Has Financial Knowledge Increased in the United States?

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This study explores financial knowledge patterns from 2009 to 2018, focusing on objective and subjective knowledge, overconfidence in financial knowledge, and "Don't know" responses. We used four waves of National Financial Capability Study (NFCS) datasets. Objective financial knowledge was lower in 2018 than in 2009, and the proportion of individuals who were overconfident was higher in 2018 than in 2009. The mean number of "Don't know" responses to objective knowledge questions increased consistently over the period. Most of these patterns persisted when we controlled for household characteristics in regressions. The lack of increases in financial knowledge despite formal and informal educational efforts raises the question as to whether existing efforts for formal and informal education are sufficient.

Keywords: financial knowledge, financial literacy, national financial capability study, overconfidence, trends

Financial knowledge and financial literacy have been salient topics for the past 20 years (e.g., Greenspan, 2001). Many studies have found evidence of relationships between financial knowledge and various financial behaviors, including savings (Beckmann, 2013; Henager & Mauldin, 2015), wealth accumulation (Behrman et al., 2010; Letkiewicz & Fox, 2014), retirement preparation (Agnew et al., 2013; Alessie et al., 2011), and stock market participation (Almenberg & Dreber, 2015; van Rooij et al., 2011; Xia et al., 2014). Lin et al. (2019) found that the percentage of respondents answering the majority of financial knowledge questions correctly has been decreasing since 2009, despite increased attention from the U.S. federal government to financial illiteracy and its impacts in the aftermath of the 2008–2009 financial crisis (Lusardi & Mitchell, 2014).

Lusardi and Mitchell (2014) designed a set of questions to measure objective financial knowledge incorporating three fundamental concepts: (a) interest rate (compound interest), (b) inflation, and (c) risk diversification. These "Big Three" questions were initially included in the 2004 Health and Retirement Study (HRS) and have been used as a benchmark to measure financial literacy. The Big Three questions have been included in various household-level surveys, including Survey of Consumer Finances (SCF), National Financial Capability Study (NFCS), and the National Longitudinal Survey of Youth (NLSY) (Lusardi & Mitchell, 2014). The NFCS included two additional items about mortgage payment and asset pricing in the survey. There are various measures of financial knowledge in the existing literature, for example, Knoll and Houts (2012) developed a psychometrically tested scale based on the Item Response Theory to improve the variability of measure in financial knowledge. Other researchers have used larger sets of financial knowledge items (e.g., Agnew & Szykman, 2005; Bannier & Schwarz, 2018; Chen & Volpe, 2002; Hilgert et al., 2003; van Rooij et al., 2011). However, the advantages of "Big Three" or "Big Five" questions are still considerable due to the high comparability of statistics to many U.S. national datasets including NFCS, SCF, HRS, and NLSY, and the simplicity of implementation due to the small number of questions. In addition to objective financial knowledge, which captures one's actual understanding of financial concepts, the perception of one's financial knowledge, or self-assessed subjective financial knowledge has also been found to be related to many financial behaviors (Deenanath et al., 2019; Lind et al., 2020; Robb & Woodyard, 2011). For some financial behaviors, the effects of subjective financial knowledge were larger than the

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http://dx.doi.org/10.1891/JFCP-2021-0049

effects of objective financial knowledge (Lind et al., 2020; Robb & Woodyard, 2011).

However, one of the obstacles in understanding the relationship between financial knowledge and financial behaviors is that one's actual and perceived ability, or objective and subjective financial knowledge, do not necessarily align. Individuals could overestimate or underestimate the financial knowledge level, which could lead to suboptimal financial decisions. Although the effect of financial knowledge overconfidence on financial behaviors has recently emerged as a research topic and its links to undesired financial behaviors have been documented (e.g., Kim et al., 2020; Robb et al., 2015; Xia et al., 2014), there is a very limited attempt to examine the time trend in the financial knowledge overconfidence level.

