



Financial Knowledge and Consumer Saving Behaviors: Evidence from the USA

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

With the increase in average life expectancy and the reform of pension and social welfare systems, saving has gradually become a preventive measure against risk and an important means of filling the financial gap. Meanwhile, a large and growing literature has examined the determinants of consumer savings. Using data from 2009, 2012, 2015, and 2018 U.S. National Financial Capability Study, this study aims to examine the association between financial knowledge and consumer saving behaviors through an ordered probit regression approach. In addition, this study conducts a comprehensive robustness test by replacing the estimation method and removing outliers with income. The results indicate that there is a positive relationship between financial knowledge and consumer savings. Therefore, policymakers are recommended to formulate policies to promote financial education to raise consumer savings.

Keywords: *Consumer saving behaviors; financial knowledge; financial capability; ordered probit regression.*

1. INTRODUCTION

As the financial sector continues to grow in countries around the world and new products and financial services become more widely available, financial knowledge is playing an increasingly important role in consumers' daily lives. However, the level of financial knowledge is low in most of the countries of the world, and even in developed countries like the United States, the level of financial knowledge is not optimistic [1]. Higher levels of national income do not mean equal levels of financial knowledge, and increasingly complex financial instruments in the market and relatively low levels of financial knowledge exacerbate the risks to consumers and financial markets [2].

Financial literacy surveys in most developed countries indicate that consumers' lack of knowledge about financial products and businesses may prevent them from having good retirement plans and the ability to deal with savings and investments [3]. These problems are most pronounced among specific demographic subgroups, such as the National Economic Council noted gender and minority gaps in financial literacy in a 24-item questionnaire in 2005, with White students and adults, tend to score higher than the Black and Hispanic, and women also typically score lower than men [4]. Also, the least educated are more likely to take out loans against their 401(k) and pension accounts [5]. Low-educated consumers make up a large portion of the unbanked population [6]. Moreover, Lusardi et al. [7] suggested that the least financially savvy will incur higher transaction costs, pay higher fees, and choose the most expensive ways to borrow. Those who are financially illiterate will be overburdened by their inability to judge their debt situation. Only two-thirds of older adults in the U.S. understand compound interest, only half of the respondents can correctly answer questions about compound interest and inflation, and only one-third can adequately answer both questions and one question about risk diversification. This indicates a general lack of financial literacy among older Americans, with one-third of adults in their 50s not having any retirement savings plans [8]. Financial literacy also plays a key role in saving and wealth accumulation [9]. For consumers with widely varying levels of financial knowledge, their saving patterns are different [10].

There are nine main motives regarding reasons for saving, which are Keynes listed eight motives

as follows: precautionary motive, life cycle motive, intertemporal substitution motive, improvement motive, independence motive, corporate motive, pursuit motive, and greed motive, and Lusardi et al. [4] proposed the down payment motive. Motivations to save and accumulate wealth are lower in countries with high social security benefits [11]. Durante et al. [12] suggested that stress usually leads consumers to save money. Besides, household income, attitudes, and expectations towards goods determine consumer spending, saving, and credit at the aggregate level. Besides, general national economic conditions, inflation, unemployment, and savings often affect consumers' willingness to buy, borrow, or save [13]. In many countries, employer-sponsored defined benefit pension plans are gradually being replaced by private defined contribution plans, with employers thus shifting the responsibility for retirement savings and investments to employees [2]. Also, a large body of prior research has explored a number of factors that affect consumer saving behaviors, including stress, financial situation, and the like. However, few empirical studies have examined the impact of financial knowledge on consumers' saving behaviors. As financial knowledge becomes more pervasive in individuals' daily lives, failure to acquire adequate financial knowledge may increase consumers' financial risk thereby further exacerbating wealth inequality. It is necessary to investigate whether financial knowledge facilitates or hinders consumer savings.

The purpose of this study is to examine the role of financial knowledge in consumer saving behaviors, which is informative for both policymakers and consumers. In this study, financial knowledge is measured through the questions of compound interest, inflation, and risk diversification. The rest of this study is structured as follows. Section 2 provides a review of the literature related to financial knowledge and consumer saving behaviors and hypothesizes the role of financial literacy in consumer saving. Section 3 describes the sample data, model specification, variable measurement, and statistical description. Section 4 presents the empirical results. Section 5 provides conclusions and implications.

