# Self-assessed cognitive abilities and financial wealth: Are people aware of their cognitive decline?

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# Motivation

- A key aspect of the aging process is the decline of cognitive ability.
- Cognitive functioning is crucial for decision making because:
  - It influences individuals' ability to process information and to make "good choices".
  - In addition, older individuals are increasingly required to make complex financial, health, and long-term care decisions that might affect their resources, health and welfare.
- Are older people aware of their cognitive decline?
- When not, what are the consequences for their decisions and life-time resources?
- The increasing longevity and the large fraction of assets held by the elderly make these problems very relevant.

# This paper

- We use data from the Health and Retirement Study (HRS) to investigate whether HRS respondents correctly perceive their own cognitive decline and the potential financial consequences of misperception.
- We show that:
  - HRS respondents tend to grossly underestimate their own cognitive decline. ▸ profiles
  - Those who experience a severe cognitive decline but are unaware of it are more likely to suffer large wealth losses compared to those who are aware of it or do not experience a severe cognitive decline.
  - Large wealth losses are mainly reported by respondents in the top half of the wealth distribution and mainly involve their financial assets.

# Related literature

- Cognitive decline and decision making (e.g., Carpenter and Yoon, 2011).
  - Aging is associated with risk aversion (e.g., Dohmen et al., 2010, 2018; Koscielniak et al., 2016).
  - Older adults are more likely to use heuristic methods and biased strategies which are inconsistent with fully-informed rational decision-making (Abaluck and Gruber, 2011)
- Cognitive ability, financial literacy and financial performance
  - Substantial evidence of a hump-shaped profile of financial performance that follows closely that of cognitive performance (Agarwal et al. 2009; Korniotis and Kumar 2011)
- Wealth dispersion around retirement
  - Saving rates (Dynan et al., 2004), risk aversion (Calvet et al., 2009)
  - Heterogeneity in rates of returns (Fagereng et al., 2016) arising from large differences in financial knowledge (Lusardi et al., 2017).
  - We provide evidence for a different channel that affects longitudinal variation in wealth $\rightarrow$ Different policy implications

