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Financial Literacy Overconfidence and Stock Market Participation

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Abstract Stock market participation is considered as an indicator of consumer financial well-being. This study examined the association between financial literacy overconfidence and stock market participation. Financial literacy overconfidence was measured by the difference between an individual's subjective and objective financial literacy scores. Data from the 2012 Chinese Survey of Consumer Finance was analyzed. The results showed that financial literacy overconfidence is positively correlated with stock market participation. On the other hand, under-confidence is negatively correlated to stock market participation. This study contributes to the existing literature by relating a unique factor, financial literacy overconfidence, to stock market participation.

Keywords Stock market participation · Subjective financial literacy · Objective financial literacy · Overconfidence

1 Introduction

The stock market plays an important role in the financial lives of many individuals. Seeing stocks as a form of investment, many households use it as a means to generate their asset based income. From a theoretical point of view, the stock market provides a channel for

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families to effectively allocate their assets across multiple periods. Therefore, even households with relatively low risk tolerance should participate, to some degree, in the stock market (Campbell 2006). Effective stock investments should, in theory, enhance consumer financial well-being in the long term.

In reality, many families do not participate in the stock market. According to a 2011 Chinese survey on urban household family finance and consumption, the average stock market participation of Chinese households is 17.5 % (Wang and Liao 2013). The low rate of stock market participation can also be observed in developed nations. According to the Survey of Consumer Finance, the rate of stock market participation in the United States in 2010 was only 15 % (Bricker et al. 2012). In Europe, Guiso et al. (2003) reported that the household stockholding rate was only 23 %.

The stock market "participation puzzle" was first investigated by Haliassos and Bertaut (1995). Since then, a number of factors have been identified that contribute to stock market participation. These include IQ (Grinblatt et al. 2011), financial literacy (Van Rooij et al. 2011), political preference (Kaustia and Torstila 2011), awareness (Guiso and Jappelli 2005), education (Christiansen et al. 2008) and social interactions (Hong et al. 2004).

This paper explores an additional factor, financial literacy overconfidence, that may affect stock market participation. We believe that optimistic biases can affect economic behavior, in particular-participation in stock market. Camerer and Lovallo (1999) found that overconfident individuals are more likely to participate in risky activities. Based on this, we propose that overconfident individuals are more likely to participate in the stock market. Our results show that overconfidence is positively correlated to stock market participation. Also, individuals who are under-confident about their financial literacy are less likely to participate.

The remainder of the paper proceeds as follows. Section 2 gives a brief literature review on overconfidence and its effects on economic behavior. Section 3 presents the data and variables featured in this study. Sections 4 analyzes the relationship between overconfidence and stock market participation. Finally, Sect. 5 concludes.

2 Literature Review

According to the psychological literature, overconfidence can be defined as the "overestimation of one's actual ability, performance, level of control, or chance of success" (Moore and Healy 2008). In other words, an overconfident individual is more optimistic about positive outcomes resulting from their actions. Numerous studies have shown that most people tend to be overconfident (Weinstein 1998; Taylor and Brown 1988). Svenson (1981) showed that most drivers regard themselves as more skillful and less risky than the average driver.

In the finance literature, overconfidence has been linked to various risky behaviors. It was identified that overconfident individuals are more likely to enter into competitive markets and games (Camerer and Lovallo 1999). More specifically, Malmendier and Tate (2005) identified a positive relationship between CEO overconfidence and risky investment decisions. In another paper, the same authors looked at the role of overconfidence in mergers and acquisitions. Overconfident CEOs may overestimate the value creating potential of merger opportunities. Furthermore, overconfidence may lead to a higher reservation price for the target firm. Thus, the subsequent mergers will negatively impact shareholder wealth (Malmendier and Tate 2008).

Within the subject of stock markets, overconfidence has been linked to trading volume (Statmen et al. 2006) and turnover (Barber and Odean 2001). Grinblatt and Keloharju (2009) found that a unit increase in overconfidence is accompanied by a four percent increase in stock market trades. Along with the previous result, the authors also investigated the performance of overconfident traders. They found that overconfident investors exhibit negative portfolio performance which rules out any effects arising from superior information.

A common method of measuring overconfidence, employed in the psychological literature, involves comparing measures of subjective confidence with objective performance (Brenner et al. 2005; Larrick et al. 2007). This method of measurement has also been used in finance literature to measure overconfidence (Biais et al. 2005). Glaser and Weber (2007) estimated overconfidence in stockbrokers by asking them to state upper and lower bounds of ninety percent confidence intervals to general knowledge questions.