2. LITERATURE REVIEW

2.1 Financial Knowledge

Financial knowledge is like a global passport that

allows consumers to make sound financial decisions using the excessive financial products available in the financial markets. Currently, financial knowledge should be viewed as equally important as basic literacy, otherwise, individuals and societies will not reach their full potential [2]. Financial knowledge is currently measured primarily by a standard set of questions that are designed with four principles in mind. The first is simplicity and these questions should measure knowledge of basic decision-making blocks over time. The second is relevance and these questions should relate to concepts relevant to everyday financial decisions over individuals' life cycle. The third is streamlining and the number of questions must be small in order to ensure widespread adoption. The fourth is the ability to differentiate, i.e., the questions should distinguish between different financial knowledge in order to allow for interpersonal comparison [14]. The three basic financial literacy questions that are now generally more accepted are as follows: (1) computational ability involving interest rate calculations and interest compounding, (2) understanding of inflation, and (3) understanding of risk diversification, with consumers who score higher on these questions being perceived as having more actual financial knowledge [15]. Knoll and Houts [16] developed a heart-measured 20-item scale that includes interest, inflation, and the time value of money to measure financial knowledge. Moreover, Houts and Knoll [17] constructed an improved financial knowledge scale while proposing a quantitative measure of financial knowledge so that policymakers and program evaluators are able to estimate the impact of interventions on financial behaviors.

Furthermore, a large body of literature now suggests that most consumers are financially illiterate and unable to grasp basic financial concepts. Less than one-third of young people in the U.S. have basic financial knowledge about interest rates, inflation, and risk diversification [18]. The lack of financial literacy among specific subgroups is common: Users of mobile payment apps and technologies are typically high-income, well-educated, full-time males [19]. Also, even in Finland, where there is relative gender equality, women are less likely than men to answer the three basic financial knowledge questions correctly [2]. To be more specific, women also have a lower risk tolerance and are generally more conservative in their investments than men [20]. Many millennials know little about student loans, and many have not even calculated the

payments associated with the loans they take [21]. Less-educated people are more likely to take out loans from their 401(k) and pension accounts [5], while financially literate people are more likely to come up with \$2,000 in 30 days or be able to cover a \$400 emergency expense [22]. In addition, Lusardi et al. [14] claimed that many Americans over age 50 are not financially sophisticated because they do not understand the basic financial knowledge of risk diversification, asset valuation, portfolio selection, and investment fees. They also argued that patterns of the vulnerability of specific demographic subgroups can be considered to exacerbate the situation of low financial knowledge.

As a result, there is a growing emphasis on financial knowledge. Schools, workplaces, and community platforms offer unique opportunities to provide financial education to large and diverse populations. Besides, specific subgroups, such as women and young adults, are ideal targets for financial literacy programs [2]. Lusardi et al. [9] argued that effective financial education programs delivered in the workplace recognize the socioeconomic background of employees and provide interventions tailored to each individual's specific needs. In a study of U.S. employees in 2013, Federal Reserve System showed that financial knowledge education leads to significant changes in retirement planning and better investment portfolios. Financial education in school has three main advantages as follows. First, it allows young people to understand the basic concepts of financial decision-making before making major financial decisions, avoiding excessive student loan debt, and prompting them to start saving for retirement accounts early. Second, schools can provide easy access to financial knowledge education for groups that may not be exposed to it, such as women. Third, it is less expensive to receive financial education in school. Moreover, for many employees who work for companies that do not offer financial education or for older adults who no longer work, offering financial education in the community is the best option. The International Finance Museum, for example, can provide financial knowledge education to both young and old through museum exhibits and resource exchanges [2].

Lusardi et al. [9] pointed out that the profile of optimal financial knowledge throughout the life cycle is hump-shaped. Thus, for a fraction of individuals with low educational attainment, it is

difficult to benefit from greater financial knowledge because reaching higher financial maturity is too costly, and thus not being financially literate is somehow optimal. Fernandes et al. [23] argued that financial education declines over time, and when psychological characteristics are controlled, the marginal effect of financial knowledge declines sharply.

