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Financial Literacy Overconfidence and Consumer Financial Satisfaction: Evidence from the 2018 US National Financial Capability Study

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Authors' contributions

This work was carried out in collaboration among all authors. Authors FC and YW designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors YW and DY managed the analyses of the study. Author FC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

An increasingly prevalent topic on the associations between financial literacy and consumer financial satisfaction has been highlighted in recent years. Utilizing the data from the 2018 US National Financial Capability Study, this study conducts ordered probit regressions to examine the effects of financial literacy on consumer financial satisfaction. To verify the robustness, this study performs a comprehensive check through replacing estimation methods, removing outliers by income, and performing regressions by various consumer cohorts. The results indicate that objective financial literacy has a significantly negative effect on consumer financial satisfaction, while subjective financial literacy has played a crucial role in improving consumer financial satisfaction. Thus, consumers are overconfident in their financial literacy. The results imply that policymakers should formulate policies to cultivate rational investment concepts and raise consumers' risk awareness, as well as financial institutions should provide services of financial capability assessment to correct consumers' self-perception bias.

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Keywords: Financial satisfaction; financial literacy; financial literacy overconfidence; ordered probit regression.

1. INTRODUCTION

Finance is an important life domain in modern society. Many researchers have examined factors that contribute to life domain satisfactions, including workplace satisfaction, job satisfaction, and financial satisfaction [1]. Like other domains of satisfaction, financial satisfaction, serving as an important mediating factor between income and consumer subjective wellbeing, contributes to life satisfaction [2]. According to the definition of the Consumer Financial Protection Bureau (CFPB), consumer financial satisfaction is designated as a framework for defining and measuring financial wellbeing and is defined as a desirable state that enables consumers to face current and future financial affairs and feel satisfied in their financial future with a high quality of life [3]. It has been documented that financial satisfaction has an impact on factors as diverse as job productivity, consumer choice, and marital stress [4]. Some researchers even consider financial satisfaction as an indicator of overall welfare or wellbeing [5]. Previous studies on financial satisfaction have focused on the potential effects of relative incomes [6], different income measures [7], age difference [8], household characteristics [9], and financial risk tolerance [10]. Unlike previous research, this study focuses on the potential role of financial literacy in affecting consumer financial satisfaction and further explores whether consumers are overconfident in financial literacy.

In recent decades, financial literacy has been increasingly highlighted in the fields of consumer finance. Lusardi and Mitchell [11] proposed the theoretical and empirical evidence to address the importance of financial literacy. According to the standard economic theory, consumers are fully informed and may make rational choices in long-term financial management. However, the reality is that it is difficult for consumers to collect relevant financial information. For instance, after describing a number of rationales for consumer financial regulation, Campbell et al. [12] indicated that consumers are not fully informed and thereby are difficult to make rational financial decisions. Besides, the hypothesis is contradicted by the findings of prevailing financial illiteracy across countries. The low level of financial literacy has been documented by many researchers in the US and other developed countries [13]. There is also evidence from emerging countries. Liao et al. [14] found that financial illiteracy in Chinese households is both prevailing and severe at the national level. Results from India suggest that students, despite having high levels of numeracy, are unable to transfer that knowledge to do financial computations and achieve high financial satisfaction [15]. Hence, it is of great significance to investigate the relationship between financial literacy and consumer financial satisfaction. Financial literacy has been defined as the level of financial knowledge and the ability to use the knowledge to improve the financial status, and it can be measured both objectively and subjectively [16,17]. The subjective financial literacy is usually measured by consumer self-assessments in light of their financial knowledge. The objective financial literacy is usually measured by knowledge quiz with questions regarding the financial life domains. The two types of financial literacy may have differential effects on financial behavior and financial capability, which will directly contribute to financial satisfaction.

Previous studies have examined the possible effects of financial literacy on asset allocation, financial market participation, and household wealth. Unlike prior research, this study focuses on the associations between financial literacy and consumer financial satisfaction. To be more specific, financial literacy is measured from the objective and subjective perspective. Also, this study contributes to the literature on whether consumers overconfidently evaluate their financial literacy. To help fill the gap, this study investigates the associations between financial literacy and consumer financial satisfaction using the dataset of the 2018 US National Financial Capability Study. The remainder of this paper is organized as follows. In section 2, prior studies on financial literacy and consumer financial satisfaction are reviewed, and research hypotheses are proposed as well. In section 3, the methodology is presented, and the data source, variables as well as descriptive statistics of this study are displayed. Section 4 discusses the empirical results. Section 5 concludes and proposes out policy implications.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1 Previous Research on Financial Satisfaction