There are several other methods used to measure overconfidence in finance literature. Barber and Odean (2001) hypothesized that males are more overconfident than females. Using gender as a proxy for overconfidence, they found that males trade more than females. Grinblatt and Keloharju (2009) employed a psychological profile to measure the cross-sectional variation in overconfidence across investors.

By exploring how overconfidence motivates stock market participation, this study linked overconfidence to stock market participation. Unlike previous studies which look at the individual personality aspects of overconfidence, this study examined the potential effect of financial literacy overconfidence, which we believe is a more specific form of overconfidence. We expect that financial literacy overconfidence is positively associated with stock market participation.

3 Methods

3.1 Data Set

In 2012, The China Center for Financial Research conducted a nationwide online household consumption and finance survey. The researchers divided China into seven geological regions and selected cities from each of these regions. In total, 24 cities across China were selected to be included in the survey. The number of sampled households from each region was based on the proportion of households in that region compared to the total population of the country. Once the sample size of each region was decided, the final sample was determined by a randomized selection process. At the end, 3,122 valid samples were obtained.

3.2 Variables and Descriptive Statistics

The dependent variable of this study is stock market participation (a dummy variable). Stock market participation was obtained by directly asking respondents whether or not they participated in the stock market. Stock market participation (*stock_p*) equals one if the respondent participated in the stock market and equals zero if no participation.

Similar to Xiao et al. (2013), we measured subjective financial literacy by asking the respondents the following question on stocks, mutual funds and bonds: "How do you rate you or your family's understanding of the following financial investment types?"

The respondents would rate their understanding of each financial instrument on a scale of 1–5, where one represents "not familiar" and five represents "very familiar". The values from all three questions were then added together to produce the index of subjective financial literacy (*subjective FL*), which has a theoretical range of 3–15.

By examining various financial literacy surveys both in China and other countries, we identified and compiled the six most representative questions that measure objective financial literacy. These questions were then modified according to the Chinese financial environment. The objective financial literacy score (*objective FL*) was derived by adding together the scores from all six questions, and has a theoretical range of 0–6. Table 1 shows the translations of the original Chinese questions used to measure objective financial literacy.

Once both subjective and objective scores are obtained, the degree of financial literacy overconfidence was measured by the difference between the consumers' subjective and objective financial literacy scores. Figure 1 shows the distribution of subjective and objective financial literacy scores. The area of each circle is proportional to the number of subjects with that value. In our sample, the mean for subjective and objective scores are 9.467 and 3.093 respectively. Using the two values as cutoff points, we constructed a graph with four regions (Fig. 2) where each region represents a different type of observation.

In Region I, respondents have relatively higher subjective and objective financial literacy scores. In Region III, both subjective and objective scores are lower than the mean. These two regions represent rational respondents who correctly estimate their actual financial literacy levels. We are interested in respondents that are in Regions II and IV. In Region II, respondents' objective scores are lower than average ($objective\ FL < 3.093$), however, subjectively they believe themselves to possess an above average literacy ($subjective\ FL > 9.467$). We define respondents that fall in this region to be overconfident about their financial literacy. Conversely, respondents in Region IV have higher objective scores but lower subjective scores. We consider them being under-confident about their financial literacy.

It is important to point out that an additional test of overconfidence is incorporated into the research questions. All six financial questions in the objective knowledge test include an option, "I don't know". Then, there are two ways for respondents to answer the question incorrectly. The first is by selecting an incorrect answer and the second is by selecting "I don't know". By selecting "I don't know" respondents are signaling that they indeed do not know the correct answer. However, if a respondent is confident about the correct answer (hence not selecting "I don't know"), but subsequently gets the question wrong, then he/she is classified as overconfident. We test for this type of overconfidence by identifying subjects who did not select "I don't know" and at the same time answered the question incorrectly. We call this type of observation an "overconfidence-answer" (*overconfidence2*). Table 2 summarizes the variables included in the regression.