2.2 Consumer Saving Behaviors

Savings are generally considered as the excess of income over consumption. In addition to this, saving is often used as a precautionary measure due to unpredictable future risks and as an important means of filling fiscal gaps [24]. The theoretical underpinning of saving stems from the central principle of the modern view of the intertemporal allocation of money and time, whereby individuals attempt to make the marginal utility of spending constant over time [10]. In other words, a rational and well-informed person will consume less than his or her income in periods of high income, and when income declines (e.g., after retirement), consumption will be supported by savings [14]. Starting with Modigliani and Brumberg [25], and Friedman [26], consumers are assumed to arrange their optimal savings and declining patterns over his or her lifetime to smooth marginal utility when he or she can formulate and execute savings and spending reductions.

The main forms of saving are liquid saving, investment saving, durable goods saving, and debt saving [24]. In Keynes' General Theory, he listed three main motives for saving, namely, the transactional motive (Saving for a large expenditure), the precautionary motive (Saving for emergencies), and the speculative motive (Saving to increase wealth) [27]. Savings can play an important role in retirement planning, future investments, and insurance. First, retirement plans are shifting globally from defined benefit plans to defined contribution plans. Traditional defined benefit and defined contribution employer pension plans, in which employees must participate, are being replaced in part by the tax-deferred account (TDA) retirement plans, such as 401(k) retirement plans, which shift the responsibility for retirement savings and investments from the employer to the employee [28]. Because employer pensions are the primary source of cash income during retirement for most U.S. households [29], a growing number of consumers are concerned

that their retirement savings levels are too low. Thus, it is important to identify the determinants of retirement savings. Second, savings also offer the possibility of diversifying acquisitions without the application of loans because it ensures that a consumer is more financially independent, free from costs such as interest and future management costs associated with loans.

There are some determinants of consumer saving behaviors, such as income, interest rates, financial factors, demographic factors, and psychological, cultural, and social factors. Income is an important determinant of the ability to save, and the higher the level of a consumer income, the higher the marginal propensity to save. The most popular of the alternative hypotheses on the effect of income on the size of savings is the absolute income hypothesis proposed by Keynes in his General Theory [27]. Through examining the relationship between income and consumption and between income and savings, this theory concludes that an increase in income increases both consumption and savings, but that savings account for a higher share of income than consumption [30]. Another hypothesis is the life cycle theory developed by Modigliani and Brumberg [25]. According to this theory, consumers' expenditures are based on their rationally expected future lifetime income and not only on current income. Modigliani and Brumberg [25] argued that younger and older people have a higher propensity to consume, while middle-aged people have a higher propensity to save. Interest rates are also considered to be an important factor among economic factors that affect the level of consumer savings. However, its specific impact on consumer savings is context-dependent. Savings accumulated for special purposes (e.g., education) or precautionary motives, are not sensitive to changes in interest rates. In addition to this, savings are also related to the availability, terms, and costs of credit. Fiscal factors, tax incentives often provided by governments, such as tax-free savings schemes, to promote national savings. Demographic factors, including demographics, are also important determinants of consumer savings because children and the elderly in a country depend on the rest of the population for their livelihoods in addition to the income and savings they are not expected to generate [31]. Individual return experience, a classic example of which is that investors who earn exceptionally high returns from 401(k) savings will increase their 401(k) savings rate [32]. Net financial wealth,

which Attanasio and Rohwedder [33] argued is stronger under its greater liquidity, making it more likely to influence savings than durable goods. The value of durable goods and real estate, which Gale [34] argued also affects consumer saving behaviors because consumers typically need to save money for later purchases. Other factors, such as psychological, cultural, and social factors within a country, can affect the savings rate as well.

2.3 Financial Knowledge and Consumer Saving Behaviors

Previous research has shown that the high level of financial numeracy and cognitive skills possessed by consumers with high levels of financial knowledge motivate individuals to process information, perform business, acquire new knowledge, and search for relevant and available information [30]. All of these characteristics promote consumers' saving behaviors. The importance of financial knowledge is thus self-evident, and Lusardi et al. indicated that as long as individuals who have received financial education early in life (e.g., high school), even those who do not make any subsequent investments and allow their knowledge endowment to depreciate, will still receive a higher return on their savings, which will significantly increase the welfare of society as a whole [19]. In the United States, the long-term decline in the private savings rate cannot be attributed to demographic changes. Modigliani notes that one of the most important motivations for savings is the need to prepare for retirement so that savings can support consumption in old age when income is not available [31]. Retirement plans in the United States have shifted from Defined Benefit plans to Defined Contribution plans that have many attractive features for participants, such as portability and flexibility. However, these advantages require a certain level of financial literacy, such as the three assumptions of rationality contained in the standard economic theory of saving. First, savers aim to maximize their lifetime utility function by accumulating or reducing assets. Second, households have sufficient cognitive ability to solve the necessary optimization problems. Third, households have sufficient willpower to execute this optimal plan. However, the latter two assumptions are dubious because of the uncertainty in future returns, income flows, retirement plans, and health status [35]. Some studies also suggest that the correlation between financial knowledge and consumer saving

