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Financial literacy in the Understanding America Study

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Abstract

We provide a brief history of administering financial literacy questions in probability-based Internet panels. After financial literacy questions were asked in the Centerpanel in the Netherlands and the RAND American Life Panel, the Understanding America Study (UAS) has been administering 14 financial literacy questions in its biannual core surveys since 2014. Due to its longitudinal nature and the vast amount of available information on its panel members, the UAS provides unique opportunities for analyzing patterns of financial literacy over time and its associations with financial outcomes, cognition, health, personality, and economic preferences, among others. The UAS survey-based dataset is further enriched with administrative records from consenting respondents. Importantly, researchers can incorporate additional questions and modules to gather specific data, which can then be linked to both existing and forthcoming information on panel members. In this paper, we describe the UAS financial literacy measures and offer descriptive analyses, highlighting the patterns of financial knowledge over time and by individuals' background characteristics. We also show how financial outcomes, such as financial wealth and retirement preparedness, relate to financial literacy scores.

Keywords: financial literacy; probability sample; online survey

UAS history and overview

The development of probability-based Internet panels can be traced back to the mid-1980s, when Willem Saris, a professor of sociology at the University of Amsterdam, developed the *Telelepanel* (Hays et al. 2015). A random sample from the Dutch population was provided with a modem and a computer. Once a week, participants were asked to download a questionnaire, which they could answer on their computer and then send back. The system was later expanded and moved to Tilburg University in 1996, where it was renamed Centerpanel and became a true Internet panel. Five financial literacy questions – numeracy, interest compounding, inflation, time value of money, and money illusion – were first administered in the Centerpanel by Van Rooij et al. (2011) in 2005 and 2006.

The probability-based Internet panel Understanding America Study (UAS) is a direct descendant of the Centerpanel for two reasons. First, the Centerpanel was the first true Internet panel in the world and, hence, the originator of similar data collection efforts that followed. Second, Arie Kapteyn was the principal investigator (PI) of the Centerpanel and is the PI of the UAS. The origin of the UAS can be traced back to the early 2000s when the PI of the Health and Retirement Study (HRS), Robert J. Willis, recognized the significance of the Internet as a forthcoming mode for conducting national surveys. This foresight led to

the funding of two Research Project Grants (R01) by the National Institute on Aging (NIA), entitled "Internet Interviewing and the HRS." These projects were collaborative efforts between the University of Michigan and the RAND Corporation. As a result of the two NIA-awarded grants, the probability-based American Life Panel (ALP) was established at RAND under the leadership of Arie Kapteyn. Lusardi and Mitchell (2007) administered the same five financial literacy questions they had used in the Centerpanel to the respondents of the ALP.

When the PI of the ALP, Arie Kapteyn, moved to USC, the UAS was founded. The UAS currently comprises about 15,000 US residents aged 18 years and older (including a 3,500-person California oversample) recruited by address-based sampling and provided with Internet-enabled tablets if needed. The UAS national sample is expected to grow to 20,000 respondents by 2025, with oversamples of African Americans, Asians, and Hispanics. Recruitment takes place in batches. That is, replenishment samples are added to the existing pool of panel members on a regular basis. This allows panel administrators to improve the representativeness of the target population (US residents aged 18 years and older).[1]

Surveys are conducted online in English and Spanish (depending on the respondent's preferred language) through computers or smartphones. Since 2014, over 600 surveys have been fielded in the UAS. While not all these surveys have been completed by all panel members – either because a survey only targeted a sub-sample of the entire panel or because a respondent had not yet joined the panel when a survey was administered – they can all be merged using the unique UAS individual identifier, providing an unprecedented amount of individual-level data.

Each UAS survey dataset includes weights that are meant to make the survey sample representative of the US adult population with respect to a predefined set of sociodemographic variables. Sample weights are constructed in two steps. In the first step, a base weight is created to account for unequal probabilities of inclusion across UAS members. In the second step, final post-stratification weights are generated to correct for differential nonresponse rates and align the final survey sample with the reference population in terms of gender, race/ethnicity, age, education, and residence in census regions.[2]

To ensure that an exhaustive range of background information is collected about each panel member and tracked over time, the UAS administers a series of "core surveys" administered to the entire panel on a two-year frequency.[3] Currently, the UAS core

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[1] The UAS recruitment letter is sent to the "family living at [specific address]." All adult household members aged 18 years or older are encouraged to participate in the panel. The first household member to join is termed the "primary respondent" and is given a unique household and individual identifier. Subsequent members from the same household who join the panel are labeled as "added members." They use the same household identifier as the primary respondent but are given their own individual identifier. If added members move out, they retain their individual identifier but are assigned a new household identifier. The distinction between the primary respondent and added members is crucial for tracking changes within households and identifying unique households in the UAS, but it does not affect who is invited to fill out questionnaires or specific sections of a questionnaire. In the UAS, the survey process treats all members equally, regardless of their status as primary or added members. This means that, within households with multiple members, outcomes elicited at the household level (e.g., household asset values) are reported separately and independently by all household members. Unlike other studies like the HRS, there is no designated "financial respondent" within a household, although available background information allows researchers to determine the role of each household member in household financial decisions. About 15% of UAS members belong to the same household. Visit the UAS webpage for additional details about recruitment, panel retention, and panel representativeness: https://uasdata.usc.edu/page/Methodology.

[2] An exhaustive description of the UAS weighting procedure can be found at https://uasdata.usc.edu/page/Weights. A more technical discussion of how the UAS sampling strategy informs the construction of base weights is provided by Angrisani et al. (2019).

[3] A biannual frequency is akin to the protocols adopted by high-quality, traditional longitudinal surveys like the Panel Study of Income Dynamics and the Health and Retirement Study. Angrisani, Finley, and Kapteyn (2019) show that UAS estimates of population parameters are very similar to those obtained from traditional representative surveys like the HRS and the Current Population Survey (CPS).

surveys consist of 22 distinct questionnaires broken up into short segments, each designed to take no more than 30 minutes of survey time. They include the complete HRS instrument, which provides information about demographics, physical and mental health, family relationships and living arrangements, current labor force status and job history, and household income and assets, and separate modules eliciting personality traits (the big five), cognitive abilities, financial decision-making and outcomes, retirement prepared-ness, knowledge of Social Security rules, and subjective wellbeing. As described more extensively below, the UAS core surveys feature a battery of 14 financial literacy questions, including the five questions asked earlier in the Centerpanel and the ALP.

Because of the UAS recruitment process, study participants join the panel at different times and are invited to take the core surveys following a predefined sequence. This means that data from core modules are being collected continuously, as different participants answer at different times. Panel members are offered one or two surveys per month, including the core surveys and various other surveys or experiments, and are rewarded at the rate of $20 per 30 minutes of survey time. Survey response rates vary with the length of the fielding period. For core surveys, which remain available for two years, the average response rate is about 95%. For other surveys, which are typically in the field for a period between one and six months, response rates range from 70% to 80%. Attrition in the UAS is on par with other population representative panels. For example, for the first UAS batch recruited in 2014, the sample loss in 2023 is 44%, amounting to an annual attrition rate of 6.2% over nine years. Across batches, attrition is heavily concentrated in the first two years of membership, converging to about 2.5% annually in later years.

Over the next year, the UAS research team will considerably expand the core content by adding an extensive Life History Survey (LHS), a module on childhood experiences and education, modules on health behavior, decision-making and economic preference parameters, mental health, cognitive measurement, as well as physical and social environments.

