additionally, we do not find differences in financial transfers to children or differences in consumption using additional data from the HRS Consumption and Activities Mail Survey (HRS-CAMS).

Our paper is related to a growing literature that investigates the determinants of the large wealth dispersion observed in the U.S. and many other developed economies (see Campbell, 2016 for a review), especially around the age of retirement. While earlier literature attempts 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 also been devoted to cross-sectional heterogeneity in rates of returns (Fagereng et al., 2016) arising from large differences in financial knowledge (see for example Lusardi et al., 2017). Unlike this literature, we provide evidence for a different channel that affects longitudinal variation in wealth, namely the process of cognitive aging for people unaware of their declining skills. Our findings also have different policy implications because, instead of pointing to interventions aimed at overcoming the lack of financial literacy of older cohorts, they point to interventions aimed at moderating the overconfidence of wealth owners unaware of the fact that their previously good skills are now rapidly deteriorating.

The rest of this paper is organized as follows. Section 2 reviews the literature on cognitive aging and decision making. 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

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).

Cognitive ability involves a wide range of skills required to perform various mental processes (e.g., reasoning, remembering, understanding and problem solving), so it is generally regarded as a multidimensional concept. It is also better viewed as a latent trait, only imperfectly measured by various types of performance test. 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 froms 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 which way and to what extent the age related process of cognitive decline affects individuals' decision-making ability (see Carpenter and Yoon, 2011 for a review). According to this literature, older adults are more likely to use heuristic and biased strategies in their decision making because the aging process increases the cost of engaging in effortful cognitive activities (Hess, 2014). Older adults may in fact choose to limit both the quantity and the complexity of the information that they use. As in the macroeconomic literature on rational inattention (see, e.g., Sims, 2003 and Paciello, 2012), this may in fact be perfectly rational given their increasingly limited capacity for processing information. Consistently with this view, Abaluck and Gruber (2011) find that the elderly choices under Medicare Part D tend to focus on a quite 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 also affect the likelihood to invest in risky assets (Rosen and Wu, 2004; Bogan and Fertig, 2013).

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 longitudinal household 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 are available only from 1998. Our main sample includes all respondents aged 50 and older with non-missing information on our variables of interest, namely self-rated and assessed memory,[2] and household wealth. To avoid potential selection issues arising from mortality and institutionalization, we further restrict the sample to people not older than 80 years of age.

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 respondent-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", scored from 1 to 5 respectively. It also asks respondents 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", scored from 1 to 3 respectively. We reverse-score both variables, so higher scores represent better self-rated memory and positive changes represent perceived improvements over time.

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 asks her 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

[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 of 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.

[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] For more information about the cognitive measures in the HRS see Ofstedal et al. (2005).

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 might induce some learning. If attrition across waves is correlated with cognitive functioning, sample selection might also partially explain the observed distribution of changes in the memory score. All in all, it is reassuring to observe that the share of respondents who improve their score across waves strongly declines with age.

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.

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 associate with the Alzheimer's disease or other forms of dementia.

The HRS also includes cognitive tasks aimed at assessing other cognitive dimensions, such as basic skills of reasoning, orientation, calculation, language, and knowledge. Figure 3 shows that our measure of relative memory decline is strongly correlated with three other such tests, namely serial 7[5] and backward counting, which involve simple numerical calculations, and the total mental status score, which sums the scores from the counting, naming and vocabulary tests.[6] 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' cognitive performance.

[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.

[6] 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 thirteen asset categories: the value of primary residence; the 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, who is 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 information on Social Security wealth. Including the value of these components would complicate matters s considerably – as they can only be estimated indirectly, for example using the data and the procedure described in Barth et al. (2018)[7] – but is unlikely to substantially modify our results – as it is implausible that changes in these unmeasured components 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.[8] 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 the 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) between the initially reported values. Unfortunately, missing or incomplete information (e.g. bracketed amounts in an unfolding bracket sequence) on some wealth components represents a serious challenge. The RAND HRS files provide imputed values for these cases.[9] To limit the impact of the imputation procedures on our results, we restrict the sample to

[7] Barth et al. (2018) compute Social Security wealth they exploit the link between individuals in the HRS and income data available through the Master Earnings File maintained by the U.S. Social Security Administration, which is constructed using data from employer's reports and records from the U.S. Internal Revenue Service (W-2 forms and other annual tax figures).

[8] CPI data have been downloaded from the U.S. Bureau of Labor Statistics website: https://www.bls.gov/cpi/.

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

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 percentiles. The resulting working sample consists of 22,747 individuals (9,720 males and 13,027 females), observed on average for 3.7 waves, and represents 94% of the individuals aged 50–80 in the original HRS sample. Figure 2 shows that, as expected, the wealth distribution is heavily skewed to the right.

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 individual i is interviewed in month t and re-interviewed T months later. Given her initial amount of wealth W_{ijt} in asset category j, we compute the expected value $EV_{ij,t+T}$ of her wealth in that category at the time of the next interview by the formula:

$$EV_{ij,t+T} = W_{ijt} \prod_{s=t+1}^{T} (1 + r_{js}),$$

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

3.4 Descriptive statistics

Figure 4 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 A.1, which separately analyzes the longitudinal trajectories of the first three HRS cohorts,[11] and by Figure A.2, 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

[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 Boomers (EBB) cohort born 1948–1953 and the Mid Boomers (MBB) cohort born 1954-1959.

or an absolute decline of one standard deviation or more) actually rate their memory as stable or improved. Figure 5 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 6 shows the distribution of the assessed memory performance in the wave before the occurrence of a severe cognitive loss. Although we use the relative definition of severe loss (a 20% decline of the initial memory score), respondents who experienced a severe loss still show on average higher initial memory performance than those who did not experienced a severe loss (top figure). When we only consider the subset of respondents with a severe memory loss (bottom figure), 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 be unaware of their memory decline. Specifically, we report the estimated marginal effects from probit models for the probability of being unaware conditional on having a relative memory loss as defined above. In Column 1, we control for basic socio-demographic characteristics and wealth quartiles, while in the following columns we include additional controls for memory score in the previous wave (Column 2), health conditions in the previous waves (Column 3), or health changes across waves (Column 4). Consistently with Figure 5, age strongly affects the likelihood of being unaware, with females more likely to be unaware of their memory decline than males. It is worth noting that respondents who have higher memory scores and are in better health conditions at the baseline are more likely to be unaware of their memory decline in the next wave (Columns 2–4). Education does not appear to be associated with awareness (Column 1), unless we condition on previous memory score and health conditions. Contrary to what one might expect, among people who experience a severe memory decline, those unaware are not retired people with low education and poor health and cognitive functioning. Instead, they appear to have better initial health and memory capacity and therefore likely to be still confident about their skills. Column 1 also suggests that education does not affect the likelihood of being aware while people who are working are more likely of being unaware. As for wealth wealth, people in the lowest quartile are slightly more likely to be aware of their declining memory than better off respondents.

4 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 self-rated memory changes for

two reasons. First, we want to investigate the wealth trajectories of respondents who experience a severe memory decline, so we are more interested in their perceived changes in memory performance than in their perceived memory performance at a point in time. Second, among respondents who experience a severe memory decline, as measured by the change in their memory score, we can 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.