behaviors is not very strong, since financial decisions may also be confounded by factors other than financial knowledge such as impulsivity, behavioral biases, unusual preferences, or the external environment. When financial literacy does not independently predict the use of financial products, then education may be less effective than other interventions [36]. Miller et al. [37] showed through a field experiment linking financial education and savings outcomes that training has little effect on actual saving behaviors.

Based on the aforementioned survey of the literature, this paper proposes the following two competing hypotheses. Financially literate consumers are more likely to learn skills, acquire new information, and have the cognitive ability to anticipate the possibility of future risks. Thus, they are more willing to increase savings. Therefore, the hypothesis is proposed as:

H₁: The association between consumer financial knowledge and savings is positive.

Nevertheless, financially educated consumers are more confident and have more access to information in the marketplace to choose other financial products with higher returns. Meanwhile, consumers who are generally more financially literate also have higher incomes, and the more certain they are in anticipation of their future income, the less the individual is driven to have to save. Therefore, this study puts forward the completing hypothesis as follows:

H₂: Financial knowledge negatively contributes to consumer saving behaviors.

3. METHODOLOGY AND DATA DESCRIPTION

3.1 Data

The data set in this study comes from the National Financial Capability Study (NFCS) in 2009, 2012, 2015, and 2018. The survey was initiated by the Financial Industry Regulatory Authority Investor Education Foundation, which was funded by the U.S. Department of the Treasury and the President's Advisory Council on Financial Literacy. In the survey, state-by-state figures are weighted according to state representation in terms of age, gender, race, and education. National figures are weighted for age, race, education, and census sector to represent

Table 1. Variable specification

Variable	Attribute
Saving for emergencies	“Have you set aside emergency or rainy-day funds that would cover your expenses for 3 months, in case of sickness, job loss, economic downturn, or other emergencies?”
Saving for retirement	“Before your [spouse/partner] retired, did you try to figure out how much you needed to save for retirement?”
Financial knowledge (The sum of correct responses to six financial knowledge test questions)	“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?” “Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?” “If interest rates rise, what will typically happen to bond prices?” “Suppose you owe \$1,000 on a loan and the interest rate you are charged is 20% per year compounded annually. If you didn’t pay anything off, at this interest rate, how many years would it take for the amount you owe to double?” “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.” “Buying a single company’s stock usually provides a safer return than a stock mutual fund.”
Age	1=18 to 24, 2 = 25-34, 3=35 to 44, 4=45 to 54, 5=55 to 64, 6=greater than 65
Gender	1=male, 0=female
High school or lower	1=yes, 0=no
Some college to a bachelor’s degree	1=yes, 0=no
Postgraduate degree or higher	1=yes, 0=no
Marital status	1=being married, 0=not married
Children	The number of children financially dependent on their parents.
Annul income	1=<\$15,000, 2=\$15,000-\$25,000, 3=\$25,000-\$35,000, 4=\$35,000-\$50,000, 5=\$50,000-\$75,000, 6=\$75,000-\$100,000, 7=\$10,000-\$150,000, 8=>\$15,0000
Participating in financial markets	“Do you have any investments in stocks, bonds, mutual funds, or other securities?” 0=no, 1=yes

Note: The content is arranged by the authors

the national population. In addition, the survey results are weighted to represent the census distribution. The survey, a national online survey of 25,000 U.S. adults, developed benchmarks of financial capability to assess how these change with underlying demographics, behaviors, attitudes, and financial knowledge characteristics. In addition, the study quantifies consumer financial capability and financial behaviors from a variety of perspectives.