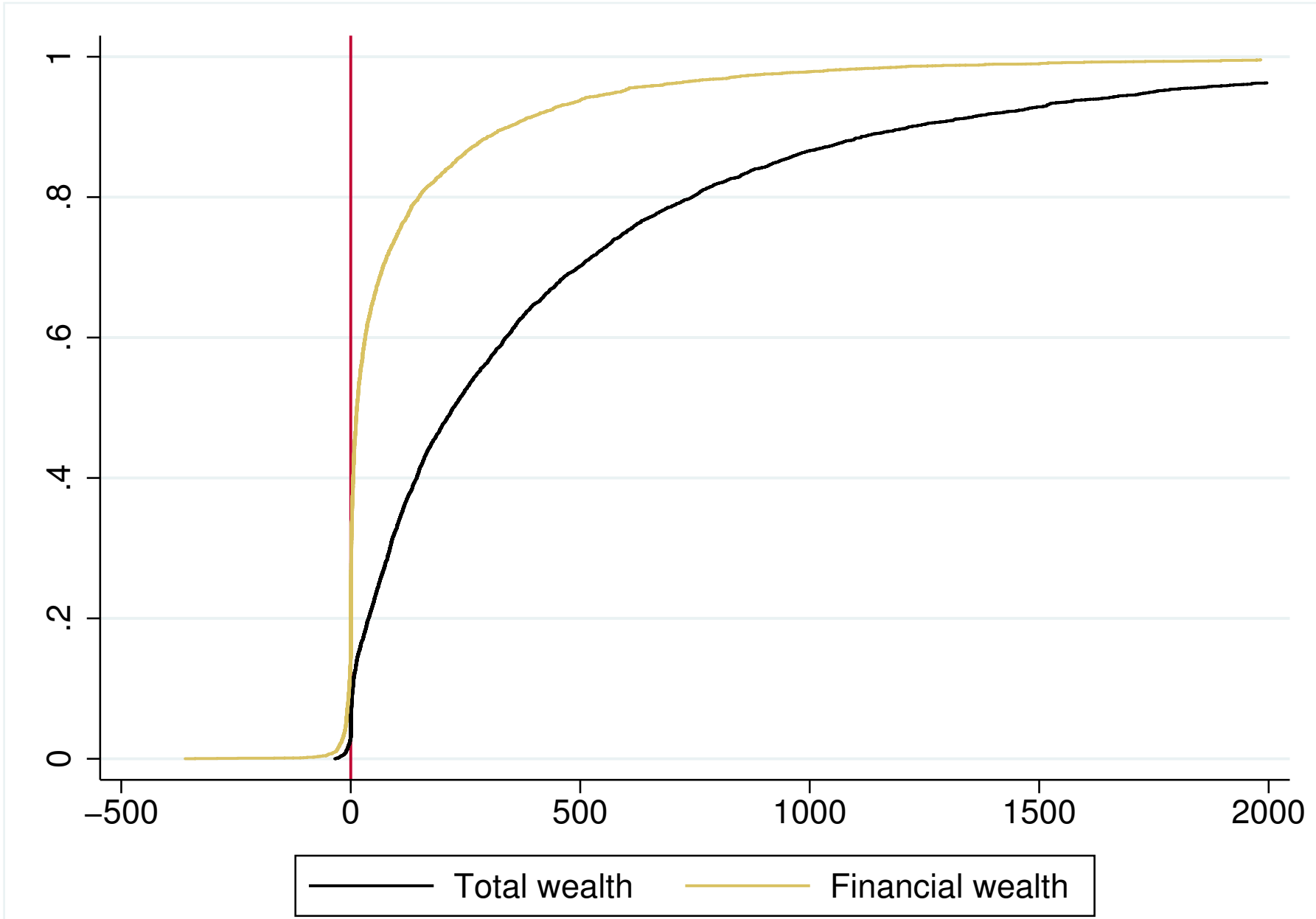
# Data

- We use the RAND-HRS data, a cleaned and easy-to-use version of the HRS, which include RAND imputations of wealth, income, and medical expenditures.
- Sample selection criteria:
  - We select people aged 50–80 in Waves 4–12 (1996-2014) with no missing data on the key variables of interest
  - We keep observations for which imputations $\leq 20\%$ of the value of assets/debts (87% of the observations).
  - We trim at the 1st and the 99th percentile.
- Our final working sample consists of 22,747 individuals (9,720 males and 13,027 females) observed on average for 3.7 waves.
- In our robustness checks we also use data from the HRS Consumption and Activities Mail Survey (HRS-CAMS), a paper-and-pencil sub-survey on consumption expenditure fielded biennially in odd-numbered years.

# Wealth measures

- HRS collects detailed information on household wealth and its individual components, distinguishing between several asset categories.
- We mainly focus on total wealth and non-housing financial wealth and their single components.
- The net value of non-housing financial wealth is computed as the sum of financial wealth components less debt, that is, as:
  - Stock, mutual funds, and investment trusts + Value of checking, savings, and money market accounts + Value of CD, government savings bonds, and T-bills + Other savings - Debts.
- Asset verification: Respondents are asked to verify or correct asset values reported in the previous and current wave whenever there is a large discrepancy (more than $50,000) between the two values.

# Distribution of total wealth and financial wealth



# Memory

- Self-rated memory:
  - *How would you rate your memory at the present time?*
  - Excellent, Very good, Good, Fair, Poor.
- Self-rated memory change:
  - *Compared to the last interview, would you say your memory is better now, about the same, or worse now than it was then?*
- Recall tests:
  - Consist of verbal registration and recall of a list of 10 words. The respondent hears the complete list only once and the test is carried out two times, immediately after the encoding phase (immediate recall) and after a few minutes (delayed recall).
  - Our memory score is the sum of the scores in the two recall tests (0–20 range).
  - Proxy interviews are excluded.
- The survey also includes other cognitive tests (serial 7, backward 20, and total mental score). They are highly correlated with the recall tests, and we use them for robustness checks.