Our 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 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 her 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 her memory as stable or improving, $\boldsymbol{X}_i$ 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), for being the financial respondent in the household 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 her 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 similar in terms of observable characteristics, we also present the results of a more general model that controls for differences in the initial wealth and memory levels by including the wealth and memory score in the previous wave as additional time-varying regressors. This is done because wealth changes may be expected to be larger for people with a larger initial amount of wealth. Further, we investigate the heterogeneity of the results across quartiles of the initial wealth distribution.

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 regression model (1). We then discuss alternative interpretations of our empirical findings and present the results of a number of robustness checks.

5.1 Baseline model

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). In Column (1) we do not condition on initial wealth or memory levels. In this case we see little evidence of systematic differences in wealth changes over time between people with and without severe memory losses. In Column (2) we instead condition on a respondent's initial wealth and memory levels. The large and statistically significant negative coefficient now associated with the memory loss indicator reflects the fact that wealth changes tend to be negative for people starting with large wealth values, and these wealth losses tend to be much larger for people with severe memory losses. Column (3) removes the restriction that $\beta_1 = \beta_2$ in model (1) and shows that wealth losses are on average much larger for respondents who are unaware of their memory decline. For this reason, in the last three columns of Table 3 we focus on the subset of respondents who experience a severe memory decline. Column (4) shows that the expected difference in wealth losses between aware and unaware respondents is negative and statistically significant, that is, wealth losses are larger for respondents who are unaware of their memory decline. Columns (5) and (6) further distinguish between those who are designated in the survey as financial respondents, and therefore are more likely to take financial decisions in the household, and those who are not. A comparison of the two columns shows that the expected wealth losses are 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 take financial decisions in a household.

Table 4 presents the results obtained by fitting model (1) separately for each quartile of the distribution of initial wealth in order to account for heterogeneous effects depending on the position in the initial wealth distribution. We again present the results separately for all respondents and for the subset of respondents who experience a severe memory decline. 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 3% decline with respect to their mean wealth value.

So far we only investigated the relationship between severe memory changes (self-rated or as-

sessed) and total wealth changes. In order to explore potential mechanisms behind the observed relationship, Table 5 presents the results obtained by fitting model (1) for total wealth changes (Column 1 is the same as Column 3 of Table 3) and separately for changes in the value of five broad wealth categories, namely financial wealth, individual retirement accounts, housing, other real estate, and farm/business.[12] The table shows that the wealth losses for respondents who are unaware of their declining memory are mainly the results of decreases in their financial wealth, followed by decreases in the value of their individual retirement accounts. Changes in the value of the other wealth categories (housing, other real estate, and farm/business) are smaller and statistically less significant. Using the RAND HRS definition of financial wealth, which excludes individual retirement accounts, we account for about 60% of the total wealth loss estimated in Table 3 (reported also in the first column of Table 5). If we also include individual retirement accounts, we account for more than 80%.

Table 6 presents the results obtained by 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 wealth above the median. More specifically, people in the third and fourth quartiles of the wealth distribution who are unaware of their memory decline experience substantial financial losses across waves, the magnitude of which corresponds to roughly 8% 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 7 shows that half of the average loss in financial wealth (which, from Table 6, is equal to about 18 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 other half 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).

All in all, these results show that wealth losses are concentrated among wealthier respondents who are unaware of their cognitive decline, and the losses mainly involve the value of their financial assets. Since wealth losses are concentrated among the financial respondents, who are more likely to take financial decisions, it is possible that these people may have undertaken bad financial investments because unaware of their falling cognitive performance. We also know that respondents who experience a severe memory loss show better cognitive performance at the baseline (Table 2 and

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

Figure 6) and are therefore more likely to be more confident about their ability and less likely to delegate financial decision to others.

This "bad-investment interpretation" is supported by an analysis of the changes in consumption patterns based on the HRS-CAMS data, which we present in Table A.4 of the Appendix. This table shows that relative memory losses, for both aware and unaware respondents, are associated neither with increases in total consumption nor with increases in particular consumption categories, such as durables or non-durables. So we can exclude that these respondents are consuming more because of a rational (optimal disinvestment) or irrational behavior.

To further support this interpretation, in Table 8 we investigate the difference between the respondent's total financial wealth in a given wave and the financial wealth predicted using the value of total financial wealth in the previous wave capitalized at the average market rate of return for the various asset categories (as described in Section 3.3). More specifically, we estimate model (1) using as dependent variable the before described difference in absolute terms (Columns 1 and 2) or in relative terms using the financial wealth in the previous wave as denominator (Column 3 and 4). Our results show that even taking account the initial composition of the respondents' financial portfolio respondents unaware of their cognitive decline appear to largely underperform with respect to the average market market returns, far more than the other respondents including respondents aware of their cognitive decline. Again, the largest difference is found among the wealthier respondents (Columns 2 and 4). The evidence reported in this table also suggests that the differences in the wealth trajectories we reported so far are not due to differences in portfolio composition in the previous period.

5.2 Alternative interpretations

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

One such interpretation is that the negative wealth changes observed for unaware respondents do not represent losses but rational disinvestments reflecting the fact that unaware respondents may also have shorter life horizons. As already noted when discussing Table 2, among the respondents who experience a severe memory loss, those who are unaware are 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 is relevant here 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 9, where we regress changes in subjective life expectancy on the occurrence of severe memory

losses[13] using a specification similar to model (1) for wealth changes. The only case when 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. This finding allows us to reject the rational disinvestment explanation.

The last two columns of Table 9 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 the alternative interpretation that people unaware of their cognitive decline face higher medical expenses which negatively affect their wealth trajectories.

Given the well-know relationship between cognitive ability, health and stockholding, in Table 10 we also investigate whether respondents (un)aware of their cognitive decline change the composition of their financial portfolio between risky assets (stocks, mutual funds or investment trusts, but not individual retirement accounts) and safe assets (all the other assets included in our measure of financial wealth), distinguishing between changes in the probability of holding risky assets (the extensive margin) and changes in the expected share of risky assets (the intensive margin). Our results indicate that only aware respondents with wealth levels above the median appear to significantly change their portfolio towards less risky assets, but only at the extensive margin.

We also consider whether the negative wealth changes associated to people unaware of their cognitive decline are the result of differential misreporting. People who experience a severe memory decline may have more difficulties remembering the value of their assets. However, such problem should affect both aware and unaware respondents, and should only reduce the precision of our estimates via a larger variability of the regression errors in (1). No evidence on the patterns of misreporting is possible without a linkage of HRS with administrative data. Nonetheless, we find no indication that people unaware of their cognitive decline are characterized by higher levels of imputation of their financial wealth or, when restricting attention to stockholdings, by a higher likelihood of providing missing or incomplete values (Table A.2 of the Appendix).

Finally, Table A.3 of the Appendix shows no evidence of an association between severe memory losses and changes in financial transfer to children (neither in their probability nor in their total amount). 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 bequest.