3.2 Model Specification and Variables

The purpose of this study is to investigate the role of financial knowledge in consumer saving behaviors. Based on the aforementioned

hypotheses, the baseline model is specified as follows:

$$savbhv_{it} = \varphi_0 + \alpha_i * fks_{it} + \beta_i * finpart_{it} + \sum_{k=1}^M \delta_{ki} * CV_{k,it} + \varepsilon_{it} \quad (1)$$

In Equation (1), φ_0 is the constant term, the subscript i represents the sampling consumer individual, M stands for the number of demographic characteristic variables, and ε is the random disturbance term.

In detail, *savbhv* is specified as the dependent variable, indicating saving for emergencies and retirement. The variable of saving for emergencies is measured by a 2-point scale according to “Have you set aside emergency or

rainy-day funds that would cover your expenses for 3 months, in case of sickness, job loss, economic downturn, or other emergencies?" Responses range from 0 to 1, where a score of 1 indicated yes and otherwise 0. Moreover, the variable of saving for retirement is measured by a 2-point scale according to "Before your [spouse/partner] retired, did you try to figure out how much you needed to save for retirement?". Specifically, the variable is coded as 1 if the respondent answers yes and otherwise 0.

Independent variables consist of financial knowledge, participation in the financial markets, and other control variables. *fks* stands for financial knowledge, which is measured by the sum of correct responses to six financial knowledge questions related to the interest rate, the relationship between savings and interest rate, mortgage, and stock. The questions are detailed in Table 1. The more questions respondents answer correctly, the higher their score for financial knowledge. *finpart* indicates whether the respondents have participated in the financial market, such as investments in stocks, bonds, mutual funds, or other securities.

CV_{ki} denotes the control variable k of demographic characteristics. The control variables include six categorical variables for ages (Six categories as 18-24, 25-34, 35-44, 45-54, 55-64, and 65+), three categorical variables for education (Three categories as high school or lower, some college to bachelor's and the postgraduate degree or higher), marital status (1 stands for married, 0 otherwise), gender (1

represents male, 0 otherwise), number of financially dependent children, and annual income (Ranging from 1 to 8).

3.3 Estimation Method

In the case of the survey data, the variable of saving for emergencies is not continuous (Ranging from 0-no to 1-yes). Therefore, the traditional Ordinary Least Squares (OLS) is difficult to produce accurate estimates. In this study, the method of the probit regression is conducted, which is positive to alleviate the estimation bias caused by inadequate regression approaches.

3.4 Statistical Description

Table 2 shows the results of the descriptive statistics. For the dependent variable, the average value of the variable specific to saving for emergencies is 0.437 on the 2-point scale, which implies that nearly half of the consumers prefer to set aside emergency or rainy-day funds. The mean value of the variable specific to saving for retirement is 0.323, which implies that fewer consumers in the sample try to figure out how much they needed to save for retirement. The mean score of financial knowledge is 3.134, suggesting a relatively poor level of financial literacy measured by six questions in this study. The mean value of participation in the financial markets is 0.340, which indicates a relatively low degree of participation in stocks, bonds, mutual funds, and other securities.

Table2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Saving for emergencies	108,310	0.437	0.496	0	1
Saving for retirement	108,310	0.323	0.468	0	1
Financial knowledge	108,310	3.134	1.565	0	6
Gender	108,310	0.451	0.498	0	1
Age 18 to 24	108,310	0.108	0.311	0	1
Age 25 to 34	108,310	0.175	0.380	0	1
Age 35 to 44	108,310	0.174	0.379	0	1
Age 45 to 54	108,310	0.192	0.394	0	1
Age 55 to 64	108,310	0.176	0.381	0	1
Age 65 or older	108,310	0.175	0.380	0	1
High school or lower	108,310	0.594	0.491	0	1
Some college to Bachelor's degree	108,310	0.226	0.418	0	1
Post graduate degree or higher	108,310	0.113	0.316	0	1
Marital status	108,310	0.551	0.497	0	1
Children	108,310	0.708	1.080	0	4
Annual income	108,310	4.348	2.072	1	8
Participating in the financial markets	108,310	0.340	0.474	0	1

The results of descriptive statistics also show that 45.1% of sampling consumers are male. In terms of age, the largest share of consumers is between 45 and 54 years old (19.2%), followed by consumers aged 55 to 64 (17.6%). While consumers aged 25-34 (17.5%), aged 35-44, (17.4%), and aged 65 or older (17.5%) indicate nearly closer share, those whose age lies in the span of 18 to 24 account for a small share (10.8%). In terms of educational attainment, sampling consumers who attended a high school or lower account for 59.4%, while 22.6% have some college to bachelor's degree as well as 11.3% acquire a postgraduate degree or higher. Regarding marital status, 55.1% of the sampling consumers are married. The mean value of annual income is 4.348 and ranges from \$35,000 to \$50,000. Furthermore, the average value of the number of financially dependent children is 0.708, indicating that the households of sampling consumers bear fewer children who need financial support.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Results of Correlation Analysis