In addition, offering a "don't know" response may give respondents an alternative to just guessing (Lusardi et al., 2017). When respondents are allowed to choose the "Don't know" option instead of being forced to pick answers to personal finances question, it prevents respondents from guessing the answer randomly to problems. Previous studies generally assumed that "Don't know" responses represented incorrect answers when estimating objective financial knowledge (e.g., Angrisani & Casanova, 2021; Lusardi & Mitchell, 2011; Xiao et al., 2015). However, this assumption does not distinguish between respondents who are being conscious of their lack of knowledge and those who wrongly believe that they know the correct answers. Since previous studies pointed out the importance of offering a "Don't know" option for more precise measurement of knowledge (Hill & Perdue, 2008) and especially given that the financial knowledge questions could be challenging to answer for some individuals, the inclusion of a "Don't know" response should be taken into account when examining financial knowledge levels.

Our study investigated trends in financial knowledge since 2009, with a focus on objective knowledge, subjective assessment of financial knowledge, financial knowledge overconfidence, and "Don't know" responses. For empirical analyses, we used the NFCS dataset because the NFCS dataset has included the "Big Five" financial knowledge questions from the initial 2009 wave of the survey. In addition to examining the time trend of objective and subjective financial knowledge, this study is one of the first attempts to analyze changes in financial knowledge overconfidence and "Don't know" responses. This study provides important descriptive and multivariate results, which have implications for policy and research.

Conceptual Consideration and Hypotheses

While the Life Cycle Saving (LCS) model assumes that individuals are well-informed and rational (Browning & Crossley, 2001; Modigliani & Brumberg, 1954), many researchers have concluded that individuals have bounded rationality and are limited in their ability to evaluate and choose optimal behaviors. Ibrahim (2009) argued that people may face three major challenges: complex financial markets, limited financial capability, and limited time and economic resources. Therefore, there is a need for attention to levels of financial knowledge.

We reviewed previous studies on financial knowledge and overconfidence, but none of the studies have had a focus on the time trends in financial knowledge over years with appropriate empirical models. Our study investigated the question of whether there have been increases or decreases in financial knowledge and overconfidence over the 2009–2018 period by estimating a time trend controlling for various household characteristics. While it is challenging to construct formal theory-based hypotheses, below we present some hypotheses based on empirical studies and cautious reasoning.

The Council for Economic Education (2020) reported that the number of states requiring high school personal finance education to be offered has been increasing, from about 15 states in 2009 to 24 states in 2020. While there are limited reports on the number of working adults being offered financial education in the private sector, the 2020 Workplace Wellness Survey by EBRI (2020) showed that the proportion of employees being offered a financial wellness program was 33% in 2015 and 35% in 2020. This shows employers' continuing interest and investment in financial well-being of employees indirectly. Within an increase in financial education mandates as well as public attention from government agencies (e.g., Financial Literacy and Education Commission, 2016), we expected that objective financial knowledge increased over the survey years.

> **H1**: Objective financial knowledge increased from 2009 to 2012, from 2012 to 2015, and from 2015 to 2018, controlling for household characteristics.

During the Great Recession that started in 2007, U.S. households faced severe financial distress. Loss of wealth, delinquencies, foreclosures, unemployment rates, duration of unemployment, and poverty rates all rose sharply from 2007 through 2009. We expected that subjective financial knowledge increased after the formal end of the recession. While the effects of the recession lingered for many years, through 2019 there was decreasing unemployment and generally increasing wealth among those who owned investments.

> **H2**: Subjective financial knowledge increased from 2009 to 2012, from 2012 to 2015, and from 2015 to 2018, controlling for household characteristics.

If objective and subjective financial knowledge levels increased simultaneously and at the same rate, the degree of overconfidence should be constant over the years. However, given that most of the policies implemented to improve financial knowledge were focused on the younger generation by offering financial education at K-12 levels and that the NFCS surveyed adults who might have relatively limited exposure to financial educations, objective and subjective scores could have changed at different rates and thus diverge. Similar to our reasoning about subjective financial knowledge, we expected that overconfidence in financial knowledge increased after the recovery from the Great Recession.

> **H3**: Overconfidence in financial knowledge increased from 2009 to 2012, from 2012 to 2015, and from 2015 to 2018, controlling for household characteristics.

We expected "Don't know" responses to have an opposite pattern from objective financial knowledge.

> **H4**: The rate of "Don't know" responses decreased from 2009 to 2012, from 2012 to 2015, and from 2015 to 2018, controlling for household characteristics.