For consenting respondents, we have linked their survey data with Centers for Medicare and Medicaid Services (CMS) records. We are also working on linking Social Security Earnings Records and the National Death Index. Since linking this information increases the risk of disclosure, these data will be available through the NIA-supported Data Linkage enclave (https://www.nia.nih.gov/research/dbsr/nia-data-linkage-program-linkage).

The UAS has pioneered the passive collection of financial information through a financial aggregator in a population representative panel. Over the years, about 1,000 respondents have provided permission to retrieve real-time transactions and balances from at least one of their financial accounts (Angrisani et al. 2023). In addition, about 3,500 panel members have provided permission to obtain credit reports from one of the major consumer credit reporting companies in the US and link them with survey responses for research purposes. These data, too, are treated as restricted and available to registered UAS data users through the NIA-supported Data Linkage enclave.

The UAS also retrieves and makes available survey para-data, including the type of device used by the participant (e.g., a laptop, a smartphone, and a tablet), survey completion time, and time spent on each screen, as well as the number of taps, clicks, or mouse movements. These data, which can be merged with survey answers using the respondent's unique identifier, can provide valuable insights into data quality, help understand how participants interact with each survey, and inform survey design optimization.

In this paper, we describe how UAS data can be used to conduct research on financial literacy and financial outcomes. In doing so, we will highlight several unique features of these data. First, since financial literacy and financial outcomes are part of the UAS core content, they are measured longitudinally for all panel members and for as long as they remain in the panel. This allows researchers to examine how individual financial knowledge varies as people age, experience changes in cognitive function, or go through life events like becoming homeowners, divorcing, or retiring. Additionally, the

longitudinal dimension of the data permits identifying how different levels of financial literacy are associated with varying paths toward financial wellbeing over time. Second, as mentioned above, the UAS offers comprehensive background information for each respondent. Hence, when linking financial literacy to financial outcomes, it is possible to control for a wide range of individual characteristics to reduce omitted variable bias and to explore heterogeneity in the relationships of interest by variables that are rarely available in other studies measuring financial literacy, including preference parameters, cognitive ability, and personality traits to name a few. Third, the UAS offers a dynamic platform where researchers with their own funds can collect data and integrate their own survey questions within an unparalleled, longitudinal, rich dataset. This approach unlocks the potential for pursuing novel research avenues with unprecedented accuracy and detailed context that standalone studies often cannot match. By leveraging the extensive information already available for each respondent, researchers can embark on specific investigations without the burden of initiating an entirely new data collection process, thus conserving significant time and resources. Moreover, the flexibility to incorporate new questions enables the UAS to adapt and grow in alignment with evolving trends, scientific developments, or societal changes.

The UAS infrastructure aims to optimize engagement with the broader research community in data dissemination and soliciting input on content and methods. The substantive focus of the UAS is to understand how health disparities and economic inequality develop over the life course. To encourage input from the research community, the UAS has reserved 100,000 minutes of free survey time per year for outside researchers. For the next five years, scientifically meritorious proposals that exploit the information already being collected in the panel and help elucidate factors affecting inequality and health disparities over the life course will be awarded, allowing researchers to add survey questions and collect novel data at no cost. The call for proposals, including forthcoming submission deadlines and details about priorities and evaluation criteria, can be found at this link (also accessible from the UAS homepage https://uasdata.usc.edu).

Researchers across universities and institutions regularly use the UAS as a data collection platform for their studies. Those interested in carrying out their own projects within the UAS can contact the UAS and learn about the data collection process – from questionnaire development, programming, and testing to sample selection, data release, and visualization – and the associated cost. The UAS brochure, with information about accessing existing data and collecting new data, can be found at this link and is also provided as an Appendix to this paper.

Measures of financial literacy in the UAS

Financial literacy is among the UAS core topics. Thus, the entire panel is administered an extensive battery of 14 financial literacy questions every two years. As noted, these include the five questions added earlier to the Centerpanel and the ALP, described by Van Rooij et al. (2011) and Lusardi and Mitchell (2007), respectively.

As of December 2023, financial literacy has been measured for 18,796 distinct individuals over four waves of data collection covering the period 2014–2023. Because of the different pace with which UAS batches were recruited over time (slower at the beginning and faster in more recent years), the different pace with which respondents answer core surveys upon invitation, and the fact that the regular biannual schedule of core surveys was implemented after a couple of years of the panel's existence, the waves' data collection period often extends beyond two years, especially for early waves. The following timeline provides an approximate but fairly accurate correspondence between each financial literacy data collection wave and years:

Table 1. Financial literacy measures: panel breakdown

Number of assessments	Number of respondents
1	9,149
2	3,143
3	2,687
4	3,817
Total	18,796

Note: The table reports the total number of UAS respondents who completed the financial literacy module at least once and the breakdown by the number of times they completed it (from 1 to 4 times).

2014–2017	2018–2019	2020–2021	2022–2023
• Wave 1	• Wave 2	• Wave 3	• Wave 4

Table 1 presents the number of respondents for whom longitudinal measurements of financial literacy are available. More than half of the 18,796 distinct study participants included in the sample have been assessed multiple times. Specifically, 3,817 respondents completed the financial literacy module four times, 2,687 three times, and 3,143 two times. The 9,149 individuals with just one assessment include attritors and those who joined the panel in 2021 or later and, therefore, have yet to be invited to complete the second round of core surveys. The rapid expansion of the UAS in the last few years implies that a relatively large number of new members fall into this latter category.

The battery of financial literacy questions includes the three items most commonly asked in surveys, also known as the "Big Three."

1) *Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, less than $102?*
   (i) More than $102
   (ii) Exactly $102
   (iii) Less than $102
   (iv) I don't know
2) *Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?*
   (i) More than today
   (ii) Exactly the same as today
   (iii) Less than today
   (iv) I don't know
3) *Do you think the following statement is true? Buying a (single company's stock/stock mutual fund) usually provides a safer return than a (stock mutual fund/single company's stock).*
   (i) True
   (ii) False
   (iii) I don't know
   and one of the two additional questions comprising the five most commonly asked financial literacy items, also known as the "Big Five."

4) *If the interest rates (rise/fall), what should happen to bond prices?*
   (i) They should rise
   (ii) They should fall
   (iii) They should stay the same
   (iv) I don't know

The true/false question about the relationship between the length of a mortgage and the overall interest paid over the life of the loan, which is part of the Big Five – "*A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.*" – was asked in the first wave of the UAS financial literacy core survey but was not repeated in subsequent waves. This question will be added back to the financial literacy module in the next wave.

The other questions included in the UAS financial literacy battery aim to further test individuals' knowledge about compound interest, discounting, inflation and purchasing power, the stock market, risk diversification, as well as investing and types of assets.