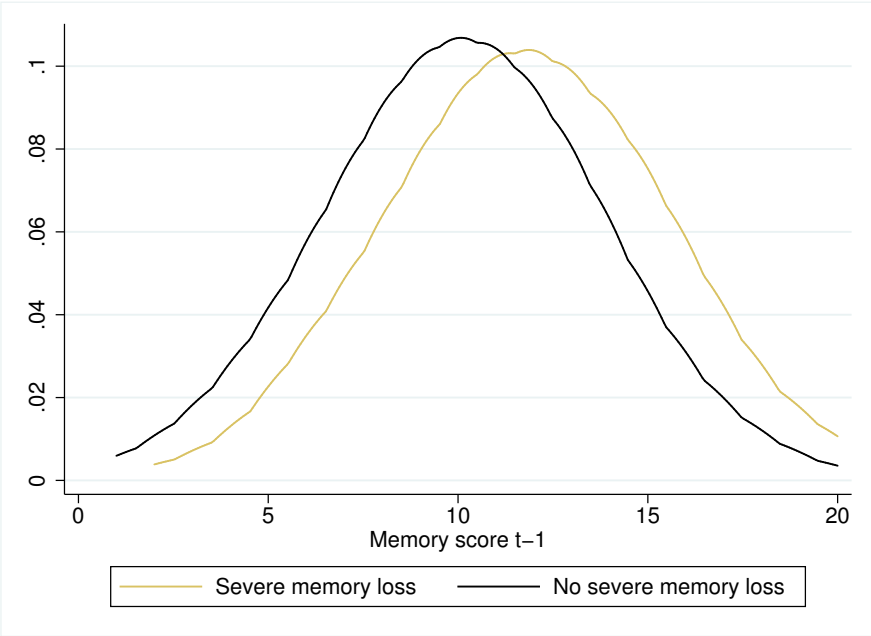
# Severe memory losses

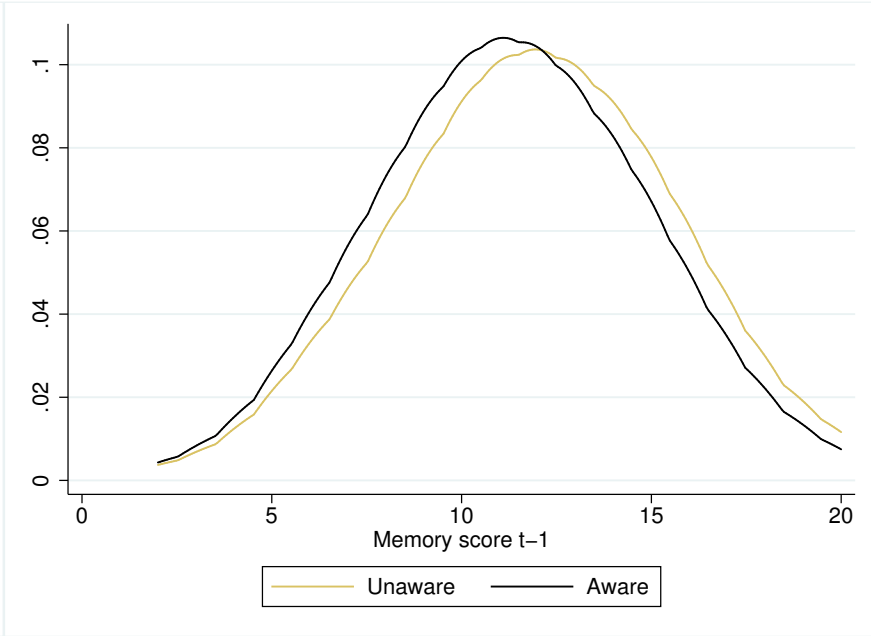
- We focus on memory losses that are sufficiently severe.
- Based on the change in the memory score across waves, we consider two main definitions:
  - Severe relative memory loss: Decline of 20% or more ($\approx$ 1st quintile of the change).
  - Severe absolute memory loss: Decline of 3 points or more ($\approx$ 1 standard deviation of the change).
- We present results based on the relative definition.
- The absolute definition is taken from the neuropsychological literature (Nasreddine et al., 2005) but may understate cognitive decline among respondents with poor initial memory scores (floor effect).
- In the Appendix we also present the results obtained using the absolute definition.

# Self-rated vs. assessed memory

| | Severe relative memory loss | | |
|---|---|---|---|
| Self-rated memory change | No | Yes | Total |
| Stable or improved | 60.8% | 18.8% | 79.6% |
| Worse | 14.9% | 5.5% | 20.4% |
| Total | 75.7% | 24.3% | 100.0% |

# Differences in initial distribution of memory scores



# Who is more likely to be aware?

Among those respondents who experience a severe memory decline:

- Most of the factors that "protect" from experiencing a severe memory decline only weakly affect the probability of being unaware or even increase that probability:
  - Age and education are only weakly correlated with awareness.
  - People starting from better memory score and health conditions are less likely to be aware.
  - Female, blacks and previously working people are less likely to be aware.
  - Having children increases the awareness but does not affect the probability of having a memory decline.

▸ probit

# Baseline model

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

where:

- $\Delta W_{it}$ is the wealth change of individual $i$ between waves $t-1$ and $t$,
- $Aware_{it}$ is a binary indicator equal to one if individual $i$ experiences a severe memory loss 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 loss 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 controls for marital status, labor force status, financial respondent status, census division,
- $\delta_t$ is a survey year effect,
- $\epsilon_{it}$ is an error term assumed to be mean independent of all the regressors.

# Remarks

- Model parameters have a different interpretation than for a model in levels.
- $\beta_1 - \beta_2$ measures the difference in the expected value of $\Delta W_{it}$ 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.
- To guarantee that we are comparing individuals who are similar in terms of observable characteristics, we also controls for differences in the initial wealth and memory levels.
  - Wealth changes may be expected to be larger for people with a larger initial amount of wealth.
  - Wealthy people are less likely to experience a severe memory decline (although more likely to be unaware).
- We can avoid it using the log transformation (robustness check).