Methods

Data

We used the state-by-state and restricted version of the NFCS dataset commissioned by the Financial Industry Regulatory Authority (FINRA) Investor Education Foundation (Mottola & Kieffer, 2017). We created a pooled dataset from the 2009, 2012, 2015, and 2018 NFCS datasets. The total analytic sample size of the pooled dataset is 108,310, which consists of 28,146 observations from the year 2009, 25,509 from 2012, 27,564 from 2015, and 27,091 from 2018. The dataset contains detailed information on socio-demographic, economic, and behavioral traits of households in the U.S.

The NFCS dataset includes measures to estimate both perceptions of one's own financial knowledge and actual understanding of financial matters (Angrisani et al., 2016). Taking advantage of these variables, we examined the time trend in (1) objective financial knowledge, which refers to the actual understanding, (2) subjective financial knowledge, which refers to the self-perceptions, (3) overconfidence in financial knowledge, which refers to the discrepancy between objective and subjective knowledge measures, and (4) "Don't know" response to objective financial knowledge questions.

Variables

Objective Financial Knowledge. Five questions were included to measure objective financial knowledge related to various topics: (1) interest rate, (2) inflation, (3) bond price, (4) mortgage, and (5) risk. These questions are often referred to as "Big 5" financial knowledge questions (e.g., Anderson et al., 2017; Hastings et al., 2013). We created an objective financial knowledge score by coding correct responses to each question as 1 and other responses as 0, including "Don't know" responses. The objective financial knowledge score was constructed by adding those values, and the total score could range from 0 to 5.

Subjective Financial Knowledge. Subjective financial knowledge is measured using the self-assessment of one's financial knowledge level. In the survey, respondents were asked, "On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?" Observations with responses "Don't know" and "Prefer not to say" were considered as missing.

Overconfidence in Financial Knowledge. Two measures were used to estimate overconfidence in financial knowledge in this study. The first measure is the numerical difference between standardized objective and subjective financial knowledge, using a method described by Kim et al. (2020). A positive difference indicates an overestimation of financial knowledge, and a negative difference indicates

an underestimation. The divergence shows the degree of misevaluating financial knowledge.

The second measure of overconfidence is a binary variable constructed based on the combination of objective and subjective scores**.** We constructed the variable following the procedure of previous studies (Kim et al., 2020; Porto & Xiao, 2016; Robb et al., 2015; Xia et al., 2014). Each respondent was categorized as having higher than, or lower than or equal to median objective and subjective knowledge scores. An individual with higher than median subjective knowledge and lower than or equal to median objective knowledge was classified as being overconfident. The remaining group was classified as not being overconfident. We used medians of each year as the criteria. The median subjective score was 5, and the median objective score was 3 in all four waves.

"Don't Know" Responses to Financial Knowledge. One of the features of the NFCS dataset is that individuals are allowed to choose "Don't know" responses to most of the questions. While we considered "Don't know" responses to objective financial knowledge questions as incorrect answers and assigned the value 0, people who choose the "Don't know" option instead of arbitrarily picking the answer have distinctive characteristics (Chen & Garand, 2018; Kim & Mountain, 2019). Thus, to fully comprehend the time trend of individuals' financial knowledge level, "Don't know" responses must be taken into account. We created a variable indicating the number of "Don't know" responses to Big 5 financial knowledge questions, with values ranging from 0 to 5.

Independent Variables. Given the focus of the current study, the key independent variable of multivariate analyses was the survey year. In addition to the year indicator, various sociodemographic factors were controlled such as age, gender, racial/ethnic status, marital status, education, employment status, number of children, household income, and risk tolerance. We also included the current state of residence to control the possible influence of geographical factors.

Analyses

We conducted basic descriptive analyses to examine the time trends for objective and subjective financial knowledge, overconfidence in financial knowledge, and "Don't know" responses. We conducted pairwise comparisons of knowledge by year through *t*-tests using Duncan's method. Lastly, we conducted multivariate regression analyses of financial knowledge, including OLS regressions on (1) objective financial knowledge, (2) subjective financial knowledge, (3) overconfidence index 1 and (4) "Don't know" responses. We conducted a logistic regression on overconfidence index 2, the dichotomous variable indicating where one was overconfident or not. We included the independent variables listed previously as control variables, plus dummy variables for the survey year. We weighted the multivariate regressions using the national-level weight provided in the NFCS datasets.