Previous studies have examined the effects of income, financial circumstances, and financial capability. Based on a sample of American consumers, Grable et al. [18] suggested that perceived income adequacy is positively associated with financial satisfaction. A study conducted in Norwegian engaging older consumers indicates that financial circumstances, such as levels of assets and debts, have played substantial roles in improving consumer financial satisfaction [19]. Using the data from the US, Shim et al. [20] showed that self-actualizing personal values, formal financial education at school, and financial education at home may play important anticipatory socialization roles in the ways that young adults acquire knowledge in financial domains, which was related to their financial wellbeing. Xiao et al. [21] examined the associations between financial capability and consumer financial satisfaction and revealed that desirable financial behaviors improve consumer financial satisfaction, while risky financial behaviors have negative effects. Moreover, the results also indicate that positive associations between objective financial literacy and financial satisfaction have been found in the bivariate analysis but not in multivariate analysis. Utilizing programs targeting different groups, such as expectant parents, employees, young people, and hard-to-reach groups, Taylor et al. [22] explored how levels of financial capability may relate to and affect financial satisfaction.

Furthermore, prior studies have also investigated the roles of other factors in consumer financial satisfaction. A study conducted in a transitional economy, Albania, reveals that workers in informal sectors are less financially satisfied than their counterparts in formal sectors [23]. Besides, Kalantarie et al. [24] claimed that age and education are positively associated with financial literacy and financial wellbeing. Moreover, they also argued that married people and males are more financially literate than the counterpart, and thereby higher financial literacy produces greater financial wellbeing. Unlike prior research, this study aims to examine the potential associations between financial literacy and consumer financial satisfaction, which helps fill the gap in the literature on consumer financial satisfaction.

2.2 Financial Literacy and Consumer Financial Satisfaction

An explicit assumption among prior studies is that financial literacy has effects on financial capability, financial behavior as well as economic decisions, all of which in turn have vital roles in improving consumer financial satisfaction [25]. Also, financial literacy is considered to have direct and positive effects on consumer financial satisfaction [26]. In terms of extant literature, financial literacy is designated to affect consumer financial satisfaction through the following aspects, such as perceived financial behaviors, financial market participation, asset diversifications, and financial outcomes. Previous research provides evidence that households with high financial literacy enable themselves to perform better in making sound financial decisions and retirement planning [27]. Besides, consumers with high financial literacy are more likely to have desirable financial behaviors in credit card usage, paying bills on time, saving out of each paycheck, and dealing with debts [28]. Bernheim and Garrett [29] suggested that financially literate consumers are more inclined to save more for the future. On the contrary, the lack of financial literacy has proved to negatively affect consumers' participation in the stock market and thereby causing investors to lose opportunities to make full use of financial markets to allocate personal or household assets, which may incur the decline of financial wellbeing in the long-term [30].

Notwithstanding, previous research has not, to the best of knowledge, provided consistent conclusions on how financial literacy affects the diversification of asset allocation. Meanwhile, it is also difficult to draw a consistent conclusion on the impact of financial literacy on consumer financial satisfaction. In terms of the micro survey data, Chu et al. [16] examined the potential impact of financial literacy on household portfolio choices between the stock and mutual fund. The results indicate that household groups with a high level of financial literacy are more likely to diversify their portfolios and achieve higher returns, which implies that high financial literacy is positively associated with financial satisfaction. However, Korniotis and Kumar [31] argued that smart investors possess more related information and tend to hold concentrated portfolios with only a handful of stocks. As a result, a lower return on investment is often accompanied by a higher risk, which reduces investors' financial satisfaction. Moreover, prior studies also show that investors with higher financial literacy tend to have more confidence in their information judgments, which incurs excessive trading of risky assets and thereby decreasing the diversification of portfolios [32]. The results reveal that financial literacy may decrease investors' financial satisfaction due to concentrating portfolios and risks. On the contrary, Gaudecker [33] revealed that almost all households with high scores in financial literacy achieve considerable investment outcomes, and thereby improving their financial satisfaction. Behrman et al. [34] also found positive evidence that financial literacy has played an even more prominent role in wealth accumulation than school education. According to the discussion of the above studies, financial literacy may not only promote consumer financial satisfaction but also have a negative impact. To adequately investigate the effects of financial literacy on consumer financial satisfaction, this study divides financial literacy into objective and subjective ones. In detail, the objective financial literacy is usually measured by knowledge quiz with questions regarding the financial life domains and the subjective financial literacy is often measured by consumer self-assessments in light of their financial knowledge. Based on the previous studies, this study proposes two competing hypotheses as follows:

H_{1a} Given economic resources and other control variables, consumers with higher objective financial literacy are more likely to feel financially satisfied.