# Changes in total wealth

| | All | Resp. w/severe mem. loss | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Aware | -10.202 | | | |
| | (7.828) | | | |
| Unaware | -25.052 *** | -13.064 * | -18.005 ** | -5.649 |
| | (4.754) | (7.582) | (9.257) | (12.849) |
| $\beta_1 - \beta_2$ | -14.850 * | | | |
| | (8.053) | | | |
| $N$ | 83193 | 20231 | 14270 | 5961 |
| Mean $W$ ($1,000) | 423.7 | 385.9 | 342.1 | 490.8 |
| Mean $\Delta W$ ($1,000) | 4.7 | 1.3 | -2.5 | 10.5 |
| Age & year | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes | Yes |
| Fin. resp. (FR) | All | All | Only FR | Non-FR |

Notes: Observations are weighted using the HRS respondent-level weights. We use robust standard errors clustered at the household level. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

# Changes in total wealth by quartile of initial wealth (FR)

| | 1st quartile | 2nd quartile | 3rd quartile | 4th quartile |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Aware | -5.399 * | -.870 | -7.388 | 35.208 |
| | (3.037) | (5.248) | (9.832) | (32.147) |
| Unaware | -2.449 | -3.818 | -16.118 *** | -45.701 ** |
| | (2.006) | (2.765) | (5.998) | (18.491) |
| $\beta_1 - \beta_2$ | 2.950 | -2.948 | -8.730 | -80.909 ** |
| | (3.347) | (5.625) | (10.569) | (34.803) |
| Obs. | 17089 | 14808 | 13701 | 12843 |
| *N* | 6878 | 6582 | 5959 | 4500 |
| Mean | 27.175 | 131.436 | 359.417 | 1154.363 |
| Mean $\Delta$ | 20.627 | 21.967 | 43.117 | -73.270 |
| Age & year | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes |
| Initial mem. | Yes | Yes | Yes | Yes |

# Changes in the value of wealth components (FR)

| | Total | Financial | IRAs | Housing | Real estate | Business |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Aware | -6.390 | -4.318 | -2.892 | -2.550 | .003 | .005 |
| | (9.307) | (5.182) | (3.062) | (2.381) | (.004) | (.004) |
| Unaware | -27.291*** | -17.806*** | -6.196*** | -2.171 | -.003 | .002 |
| | (5.608) | (3.065) | (1.728) | (1.855) | (.002) | (.002) |
| $\beta_1 - \beta_2$ | -20.901** | -13.488** | -3.303 | .378 | -.006 | -.002 |
| | (9.884) | (5.341) | (3.059) | (2.691) | (.004) | (.004) |
| Obs. | 58441 | 58441 | 58441 | 58441 | 58441 | 58441 |
| *N* | 16723 | 16723 | 16723 | 16723 | 16723 | 16723 |
| Mean | 379.195 | 96.643 | 58.479 | 149.609 | 32.323 | 26.521 |
| Mean $\Delta$ | 3.479 | -1.260 | 2.876 | 9.034 | -.004 | -.003 |
| Age & year | Yes | Yes | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes | Yes | Yes | Yes |

# Changes in the value of financial wealth components (FR with positive initial financial wealth)

| | Stocks | Bonds | Debt | CDs | Checking/ savings | Other assets |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Aware | -3.724 | .080 | -.038 | .990 | -1.485 | 3.142 |
| | (5.524) | (1.195) | (.251) | (1.328) | (2.147) | (2.227) |
| Unaware | -12.558*** | .235 | .004 | -1.383** | -3.952*** | -4.233*** |
| | (2.555) | (.889) | (.247) | (.648) | (1.114) | (1.240) |
| $\beta_1 - \beta_2$ | -8.834 | .155 | .042 | -2.373* | -2.466 | -7.376*** |
| | (5.395) | (1.368) | (.316) | (1.410) | (2.254) | (2.329) |
| Obs. | 40696 | 40696 | 40696 | 40696 | 40696 | 40696 |
| *N* | 13336 | 13336 | 13336 | 13336 | 13336 | 13336 |
| Mean | 65.979 | 8.966 | 2.965 | 15.843 | 34.125 | 15.572 |
| Mean $\Delta$ | -3.785 | -.160 | 1.173 | .034 | .640 | -2.246 |
| Age & year | Yes | Yes | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes | Yes | Yes | Yes |

# Bad investment decisions?

- Wealth losses are concentrated among wealthier (financial) respondents who are unaware of their cognitive decline, and mainly involve the value of their financial assets.
- Respondents who experience a severe memory loss show better cognitive performance at the baseline and are therefore more likely to be more confident about their ability and less likely to delegate financial decision to others.
- This interpretation is also supported by our investigation of the "assets change" module of HRS:
  - respondents who report owning (or to own at $t-1$) stocks or shares in mutual funds are asked about their stock market activity in the last two years (whether they sold and/or bought stocks or mutual funds shares including automatic reinvestments).