5.3 Robustness checks

In this section we discuss the results of a number of robustness checks carried out mainly to assess the sensitivity of our results to alternative definition of memory loss. As already mentioned, our general

[13] The HRS asks the respondents what is the percentage chance that she will reach a target age which varies from 75 to 95 years depending of the age of the respondent at the time of the interview.

conclusions do not change when we adopt the absolute definition of memory loss typically used in the neuropsychological literature, namely one standard deviation decline in memory score. Table A.5 in the Appendix shows that the results obtained in this case are quantitatively and qualitatively similar to those reported in Table 3.

We show in the Appendix that our results remain essentially unchanged when we vary the threshold for the relative definition of severe memory loss. Instead of our earlier 20% threshold (which roughly corresponds to the first quintile of memory changes), in Tables A.6 and A.7 we consider two alternatives, namely a lower threshold of 15% and a higher threshold of 25%. Irrespective of what threshold is used, severe memory losses are associated with negative wealth changes. Not surprisingly, the difference between aware and unaware respondents is smaller when using the lower threshold and larger when using the higher threshold.

Given the right-skewed distribution of wealth (Figure 2), 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) prevented 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 – for whom the probability of having a negative wealth value is very low – the results obtained using the log transformation are very similar to those reported in the main text.

Of course, the main concern with model (1) is potential model misspecification leading to failure of the assumption that the unobservable error term ϵ_{it} in (1) is mean independent of the included regressors. One possibility is that the estimated difference in wealth changes between aware and unaware respondents is only the consequence of a different timing or a different dynamic. For instance, some respondents might just experience a wealth loss one or a few years before their memory loss is detected by the HRS memory tasks. More generally, it is interesting to investigate how the wealth changes of these people look like before and after the memory loss event. Figure A.3 in the Appendix separately presents the wealth changes of aware and unaware respondents as an event study. Specifically, we look at the wealth changes of (un)aware respondents up to four years before and after the memory loss event. The figure shows that, for unaware respondents, substantial wealth losses are observed only at the time of the memory loss event. Aware respondents, instead, show no substantial wealth losses and, if anything, they seem to experience some wealth gains over a 4-year period. It is worth noting that many respondents experience more than one memory loss event, of which they need not be always aware or unaware. To partially address this issue, we only consider the time to and from the first memory loss event registered in the data. However it is reassuring that results are quantitatively similar to those reported in the main text.

Finally, Table A.9 in the Appendix presents the results obtained when we include as additional regressors in model (1) 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 HRS, a large representative longitudinal dataset on American people over age 50, we show that people tends to largely underestimate their own cognitive decline and the financial consequences of financial consequences of misperception. To evaluate people awareness of their cognitive decline we investigate the difference between self-rating of changes in memory across waves and the actual change in memory measured using using two word list recall test. We find that respondents unaware of their own cognitive decline are more likely to experience a larger decline in their financial wealth compared to respondents who are aware of their declining memory respondents, and to all other respondents who did not experience a similar decline in their memory performance. We investigate several alternative explanations for our results including a rational disinvestments explanation related to the fact that they might be in worse health conditions and have a shorter (subjective) life horizon. Moreover, we find differences neither in consumption nor in transfer to children between the two types of respondents. Then, the more reasonable explanation for our results seems to be that unaware respondents are likely to make bad financial decisions which negatively affect their wealth trajectories across waves. This is consistent with an overconfidence interpretation, as wealth losses are concentrated among financial respondents and those in the highest wealth quartiles who show a better initial memory performance.

After the recent financial crisis, there has been a strong commitments among policymakers to improve the quality of household financial decision making, and lot of attention has been devoted on individuals' financial literacy and how to raise its levels especially among younger people. However, what we show is that the decline of financial wealth associated with declining cognitive performances mainly involves wealthier respondents who initially have better cognitive performances. Therefore, our results suggest that what matters is not only whether people in old age have accumulated sufficient financial knowledge, but also whether they are aware that their cognitive performance is declining.

As for the policy responses to the problems identified in our paper, most of the key issues have already been identified and lucidly discussed in Agarwal et al. (2009) who consider in detail the pros and cons of several types of intervention. Here we briefly review the interventions that primarily target individual investors, leaving aside regulations aimed at increasing the fiduciary duties of sellers of financial products or imposing safety and quality standards on the financial products themselves. Two of these interventions, namely strengthening disclosure requirements and "libertarian paternalism" (i.e., the use of benevolent institutional "nudges" to correct behavioral biases) may be ruled

out because it is recognized that they are unlikely to be effective on older people with significant cognitive declines. This leaves four possible approaches: laissez-fair, financial "driver's licenses", protecting assets in a mandatory "safe harbor", and mandatory advance directives. Laissez-fair may be viewed as second-best optimal to overcome the problems associated with strong regulatory interventions. Financial "driver's licenses" would require individuals to pass a "license" test before being allowed to make nontrivial financial decisions. Such an approach faces important practical problems, including the exact nature of the test, how often would people be required to take it, and whether this would be enough to catch people as they transition into a state of significant cognitive impairment. Protecting a retiree's financial assets in a mandatory "safe harbor" account is essentially a generalization of the type of mandatory annuitization schemes already popular in several countries outside the U.S. Unfortunately, this approach would considerably restrict individual choices and may create risks of political manipulation. Finally, mandatory advance directives would require people to set up protective mechanisms well ahead of time in the form of family oversight, competent and trustworthy financial advisers, and formal trusts. Our paper stresses two key problems associated with this last approach, namely the failure to anticipate, when cognitively healthy, the possibility of one own's cognitive decline, and the mistaken belief that one will recognize when the time has come.

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Table 1: Self-rated vs. assessed memory

	Relative memory loss	
Self-rated memory change	No	Yes
Stable or improved	46956	15774
Worse	12277	5012
	Absolute memory loss	
Self-rated memory change	No	Yes
Stable or improved	48473	14386
Worse	13000	4335

Notes: This table compares self-rated memory changes (relative to the last interview) with two different measures of memory loss based on the word recall test: 1) the "relative" memory loss is defined as a decline of 20% or more in the memory score (first quintile); the "absolute" memory loss is defined as a memory score change of one standard deviation or more.