H_{1b} Given economic resources and other control variables, higher objective financial literacy contributes negatively to consumer financial satisfaction.

H_{1a} is justified because the objective financial literacy can contribute positively to perceived financial behaviors such as financial management, paying bills on time, retirement planning, and thereby promoting consumer financial satisfaction. Also, the objective financial literacy may eliminate undesirable financial behaviors, such as poor financial decisions in equity investment, default on debt, and credit impairing, which have played a crucial role in improving consumer financial dissatisfaction. Financial market returns may be other possible ways to affect consumer financial satisfaction. Cocco et al. [35] suggested that the welfare loss caused by residents' non-participation in the stock market accounts for 2% of their annual wealth. H_{1b} is supported since consumers with higher objective financial literacy are more likely to invest in only a handful of stocks or risky assets, which may produce uncertain financial outcomes and contribute negatively to their financial satisfaction.

2.3 Consumer Overconfidence in Financial Literacy

Financial literacy overconfidence is measured by the difference between an individual's subjective and objective financial literacy. Xia et al. [17] applied the dummy variable to measure financial literacy overconfidence, where 1 indicates that respondents consider their financial knowledge is at an average level or above but the objective financial literacy is below the average level. In this study, the consumer overconfidence in financial literacy is measured by comparing the effects of subjective and objective financial literacy on consumer financial satisfaction.

Although the effects of financial literacy on consumer financial satisfaction has yet reached a consistent conclusion, the negative impact of financial literacy overconfidence on consumer financial satisfaction has been proved by previous research. For instance, Barber and Odean [36] showed that investors tend to overestimate their levels of financial knowledge, and the accuracy of the information they are searching for. The result also suggests a tendency of overconfidence in asset allocation ability, which causes excessive trading of single risk assets and thereby decreases the diversification of investment portfolios. Chu et al. [16] explored how investors allocate their financial resources between the stock and mutual fund and indicated that financial literacy has a significant positive effect on the diversification of investment portfolios, while overconfidence in financial literacy may weaken the positive effect and causes an increase of investing risks. Therefore, if there is a difference between the subjective and objective financial literacy, consumers' overconfidence in financial literacy would prove to exist. Thus, following the discussions of Chu et al. [16] and Xia et al. [17], this study puts forward following two competing hypotheses as follows:

H_{2a} Given economic resources and other control variables, if the effect of subjective financial literacy on consumer financial satisfaction is statistically positive, while that of objective financial literacy is statistically negative, consumers are overconfident in financial literacy.

H_{2b} Given economic resources and other control variables, if the effect of subjective financial literacy on consumer financial satisfaction is statistically negative, while that of objective financial literacy is statistically positive, consumers are under-confident in financial literacy.

3. METHODOLOGY

3.1 Empirical Strategy

This study aims to investigate the associations between financial literacy and consumer financial satisfaction. To initially verify the level of correlation, this study conducts a series of bivariate analyses between financial literacy and consumer financial satisfaction. Moreover, ordered probit regressions are performed in which consumer financial satisfaction works as the dependent variable, and financial literacy-related variables and control variables are independent variables. In terms of the hypotheses discussed above, this study specifies the baseline empirical estimation as follows:

$$fin\_sat_i = \alpha_0 + \sum_{k=1}^{N} \beta_k \times fin\_lit_{k,i} + \sum_{l=1}^{M} \gamma_l \times cv_{l,i} + \varepsilon_i \quad (1)$$

In equation (1), *fin_lit* refers to the related variables of financial literacy, such as objective financial literacy, and subjective financial literacy. Also, *fin_sat* stands for consumers' subjective evaluation of their financial wellbeing, and *cv* indicates the control variable, primarily incorporating demographic characteristics and financial circumstance-related variables. Besides, *i* is the respondent individual, α_0 is the constant term, β_k and γ_l are the coefficients of financial literacy-related variables and control variables, and ε_i is the random error term. More specifically, *N* and *M* are the numbers of financial literacy-related variables and control variables.