Results

Trends in Financial Knowledge Variables

The overall pattern of individual financial knowledge scores is presented in Table 1. The mean objective financial knowledge score was 3.0 on a scale of 0–5. The mean subjective financial knowledge score was 5.1 on a scale of 1–7. The mean of overconfidence index 1 was −0.029. The mean of overconfidence index 2 indicates that 18.5% of respondents had financial knowledge overconfidence. For the five objective financial knowledge questions, the mean number of "Don't know" responses was 1.2. In other words, people chose "Don't know" responses for 24% of the questions.

Panel A of Table 2 presents the pairwise comparison results of objective financial knowledge scores by year, and the actual value line in Figure 1 also shows the trend. The objective financial knowledge score decreased in each survey year, though the scores in 2012 and 2015 are not statistically different.

Panel B of Table 2 presents the pairwise comparison results of subjective financial knowledge scores by year. Subjective financial knowledge increased from 2009 to 2015, then it decreased slightly from 2015 to 2018. The actual value line in Figure 2 also shows this trend in subjective financial knowledge by year. The difference between 2012 and 2018 was not statistically significant.

Pairwise comparison results of two financial knowledge overconfidence indices are reported in Panel C and D of Table 2 and also illustrated in Figures 3 and 4. The trend of overconfidence index 1 was not consistent, as shown in Figure 3, but the percent of respondents who were overconfident (index 2) generally increased over the years (Figure 4). The degree of

TABLE 1. Summary Statistics, Financial Knowledge Level by Year, 2009–2018 NFCS

Variables	2009	2012	2015	2018	Total
Objective financial knowledge	3.172	3.029	2.981	2.843	3.007
	(1.390)	(1.437)	(1.452)	(1.479)	(1.445)
Subjective financial knowledge	4.988	5.170	5.259	5.127	5.134
	(1.287)	(1.276)	(1.203)	(1.354)	(1.285)
Overconfidence index 1	−0.028	−0.032	−0.027	−0.028	−0.029
	(1.200)	(1.209)	(1.234)	(1.198)	(1.211)
Overconfidence index 2 (proportion overconfident)	0.138	0.186	0.212	0.207	0.185
	(0.345)	(0.389)	(0.409)	(0.405)	(0.388)
Number of "Don't know" responses to objective questions	1.138	1.202	1.224	1.296	1.214
	(1.324)	(1.363)	(1.366)	(1.434)	(1.373)

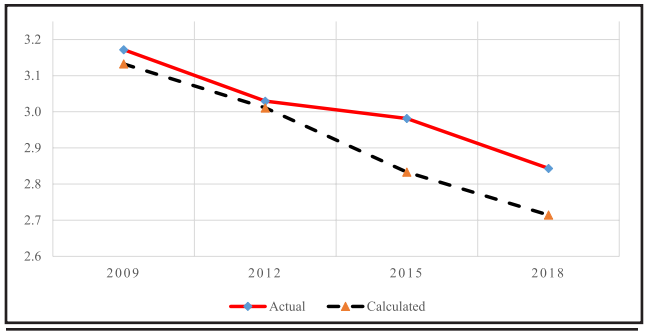
Note. Standard errors in parentheses.

TABLE 2. Summary Statistics, Financial Knowledge Pairwise Comparison by Year, 2009–2018 NFCS