1. *Suppose you had $100 in a savings account and the interest rate was 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?*
   (i) More than $200
   (ii) Exactly $200
   (iii) Less than $200
   (iv) I don't know
2. *Assume a friend inherits $10,000 today and his sibling inherits $10,000 but 3 years from now. Who is richer today because of the inheritance?*
   (i) My friend
   (ii) His sibling
   (iii) They are equally rich
   (iv) I don't know
3. *Suppose that in the year 2023, your income has doubled and prices of all goods have doubled too. In 2023, will you be able to buy more, the same or less than today with your income?*
   (i) Buy more than today
   (ii) Buy the same as today
   (iii) Buy less than today
   (iv) I don't know
4. *Which of the following statements describes the main function of the stock market?*
   (i) The stock market helps to predict stock earnings
   (ii) The stock market results in an increase in the price of stocks
   (iii) The stock market brings people who want to buy stocks together with those who want to sell stocks
   (iv) None of the above
   (v) I don't know
5. *When an investor spreads his or her money among different assets, does the risk of losing a lot of money increase, decrease, or stay the same?*
   (i) Increase
   (ii) Decrease
   (iii) Stay the same
   (iv) I don't know

6. *Which of the following statements is correct?*
   - (i) Once one invests in a mutual fund, one cannot withdraw money in the first year
   - (ii) Mutual funds can invest in several assets, for example, invest in both stocks and bonds
   - (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance
   - (iv) None of the above
   - (v) I don't know

7. *Do you think that the following statement is true or false? (Stocks/Bonds) are normally riskier than (stocks/bonds).*
   - (i) True
   - (ii) False
   - (iii) I don't know

8. *Considering a long period (for example 10 or 20 years), what normally gives the highest return?*
   - (i) Savings accounts
   - (ii) Bonds
   - (iii) Stocks
   - (iv) I don't know

9. *Normally, which asset described below displays the highest fluctuations over time: savings accounts, bonds, or stocks?*
   - (i) Savings accounts
   - (ii) Bonds
   - (iii) Stocks
   - (iv) I don't know

10. *Is the following statement true? Housing prices in the US can never go down.*
    - (i) True
    - (ii) False
    - (iii) I don't know

Questions 1–4 were initially proposed by Lusardi and Mitchell (2011a) and have been added to the survey instrument of various studies worldwide over the years, providing a consistent and reliable assessment of an individual's basic financial knowledge (Lusardi and Mitchell 2011b). We included them in their original format. All the other questions listed above adhere to the guidelines suggested by Lusardi and Mitchell (2011b) in that they are meant to assess fundamental financial literacy concepts (*simplicity*) and to relate to financial decisions that people make regularly (*relevance*). They are all multiple-choice or true/false questions to help respondents identify and select their preferred answer. They always feature a "don't know" option, capturing participants' uncertainty or intention to decline to respond, which may have different implications from a wrong answer. Unlike other studies eliciting financial literacy (e.g., the National Financial Capability Study), there is not a "refuse to answer" option. It should be noted that to minimize item nonresponse, all UAS surveys include a one-time prompt that encourages respondents to answer any skipped question before moving on to the next one. This contributes to a low item nonresponse rate of about 0.1% across all UAS surveys. Questions 1, 2, 5, 6, and 7 are the five questions administered by Van Rooij et al. (2011) in the Centerpanel and by Lusardi and Mitchell (2007) in the ALP.

Two aspects make the series of financial literacy questions in the UAS unique. First, unlike most other population representative studies, the UAS devotes ample survey time to assess individuals' level of financial literacy. The 14 questions listed above allow for

Table 2. Proportion of correct answers by question version

	Buying a single company's stock usually provides a safer return than a stock mutual fund	Buying a stock mutual fund usually provides a safer return than a single company's stock	$H_0:\Delta=0$ t-test p-Value
Wave 1	65%	63%	0.042
Wave 2	64%	59%	0.000
Wave 3	64%	60%	0.000
Wave 4	62%	61%	0.188
	Stocks are normally riskier than bonds	Bonds are normally riskier than stocks	$H_0:\Delta=0$ t-test p-Value
Wave 1	83%	80%	0.000
Wave 2	79%	75%	0.000
Wave 3	77%	73%	0.000
Wave 4	78%	73%	0.000
	If the interest rates rise, what should happen to bond prices?	If the interest rates fall, what should happen to bond prices?	$H_0:\Delta=0$ t-test p-Value
Wave 1	30%	29%	0.594
Wave 2	29%	31%	0.031
Wave 3	31%	30%	0.162
Wave 4	32%	31%	0.708

Note: The table displays the proportions of correct responses for each wave to three financial literacy questions. These questions compare two alternatives, with their order in the question text randomly determined.

more breadth, covering a variety of broad concepts, and for more nuanced measurement, inquiring about different facets of the same concept. The resulting data provide researchers with enhanced capability to differentiate between levels of financial knowledge.

Second, exploiting the flexibility of self-administered online interviews, the UAS financial literacy module contains a series of experiments to improve data quality. Specifically, whenever two alternatives are compared, like a single company's stock and stock mutual fund in question 3 or stocks and bonds in question 11, the order in which they appear in the question text is randomized to minimize order effects. The evaluation of these experiments, reported in Table 2, reveals that question phrasing does matter when assessing individuals' level of financial knowledge. Specifically, the standard version of question 3 – "*Buying a single company's stock usually provides a safer return than a stock mutual fund.*" – leads to a systematically higher fraction of correct answers than its alternative version – "*Buying a stock mutual fund usually provides a safer return than a single company's stock.*" Across the four waves of data collection, the difference ranges between 1 and 5 percentage points and is mostly statistically significant. Analogously, asking survey participants whether "*Stocks are normally riskier than bonds.*" is associated with a substantially larger proportion of correct answers than asking whether "*Bonds are normally riskier than stocks.*" In this case, the difference of 3 to 6 percentage points is highly significant across waves. These findings indicate that the adoption of standard question phrasing commonly used by other representative studies, which gives prominence to the

option that is relatively more familiar to people (e.g., stocks over bonds), may result in an overestimation of the level of financial knowledge in the population.

Another experiment embedded in the UAS financial literacy module concerns question 4, where respondents are randomly assigned the cases of rising and falling interest rates when asked about the relationship between interest rates and bond prices. This ensures a fair representation of these two scenarios, reducing the risk of framing and anchoring biases. As can be seen in the bottom panel of Table 2, phrasing the question in terms of rising or falling interest rates has no apparent effect on the likelihood that individuals answer correctly. The percentage of correct answers is relatively low and barely reaches 30%, which is broadly consistent with the assumption that respondents pick an answer randomly.

Lastly, it is interesting to compare responses to questions 1 and 5. While these two questions are similar, they differ in two important aspects. First, question 1 provides answer choices that do not require calculating compound interest to answer correctly (e.g., the account balance is $102 after one year, suggesting it should be more than $102 after five years). As such, Lusardi and Mitchell (2011a) view this question as testing numeracy rather than understanding of compound interest. In contrast, question 5 necessitates calculations related to compound interest. Second, the interest rate mentioned in question 1 is 2% versus 20% in question 5. Given that people's ability to process numerical problems often depends on their familiarity with specific rates of return, the more common 2% rate likely makes question 1 easier to answer. These factors lead to the expectation that survey participants would find question 1 simpler than question 5, a hypothesis that is supported by empirical evidence. Across waves, the fraction of respondents who answer question 1 correctly and question 5 incorrectly is between 26% and 31%. In contrast, the fraction of those who answer question 1 incorrectly and question 5 correctly is only 3%.

General statistics about UAS financial literacy data

Given the illustrative purpose of our discussion, in what follows, we will use a total financial literacy score constructed by adding one point for each correct answer to the 14 financial literacy quiz questions described above. Clearly, the UAS data allow researchers to conduct more nuanced analyses, by focusing on specific items of interest or computing sub-indexes using items eliciting the same conceptual knowledge (e.g., items testing knowledge of inflation and purchasing power). It is also possible to experiment with alternative definitions of a composite financial literacy score with different weights assigned to different items.

Our total financial literacy score takes values between 0 and 14. Its weighted average by wave is reported in Figure 1. As seen in the left panel of Figure 1, the overall score appears to be relatively stable, around 9 – indicating that people get approximately two-thirds of the questions right – with a slight tendency to decline over time. This downward trend is more evident when focusing on the sub-sample of respondents who completed the financial literacy module in all four waves. This group's performance in wave 1 is somewhat higher than the overall average (9.2 vs. 9); it then decreases monotonically to reach 8.6 in wave 4, the same as the overall average. Such decline could be partly attributed to the aging of this sub-sample and the associated worsening of memory and cognitive functioning more broadly, which can adversely affect survey behavior and responses. It does not seem to support the presence of strong and positive practice effects, which might counteract the negative impact of aging.