# Changes in the value of financial wealth by stock market activity (FR)

| | Financial wealth | | |
|---|---|---|---|
| | Active | Inactive | Inactive + no stocks |
| | (1) | (2) | (3) |
| Aware | 8.311 | .116 | -3.984 |
| | (33.724) | (15.344) | (6.638) |
| Unaware | -53.370*** | -6.491 | -9.928** |
| | (18.665) | (10.713) | (4.337) |
| $\beta_1 - \beta_2$ | -61.681* | -6.607 | -5.944 |
| | (35.296) | (17.132) | (7.456) |
| Obs. | 5600 | 7764 | 45077 |
| *N* | 2976 | 4295 | 14803 |
| Mean | 343.669 | 169.357 | 53.430 |
| Mean $\Delta$ | 4.832 | -8.799 | -.742 |
| Age & year | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes |

# Alternative interpretations

- We now consider a number of alternatives to our "bad-investment interpretation" (e.g., rational disinvestment).
- All of them stress potential differences in observable or unobservable characteristics between respondents aware and unaware of their cognitive decline:
  - Health:
    - Subjective life expectancy.
    - Out-of-pocket health expenditure. ▸ lifexp
  - Misreporting:
    - Tests for differential imputation or missing values in financial assets.
    - Tests for differential mistakes in asset reporting detected by the HRS asset verification procedure. ▸ misrep
  - Portfolio composition:
    - Differences in ownership of risky assets. ▸ risky
    - Actual vs. predicted financial wealth in the next wave for respondents with positive initial financial wealth. ▸ wealth

# Differences in subjective life expectancy and out-of-pocket health expenditure

back

| | Subjective life expectancy | | Out-of-pocket expenditure | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Severe mem. loss | -.454 | | .084 | |
| | (.329) | | (.116) | |
| Aware | | -2.088*** | | .384 |
| | | (.610) | | (.367) |
| Unaware | | .218 | | .000 |
| | | (.354) | | (.106) |
| *N* | 63929 | 63929 | 69089 | 69089 |
| Age & year | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes |
| Fin. resp. | Yes | Yes | Yes | Yes |

# Tests for misreporting

back

| | (1) Fraction of financial wealth imputed | (2) Incomplete or missing value of stocks | (3) any asset misreported | (4) any fin. asset misreported |
|---|---|---|---|---|
| Aware | -.001 | -.001 | -.009 | -.006 |
| | (.002) | (.002) | (.009) | (.006) |
| Unaware | .000 | .000 | -.007 | -.008* |
| | (.001) | (.001) | (.007) | (.004) |
| Obs. | 58441 | 13566 | 58441 | 58441 |
| *N* | 16723 | 5160 | 16723 | 16723 |
| Mean | .063 | .106 | .088 | .050 |
| Age and year | Yes | Yes | Yes | Yes |
| Socio-demographic | Yes | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes | Yes |

# More in the Appendix

- Consumption patterns.
- Bequests and transfers to children.
- Income.

# Robustness checks

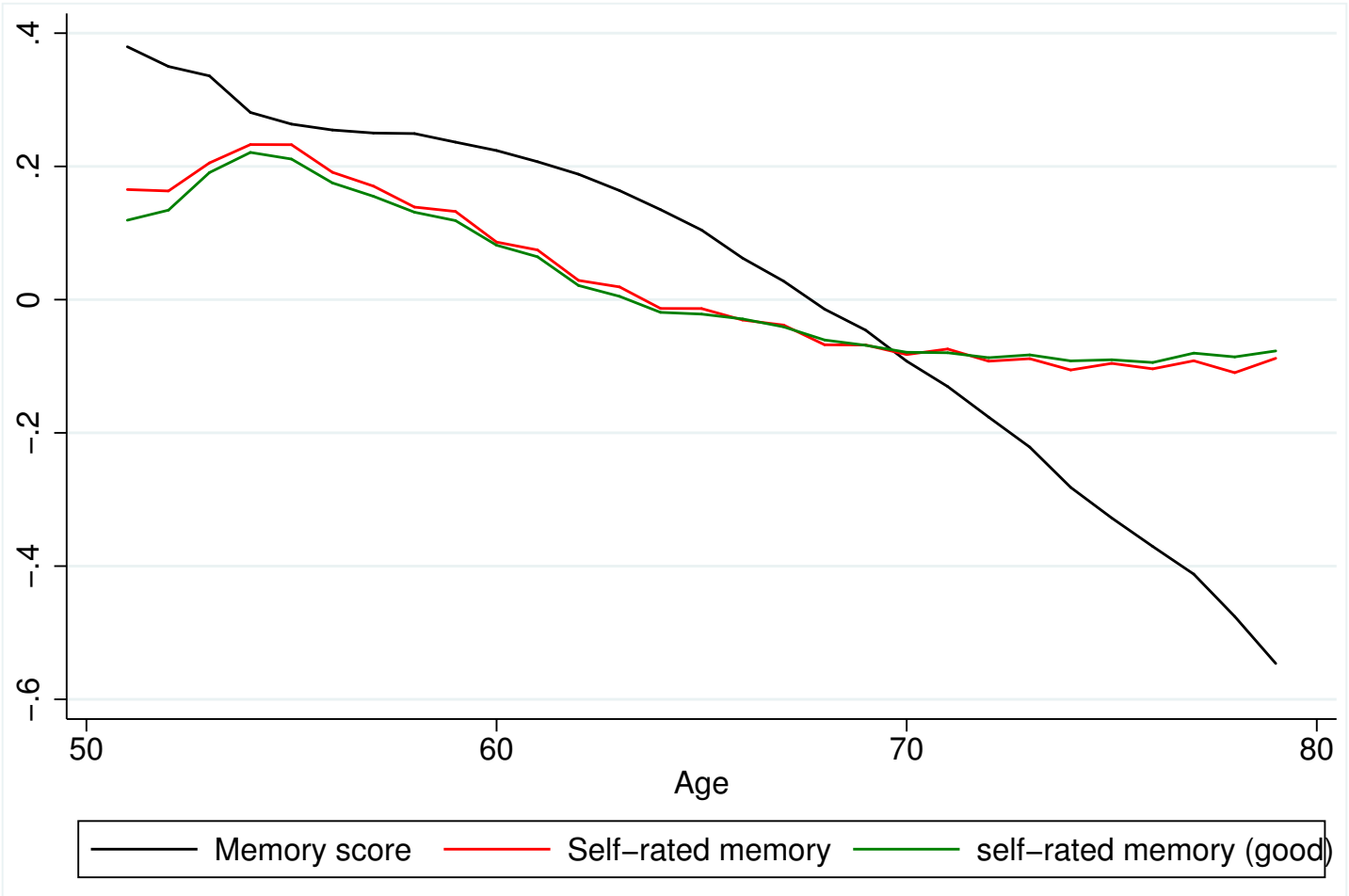
- Memory loss definition (absolute, or different thresholds, 15 or 25%).
- Log transformation.
- Effect dynamic. ▸ timeline
- Controls for initial health status.