Survey year	Difference	Standard Error	*t*-statistics	*p*-value
Panel A: Objective financial knowledge				
2012 vs. 2009	−0.121	0.034	−3.600	<0.001
2015 vs. 2009	−0.178	0.027	−6.670	<0.001
2018 vs. 2009	−0.296	0.028	−10.660	<0.001
2015 vs. 2012	−0.057	0.040	−1.420	0.155
2018 vs. 2012	−0.175	0.041	−4.270	<0.001
2018 vs. 2015	−0.118	0.036	−3.310	0.001
Panel B: Subjective financial knowledge				
2012 vs. 2009	0.200	0.018	11.000	<0.001
2015 vs. 2009	0.288	0.015	18.920	<0.001
2018 vs. 2009	0.166	0.019	8.620	<0.001
2015 vs. 2012	0.088	0.019	4.570	<0.001
2018 vs. 2012	−0.033	0.023	−1.480	0.140
2018 vs. 2015	−0.122	0.020	−5.970	<0.001
Panel C: Overconfidence index 1				
2012 vs. 2009	−0.007	0.018	−0.380	0.705
2015 vs. 2009	0.002	0.016	0.110	0.916
2018 vs. 2009	−0.003	0.016	−0.190	0.848
2015 vs. 2012	0.009	0.020	0.420	0.674
2018 vs. 2012	0.004	0.021	0.180	0.855
2018 vs. 2015	−0.005	0.019	−0.260	0.797
Panel D: Overconfidence index 2 (proportion overconfident)				
2012 vs. 2009	0.048	0.003	14.070	<0.001
2015 vs. 2009	0.074	0.003	22.050	<0.001
2018 vs. 2009	0.069	0.003	20.440	<0.001
2015 vs. 2012	0.026	0.003	7.480	<0.001
2018 vs. 2012	0.021	0.003	6.000	<0.001
2018 vs. 2015	−0.005	0.003	−1.460	0.143
Panel E: Don't know responses				
2012 vs. 2009	0.044	0.025	1.770	0.077
2015 vs. 2009	0.074	0.020	3.670	<0.001
2018 vs. 2009	0.108	0.021	5.100	<0.001
2015 vs. 2012	0.030	0.029	1.070	0.286
2018 vs. 2012	0.064	0.029	2.190	0.029
2018 vs. 2015	0.033	0.025	1.310	0.189

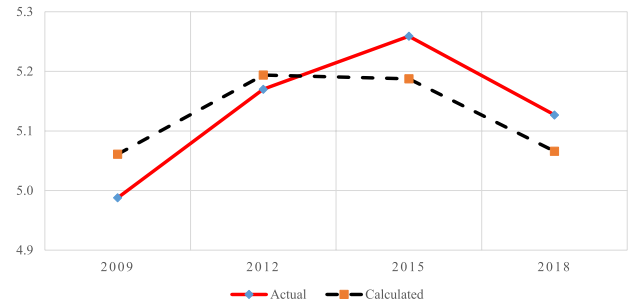
Note. Overconfidence index 1 is a numerical difference between standardized subjective and objective financial knowledge. Overconfidence index 2 is a binary variable constructed based on having higher than median subjective knowledge and lower than or equal to median objective knowledge.

Figure 1. Actual and Calculated Level of Objective Financial Knowledge by Year, 2009–2018 NFCS.



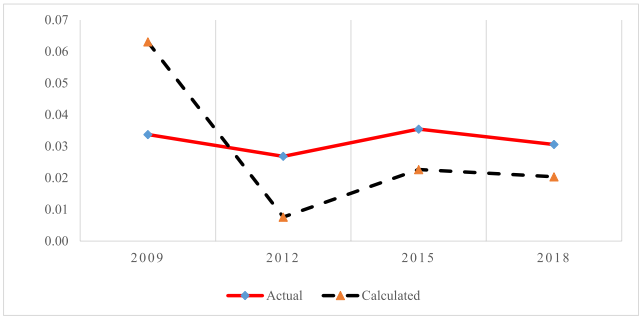
Notes. Calculated level created by authors based on coefficients from Table 3 Column 1, holding all other variables at mean values.

Figure 2. Actual and Calculated Level of Subjective Financial Knowledge by Year, 2009–2018 NFCS.



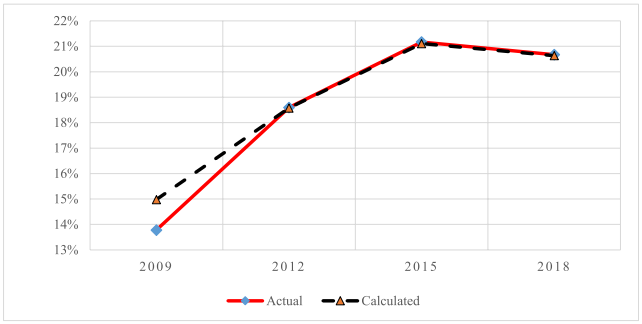
Notes. Calculated level created by authors based on coefficients from Table 3 Column 2, holding all other variables at mean values.