To shed light on possible practice effects, we take advantage of refreshment samples in the UAS and compare respondents with different degrees of exposure to financial literacy questions within a specific wave. The results of this exercise are reported in Figure 2.
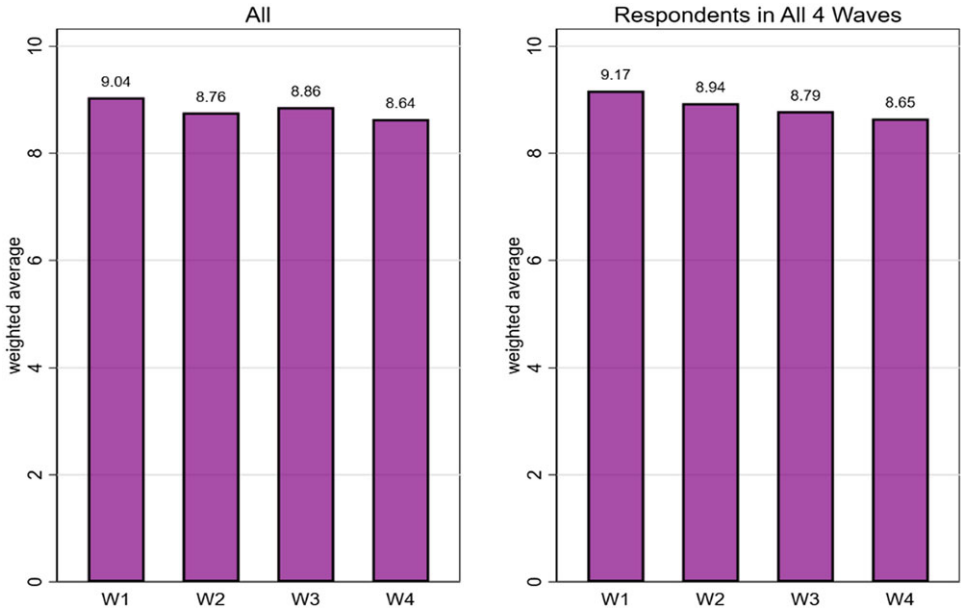
Figure 1. Weighted average total financial literacy score by wave.

Note: The figure shows the weighted average of the total financial literacy score across waves. The left panel includes all UAS respondents who have completed the financial literacy module at least once. The right panel includes only UAS respondents who have completed the financial literacy module in all four waves.
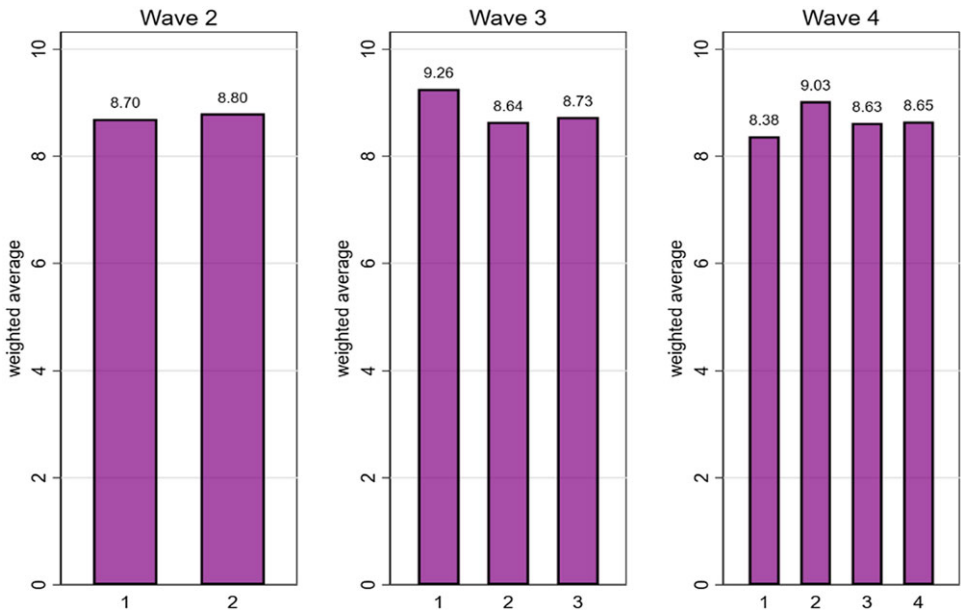

Figure 2. Weighted average total financial literacy score by number of completed surveys.

Note: The figure shows the weighted average of the total financial literacy score in waves 2–4 by the number of times respondents have completed the financial literacy module. The left panel reports the score separately for those who, in wave 2, completed the module 1 and 2 times; the middle panel reports the score separately for those who, in wave 3, completed the module 1, 2, and 3 times; the right panel reports the score separately for those who, in wave 4, completed the module 1, 2, 3, and 4 times.
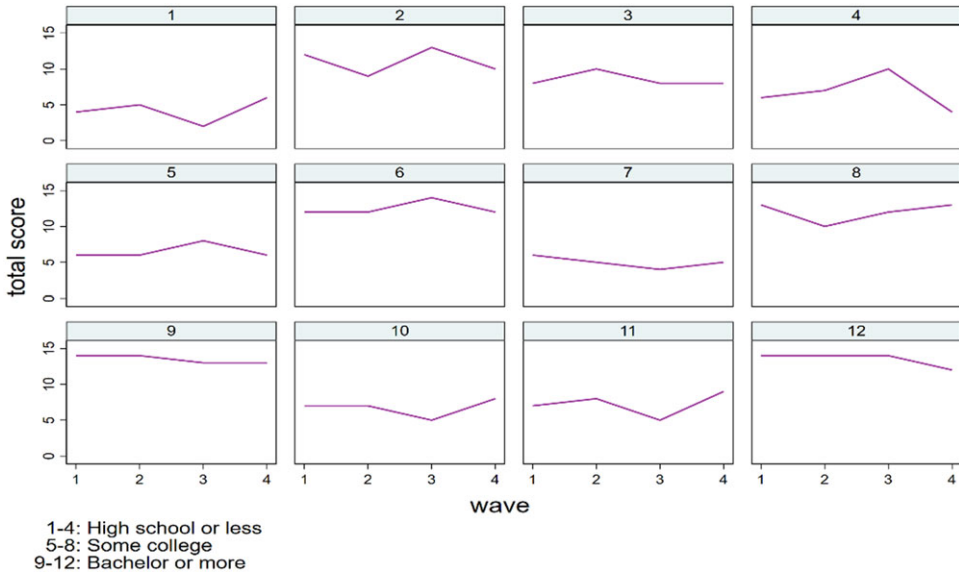
Figure 3. Financial literacy score trajectories for 12 randomly selected respondents.
Note: This figure is an example of how longitudinal data can capture diverse ways in which financial literacy may evolve over time. It shows individual-level trajectories for 12 randomly selected respondents, 4 with high school or less, 4 with some college education, and 4 with at least a bachelor's degree.