Table 3 reports the correlations among the variables of saving for emergencies, saving for retirement, financial knowledge, annual income as well as participating in financial markets. Most of the correlations are as expected. The correlation coefficient between financial knowledge and saving for emergencies at a significance of 1% is 0.2558, indicating that there is a positive relationship between financial knowledge and saving for emergencies. Moreover, the coefficient between financial knowledge and saving for retirement is 0.1962, implying a slightly weaker positive nexus between financial knowledge and saving for retirement. Besides, the associations between

the variable of annual income, and the variable of saving for emergencies, as well as saving for retirement are all statistically positive. Also, the nexus between consumer financial knowledge and participation in the financial market is positive at a significance of 1%. Additionally, the results show that consumers who participate in the financial market are more likely to save for emergencies.

4.2 Financial Knowledge and Saving for Emergencies

Table 4 presents the regression results of financial knowledge on saving for emergencies and saving for retirement. In Columns (1) to (4), only the control variables are entered. In Columns (5) to (6), financial knowledge is added. Columns (1) and (2) show the results of OLS regression. In Columns (3) to (6), the probit regression is performed to produce more accurate estimates.

In Column (1), most of the control variables are statistically significant. Thus, the positive coefficient for gender suggests that, on average, male consumers are more likely to save for emergencies than the female. The coefficients for the various age groups are all negative. The lowest coefficient is found for the 25-34 age group, while the largest coefficient is found for the 55-65 age group. The nonlinear associations between age and consumer saving behaviors is aligned with Chen et al. [38]. These results indicate that the younger the people are less likely to save for emergencies while the elder, especially those over 55, are more willing to save for emergencies. The reasons for these results could be that the younger consumers have a more positive mindset and rarely worry about the future. In terms of education, the coefficient for the postgraduate degree or higher education and college to bachelor's degree are proved to be

Table 3. The results of correlations

Variables	Saving for emergencies	Saving for retirement	Financial knowledge	Annual income
Saving for retirement	0.180***			
Financial knowledge	0.256***	0.196***		
Annual income	0.357***	0.295***	0.351***	
Participating in financial markets	0.406***	0.225***	0.304***	0.397***

Notes: The sample size is 108,310. Besides, ***, ** and * denote statistical significance at 1%, 5%, and 10% levels, respectively

Table 4. The results of regressions of financial knowledge on saving for emergencies