# Conclusions

- A large fraction of people who experience severe memory losses appear to be unaware of it.
- Memory losses across waves are strongly correlated with other measures of cognitive decline.
- Respondents unaware of their cognitive decline experience worse financial performances across waves. This effect seems to be large or less noisy for financial respondents.
- Financial losses are mainly driven by a decrease in the value of their financial assets.
- 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
- 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.

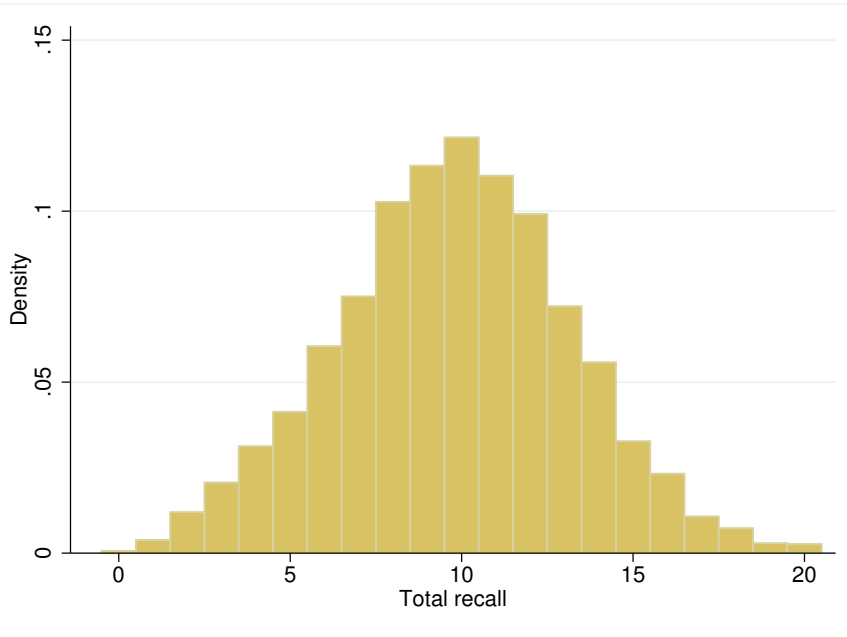
# Cross-sectional age-profile of self-rated and assessed memory