In wave 2, there is virtually no difference between those who answered the financial literacy battery for the first time and those who did it for the second time. In wave 3, first-timers performed better (by about three-quarters of a point) than those who completed the survey for the second or third time. In wave 4, novices performed significantly worse (by two-thirds of a point) than second-timers but only slightly worse (by a quarter of a point) than those who answered the survey three or four times. Overall, there is no indication that practice effects contribute to consistent improvements in quiz scores despite participants facing the same financial literacy questions repeatedly. It is important to highlight that UAS members do not receive feedback on their financial literacy (or any other) test results. Therefore, to improve their scores, they would need to take the initiative to find the correct answers and remember them for future surveys. Given that survey compensation is tied to the anticipated time to completion and independent of the performance in any test embedded in the survey, there is minimal motivation for respondents to seek out the correct answers. Furthermore, the two-year gap between UAS core surveys presents a significant challenge for memory retention, even if participants were motivated to engage in such investigative efforts.

While informative, aggregate statistics mask the substantial heterogeneity captured by the data, both between and within individuals. To showcase this heterogeneity, we randomly selected 12 respondents who answered the financial literacy module in all four waves and plotted their total financial literacy score trajectories over time in Figure 3. Each row in the figure refers to individuals with certain educational achievement, namely high school or less (first row, individuals 1–4), some college (second row, individuals 5–8), and a bachelor's degree or more (third row, individuals 9–12). As can be seen, individuals' level of financial literacy varies substantially within each education group. Moreover, noticeable differences exist in how each respondent's performance in the financial literacy module changes over time. Given the wealth of background information available for all
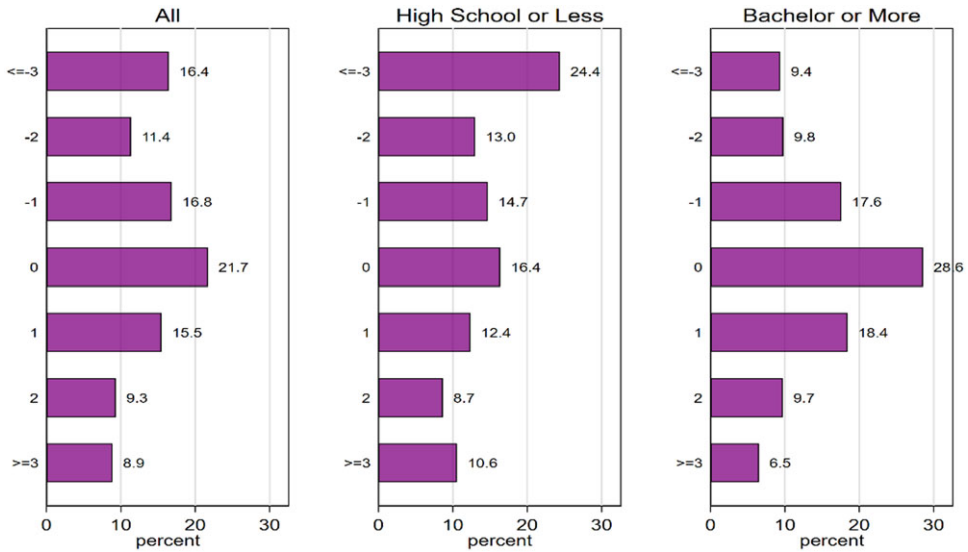
Figure 4. Difference between last and first financial literacy score among respondents with four assessments (proportions in each bin).

Note: The figure reports the difference in total financial literacy score between the fourth and the first wave for those who completed the financial literacy module 4 times. The left panel includes all respondents; the middle panel includes only respondents with high school or less; the right panel includes only respondents with at least a bachelor's degree.

UAS respondents, these data are ideal for studying these ample variations across and within individuals and identifying their determinants.

The availability of longitudinal data is crucial to shed light on how stable financial knowledge is over time. The trajectories reported in Figure 3 suggest that, while individuals' performances in the financial literacy quiz do vary across waves, the magnitude of these changes is modest (in line with the findings of Angrisani et al. 2023). In Figure 4, we consider respondents with four waves of data and compute the difference between their last and first financial literacy scores, which can be between 6 and 8 years apart. The score remains unchanged for 22% of these respondents, while for another 32%, it varies by only 1 point. Positive changes by 3 or more points are relatively rare and experienced by about 9% of respondents. In contrast, a sizeable fraction of 16% exhibits a drop of 3 or more points in their score. The breakdown by education, comparing those with high school or less and those with a bachelor's degree or more, reveals an interesting pattern. Among low-educated individuals, large changes seem more likely. The mode is a negative change of 3 or more points (about 25%), while a non-negligible fraction of 11% experiences a positive change of the same amount. The fraction with 0- or 1-point change is 43%. Financial knowledge is instead more stable among college graduates, as the fraction with 0- or 1-point change is 65%. Within this group, large swings in the score are less common than among low-educated individuals (9% and 6% have a negative and positive change of 3 or more points, respectively). One hypothesis could be that respondents with lower educational achievement guess more often, leading to more random variation over time. In this exercise, we decided to examine medium-run changes in financial literacy by comparing scores over a period of 6 to 8 years. Similar analyses can be carried out focusing on short-term changes to check whether different patterns emerge.

In Figure 5, we report the distributions of financial literacy scores (upper panel) and changes in financial literacy scores across two consecutive waves (bottom panel) by level of cognitive ability. We restrict attention to the group of respondents with a bachelor's degree
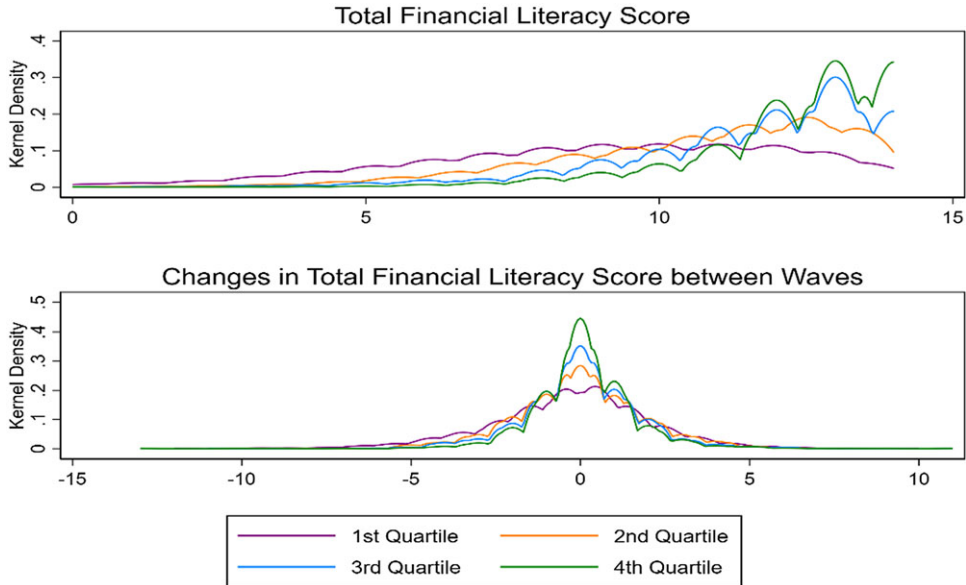
Figure 5. Levels and changes in financial literacy score by cognitive ability score quartiles among respondents with college graduates.
Note: The top figure reports the distributions (kernel density) of the total financial literacy score for individuals with at least a bachelor's degree by cognitive ability score quartiles. The bottom figure reports the distributions (kernel density) of the change in total financial literacy score between consecutive waves for individuals with at least a bachelor's degree by cognitive ability score quartiles.

or more, which we divide into cognitive ability score quartiles.[4] Once again, the graphs in the figure underscore remarkable heterogeneity across individuals, even within a group characterized by homogeneous educational achievement. In particular, there is ample variation in financial literacy quiz performance by level of cognitive ability, especially when moving from the bottom to the second quartile and from the second to the two top quartiles. Wave-to-wave changes in financial literacy scores also vary greatly by cognitive ability, with the bottom two quartiles exhibiting higher variability and substantially larger changes. These findings point to a positive correlation between cognitive ability and both the level and the change of financial literacy. As described above, the UAS core surveys provide a comprehensive set of cognitive assessments for each panel member over time, allowing researchers to account for such correlation in their analyses and isolate the effect of financial literacy on various outcomes from that of cognitive skills.