Variables	(1) Saving for emergencies	(2) Saving for retirement	(3) Saving for emergencies	(4) Saving for retirement	(5) Saving for emergencies	(6) Saving for retirement
Financial knowledge					0.071 ^{***} (0.003)	0.095 ^{***} (0.003)
Male	0.030 ^{***} (0.003)	0.032 ^{***} (0.003)	0.096 ^{***} (0.008)	0.101 ^{***} (0.009)	0.058 ^{***} (0.009)	0.051 ^{***} (0.009)
Age 25 to 34	-0.108 ^{***} (0.004)	0.198 ^{***} (0.004)	-0.339 ^{***} (0.013)	0.679 ^{***} (0.014)	-0.314 ^{***} (0.014)	0.720 ^{***} (0.014)
Age 35 to 44	-0.141 ^{***} (0.004)	0.203 ^{***} (0.004)	-0.448 ^{***} (0.014)	0.685 ^{***} (0.014)	-0.441 ^{***} (0.014)	0.702 ^{***} (0.015)
Age 45 to 54	-0.146 ^{***} (0.004)	0.225 ^{***} (0.004)	-0.465 ^{***} (0.013)	0.746 ^{***} (0.013)	-0.469 ^{***} (0.013)	0.748 ^{***} (0.013)
Age 55 to 64	-0.061 ^{***} (0.004)	0.164 ^{***} (0.004)	-0.198 ^{***} (0.013)	0.570 ^{***} (0.013)	-0.211 ^{***} (0.013)	0.559 ^{***} (0.014)
Some college to Bachelor's degree	0.048 ^{***} (0.003)	-0.004 ^{***} (0.003)	0.153 ^{***} (0.010)	-0.008 ^{***} (0.010)	0.151 ^{***} (0.010)	-0.009 ^{***} (0.010)
Post graduate degree or higher	0.106 ^{***} (0.004)	0.039 ^{***} (0.004)	0.328 ^{***} (0.014)	0.117 ^{***} (0.013)	0.297 ^{***} (0.014)	0.076 ^{***} (0.013)
Being married	0.026 ^{***} (0.003)	-0.041 ^{***} (0.003)	0.084 ^{***} (0.010)	-0.121 ^{***} (0.010)	0.078 ^{***} (0.010)	-0.129 ^{***} (0.010)
Children	-0.038 ^{***} (0.001)	0.021 ^{***} (0.001)	-0.124 ^{***} (0.005)	0.059 ^{***} (0.004)	-0.118 ^{***} (0.005)	0.066 ^{***} (0.004)
Annual income	0.059 ^{***} (0.001)	0.049 ^{***} (0.001)	0.182 ^{***} (0.003)	0.153 ^{***} (0.003)	0.170 ^{***} (0.003)	0.137 ^{***} (0.003)
Participating in the financial markets	0.303 ^{***} (0.003)	0.150 ^{***} (0.003)	0.842 ^{***} (0.009)	0.438 ^{***} (0.010)	0.808 ^{***} (0.009)	0.393 ^{***} (0.010)
Constant	0.143 ^{***} (0.011)	-0.066 ^{***} (0.011)	-1.074 ^{***} (0.033)	-1.729 ^{***} (0.034)	-1.228 ^{***} (0.034)	-1.948 ^{***} (0.035)
State fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	108310	108310	108,310	108,310	108,310	108,310
Adjusted R ²	0.244	0.149				
Pseudo R ²			0.195	0.127	0.198	0.134

Notes: Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01

positive. In addition, the coefficient for postgraduate education or higher is greater than that for the college to bachelor's degree. Meanwhile, the positive coefficient on the specific variable of marital status suggests that married consumers are more likely to save for emergencies, while the number of children negatively contributes to retirement savings. Additionally, consumers who participate in the financial markets or consumers with more annual income are more likely to save for emergencies, indicated by the positive coefficients presented in Table 4.

In Column (2), most of the coefficients for the control variables are significantly different from Column (1). Firstly, the positive coefficient for gender indicates that male consumers are still more likely to save for retirement than the female. Nevertheless, the coefficients of different age

groups are all positive. The largest coefficient is for the 45-54 age group, followed by the 35-44 age group, and the fourth-highest coefficients are for the 25-34 age group and the 55-64 age group. The results suggest that the 45-54 age group is more likely to save for retirement. Regarding education, since the coefficient for the postgraduate degree or higher is positive, while the coefficient for college to bachelor's degree proves to be negative. Meanwhile, the negative coefficient on the specific variable of marital status suggests that married consumers are less likely to save for retirement while both the number of children and annual income have a positive impact on retirement savings, which is consistent with Chen et al. [39]. Additionally, consumers who participate in the financial markets are also more likely to save for retirement indicated by the positive coefficient shown in Table 4.