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

	(1)	(2)	(3)	(4)
Age	-.002 *	-.002	-.003 **	-.002
	(.001)	(.001)	(.001)	(.001)
Age^2	-.000	.000	.000	.000
	(.000)	(.000)	(.000)	(.000)
$Alone_{t-1}$	-.017 *	-.017 *	-.023 **	-.017 *
	(.010)	(.010)	(.009)	(.010)
Female	.029 ***	.043 ***	.042 ***	.043 ***
	(.009)	(.009)	(.009)	(.009)
Education	.000	-.003 *	-.007 ***	-.003 *
	(.001)	(.001)	(.001)	(.001)
$Working_{t-1}$	.052 ***	.047 ***	.008	.048 ***
	(.009)	(.009)	(.009)	(.009)
Q2 $wealth_{t-1}$	.027 **	.022 *	.000	.022 *
	(.011)	(.011)	(.011)	(.011)
Q3 $wealth_{t-1}$	.021 *	.012	-.023 *	.012
	(.013)	(.012)	(.012)	(.012)
Q4 $wealth_{t-1}$	.017	.007	-.042 ***	.007
	(.014)	(.014)	(.013)	(.014)
$Recall_{t-1}$		.024 ***	.017 ***	.023 ***
		(.003)	(.003)	(.003)
SRH_{t-1}			.061 ***	
			(.003)	
ADL_{t-1}			-.057 ***	
			(.011)	
ΔSRH				-.047 ***
				(.011)
ΔADL				.021 ***
				(.004)
N	19843	19843	19843	19843
Mean	.76	.76	.76	.76

Notes: This table shows marginal effects from probit estimates of the probability of being unaware 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, self-rated health (SRH) and limitations with activities of daily living (ADL). Column (4) includes changes in health across waves instead of initial health levels. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table 3: Changes in total wealth (thousands 2014 U.S. dollars) and severe memory losses

	All			Resp. with severe memory losses		
	(1)	(2)	(3)	(4)	(5)	(6)
Mem. loss	-1.203	-21.213***				
	(4.167)	(4.384)				
Mem. loss aware			-10.202			
			(7.828)			
Mem. loss unaware			-25.052***	-13.064*	-18.005**	-5.649
			(4.754)	(7.582)	(9.257)	(12.849)
N	83193	83193	83193	20231	14270	5961
Mean wealth	423.665	423.665	423.665	385.909	342.084	490.820
Mean change	4.737	4.737	4.737	1.316	-2.494	10.542
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Initial wealth and memory	No	Yes	Yes	Yes	Yes	Yes
Financial respondent (FR)	All	All	All	All	Only FR	Non-FR

Notes: Socio-demographic controls include a quadratic age term, marital status, years of education, labor force status, gender, race, dummy for financial respondent and census region. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table 4: Changes in total wealth (thousands 2014 U.S. dollars) and severe memory losses by quartile of the initial wealth distribution

	1st quartile		2nd quartile		3rd quartile		4rd quartile	
	All	With loss	All	With loss	All	With loss	All	With loss
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mem. loss aware	-6.110**		-.147		-1.779		22.568	
	(2.713)		(4.673)		(8.222)		(25.149)	
Mem. loss unaware	-3.293*	2.222	-2.596	-1.572	-10.525**	-7.675	-30.441**	-50.273*
	(1.812)	(2.764)	(2.544)	(5.304)	(4.724)	(8.763)	(14.224)	(25.704)
N	20799	5560	20800	5213	20797	4869	20797	4589
Mean wealth	29.777	27.294	134.186	131.246	361.747	356.240	1169.031	1141.174
Mean change	23.207	19.995	23.721	21.875	43.726	35.494	-63.616	-71.576
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Memory	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table 5: Changes in wealth components (thousands 2014 U.S. dollars) and severe memory losses

	Only respondents with memory loss					
	(1)	(2)	(3)	(4)	(5)	(6)
Wealth components:	Total	Financial	IRAs	Housing	Real estate	Business
Mem. loss unaware	-25.052***	-15.171***	-5.317***	-3.256**	-2.248*	.994
	(4.754)	(2.810)	(1.459)	(1.470)	(1.300)	(1.448)
N	83193	83193	83193	83193	81040	81040
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table 6: Changes in financial wealth (thousands 2014 U.S. dollars) and occurrence of memory losses by ownership of financial wealth and wealth quartiles

	(1)	(2)	(3)	(4)
	No financial wealth	Positive financial wealth	3rd wealth quartile	4rd wealth quartile
Mem. loss unaware	.578	-18.189***	-6.362**	-27.989***
	(1.313)	(3.431)	(3.020)	(8.009)
N	23250	59943	18432	20054
Mean financial wealth	3.368	148.253	84.591	344.706
Mean change	14.026	-6.110	13.290	-32.399
Age and year controls	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes
Financial resp:	Yes	Yes	Yes	Yes

Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table 7: Changes in the value of financial wealth components (thousands 2014 U.S. dollars) and severe memory losses for respondents with positive initial wealth

	All respondents					
	(1) Stocks	(2) Bonds	(3) Debt	(4) CDs	(5) Checking/ Savings	(6) Others
Mem. loss unaware	-9.131***	.218	.038	-1.950***	-3.396***	-4.193***
	(2.051)	(.795)	(.205)	(.591)	(.938)	(1.161)
N	59943	59943	59943	59943	59943	59943
Mean wealth category	71.913	9.650	3.092	17.314	35.987	16.482
Mean change	-3.660	-.140	1.195	.194	.724	-2.033
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Financial resp:	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table 8: Actual vs. expected financial wealth at time t

	(1)	(2)	(3)	(4)
	Absolute difference		Relative difference	
Mem. loss aware	-7.980	-9.485	-.033	-.081
	(5.687)	(8.111)	(.068)	(.050)
Mem. loss unaware	-13.608***	-17.996***	-.066*	-.096***
	(3.690)	(4.780)	(.040)	(.030)
N	59943	41580	57497	41466
Mean value	-6.683	-14.130	-.069	-.074
3-4 wealth quartile:	No	Yes	No	Yes
Age (sq) and year FE	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes
Initial wealth and memory	Yes	Yes	Yes	Yes

Notes: In Column 1 and 2 the dependent variable is a variable indicating the absolute difference between the observed financial wealth at time t and the expected financial wealth. The expected financial wealth 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 the average market returns (taking into account the portfolio composition at $t-1$). In Column 3 and 4 the absolute difference has been standardized using the value of the financial wealth at $t-1$. Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. 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 9: Changes in subjective life expectancy and in out-of-pocket (OO) health expenditure and severe memory losses

	(1)	(2)	(3)	(4)
	Life expectancy		OOP expenditure	
Mem. loss	-.454		.084	
	(.329)		(.116)	
Mem. loss unaware		.218		.000
		(.354)		(.106)
Mem. loss aware		-2.088***		.384
		(.610)		(.367)
N	63929	63929	69089	69089
Age and year controls	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes

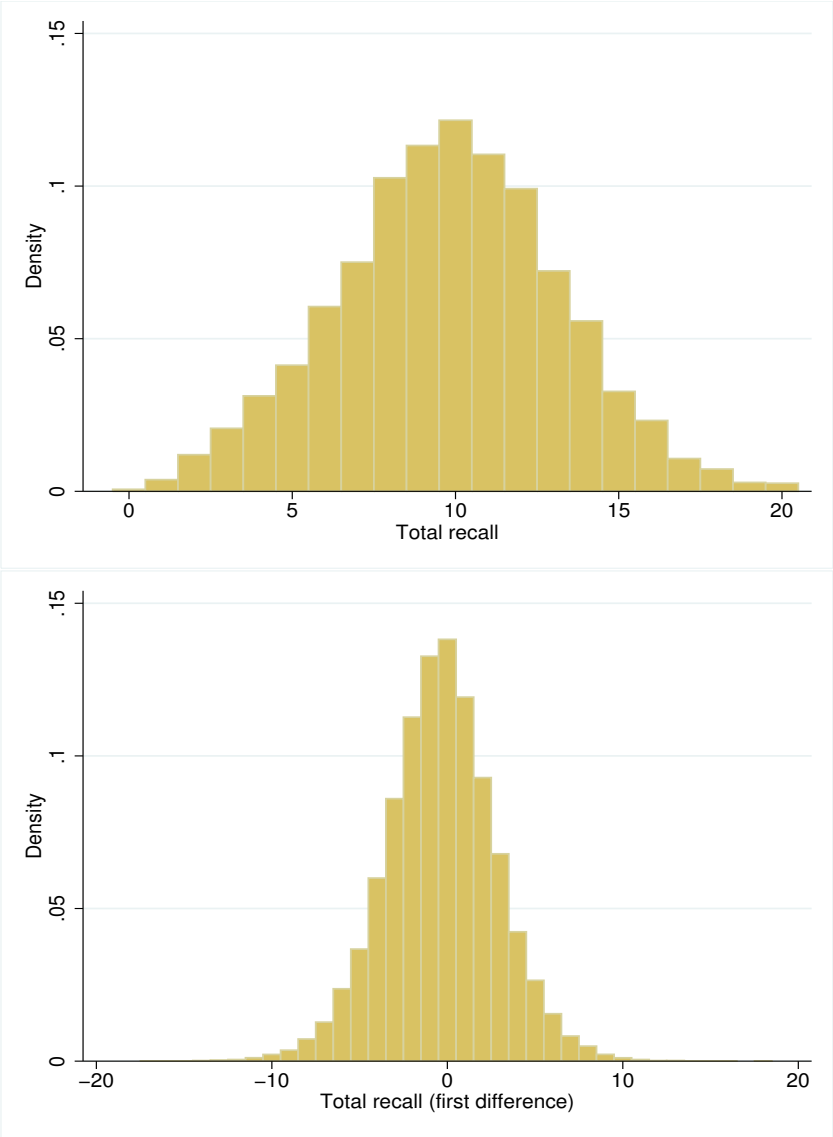
Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Columns (1) and (3) include all respondents, while Columns (2) and (4) only include respondents who experienced a severe memory loss across two waves. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level sample weights.

Table 10: Change in risky assets holding and share

	(1)	(2)	(3)	(4)
	Risky assets (Y/N)		Risky share	
Mem. loss unaware	-.004	-.012	.007	-.002
	(.006)	(.008)	(.008)	(.008)
Mem. loss aware	-.013	-.023**	.001	-.006
	(.009)	(.011)	(.014)	(.014)
N	59943	41580	21462	19645
3-4 wealth quartile:	No	Yes	No	Yes
Age (sq) and year FE	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes
Initial wealth and memory	Yes	Yes	Yes	Yes

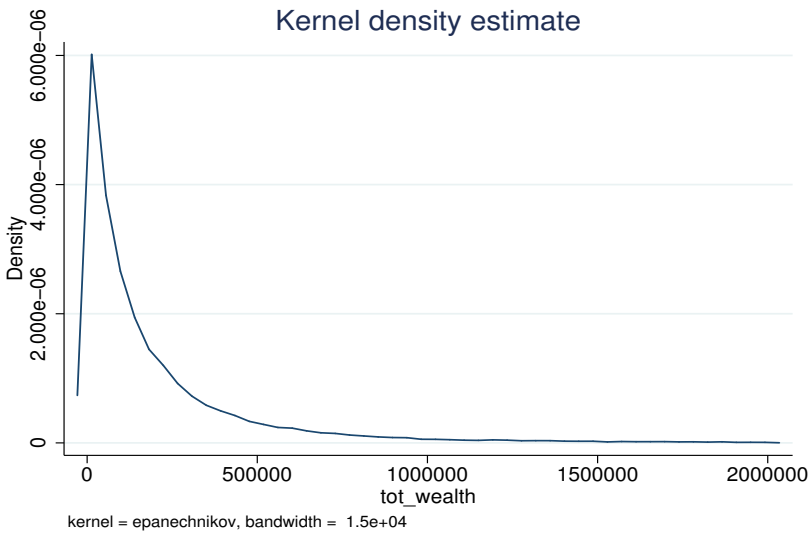
Notes: In Column (1) and (2), the dependent variable is a dummy variable which indicates whether the respondent holds any risky financial asset (extensive margin), while in Column (3) and (4) the share invested in risky asset conditional on having risky assets (intensive margin). Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. 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.

Figure 1: Test score density, level (top) and first difference (bottom)



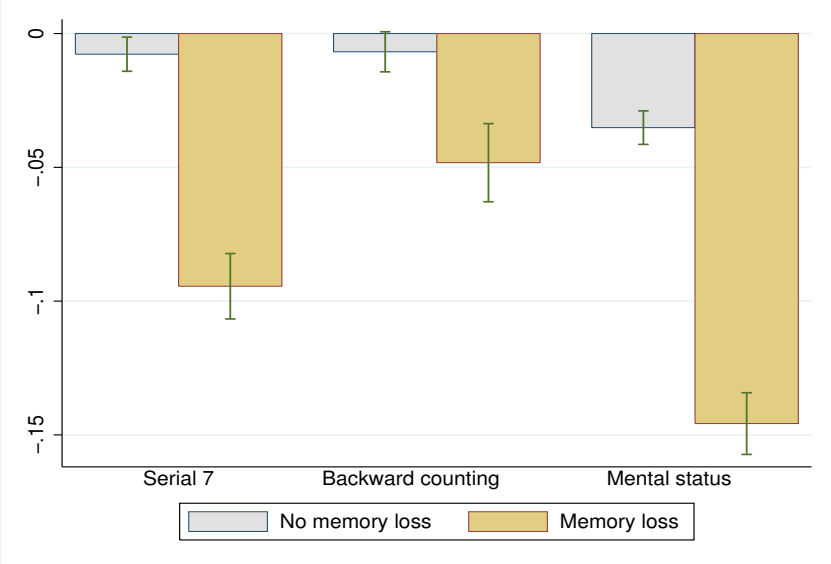
Notes: This figure shows the density of the memory score in levels (top panel) and first differences (bottom panel). The vertical red lines show the mean value.

Figure 2: Total wealth distribution



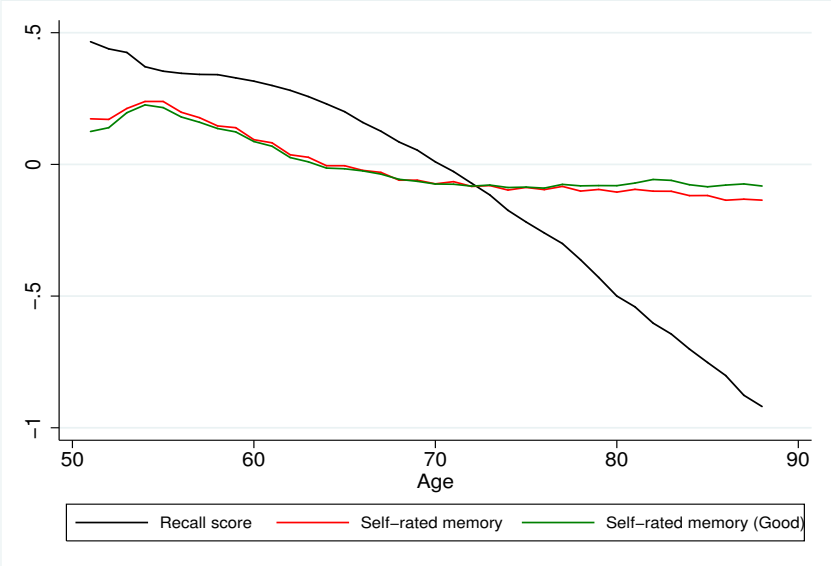
Notes: This figure shows the unconditional real wealth distribution (in 2014 U.S. dollars) among HRS individuals in our sample using the HRS respondent-level weights.