3.2 Data and Variables

The 2018 National Financial Capability Study (NFCS) is conducted by the US FINRA Investor Education Foundation. The State-by-State Survey was conducted online from June through October 2018 among a nationally-representative sample of 27091 American Adults, reaching approximately 500 respondents per state, plus the District of Columbia, with oversamples of 1250 in Washington and Oregon. The NFCS is designed to measure perceptions, attitudes, experiences, and behaviors on a wide variety of themes. The largest component of the NFCS, the State-by-State Survey, is conducted across a large and diverse sample so that it can provide a comprehensive analysis of the financial capability of the national population as a whole. To provide more insights on investing decisions, separate follow-up surveys of investors are also conducted as a part of the NFCS.

The dependent variable in this study is consumer financial satisfaction, measured by a 10-point scale according to the question "Overall, thinking of your assets, debts, and savings, how satisfied are you with your current personal financial condition?" Responses range from 1 to 10, where 10-point means extremely financially satisfied while 1-point means dissatisfied at all, as well as 0-point stands for no answer. Independent variables include subjective financial literacy, objective financial literacy, and control variables. Consumers' subjective financial literacy is measured by a 7-point scale according to the question "On a scale from 1 to 7, where 1 means very low and 7 means very high, how you would assess your overall financial knowledge?" Another set of variables are used to measure consumers' objective financial literacy. In the 2018 NFCS, 6 related questions including compound interest rates (two questions included), inflation, bond prices, mortgages, and risk diversification are applied to measure consumers' objective financial literacy. If the respondent provides a correct answer, the variable is encoded 1 and 0 otherwise. An index of objective financial literacy is created by counting the number of correct answers of the 6 related questions concerning consumers' objective financial literacy, and the value of this variable ranges from 0 to 6.

Following the practices of previous studies on consumer financial satisfaction [18,23,37,38], several demographic and socioeconomic variables are incorporated as control variables. These are gender (1 stands for male and 0 otherwise), age (six categories as 18–24, 25–34, 35-44, 45-54, 55-64, and 65 or elder), whether being married (1 represents married and 0 otherwise), the number of financially depended children, education background (three categories: high school graduate or lower, some college to bachelor's degree, postgraduate degree or higher), whether working, family income [eight categories, ranging from 1 (less than $15,000) to

8 ($150,000 or more)]. Besides, variables related to financial circumstances are also included in the control variables: the credit record rating, the risk attitude, whether participating in the financial markets, and the desirable financial behaviors. The credit record rating is measured by a 5-point scale in terms of the question “How would you rate your current credit record?” Responses range from 1 (very bad) to 5 (very good) as well as 0 (no answer). The risk attitude is measured by a 10-point scale in light of the question “When thinking of your financial investments, how are you willing to take risks?”, and responses range from 1 (not at all willing) to 10 (very willing) as well as 0 (no answer). Regarding consumers whether participating in the financial markets, 1 stands for performing the activity and 0 otherwise. Also, consumers’ desirable financial behaviors are measured by 6 questions including whether consumers can cover expenditure with income, whether to have the capability of paying debt, whether to have a stable income, whether to have the savings for an emergency, whether to have saving for child educating, and whether to save for retirement. If the respondent provides a correct answer, the variable is encoded 1 and 0 otherwise. An index of the desirable financial behaviors is also created by counting the correct answers and the value of this variable ranges from 0 to 6.

3.3 Descriptive Statistics

Table 1 presents the results of the descriptive statistics. The average score of consumer financial satisfaction is 5.608 on the 10-point scale, which implies a relatively high degree of subjective evaluation of consumer financial satisfaction. The objective financial literacy measured by 6-point scales, of which the average score is 3.116, while the subjective financial literacy measured by 7-point scales, of which the average score is 4.986. Regarding the control variables related to financial circumstances, the mean value of the credit record rating measured by 5-point scales is 3.715. The mean value of the risk attitude, which is measured by 10-point scales, is 4. 764. Moreover, the mean value of the desirable financial behaviors measured by 6-point scales is 3.112. Also, 33% of the sampling respondents have participated in the financial markets.

The results of descriptive statistics also show that 44.1% of the sampling respondents are male. Besides, 27.7% educate a high school or lower, while 59.2% have some college to bachelor’s degree, as well as 13.1% acquire a postgraduate degree or higher. In terms of consumers’ marital status, 53.4% are married. The average value of annual income is 4.479,