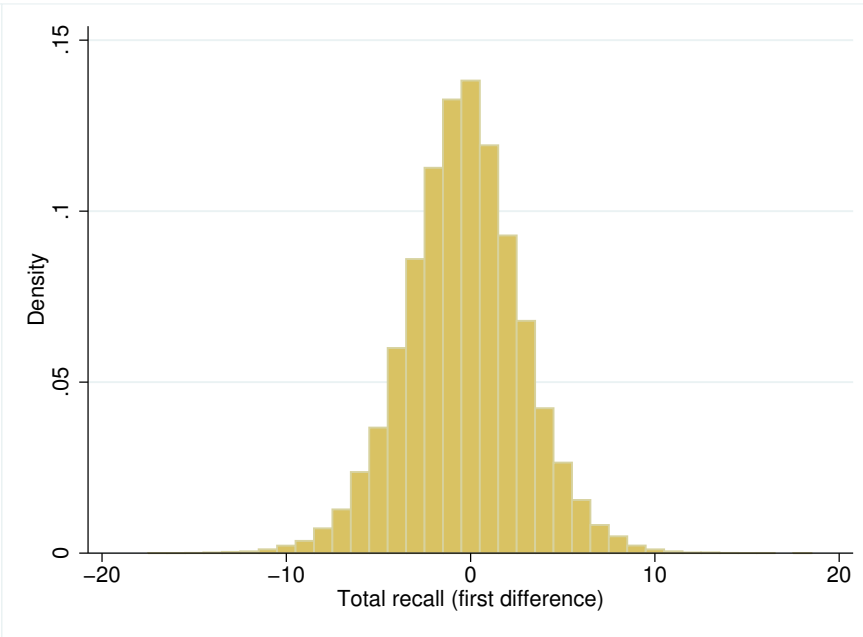
back



# Distribution of memory score levels and first differences

back



# Probit models for the probability of being aware

back

| | (1) | (2) | (3) |
|---|---|---|---|
| Age | .002 * | .002 | .003 ** |
| | (.001) | (.001) | (.001) |
| $Age^2$ | .000 | -.000 | -.000 |
| | (.000) | (.000) | (.000) |
| $Alone_{t-1}$ | .017 * | .017 * | .023 ** |
| | (.010) | (.010) | (.009) |
| Female | -.033 *** | -.046 *** | -.043 *** |
| | (.008) | (.008) | (.008) |
| Education | -.000 | .003 * | .007 *** |
| | (.001) | (.001) | (.001) |
| $Working_{t-1}$ | -.052 *** | -.047 *** | -.008 |
| | (.009) | (.009) | (.009) |
| Q2 $wealth_{t-1}$ | -.027 ** | -.022 * | -.000 |
| | (.011) | (.011) | (.011) |
| Q3 $wealth_{t-1}$ | -.021 * | -.012 | .023 * |
| | (.013) | (.012) | (.012) |
| Q4 $wealth_{t-1}$ | -.017 | -.007 | .042 *** |
| | (.014) | (.014) | (.013) |
| $Recall_{t-1}$ | | -.024 *** | -.017 *** |
| | | (.003) | (.003) |
| $SRH_{t-1}$ | | | -.061 *** |
| | | | (.004) |
| $ADL_{t-1}$ | | | .057 *** |
| | | | (.011) |
| *N* | 19843 | 19843 | 19843 |
| Mean | .24 | .24 | .24 |

# Predicted financial wealth

- 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.
- Suppose individual $i$ is interviewed in month $t$ and re-interviewed $m$ months later.
- Given her initial amount of wealth $W_{ijt}$ in asset category $j$, we compute the predicted value $W^*_{ij,t+m}$ of her wealth 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 adding up the predicted values of all asset categories.

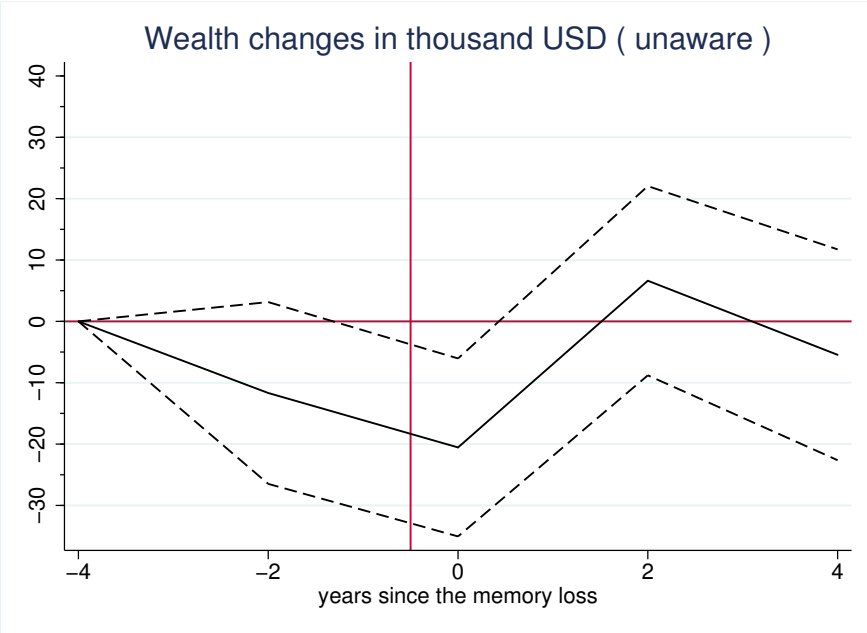
# Actual vs. predicted financial wealth in the next wave (respondents with positive initial financial wealth)