Figure 3. Actual and Calculated Level of Overconfidence in Financial Knowledge (Index 1) by Year, 2009–2018 NFCS.



Notes. Calculated level created by authors based on coefficients from Table 3 Column 3, holding all other variables at mean values.

Figure 4. Actual and Calculated Percent of Respondents' Overconfident in Financial Knowledge (Index 2) by Year, 2009–2018 NFCS.



Notes. Calculated level created by authors based on coefficients from Table 3 Column 4, holding all other variables at mean values.

overconfidence did not change significantly, but the proportion of people who were overconfident increased.

Pairwise comparison results for "Don't know" responses are reported in Panel E of Table 2 and also illustrated in Figure 5. The mean number of "Don't know" responses out of five objective knowledge questions increased from 2009 to 2018, though the changes from 2012 to 2015 and from 2015 to 2018 were not significant.

Regression Results

The results presented above simply compared the average score of financial knowledge indices by year. Therefore, in order to ascertain whether changes were due to changes in respondent characteristics, we conducted regression analyses. Table 3 shows the results of regressions on (1) objective financial knowledge, (2) subjective financial knowledge, (3) overconfidence index 1, (4) overconfidence index 2, and (5) "Don't know" response, respectively.

The objective financial knowledge score continuously decreased over the years as shown in both Column 1 of Table 3 and the calculated value line in Figure 1, even after controlling for other variables. We confirmed that there exists a consistent decreasing trend in objective financial knowledge over the years. On the other hand, as shown in Column 2 of Table 3, the subjective knowledge score was higher in 2012 and 2015 than in 2009. We found no significant difference in the subjective knowledge score between the years 2018 and 2009, controlling for other variables.

TABLE 3. Multivariate Regression on Financial Knowledge Variables, 2009–2018 NFCS

Variables	(1) OLS Objective Knowledge	(2) OLS Subjective Knowledge	(3) OLS Overconfidence Index 1	(4) Logistic Overconfidence Index 2	(5) OLS # of "Don't Know"
Year (Reference: 2009)					
2012	−0.122***	0.133***	−0.056***	0.259***	0.067***
	(0.015)	(0.012)	(0.013)	(0.031)	(0.014)
2015	−0.299***	0.126***	−0.040***	0.418***	0.205***
	(0.015)	(0.012)	(0.013)	(0.029)	(0.014)
2018	−0.418***	0.005	−0.043***	0.389***	0.231***
	(0.014)	(0.014)	(0.013)	(0.030)	(0.014)
Constant	2.071***	3.857***	0.145***	−2.091***	2.159***
	(0.049)	(0.052)	(0.055)	(0.098)	(0.052)
Control variables[a]	Included	Included	Included	Included	Included
State fixed effect (State of residence)	Included	Included	Included	Included	Included
Observations[b]	102,820	103,024	101,222	101,222	104,137
R^2	0.270	0.163	0.080	0.052[c]	0.179

Note. Standard errors in parentheses.

Significance level: $^{***}p < 0.01$.

Weighted analyses by authors. Overconfidence index 1 is a numerical difference between standardized subjective and objective financial knowledge. Overconfidence index 2 indicates overconfidence and is a binary variable constructed based on having higher than median subjective knowledge and lower than or equal to median objective knowledge.

[a]Control variables include age, gender, education, marital status, occupation, racial/ethnic status, number of children, income, and risk tolerance.

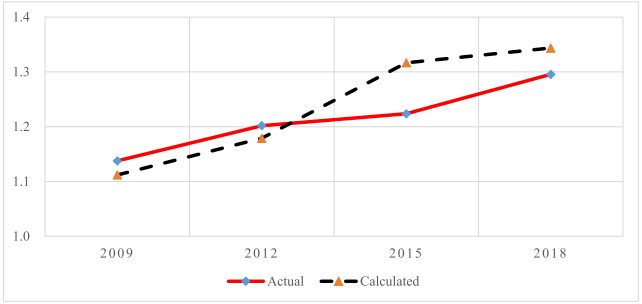
[b]Differences in analytic sample sizes due to number of missing values.

[c]Pseudo R-squared.

The dashed line in Figure 2 presents the calculated value of subjective financial knowledge level by year, holding other variables at mean levels. We found that subjective knowledge scores increased in 2012 and 2015 but dropped to the initial level in 2018.