Table 1. Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
Consumer financial satisfaction	27091	5.608	2.955	0	10
Objective financial literacy	27091	3.116	1.687	0	6
Subjective financial literacy	27091	4.986	1.576	0	7
Gender	27091	0.441	0.497	0	1
Age 18 to 24	27091	0.103	0.304	0	1
Age 25 to 34	27091	0.173	0.378	0	1
Age 35 to 44	27091	0.167	0.373	0	1
Age 45 to 54	27091	0.172	0.378	0	1
Age 55 to 64	27091	0.181	0.385	0	1
Age 65 or older	27091	0.203	0.403	0	1
High school or lower	27091	0.277	0.448	0	1
Some college to Bachelor’s degree	27091	0.592	0.492	0	1
Postgraduate degree or higher	27091	0.131	0.337	0	1
Being married	27091	0.534	0.499	0	1
Number of financially depended children	27091	0.664	1.059	0	4
Risk attitude	27091	4.764	2.764	0	10
Participating in the financial markets	27091	0.330	0.470	0	1
Desirable financial behaviors	27091	3.112	1.416	0	6
Credit record rating	27091	3.715	1.494	0	5
Annual income	27091	4.479	2.073	1	8

Source: The results of descriptive statistics are from the dataset of the 2018 NFCS which lies in the span of $35,000 to $50,000. Furthermore, in terms of consumers' age distribution, 10.3 % aged 18–24, 17.3% aged 25-34, 16.7% aged 35-44, 17.2% aged 45-54, 18.1% aged 55-65, and 20.3% aged 65 or older.

According to the descriptive statistics, results suggest that consumers' objective financial literacy is at an intermediate level, while their subjective financial literacy is slightly higher. The difference between subjective financial literacy and objective financial literacy makes it possible for consumers to be overconfident in their financial affairs. Consumers' low scores on risk attitudes indicate that they are more likely to conservatively invest and diversify their portfolios.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Results of Bivariate Analyses

Table 2 presents the results of correlations between consumer financial satisfaction and financial literacy-related variables, as well as the variables related to financial circumstances. The results indicate that both objective financial literacy and subjective financial literacy are positively associated with consumer life satisfaction, and the correlation coefficients are 0.212 and 0.437 at a significance of 1%, respectively. To be more specific, the correlation coefficient of subjective financial literacy is greater than that of objective financial literacy, which implies that consumers' subjective assessments are more likely to affect their financial wellbeing. Besides, the variables specific to financial circumstances are all positive and significant to consumer financial satisfaction as well. Accordingly, the variables of the desirable financial behaviors and the credit record rating are highly correlated to consumer financial satisfaction, and the coefficients are 0.560 and 0.470 at a significance of 1%, respectively.

4.2 Financial Literacy and Consumer Financial Satisfaction

Since financial literacy contributes to consumer financial satisfaction both objectively and subjectively, this study aims to examine the effects of subjective and objective financial literacy on consumer financial satisfaction. Table 3 displays the results of regressions of financial literacy on consumer financial satisfaction. In Column (1), only the control variables are added. In Column (2), the variable of objective financial literacy is entered. Besides, in Columns (1) and (2), the method of Ordinary Least Squares (OLS) regression is performed. To produce more accurate estimates, in Columns (3) to (5), ordered probit regression is utilized, as well as robust standard errors are also calculated. Furthermore, to remove the impact of the U.S. state heterogeneity, the dummy variables of all of the U.S. states are controlled in all of the estimates.

In Column (1), most of the control variables are significant at a significance of 1%. More specifically, the coefficient of gender is statistically positive. Compared with female consumers, male consumers feel higher financial satisfaction. As far as the age of consumers is concerned, the results show a U-shaped pattern, which means that the financial satisfaction of consumers will decline first and then increase with age. Also, the transitional group of age that tendency of consumers' subjective assessments of financial satisfaction changes from reduction to augment is 45-54. Moreover, the coefficient of the variable specific to consumers aged 65 years or older has even changed from negative to positive. It implies that older consumers are more likely to be conservative and have less ambition, which makes them easier to be financially satisfied. Regarding marital status, consumers that are married are more likely to feel financially satisfied. In terms of education, consumer financial satisfaction tends to decline compared to those who have only received high school or lower education. Simultaneously, the result shows that the number of financially depended children is significantly negative to consumer financial satisfaction. Since these households are more likely to have a higher financial burden, which decreases consumer financial satisfaction. Besides, consumers with higher annual income feel more financially satisfied, since the related coefficient is positive at a significance of 1%.