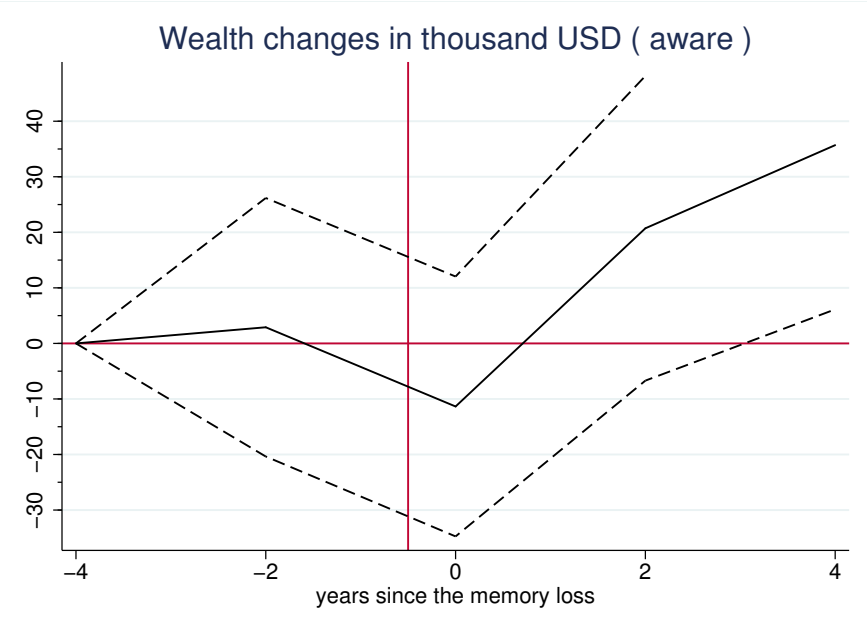
back

| | Absolute difference | | Relative difference | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Aware | -6.344 | -7.776 | -.095 | -.071 |
| | (7.404) | (10.939) | (.081) | (.058) |
| Unaware | -16.631*** | -22.892*** | -.058 | -.140*** |
| | (4.282) | (5.872) | (.050) | (.037) |
| $\beta_1 - \beta_2$ | -10.287 | -15.116 | .036 | -.068 |
| | (8.080) | (11.714) | (.088) | (.062) |
| Obs. | 40696 | 27086 | 38925 | 27019 |
| *N* | 13336 | 9309 | 12891 | 9296 |
| 3rd-4th wealth quartiles | No | Yes | No | Yes |
| Age & year | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes | Yes |

# Estimated time profile of wealth changes

back




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.

# Differences in ownership and share of risky assets

back

| | Risky assets ownership | | Risky assets share | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Mem. loss aware | -.016 | -.026 * | -.004 | -.012 |
| | (.011) | (.015) | (.018) | (.017) |
| Mem. loss unaware | -.009 | -.020 ** | .007 | -.010 |
| | (.007) | (.009) | (.010) | (.010) |
| Obs. | 40696 | 27086 | 13634 | 12387 |
| *N* | 13336 | 9309 | 5172 | 4662 |
| Mean | .361 | .457 | .455 | .558 |
| 3rd-4th wealth quartile | No | Yes | No | Yes |
| Age and year controls | Yes | Yes | Yes | Yes |
| Socio-demographic controls | Yes | Yes | Yes | Yes |
| Initial wealth & memory | Yes | Yes | Yes | Yes |

# Changes in total wealth (thousands 2014 U.S. dollars)

| | All respondents | | | Resp. w/severe mem. loss | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Severe mem. loss | -1.758 | -21.213*** | | | | |
| | (4.280) | (4.384) | | | | |
| Aware | | | -10.202 | | | |
| | | | (7.828) | | | |
| Unaware | | | -25.052*** | -13.064* | -18.005** | -5.649 |
| | | | (4.754) | (7.582) | (9.257) | (12.849) |
| $\beta_1 - \beta_2$ | | | -14.850* | | | |
| | | | (8.053) | | | |
| Obs. | 83193 | 83193 | 83193 | 20231 | 14270 | 5961 |
| *N* | 22747 | 22747 | 22747 | 13926 | 9970 | 4311 |
| Mean | 423.7 | 423.7 | 423.7 | 385.9 | 342.1 | 490.8 |
| Mean $\Delta$ | 4.7 | 4.7 | 4.7 | 1.3 | -2.5 | 10.5 |
| Age & year | Yes | Yes | Yes | Yes | Yes | Yes |
| Socio-dem. | Yes | Yes | Yes | Yes | Yes | Yes |
| Initial wealth | No | Yes | Yes | Yes | Yes | Yes |
| Fin. resp. (FR) | All | All | All | All | Only FR | Non-FR |