Column 3 of Table 3 shows that the overconfidence index 1 was lower in 2012, 2015, and 2018 than in 2009, controlling for other variables. As shown in Figure 3, the calculated level of overconfidence index 1 was the highest in the year 2009, followed by 2015, 2018, and 2012. However, overconfidence index 2 (percent who were overconfident) showed a completely different trend, with the percent who were overconfident higher in 2012, 2015, and 2018 than in 2009, even after controlling for the other variables. The calculated value line in Figure 4 also illustrates the consistent pattern.

Figure 5. Actual and Calculated Mean Number of "Don't know" Responses to Five Objective Financial Knowledge Questions by Year, 2009–2018 NFCS.



Notes. Calculated level created by authors based on coefficients from Table 3 Column 5, holding all other variables at mean values.

As previously mentioned, one of the unique features of the NFCS dataset is that individuals are allowed to choose "Don't know" response instead of being forced to arbitrarily choose the answer they are unsure of. Column 5 of Table 3 presents OLS regression analysis results on the number of "Don't know" responses out of five questions. Compared to the year 2009, the number of "Don't know" responses were higher in 2012, 2015, and 2018 than in 2009, even after controlling for other variables.

Discussions, Limitations, and Implications

Discussions

This study explored trends in financial knowledge using the 2009–2018 NFCS datasets with representative samples of U.S. households. We investigated financial knowledge trends in four aspects; objective and subjective financial knowledge, overconfidence, and "Don't know" responses, with appropriate statistical models. The mean objective financial knowledge score decreased consistently since 2009 with the dummy variables for 2012, 2015, and 2018 (Column 1 of Table 3), so H1, which posited the increasing trend of objective financial knowledge, is not accepted. In the regression on subjective financial knowledge (Column 2 of Table 3), the effects for the dummy variable for 2012 and for 2015 were positive and significant, but the variable for 2018 was not significantly different from zero, so Hypothesis H2, which posited the increasing trend of subjective financial knowledge, is only partially supported. In the regression for the degree of overconfidence, Index 1 (Column 3 of Table 3), the dummy variables for 2012, 2015, and 2018 were negative and significant. However, in the regression for overconfidence index 2 (the percent of respondents who were overconfident), the effects for the year dummy variables were positive and significant. Therefore, Hypothesis H3, which posited the increase of overconfidence in financial knowledge, is partially supported. Lastly, in the regression on the number of "Don't know" responses to objective knowledge questions (Column 5 of Table 3), the dummy variables for 2012, 2015, and 2018 were positive and significant, so Hypothesis 4 which posted the decrease of "Don't know" responses, was not accepted.

Major findings from the current study provide important insights for policymakers as well as financial educators. The Financial Literacy and Education Commission (FLEC) under the Department of the Treasury has invested huge efforts nationally to enhance one's financial knowledge through various types of financial education, including state financial education mandates (Financial Literacy and Education Commission, 2016). While a meta-analysis of empirical studies related to financial education found clear evidence that financial education positively affects financial knowledge and behaviors in the short run (Kaiser et al., 2020), the effect on both objective and subjective financial knowledge must be comprehensively understood for the national campaign and education policy to be more successful. The opposite time trends for objective and subjective knowledge raise a concern about the outcome of financial education. There is potential for overconfidence in financial knowledge to cause inappropriate financial decisions (Porto & Xiao, 2016; Robb et al., 2015), and financial education must be cautiously approached and implemented not to give a false illusion of the ability to individuals.

Notably, within the scope of overconfidence, we also observed inconsistent time patterns between the overconfidence measure that captures the degree (index 1), and the overconfidence measure that captures the overall proportion of overconfident respondents (index 2). The degree of overconfidence became lower after 2009, even after controlling for the effects of other characteristics, perhaps indicating people making somewhat more accurate judgments of their own financial knowledge. However, the trend of overconfidence index 2 suggests a general increase in the tendency of over-evaluating one's financial knowledge compared to others. It is imprudent to make precise suggestions with results from this study without observing the change in overconfidence using longitudinal surveys. Nevertheless, the increase in the size of the overconfident population is something policymakers and financial educators should be aware of.