Figure 3: Average changes in other cognitive tests by memory loss



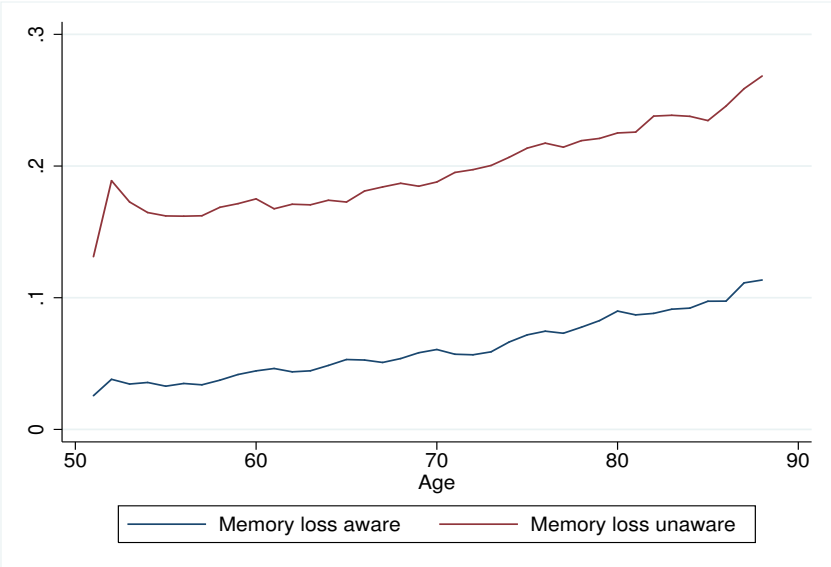
Notes: This figure compares the average changes in other cognitive test scores (serial 7, backward counting and total mental status) for respondents who experience a memory loss versus all the other respondents.

Figure 4: Age profiles of assessed vs. self-rated memory



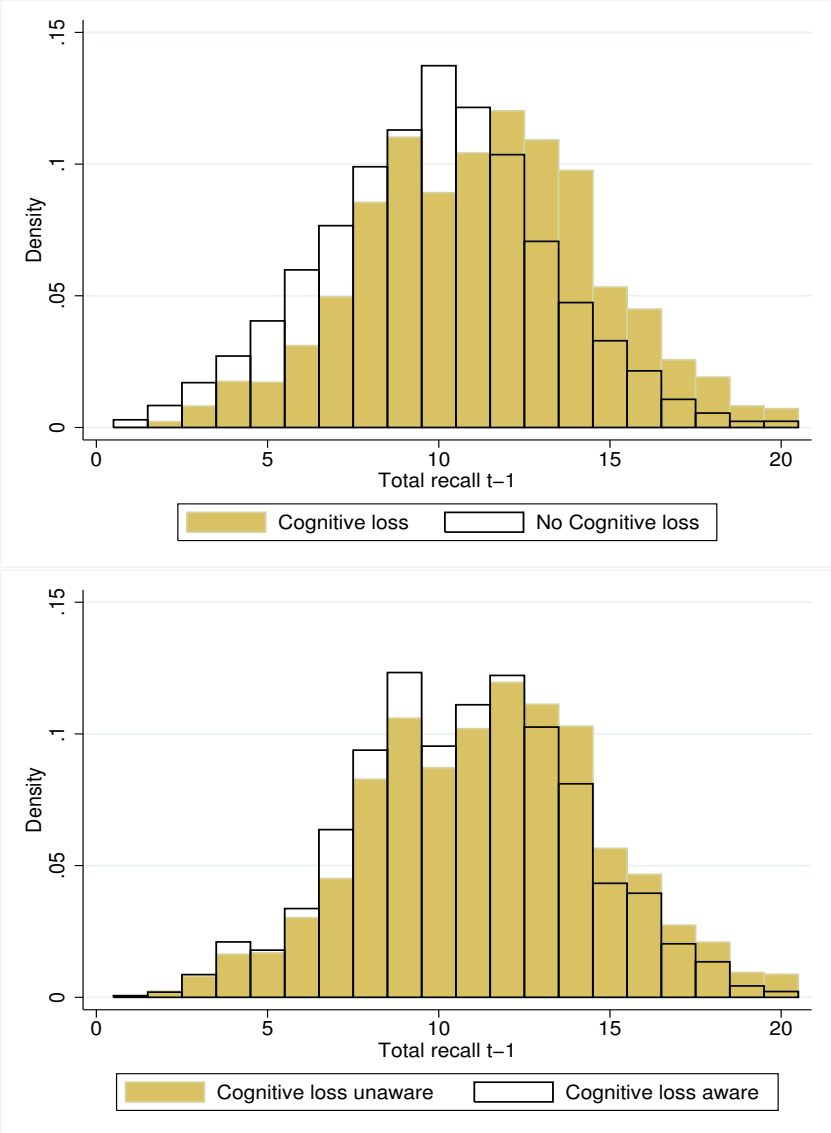
Notes: This figure presents the average age-profile of three indices: the total score in the immediate and delayed recall tasks (in black), the self-rated memory score (in red) and the share of respondents rating their memory as "good" or "very good" (in green). We standardize each index using its mean 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 5: Share of respondents aware and unaware of their memory loss



Notes: This figure shows the proportion 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 6: Memory score in the previous wave



Notes: This figure compares...

Table A.1: Average change in total wealth (thousands 2014 U.S. dollars)

	All respondents		
	No mem. loss	Mem. loss aware	Mem. loss unaware
Average wealth change	5.754	5.464	.155
(SD)	(529.74)	(392.99)	(406.06)
N	62962	4601	15630
	Only respondents with initial financial wealth		
	No mem. loss	Mem. loss aware	Mem. loss unaware
Average wealth change	1.831	.454	-7.635
(SD)	(600.85)	(452.63)	(467.61)
N	45778	3245	10920
	Respondents with wealth above the median		
	No mem. loss	Mem. loss aware	Mem. loss unaware
Average wealth change	-10.060	-8.75	-21.13
(SD)	(714.32)	(545.81)	(566.41)
N	29761	2018	6707

Table A.2: Misreporting in asset value

	(1) Degree of imputation (financial wealth)	(2) Incomplete or missing stock value
Mem. loss unaware	.001	.004
	(.002)	(.004)
Mem. loss aware	-.001	-.002
	(.002)	(.006)
N	59943	17464
Age and year controls	Yes	Yes
Socio-demographic controls	Yes	Yes
Initial financial wealth and memory	Yes	Yes