Although the estimation methods are various in Columns (2) and (3), the coefficients of objective financial literacy are all statistically negative at a significance of 1%. The results imply that consumers with higher objective financial literacy are more likely to feel financially dissatisfied, which is as hypothesized in H_{1b}. Nevertheless, the result of the bivariate analysis shows that objective financial literacy is significantly positive to consumer financial satisfaction. The two results seem to be contradictory. However, it is

Table 2. Correlations between financial education and consumer financial satisfaction

Variables	Consumer financial satisfaction	Objective financial literacy	Subjective financial literacy	Risk attitude	Participating in the financial markets	Desirable financial behaviors
Objective financial literacy	0.212***					
Subjective financial literacy	0.437***	0.319***				
Risk attitude	0.374***	0.185***	0.316***			
Participating in the financial markets	0.377***	0.315***	0.280***	0.327***		
Desirable financial behaviors	0.560***	0.333***	0.392***	0.308***	0.400***	
Credit record rating	0.470***	0.341***	0.369***	0.196***	0.333***	0.483***

*Notes: Sample size = 27091. Besides, ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively*

Table 3. Results of regressions of financial literacy on consumer financial satisfaction

Variables	(1)	(2)	(3)	(4)	(5)
Objective financial literacy		-0.160***	-0.074***		-0.094***
		(0.009)	(0.005)		(0.005)
Subjective financial literacy				0.152***	0.165***
				(0.006)	(0.006)
Constant	0.757***	0.893***			
	(0.120)	(0.120)			
Gender	0.122***	0.193***	0.081***	0.034***	0.077***
	(0.028)	(0.029)	(0.014)	(0.013)	(0.014)
Age 25 to 34	-0.338***	-0.364***	-0.140***	-0.140***	-0.155***
	(0.058)	(0.058)	(0.027)	(0.027)	(0.027)
Age 35 to 44	-0.639***	-0.620***	-0.273***	-0.303***	-0.295***
	(0.059)	(0.059)	(0.027)	(0.028)	(0.028)
Age 45 to 54	-0.755***	-0.684***	-0.303***	-0.372***	-0.336***
	(0.058)	(0.058)	(0.027)	(0.027)	(0.027)
Age 55 to 64	-0.196***	-0.098*	-0.031	-0.136***	-0.083***
	(0.058)	(0.058)	(0.027)	(0.027)	(0.027)
Age 65 or older	0.578***	0.702***	0.343***	0.195***	0.263***
	(0.058)	(0.059)	(0.028)	(0.028)	(0.028)
Some college to Bachelor’s degree	-0.411***	-0.314***	-0.146***	-0.215***	-0.162***
	(0.034)	(0.034)	(0.016)	(0.016)	(0.016)
Postgraduate degree or higher	-0.450***	-0.304***	-0.139***	-0.225***	-0.142***
	(0.047)	(0.047)	(0.023)	(0.022)	(0.023)
Being married	0.173***	0.180***	0.065***	0.061***	0.066***
	(0.032)	(0.032)	(0.015)	(0.015)	(0.015)
Number of financially depended children	-0.102***	-0.108***	-0.040***	-0.043***	-0.047***
	(0.015)	(0.015)	(0.007)	(0.007)	(0.007)
Risk attitude	0.227***	0.231***	0.115***	0.097***	0.099***
	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)
Participating in the financial markets	0.401***	0.458***	0.228***	0.184***	0.218***
	(0.033)	(0.033)	(0.016)	(0.016)	(0.016)
Desirable financial behaviors	0.719***	0.737***	0.320***	0.284***	0.295***
	(0.013)	(0.013)	(0.006)	(0.006)	(0.006)
Credit record rating	0.346***	0.362***	0.159***	0.128***	0.136***
	(0.013)	(0.013)	(0.006)	(0.006)	(0.006)
Annual income	0.117***	0.129***	0.055***	0.047***	0.054***
	(0.010)	(0.009)	(0.005)	(0.005)	(0.005)
State fixed	Yes	Yes	Yes	Yes	Yes
Observations	27091	27091	27091	27091	27091
Adjusted R^2	0.447	0.452			
Pseudo R^2			0.121	0.128	0.131

Notes: Reference categories are a high school or lower, and age 18 to 24. In addition, ***, ** and * represent 1%, 5%, and 10% significance level, respectively, and the data in parentheses is the robust standard error

not the case. Prior studies provide evidence that smart investors possess more related information and tend to hold concentrated portfolios with only a handful of stocks [30,31]. However, these investors may be not smart enough but overconfident and thereby bearing higher losses due to higher investment risks. In this study, the results indicate that objective financial literacy is statistically negative to consumer financial satisfaction, which implies that consumers with higher levels of financial knowledge are less financially satisfied. Simultaneously, the results also suggest a positive relationship between subjective financial literacy and consumer financial satisfaction. Hence, the reason may be that consumers are too confident to perform a good asset portfolio, and thereby suffering higher losses due to undiversified risks. Therefore, consumers with higher objective financial literacy are more likely to invest in only a handful of stocks or risky assets, which may produce uncertain financial outcomes and contribute negatively to their financial satisfaction.