Table 5. Results of robustness check

Variables	(1)	(2)	(3)	(4)
Financial knowledge	0.120 ^{***} (0.005)	0.162 ^{***} (0.005)	0.009 ^{**} (0.004)	0.061 ^{***} (0.004)
Male	0.096 ^{***} (0.015)	0.084 ^{***} (0.015)	-0.013 (0.012)	-0.006 (0.010)
Age 25 to 34	-0.531 ^{***} (0.023)	1.295 ^{***} (0.025)	-0.579 ^{**} (0.019)	0.862 ^{**} (0.017)
Age 35 to 44	-0.745 ^{***} (0.024)	1.257 ^{***} (0.025)	-0.671 ^{***} (0.020)	0.892 ^{**} (0.018)
Age 45 to 54	-0.791 ^{***} (0.022)	1.327 ^{***} (0.024)	-0.647 ^{***} (0.018)	0.954 ^{**} (0.016)
Age 55 to 64	-0.355 ^{***} (0.021)	1.005 ^{***} (0.024)	-0.308 ^{**} (0.017)	0.660 ^{***} (0.016)
Some college to Bachelor's degree	0.257 ^{**} (0.017)	-0.010 (0.018)	0.105 [*] (0.014)	-0.091 ^{***} (0.012)
Post graduate degree or higher	0.500 ^{**} (0.023)	0.127 ^{***} (0.022)	0.182 ^{***} (0.019)	-0.067 ^{***} (0.016)
Being married	0.131 ^{**} (0.016)	-0.206 ^{**} (0.017)	0.069 ^{**} (0.013)	-0.180 ^{***} (0.012)
Children	-0.202 ^{***} (0.008)	0.103 ^{***} (0.007)	-0.211 ^{***} (0.007)	0.066 ^{***} (0.005)
Annual income	0.286 ^{**} (0.004)	0.233 ^{**} (0.004)	-0.030 ^{**} (0.005)	0.018 ^{**} (0.004)
Participating in the financial markets	1.327 ^{**} (0.016)	0.659 ^{**} (0.016)	0.437 ^{**} (0.013)	0.019 (0.012)
Constant	-2.047 ^{***} (0.057)	-3.360 ^{***} (0.059)	-2.558 ^{***} (0.050)	-2.707 ^{***} (0.042)
State fixed effect	Yes	Yes	Yes	Yes
Observations	108,310	108,310	88,330	88,330
Pseudo R ²	0.198	0.136	0.534	0.284

Notes: Standard errors in parentheses. ^{*} $p < 0.10$, ^{**} $p < 0.05$, ^{***} $p < 0.01$. In Columns (1) to (4), logit regression is utilized and no coefficient about the constant item is reported. Outliers (i.e., less than \$15,000 or more than \$150,000) in the annual income variable are excluded for better estimates in Columns (3) to (4)

In Columns (5) and (6), consumers with financial knowledge are more likely to save for emergencies and retirement, as the coefficients on financial knowledge are all statistically positive at a significance of 1%. The results suggest that the more financially literate consumers are, the more likely they are to save for emergencies and retirement. One possible explanation is that consumers with higher levels of financial knowledge have higher disposable income and thus these consumers can afford to save a portion of their life savings. In addition, they are more likely to learn skills and acquire new information than less financially literate consumers, thus giving more financially literate consumers a wider range of savings products to choose from, so these consumers will save more to protect themselves against future risks. The results provide strong evidence for H_1 .

4.3 Robustness Check

To test the robustness of the estimates, this study firstly replaces the estimation method of OLS regression and probit regression with logistic regression. Second, to reduce the effect of income outliers, this study drops the samples with annual incomes below \$15,000 or above \$150,000. The results of the robustness checks are presented in Table 5.

In Columns (1) to (2), the coefficients of financial knowledge are still significantly positive. More specifically, the positive coefficient of financial knowledge for saving for emergencies is larger than that of saving for retirement. In Columns (3) to (4), the results of the association between financial knowledge and saving for emergencies as well as retirement are not significantly different from those in the logistic regression, after removing the outliers in terms of income. According to the results of the robustness check, the results are still hypothesized in H_1 .

5. CONCLUSIONS AND IMPLICATIONS

This study first compares savings theory and the impact of relevant financial developments on savings and finds that the impact of financial knowledge on consumer saving behaviors in previous studies is uncertain. In addition, previous studies have not discussed the impact of its consumers' financial knowledge level on saving behaviors for the United States. Although the U.S. is a country with a developed financial sector, the savings level is not optimistic, since the reform of its pension and social welfare

system has further increased the importance of savings. The purpose of this study is to examine how financial knowledge affects consumers' saving behaviors based on data from 2009, 2012, 2015, and 2018 U.S. NFCS. In this study, probit regression is used to eliminate estimation bias. Moreover, alternative estimation methods and the removal of income outliers are also employed to verify the robustness.

The results indicate that financial knowledge positively contributes to consumers' savings for emergencies and retirement. The more financially literate consumers are, the more likely they are to save for emergencies and retirement. The reason for this result may be that consumers with higher levels of financial knowledge are more likely to learn skills, acquire new information, anticipate the possibility of future risks, and thus save more. Also, higher levels of financial knowledge offer them the ability to allocate a wider variety of financial savings products. The results of this study are intended to address the current mismatch between the level of financial knowledge and consumer saving behaviors in the United States and imply that consumers and policymakers are suggested to focus on financial education to promote higher consumer savings.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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