Table 3 presents descriptive statistics of the study. The descriptive analyses showed that 40.6 % of the sample population participated in the stock market. The participation rate was higher than that of a similar survey conducted by the center in 2011. The variation in data was within our expectation since the survey was conducted online, and is subject to certain sample bias such as age and education, which is related to stock market participation (Christiansen et al. 2008). However, there is currently no evidence suggesting a relationship between internet usage and overconfidence. Also, the main focus of this study is to find evidence supporting the relationship between overconfidence and stock market participation, not a description of the Chinese stock market participation rate. Furthermore, age and education are added as control variables in our regression—this control will, to some degree, reduce the effect of sample bias. Therefore, the differences in stock market

Table 1 Questions used to objectively measure the financial literacy

Questions	Answers
1. Which of the following banks is responsible for managing the financial system?	(a) Bank of China
	(b) Industrial and Commercial Bank of China
	(c) The People's Bank of China
	(d) China Construction Bank
	(e) I don't know
2. If the deposit reserve ratio of commercial banks is reduced, then the supply of money in the economy will	(a) Decrease
	(b) Increase
	(c) I don't know
3. Can diversified investment reduce risk?	(a) Yes
	(b) No
	(c) I don't know
4. If you hold the shares of a company, then:	(a) Whether it's long or short-term holding, you are lending money to the company
	(b) Whether it's long or short-term holding, you are a shareholder of the company
	(c) When it's long-term holding, you are a share holder of the company; when it's short-term holding, then you are lending money to the company
	(d) I don't know
5. If interest rates fall, the price of the bond will:	(a) Rise
	(b) Fall
	(c) I don't know
6. Assuming a foreign exchange quote is displayed as 6.3215–6.3220 yuan/dollar, which dollar figure do you think refers to the buying rate?	(a) 6.3215
	(b) 6.3220
	(c) I don't know

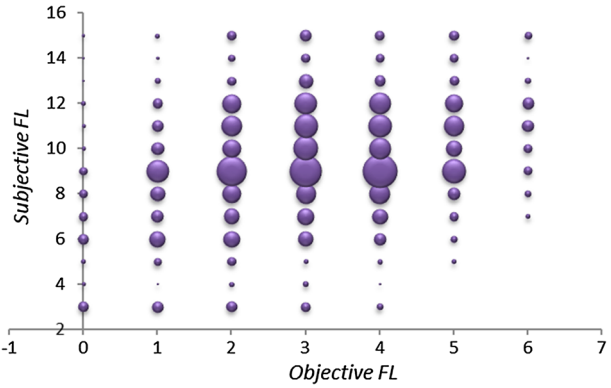

Fig. 1 Distribution of subjective and objective financial literacy scores

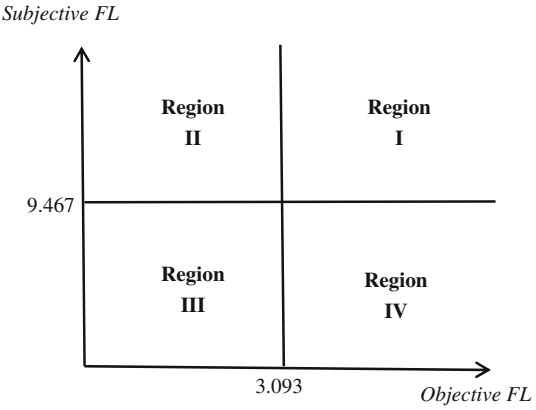

Fig. 2 Consumer types in terms of subjective and objective financial literacy

participation rates between the two surveys will not severely affect our study. Using the method previously described (Fig. 2), 23.9 % of the respondents are overconfident (Region II) and 19 % are under-confident (Region IV). Additionally, the average incorrect question answered is 2.9, of which around 2.1 were overconfidence answers (Table 3).

4 Financial Literacy Overconfidence and Stock Market Participation

4.1 Cross Table Analysis

Table 4 presents the relationship between the two financial literacy scores and stock market participation. The results show that as subjective financial literacy scores increase, there is a gradual increase in stock market participation. Similarly, as the objective financial literacy score increases, stock market participation also strictly increases. This positive relationship between financial literacy and stock market participation is in line with findings by Van Rooij et al. (2011).

To examine the effect of financial literacy overconfidence on stock market participation, we calculated the stock market participation rate of all four regions identified in Fig. 2. This result is shown in Fig. 3. As we can see the stock market participation rate of Regions