Table 4. Results of robustness check

Variables	(1)	(2)	(3)	(4)	(5)
Objective financial literacy	-0.196***	-0.170***	-0.104***	-0.139***	-0.079***
	(0.009)	(0.008)	(0.005)	(0.012)	(0.005)
Subjective financial literacy	0.311***	0.328***	0.182***	0.201***	0.167***
	(0.012)	(0.011)	(0.007)	(0.018)	(0.007)
Constant	0.139				
	(0.123)				
Gender	0.181***	0.129***	0.085***	0.158***	0.050***
	(0.028)	(0.023)	(0.015)	(0.037)	(0.015)
Age 25 to 34	-0.390***	-0.272***	-0.131***	-0.010	-0.215***
	(0.057)	(0.046)	(0.031)	(0.056)	(0.032)
Age 35 to 44	-0.649***	-0.537***	-0.284***	-0.240***	-0.329***
	(0.059)	(0.047)	(0.032)	(0.061)	(0.033)
Age 45 to 54	-0.731***	-0.606***	-0.322***	-0.350***	-0.342***
	(0.057)	(0.046)	(0.031)	(0.062)	(0.032)
Age 55 to 64	-0.193***	-0.148***	-0.054*	-0.023	-0.101***
	(0.057)	(0.046)	(0.031)	(0.062)	(0.032)
Age 65 or older	0.540***	0.493***	0.301***	0.243***	0.254***
	(0.059)	(0.048)	(0.032)	(0.071)	(0.033)
Some college to Bachelor's degree	-0.339***	-0.271***	-0.158***	-0.097*	-0.169***
	(0.033)	(0.027)	(0.018)	(0.051)	(0.018)
Postgraduate degree or higher	-0.304***	-0.261***	-0.139***	-0.227***	-0.121***
	(0.046)	(0.038)	(0.025)	(0.065)	(0.025)
Being married	0.181***	0.120***	0.052***	-0.016	0.083***
	(0.031)	(0.026)	(0.016)	(0.039)	(0.017)
Number of financially depended children	-0.120***	-0.091***	-0.039***	-0.054***	-0.054***
	(0.015)	(0.012)	(0.008)	(0.018)	(0.008)
Risk attitude	0.195***	0.171***	0.096***	0.128***	0.087***
	(0.007)	(0.006)	(0.004)	(0.009)	(0.004)
Participating in the financial markets	0.430***	0.363***	0.221***	0.309***	0.180***
	(0.032)	(0.026)	(0.017)	(0.041)	(0.017)
Desirable financial behaviors	0.676***	0.518***	0.299***	0.294***	0.300***
	(0.013)	(0.011)	(0.007)	(0.016)	(0.007)
Credit record rating	0.311***	0.261***	0.155***	0.151***	0.135***
	(0.013)	(0.011)	(0.007)	(0.015)	(0.007)
Annual income	0.126***	0.102***	0.063***	0.061***	0.055***
	(0.009)	(0.008)	(0.006)	(0.011)	(0.005)
State fixed	Yes	Yes	Yes	Yes	Yes
Observations	27091	27091	22209	4175	21917
Adjusted R^2	0.473				
Pseudo R^2		0.140	0.128	0.166	0.126

*Notes: Reference categories are a high school or lower, and age 18 to 24. Also, ***, **, and * represent 1%, 5%, and 10% significance level, respectively, and the data in parentheses is the robust standard error*

4.3 Are Consumers Overconfident in Financial Literacy?

To further explore the mixed effects of financial literacy, this study incorporates subjective financial literacy in Column (4), and the results show that subjective financial literacy has a positive role in improving consumer financial satisfaction at a significance level of 1%. Hence, the results indicate that subjective financial literacy positively contributes to consumer financial satisfaction. In Column (5), both subjective financial literacy and objective financial literacy are entered as independent variables. The results show that objective financial literacy still has a negative effect on consumer financial satisfaction at the significance level of 1%, while subjective financial literacy has a positive one. Thus, the results are consistent with H_{2a}. The results show that the absolute value of the coefficient of the subjective financial literacy is greater than that of objective financial literacy, indicating that the same unit change of these two variables, the total effect of the financial literacy will be positive.