Linking financial literacy to financial outcomes in the UAS

The UAS administers a series of core surveys, including the employment and income/asset modules of the HRS, eliciting longitudinal information on individuals' employment status, financial outcomes, behaviors, and wellbeing, and retirement preparedness. In addition, a general survey commissioned by the Financial Health Network (FHN) has been fielded in

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[4] The cognitive ability measure used in this exercise and in other analyses in this paper is based on the Woodcock–Johnson number series, picture vocabulary, and verbal analogies tests. Each series consists of 15 items, which are scored dichotomously as correctly (1) or incorrectly (0) solved. The total score for each of these tests is obtained by summing correct answers across the 15 items and converted into a T-score, where 50 is the mean and 10 is the standard deviation of the general US population. We construct a general cognitive ability score by summing the T-scores of the number series, picture vocabulary, and verbal analogies tests.

the UAS in April of every year since 2018 to track household financial health in the US. Through these surveys, data users have an extensive list of variables at their disposal to study if and how financial literacy is linked to financial outcomes. Notably, the longitudinal dimension of the data allows researchers to examine contemporaneous relationships between financial literacy and financial outcomes as well as dynamic associations capturing the predictive power of financial literacy for future financial outcomes. The latter approach overcomes the reverse causality concerns affecting much of the existing empirical work based on cross-sectional data. Moreover, the rich set of background information collected for each respondent, including demographics, cognitive ability test scores, personality traits, and economic preference parameters, to name a few, promises to reduce biases from the omission of relevant variables in the analysis and to explore heterogeneous effects of financial literacy on financial outcomes along several dimensions.

In this section, we illustrate how to combine UAS longitudinal survey data to examine dynamic associations between financial literacy and financial outcomes. For this purpose, we focus on respondents with four waves of data and regress financial outcomes observed in wave 4 on the financial literacy score observed in wave 1. We consider three financial outcomes. The first is the total value of financial wealth (in $10,000), which we obtain from the HRS asset module. It is calculated by summing the value of stocks, checking and savings accounts, CDs, and bonds and subtracting the value of non-mortgage debt. To reduce the risk that large outliers may affect the regression results, we winsorize the top 1% of this variable's distribution. The second outcome is a high-debt indicator, taking value 1 if the individual's total debt is greater than half the value of all assets and 0 otherwise. Also in this case, total debt and asset values are obtained from the HRS asset module. Third, we consider a retirement preparedness index proposed by Chard et al. (2017) and calculated as a weighted sum of the following variables: an indicator for having a defined benefit plan, an indicator for having a defined contribution plan, an indicator for being entitled to IRA assets (own/named as beneficiary), an indicator for owning an IRA, an indicator for adequate IRA funds (account balance is greater than age-adjusted income thresholds defined as $1 \times$ current income by age 35, $3 \times$ current income by age 45, $5 \times$ current income by age 55, and $8 \times$ current income by age 65), an indicator for having made no early withdrawals from IRAs, the percentage of stock held in IRAs, and an indicator of whether the percentage of IRAs held in stocks is appropriate for the age of the beneficiary (based on the rule of thumb that the adequate percentage of stocks should be approximately [100-age]%). Higher values of the index correspond to better retirement preparedness. We standardize this index to take mean 0 and standard deviation 1 within the sample. We estimate separate models for each of these financial outcomes observed in wave 4 on the financial literacy score in wave 1 (standardized to ease the comparison of estimated coefficients across regressions), the outcome variable itself in wave 1, and a set of controls including gender, race, age, marital status, education, work status, household income, census region, cognitive ability, and year fixed effects.

Figure 6 reports the results of these regressions. The height of the purple bars represents the size of the estimated coefficient of the financial literacy score in wave 1, which is also shown numerically. All four graphs demonstrate statistically significant relationships between an individual's financial literacy score and future financial outcomes, observed between 6 and 8 years later. Specifically, a one-standard-deviation increase in the financial literacy score is linked to a notable $12,000 increase in future financial wealth – a substantial 13% above the average in the sample. We also estimate a 2-percentage point reduction in the likelihood of high debt, translating into an 11% decline from the baseline 18% prevalence in the sample. Furthermore, a one-standard-deviation increase in financial literacy score correlates with about a 0.15-standard-deviation increase in the retirement preparedness z-score.
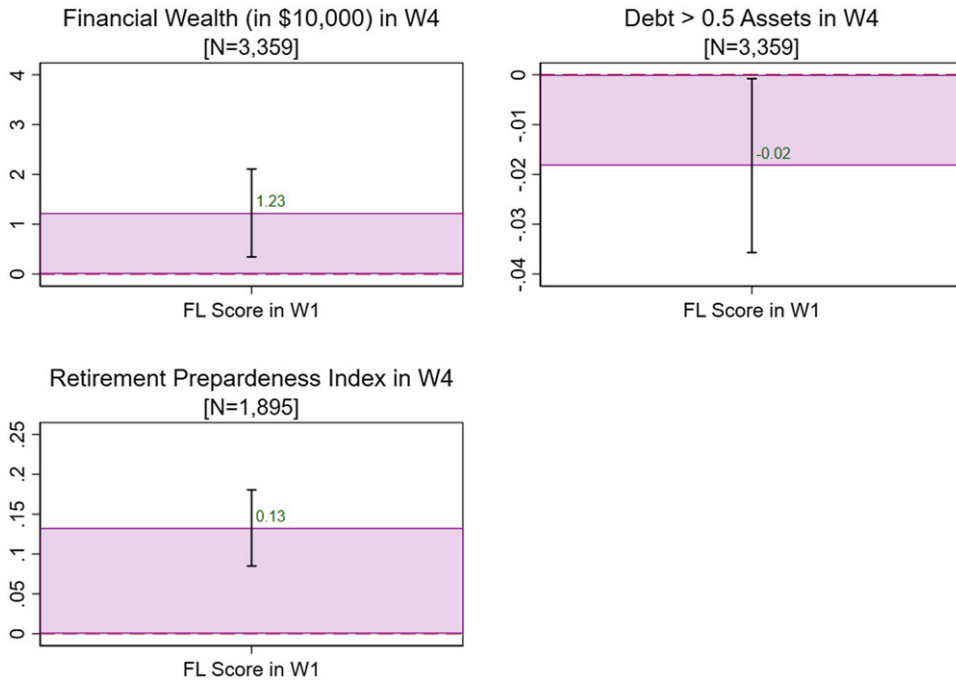
Figure 6. Dynamic associations between financial literacy and financial outcomes.
Note: The figure reports the estimated coefficients of the standardized financial literacy score in wave 4 and 95% confidence intervals from linear regressions. The dependent variable in the top-left panel is financial wealth; the dependent variable in the top-right panel is an indicator taking value 1 if the amount of debt is greater than one-half of total asset value; the dependent variable in the left-bottom panel is a standardized retirement preparedness index. Other regressors include gender, race, age, marital status, education, work status, household income, census region, cognitive ability, and year fixed effects. Time-varying regressors are fixed at their wave 1 value. The dependent variable in wave 1 is also included in the regression.