Allowing a "Don't know" option could be problematic when estimating knowledge, due to the difference in the propensity to choose the option (Mondak, 2001), but Carpini and Keeter (1993) suggested it might increase the reliability of a knowledge index by reducing random guesses by respondents. The unique feature of the NFCS dataset is that both "Don't know" and "Refuse to answer" options are available. Thus, it seems unlikely for individuals to choose "Don't know" because they are unwilling to solve the financial knowledge questions when they could easily choose the refuse option. Kim and Mountain (2019)

also noted that simply considering "Don't know" responses to knowledge questions as incorrect answers could be problematic because of non-random choices. Taking advantage of the survey design of the NFCS dataset, we found an increasing trend in the number of "Don't know" responses over the years. It is important that survey respondents are willing to acknowledge their lack of ability to solve certain questions. This might be the reason why overconfidence index 1 has been decreasing over the years. Policymakers or educators could use our findings by developing a constructive way to design tailored education policies or programs to improve financial knowledge, which leads to improving financial well-being.

Limitations

There are limitations of the study that could be addressed by future researchers. One of the major limitations of our study is the inability to estimate the change in financial knowledge or overconfidence level within an individual over the multiple survey years. The study was able to capture overall trends in financial knowledge utilizing a cross-sectional dataset of NFCS. If a longitudinal dataset is used instead, the empirical analyses would be able to provide more profound information of time trends in financial knowledge. To our knowledge, the HRS and RAND American Life Panel (ALP) are the only publicly available U.S. panel datasets that have surveyed financial knowledge questions multiple times over the decade. However, the HRS respondents are mainly age 50 and over, and the ALP survey included financial knowledge questions only in 2012 and 2018, so neither survey would provide a good basis for estimating long-term trends in financial knowledge. Another limitation of our study stems from the fundamental structure of the NFCS dataset, which is based on non-probability quota sampling. While some characteristics could be controlled by quota sampling, it is still subject to potential selection bias (Braga et al., 2019; Malhotra et al., 2017).

Even though we used the Big 5 financial knowledge questions and two indices of overconfidence, there might be some measurement issues. Lusardi and Mitchell (2014) discussed some methodological issues for assessing the effects of financial knowledge, due to possible endogeneity and measurement error. In a similar vein, it is possible that the current knowledge measures may not capture one's "true" financial knowledge. Future researchers need to consider a more comprehensive measure of financial knowledge.

Implications

Based on the 2015 NFCS results, 21% of respondents have had financial education in schools and/or a workplace. Financial knowledge scores are somewhat higher for those with financial education than for those without financial education, so increased efforts to expand access to financial education might result in higher objective financial knowledge scores in the future. The U.S. federal and state governments have invested in financial education program via state-mandated financial education; for example, 45 U.S. states included personal finance in their standard, which is more than double the 21 participating states in 1998 (Council for Economic Education, 2020).

However, given that substantial efforts have been made in the past to provide financial education to students and workers, with decreasing trends in objective financial knowledge, our results provide some potential evidence supporting the pessimistic discussion by Willis (2008). Although financial education programs may cover various areas in one's financial life, the efforts in the past 20 years to promote financial education seemingly have not aligned with the increases in financial knowledge. Thus, a more serious consideration should be given to alternatives to financial education to help improve household finances, including regulation and choice architecture, which may be more effective than financial education (e.g., Thaler & Sunstein, 2009).

Given the longer term trends we have found, with decreasing financial knowledge scores and increasing proportions of "Don't know" responses, financial educators should attempt to measure longer term retention of knowledge, as well as exploring alternative financial education approaches. Multiple exposures to financial education over time might help achieve long-term financial goals as previous studies documented (e.g., Kim & Stebbins, 2021; Wagner & Walstad, 2019). Further, financial advisors should consider simpler and timely advice given evidence that there does not seem to be long term retention of financial education among the general population. Greater reliance on "nudges" and defaults might better improve financial outcomes rather than relying only on financial education.

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Disclosure. The authors have no relevant financial interest or affiliations with any commercial interests related to the subjects discussed within this article.

Acknowledgment. This manuscript has not been published in any form. Also, the material in the manuscript will not infringe upon any statutory copyright. This paper will not be submitted elsewhere while under JFCP review.

Funding. The author(s) received no specific grant or financial support for the research, authorship, and/or publication of this article.