Together with the results in Column (3), consumers are indeed overconfident in financial literacy since the results suggest that objective financial literacy negatively contributes to consumer financial satisfaction, while subjective financial literacy has played a vital role in enhancing consumer financial satisfaction. The potential explanation is those undesirable financial behaviors, aggressive investment attitudes, and concentrated asset allocation caused by overconfidence, tend to produce bad financial outcomes, which in turn decreases consumer financial satisfaction. Moreover, overconfidence in financial literacy tends to bring higher expectations for returns. In this case, even if consumers obtain positive financial outcomes, financial satisfaction may still decline due to the anticipation gap.

4.4 Robustness Check

To examine the robustness of the estimates, this study conducts a series of additional regressions, which are shown in Table 4. First, this study replaces the estimation method with OLS and ordered logistic regression. Second, this study drops the samples whose income is less than $15,000 or more than $150,000 to eliminate the disturbance from outliers by income. Third, this study also checks the estimation robustness between the cohorts of consumers whether they have previously received financial education. Furthermore, state heterogeneity is still controlled, as well as robust standard errors are calculated in all of the estimates.

In Columns (1) and (2), the estimation approach of ordered probit regression is replaced by the methods of OLS and ordered logistic regression. The results show that the coefficients for both objective financial literacy and subjective financial literacy remain unchanged. More specifically, objective financial literacy is still statistically negative to consumer financial satisfaction, while the coefficients of subjective financial literacy indicate an unchanged association with consumer financial satisfaction. In Column (3), after dropping outliers by income, the result is still unchanged. In Column (4), consumers who have previously received financial education are included as samples, while in Column (5), the observations only include the number of consumers who have not received financial education before. The coefficients of objective financial literacy and subjective financial literacy remain statistically negative and positive, respectively. According to the results of the robustness check, there are various effects of financial literacy on consumer financial satisfaction, namely objective financial literacy is significantly negative to consumer financial satisfaction, while subjective financial literacy significantly and positively contributes to consumer financial satisfaction. Thus, consumers are overconfident in financial literacy, which is consistent with H_{1b} and H_{2a}.

5. CONCLUSIONS AND IMPLICATIONS

Previous research on financial literacy usually focuses on its potential effects on financial behaviors and potential financial outcomes. However, fewer studies are conducted on its effects on consumer financial satisfaction. The purpose of this study is to investigate the associations between financial literacy and consumer financial satisfaction. Utilizing the data from the 2018 US NFCS, ordered probit regression is employed to examine the effects of financial literacy on consumer financial satisfaction. To produce more accurate results, robust standard errors are also calculated in all of the estimates. To verify the robustness, a comprehensive check, incorporating replacing estimation methods, removing outliers by income, and performing regressions by various consumer cohorts, has been conducted in this study.

In terms of the empirical results, the effects of objective financial literacy and subjective financial literacy on consumer financial satisfaction are various, that is, objective financial literacy has a significantly negative effect on consumer financial satisfaction, while subjective financial literacy has played a crucial role in improving consumer financial satisfaction. Thus, the results suggest that consumers are overconfident in their financial literacy, which is as hypothesized in H_{2a}. The results show that consumers with higher financial literacy may also have a greater chance of suffering financial dissatisfaction if they are overconfident. The results apply to other developed countries because financial products are increasingly flooding into consumers' daily lives, and more and more governments in developed economies have begun to pay attention to consumer financial education issues. Meanwhile, this study is also of great significance to developing economies, which is positive to their governments to design financial education-related programs, thereby helping to form more sound financial markets. Previous research on financial literacy usually focuses on its potential effects on financial behaviors and financial outcomes. However, fewer studies are conducted to examine the effects of financial literacy on consumer financial satisfaction. This study has helped fill the literature gap.

According to the conclusions, measures can be taken from a strategic perspective to improve the financial literacy of American consumers, revise assessments of their financial literacy, and eliminate their overconfidence in financial literacy, and thereby improving their financial satisfaction. First, policymakers should formulate policies to cultivate rational investment concepts and raise consumers' risk awareness. Consumers' financial literacy can affect their investment behaviors, which in turn affects their financial satisfaction. As household investment needs are increasing, the importance of financial education is not only to improve consumers' financial knowledge but also to help them establish a rational investment philosophy. Meanwhile, with the improvement of consumers' financial literacy, it enables further them to optimize asset allocation and strengthen risk prevention awareness. Second, financial institutions should provide services of financial capability assessment to correct consumers' self-perception bias. The results reveal that if consumers have a bias in self-cognition and overconfidence in their investment ability, they will overestimate their financial knowledge and the accuracy of the information they are searching for, which finally causes poor financial outcomes. Therefore, when financial institutions design investor education programs for consumers, they should also increase the appropriate evaluation of their financial literacy.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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