Notes: The dependent variable in Column (1) is a variable indicating the degree of imputation of the respondent's financial wealth (ranging between 0 and 1) for respondents with positive financial wealth, while in Column (2) is a dummy variable indicating whether the respondents provided incomplete or missing value on stock value (conditional on owning some stock). Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.3: Changes in transfers to children

	(1)	(2)	(3)	(3)
	Transfers (Yes/No)		Transfers (Amount)	
Memory loss	-.001		-.868	
	(.005)		(1.082)	
Mem. loss unaware		.001		-.636
		(.006)		(.775)
Mem. loss aware		-.006		-1.618
		(.010)		(3.313)
N	81040	81040	13869	13869
Age and year controls	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes
Initial wealth and memory	Yes	Yes	Yes	Yes

Notes: The dependent variable in Column (1) is a dummy indicating whether the respondent did any transfer to children, while in Column (2) is the amount transferred to children conditional on having done a transfer. Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.4: Changes in consumption (thousands 2014 U.S. dollars) and severe memory losses

	All respondents				
	(1) Total spending	(2) Durables	(3) Non-durables	(4) Household spending	(5) Transport spending
Mem. loss aware	-1.576	-.003	-.773	-.165	-.635
	(1.494)	(.048)	(.974)	(.481)	(.827)
Mem. loss unawaree	.705	-.050	.367	.263	.125
	(1.011)	(.035)	(.553)	(.377)	(.552)
N	13823	13823	13823	13823	13823
Mean consumption category	46.631	.403	26.916	9.443	9.870
Mean change	-1.458	-.039	-.213	-.539	-.667
Age and year controls	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes
Financial respondent (FR)	Yes	Yes	Yes	Yes	Yes

Notes: Data come from the HRS Consumption and Activities Mail Survey (CAMS). Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.5: Changes in total wealth (thousands 2014 U.S. dollars) and occurrence of absolute memory losses

	All			Only respondents with memory loss		
	(1)	(2)	(3)	(4)	(5)	(6)
Mem. loss	-2.309	-23.054***				
	(4.368)	(4.628)				
Mem. loss aware			-10.363			
			(8.912)			
Mem. loss unaware			-27.323***	-16.194*	-19.293*	-10.377
			(4.994)	(8.771)	(10.291)	(16.266)
N	83193	83193	83193	20231	14270	5961
Mean wealth	423.665	423.665	423.665	385.909	342.084	490.820
Mean change	4.737	4.737	4.737	1.316	-2.494	10.542
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Initial wealth and memory	No	No	Yes	Yes	Yes	Yes
Financial respondent (FR)	All	All	All	All	Only FR	Non-FR

Notes: This table replicates Table 3 except for the use of the absolute definition of memory loss. Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.6: Changes in total wealth (thousands 2014 U.S. dollars) and occurrence of relative memory losses (decline of 15% or more in the memory score)

	All			Only respondents with memory loss		
	(1)	(2)	(3)	(4)	(5)	(6)
Mem. loss	-2.289	-22.304***				
	(4.005)	(4.199)				
Mem. loss aware			-16.885**			
			(7.216)			
Mem. loss unaware			-24.051***	-5.903	-11.109	4.165
			(4.477)	(6.667)	(8.015)	(12.960)
N	83193	83193	83193	20231	14270	5961
Mean wealth	423.665	423.665	423.665	385.909	342.084	490.820
Mean change	4.737	4.737	4.737	1.316	-2.494	10.542
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Initial wealth and memory	No	No	Yes	Yes	Yes	Yes
Financial respondent (FR)	All	All	All	All	Only FR	Non-FR

Notes: This table replicates Table 3 except for the use of the milder definition of memory loss (decline of least 15% in memory score). Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.7: Changes in total wealth (thousands 2014 U.S. dollars) and occurrence of relative memory losses (decline of 25% or more in the memory score)

	All			Only respondents with memory loss		
	(1)	(2)	(3)	(4)	(5)	(6)
Mem. loss	-4.766	-23.928***				
	(4.742)	(4.698)				
Mem. loss aware			-7.447			
			(8.840)			
Mem. loss unaware			-29.574***	-20.772**	-27.404**	-6.387
			(5.150)	(9.044)	(11.141)	(14.829)
N	83193	83193	83193	20231	14270	5961
Mean wealth	423.665	423.665	423.665	385.909	342.084	490.820
Mean change	4.737	4.737	4.737	1.316	-2.494	10.542
Age and year controls	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Initial wealth and memory	No	No	Yes	Yes	Yes	Yes
Financial respondent (FR)	All	All	All	All	Only FR	Non-FR

Notes: This table replicates Table 3 except for the use of the stricter definition of memory loss (decline of 25% or more in memory score). Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.8: Changes in the logarithm of total wealth (thousands 2014 U.S. dollars) and severe memory losses by quartile of the initial wealth distribution

	All	1st quartile	2nd quartile	3rd quartile	4rd quartile
	(1)	(2)	(3)	(4)	(5)
Mem. loss aware	-.014	-.082	-.021	-.018	-.008
	(.018)	(.079)	(.031)	(.022)	(.021)
Mem. loss unaware	-.016	-.039	-.029	-.039***	-.026**
	(.011)	(.048)	(.020)	(.013)	(.013)
N	73747	11935	20332	20708	20772
Mean wealth	476.474	42.488	137.466	363.334	1170.446
Mean change	-.021	.310	-.056	-.044	-.133
Age and year controls	Yes	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes
Initial Memory	Yes	Yes	Yes	Yes	Yes

Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and we weigh observations using the HRS respondent-level weights.

Table A.9: Changes in total wealth (thousands 2014 U.S. dollars) and occurrence of memory losses, health controls included

	(1)	(2)	(3)
Mem. loss aware	-8.745	7.314	-7.740
	(7.940)	(7.810)	(7.913)
Mem. loss unaware	-24.088***	-20.927***	-23.718***
	(4.762)	(4.571)	(4.749)
N	81917	81917	81917
Age and year controls	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes
Initial health	No	Yes	No
Health change	No	No	Yes

Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. The health controls include self-assessed health, ADL and IADL. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.10: Heterogeneity by age and employment status

	(1) Employed	(2) Not employed	(3) Age<70	(4) Age≥70
Mem. loss aware	.931	-15.527*	-10.514	-9.288
	(16.281)	(8.123)	(10.683)	(10.009)
Mem. loss unaware	-25.818***	-22.679***	-30.384***	-11.132*
	(8.167)	(4.966)	(6.297)	(5.963)
N	29358	53835	52912	30281
Mean wealth	419.386	425.999	403.421	459.039
Mean change	20.114	-6.941	10.811	-11.253
Age and year controls	Yes	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes	Yes
Initial wealth and memory	Yes	Yes	Yes	Yes