While only illustrative, these results highlight a robust connection between one's financial literacy and key medium-term financial outcomes, including the accumulation of wealth, effective debt management, readiness for retirement, and overall financial health. The estimated dynamics imply that financial literacy may play a significant role in widening economic disparities across individuals over the lifespan. The consistent pattern across different financial domains suggests that enhancing financial knowledge may be a critical lever in addressing and potentially mitigating such disparities.

Descriptive analysis of the Big Three in the UAS

In this section, we focus on the Big Three financial literacy questions and document how UAS respondents have performed in these questions over time. The goal of this analysis is twofold. First, since the Big Three have been asked in various other surveys, the findings based on UAS data can be compared with those from other studies both in the US and other countries. Second, having data from 2022 and 2023, we can offer an updated assessment of the level of financial literacy in the US relative to the one provided by Lusardi and Streeter (2023) using data from the 2021 National Financial Capability Study (NFCS).

We begin by reporting the overall score on these three basic questions in Figure 7. UAS respondents get, on average, about 2.15 questions right out of 3, achieving 72% of the
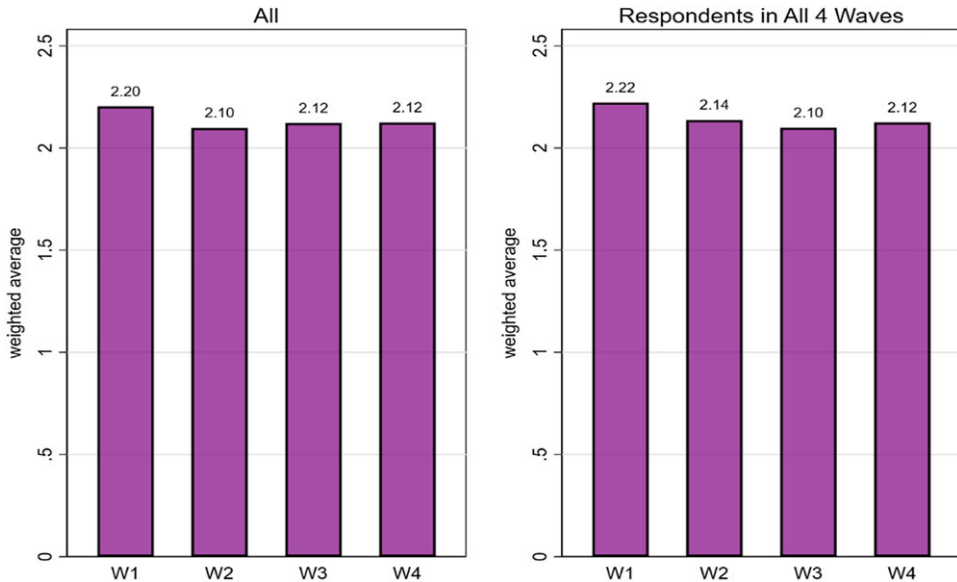
Figure 7. Big Three score across waves.
Note: The figure shows the weighted average of the financial literacy score based on the Big Three questions across waves. The left panel includes all UAS respondents who have completed the financial literacy module at least once. The right panel includes only UAS respondents who have completed the financial literacy module in all four waves.

maximum score. This is a substantially higher score than the 1.64 observed in the 2021 NFCS (Lusardi and Streeter 2023) but similar to the 2.2 in the 2016 Survey of Consumer Finances (SCF, Chien and Karson 2018) and the 2018 ALP (Angrisani et al. 2023). It is hard to know exactly where these differences are coming from. One possible explanation lies in the nature of the different sampling strategies. The UAS, ALP, and SCF are all probability-based and, hence, share similarities in their sampling strategies. As for the total financial literacy score based on the complete battery of 14 questions, the score based on the Big Three decreases slightly over time. While observed drops seem modest in magnitude (0.1 points at most), they are statistically significant.

The fraction of respondents who answered all three questions correctly is 47% in wave 1, 43% in wave 2, 45% in wave 3, and 46% in wave 4. The fraction of those who answered all three questions incorrectly is 5% in wave 1, 7% in waves 2 and 3, and 8% in wave 4. The fraction of respondents who answered "don't know" to all three questions is 2% in waves 1 and 2, 3% in wave 3, and 4% in wave 4. Hence, about half of those who answered all questions incorrectly were survey participants who systematically chose the "don't know" option.

Figure 8 shows the score breakdown for each Big Three question across waves. As can be seen, the question about compound interest is the one with the highest proportion of correct answers, well above 80%. The slight decline in the fraction of correct answers from 86% in wave 1 to 83% in wave 4 is mirrored by a 3-percentage point increase in the fraction of those who chose "don't know" (from 4% to 7%), while the fraction of incorrect answers remained constant at 10% throughout the observation period.

The question about inflation exhibits the most pronounced swings across waves. Specifically, the fraction of those who provided a correct answer was 73% in wave 1, declined to 67% in wave 2, as the fractions of incorrect and "don't know" answers climbed 4 and 2 percentage points, respectively, and was back to 72% in wave 4. The question about risk diversification has the lowest proportion of correct answers, starting at 61% in wave 1
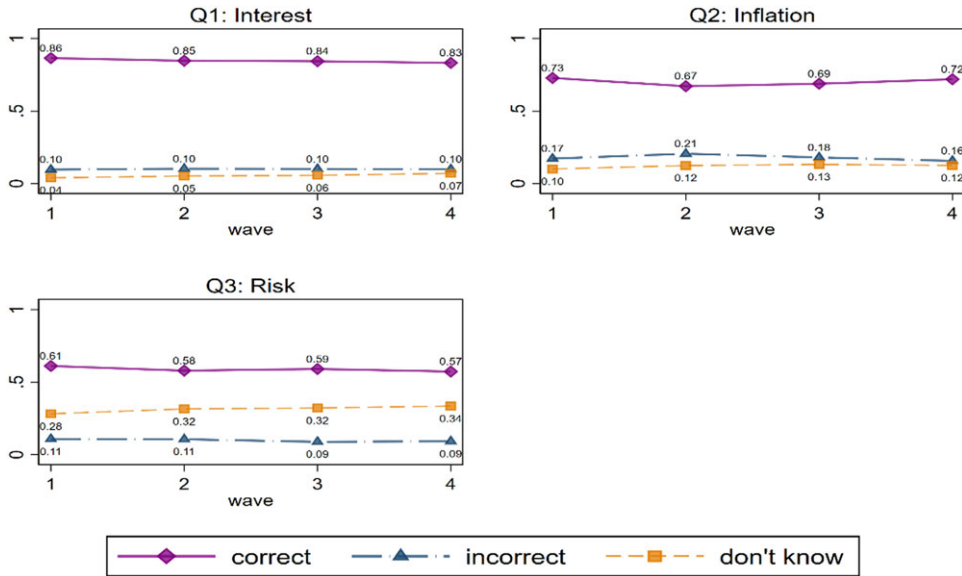
Figure 8. Big Three: score breakdown.
Note: The figure shows the weighted proportions of correct, incorrect, and don't know answers across waves, separately for each of the Big Three questions.

and declining monotonically to 57% in wave 4. Such downward tendency is entirely driven by the significant increase in the fraction of "don't know" answers – from 28% in wave 1 to 34% in wave 4 – while the fraction of incorrect answers dropped slightly from 11% in waves 1 and 2 to 9% in waves 3 and 4. It is worth recalling that, as previously reported in Table 2, the way the question about risk diversification is phrased appears to affect the likelihood of providing a correct answer. The average statistics shown in Figure 8 mask the fact that the original text – "*Buying a single company's stock usually provides a safer return than a stock mutual fund*" – is associated with a 2-percentage point higher likelihood of answering correctly relative to the alternative text – "*Buying a stock mutual fund usually provides a safer return than a single company's stock.*" Overall, the data from the UAS indicate a substantially higher level of financial literacy among US residents than the 2021 NFCS data, with differences in the fractions of respondents providing correct answers to the Big Three questions ranging between 15 and 20 percentage points.