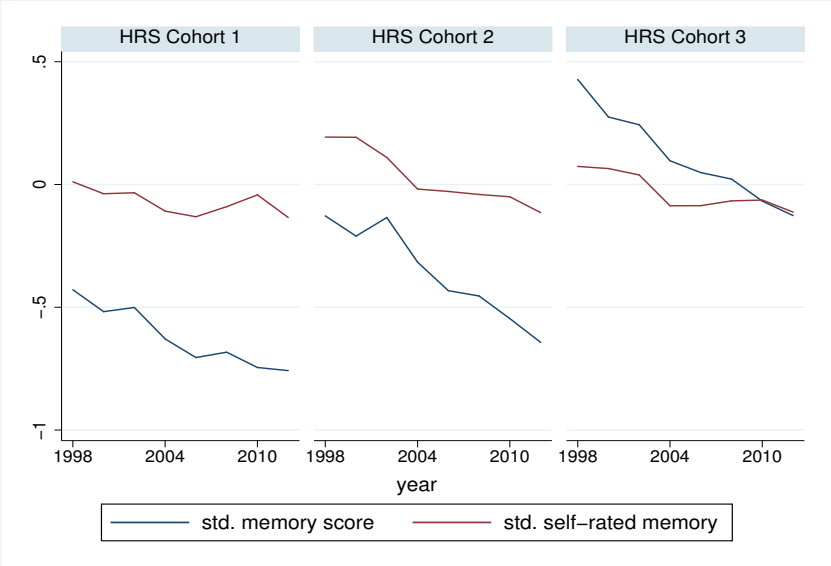
Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Table A.11: Differences in household income

	(1) Total income	(2) Capital income	(3) Earnings
Mem. loss aware	15.320	-.407	-2.340 **
	(19.276)	(.862)	(1.126)
Mem. loss unaware	-5.081 ***	-2.273 ***	-2.567 ***
	(1.488)	(.591)	(.883)
N	83193	83193	83193
Mean	81.802	15.480	39.445
Age and year controls	Yes	Yes	Yes
Socio-demographic controls	Yes	Yes	Yes
Initial wealth and memory	Yes	Yes	Yes

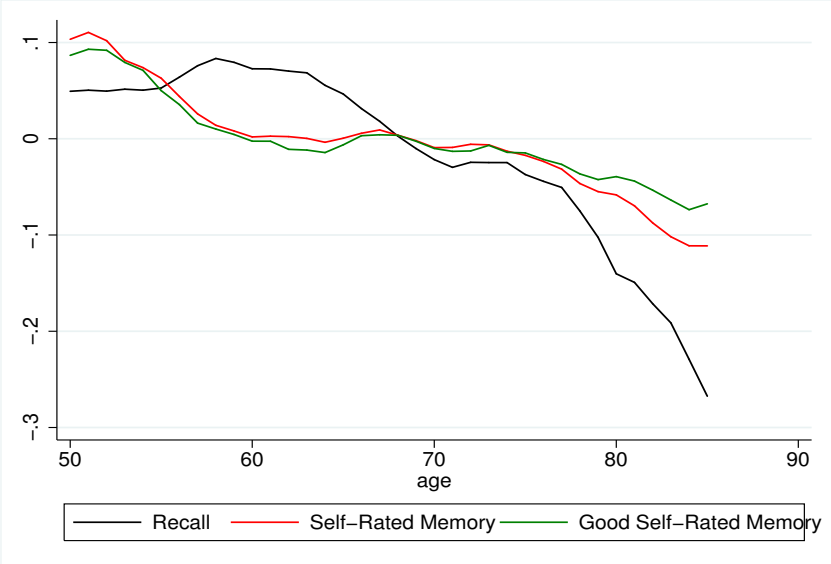
Notes: Socio-demographic controls include a quadratic age term, a control for years of education, and dummies for marital status, labor force status, gender, race, financial respondent and census regions. Significance levels: *** < 0.01, ** < 0.05, * < 0.1. We use robust standard errors clustered at the household level and weigh the observations using the HRS respondent-level weights.

Figure A.1: Longitudinal profiles of assessed vs. self-rated memory by HRS cohort



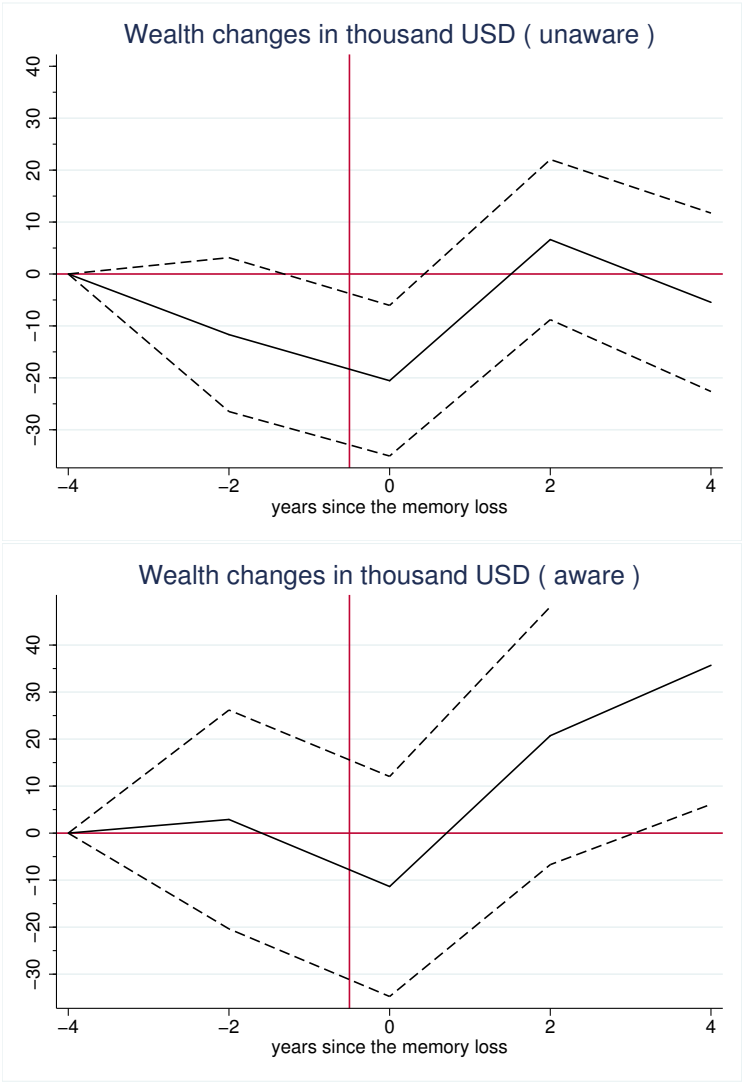
Notes: This figure compares the average longitudinal profile of the word recall test (assessed memory) and of the self-rated memory of the first three HRS cohorts.

Figure A.2: Age profiles HRS, fixed effects



Notes: This figure compares the same average age-profile of the three indices presented in Figure 4, 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.

Figure A.3: Estimated time profile of wealth changes



Notes: This figure shows the estimated wealth changes over time with respect to the first memory loss event (t=0) for unaware (upper figure) and aware respondents (bottom figure). The estimated time coefficients are the results of a regression that also includes controls for initial wealth and memory scores, a quadratic age term, gender, race, education, and survey year fixed effects. The figure also includes 95% confidence intervals.