In Table 3, we limit our dataset to wave 4 and report the weighted proportions of correct and "don't know" answers to the Big Three questions separately for different demographics. By and large, these statistics reproduce the patterns reported by Lusardi and Streeter (2023) using 2021 NFCS data. The gender gap in basic financial knowledge is considerable. Female respondents are between 15 and 20 percentage points less likely to provide correct answers than their male counterparts and twice as likely to choose the "don't know" option. Blacks and Hispanics perform significantly worse than Whites, whereas Asians perform as well or slightly better than Whites across the three questions. The level of financial literacy appears to be the lowest among individuals aged 18–35 years, increasing monotonically with age. The difference between younger (18–35) and older (66+) respondents widens as questions become more difficult/less familiar. For example, the gap between these two groups is 10 percentage points for the interest question but more than doubles (23 percentage points) for the inflation and risk diversification questions.

As expected, financial literacy is strongly and positively correlated with individuals' educational achievement, with the most significant knowledge disparity observed between

Table 3. Weighted proportions of correct and don't know answers to the Big Three by demographics (wave 4 only)

	Interest		Inflation		Risk		Overall	
	Correct	dk	Correct	dk	Correct	dk	3 Correct	≥1 dk
Gender								
Male	87.3	5.1	79.7	7.8	67.8	23.7	57.1	26.7
Female	79.2	8.8	64.3	16.9	47.2	42.9	33.7	46.3
Race								
White	86.5	5.5	77.9	10.1	63.8	29.9	54.1	33.7
Black	69.3	13.2	51.0	20.4	38.8	45.2	21.6	51.3
Asian	86.9	4.0	80.4	7.5	68.6	22.1	57.2	25.2
Other/Mixed	87.9	5.8	71.2	15.5	58.2	41.2	29.9	48.5
Hispanic	79.3	8.8	63.0	16.0	44.1	32.6	45.9	40.0
Age (years)								
18–35	77.6	11.0	61.0	20.0	47.0	40.5	33.4	48.6
36–50	83.8	7.0	67.1	13.3	54.1	36.3	42.2	40.5
51–65	85.1	5.4	78.0	8.7	60.8	31.3	50.5	34.4
66+	87.4	3.4	84.7	6.3	70.5	23.5	60.3	26.7
Education								
No high school	66.0	17.1	51.0	25.8	35.0	50.1	18.3	59.7
High school	76.2	10.7	59.3	18.6	41.1	45.7	27.5	52.3
Some college	83.6	5.7	72.7	11.3	55.5	35.6	42.7	39.9
College	93.4	1.9	85.6	4.9	77.0	18.5	68.4	20.7
Postgraduate	93.4	2.3	90.3	4.1	80.4	15.2	73.9	17.5
Labor force status								
Working	85.9	5.3	73.1	10.8	60.6	30.8	48.8	35.0
Employee	86.6	5.2	74.0	10.1	60.8	31.1	49.9	34.7
Self-employed	86.9	5.8	75.8	10.3	68.2	23.0	57.3	28.0
Unemp/on Leave/Disabled	72.0	14.0	56.0	21.6	36.8	47.5	22.7	55.7
Retired	89.8	2.3	87.6	4.6	71.0	23.6	62.8	25.7
Other	76.5	11.8	64.9	18.7	49.8	41.1	37.6	47.8

Note: The table reports the weighted proportions of correct and don't know answers to the Big Three questions by demographics in wave 4. dk indicates "don't know" and ≥1 dk indicates at least one don't know answer out of three.

college-educated individuals and those who have not attended college. Individuals with a college degree are 2.5 times more likely to correctly answer all three questions than high school graduates (68% compared to 27%). This gap almost doubles when comparing the extrema of the education distribution: only 18% of those with less than high school answer all three questions correctly, while 74% of individuals with postgraduate education do so. Yet, even among postgraduates, financial literacy is not universal, as 10% incorrectly answer the question about inflation and 20% incorrectly answer the question about risk diversification.

Finally, financial literacy levels also vary with employment status. The group not engaged in employment, encompassing unemployed, on-leave, and disabled individuals, exhibit the lowest performance, with only a 23% probability of getting all three questions right. Self-employed workers and employees perform similarly in the interest and inflation question. However, the former group is 8 percentage points more likely to answer the risk diversification correctly and, consequently, 8 percentage points more likely to obtain a perfect score across the Big Three. Retirees emerged as the most financially literate group in the population, confirming the age gradient noted before. Plausible explanations for this phenomenon include more experience with financial products/services and the necessity to manage retirement savings, which are bound to make retirees more familiar with the concepts of compound interest, inflation, and purchasing power, and with the difference between stocks and bonds.

Conclusions

In this paper, we briefly describe the UAS as an innovative platform for data collection and demonstrate the use of UAS data in conducting research on financial literacy and financial outcomes. We present descriptive analyses, which are only meant to illustrate the potential of the UAS data for analyzing both the determinants of financial literacy and the effect that financial literacy may have on financial wellbeing. These analyses highlight several distinctive aspects that make the UAS an unparalleled and valuable data source.

First, the UAS regularly measures financial literacy and outcomes as core content, capturing this information longitudinally for all panel members. This enables analysis of how financial knowledge evolves due to aging, cognitive changes, or significant life events such as homeownership, divorce, or retirement. The longitudinal nature of the data also helps in studying the correlation between varying levels of financial literacy and financial wellbeing over time. Additionally, because of the UAS recruitment design featuring the inclusion of refreshment samples over time, it is possible to investigate practice and panel conditioning effects on individuals' performance in financial literacy quizzes by comparing the level of financial literacy of existing panelists and new recruits.

Second, the UAS data contain detailed background information for each respondent, allowing researchers to control for potential confounders in their analyses to mitigate omitted variable bias. The wealth of core data provided by the UAS also enables researchers to examine the nuances of the relationship between financial literacy and financial outcomes by factors like preference parameters, cognitive abilities, and personality traits, which are rarely elicited by surveys focusing on financial literacy.

Third, the UAS represents a unique platform for primary data collection. Researchers interested in collecting data with the UAS can take advantage of an existing rich, longitudinal, and continuously expanding dataset to which their novel survey data can be linked at no additional cost. This saves time and resources (e.g., new survey instruments do not need to be as extensive as if they were administered as a standalone study or in a context where existing respondents' information is limited) while enhancing the potential for pursuing novel research avenues with unprecedented accuracy and detailed context that other panels often cannot match. Furthermore, as the UAS promotes data sharing and constantly seeks engagement with the wider research community (as demonstrated by the free survey minutes initiative mentioned above), researchers not only contribute their own data but also gain access to a vast repository of data collected by others. Such a shared ecosystem significantly broadens the scope and depth of research possibilities, enabling innovative empirical studies centered around financial literacy and financial outcomes.

Finally, the UAS stands at the forefront of data collection innovation, continuously embracing new methodologies and technologies. This is reflected in its ongoing efforts to use the latest digital tools to gather information about panel members (e.g., Fitbits and

portable air quality monitors), to combine surveys and electronic financial records to improve the measurement of financial outcomes, and to integrate para-data in empirical analyses to enhance the efficiency and quality of data collection in online surveys. Looking forward, the UAS is committed to ensure that the platform remains cutting-edge and highly relevant to contemporary research needs.

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