Table 2 Variables and definition

Variable	Variable description
Stock_p	Participation in the stock market, 1 indicating yes and 0 indicating no
Objective FL	The objective financial score (range 3–15)
Subjective FL	The subjective financial score (range 0–6)
Overconfidence	Respondents with *objective FL* < 3.093 and *subjective FL* > 9.467, then *overconfidence* = 1, otherwise = 0
Under-confidence	Respondents with *objective FL* > 3.093 and *subjective FL* < 9.467, then *under-confidence* = 1, otherwise = 0
Overconfidence2	Respondents who did not select "I don't know" and answered the question incorrectly (overconfidence answers)
Age	Age
Marriage	Marital status, 1 means married, and 0 otherwise
Sex	Gender, 1 for male, 0 for female
Children	Number of children
<High school	Education below high school = 1, otherwise = 0
High school diploma	High school diploma = 1, otherwise = 0
College diploma	College diploma = 1, otherwise = 0
Graduate school	Master's degree = 1, otherwise = 0
Risk_aversion	Risk aversion (range 1–5)
Health	Health of family individuals (range 1–4)
ln(income)	Natural logarithm of monthly income
ln(wealth)	Natural logarithm of total assets

Table 3 Descriptive statistics (N = 3,122)

Variable	Mean	SD	Min	Max
Stock_p	0.406	0.491	0.000	1.000
Objective FL	3.093	1.417	0.000	6.000
Subjective FL	9.467	2.436	3.000	15.000
Overconfidence	0.239	0.427	0.000	1.000
Under-confidence	0.190	0.392	0.000	1.000
Overconfidence2	2.064	1.226	0.000	6.000
Age	34.242	7.631	25.000	78.000
Marriage	0.840	0.367	0.000	1.000
Sex	0.710	0.451	0.000	1.000
Children	0.495	0.610	0.000	5.000
<High school	0.015	0.122	0.000	1.000
High school diploma	0.108	0.310	0.000	1.000
College diploma	0.760	0.427	0.000	1.000
Graduate school	0.117	0.321	0.000	1.000
Risk_aversion	3.098	1.060	1.000	5.000
Health	3.673	0.513	1.000	4.000
ln_income	9.141	0.757	7.131	11.002
ln_wealth	14.013	0.924	9.547	16.686

I and III are 61.58 and 21.74 %. The results are expected because it is logical for individuals with higher financial literacy and confidence (Region I) to have a higher participation rate than individuals with lower financial literacy and confidence (Region III). What is interesting is that the participation rate of Region II (overconfident) is much higher than Region III. Respondents in this region have similar objective financial literacy level to subjects in Region III. However due to their overconfidence their participation rates is close to that of Region I.

On the other hand, the stock market participation rate of Region IV is much lower than Region I. Respondents in the two regions should have similar objective financial knowledge. However, being under-confident resulted in a 26.17 % difference in stock market participation.

Figure 4 shows the relationship between overconfidence answers and stock market participation. As overconfidence answers rise ("I don't know" selection decreases) the stock market participation rate increases. Starting from the left hand side, when overconfidence answers equal zero, stock market participation is around 38 %. When we move to the right hand side, when overconfidence answers equal six, stock market participation is 50 %.

4.2 Results of Probit Regressions

Table 5 summarizes the results from the probit regression. The dependent variable is *stock_p*. A probit regression was used because *stock_p* is a binary variable. For the first probit model in Table 4, objective financial score was included into one of the explanatory variables. The results show that the coefficient for *objective FL* is 0.12 and is significant at

Table 4 Financial score and stock market participation

Variable	Financial score	Stock market participation (%)	Sample size
(Subjective financial literacy) Subjective FL	3	0	92
	4	0	16
	5	2.3	43
	6	0.5	198
	7	11.9	210
	8	29.68	310
	9	39.78	837
	10	50.27	370
	11	56.24	425
	12	63.36	363
	13	58.88	107
	14	71.43	56
	15	61.05	95
(Objective financial literacy) Objective FL	0	12.62	103
	1	26.33	338
	2	34.46	621
	3	41.35	798
	4	46.01	739
	5	51.58	411
	6	62.50	112

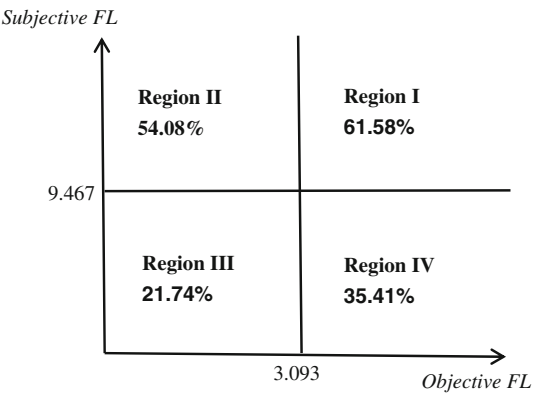

Fig. 3 Overconfidence and stock market participation

the 1 % level. This result indicates that objective financial literacy score is an important factor for stock market participation.

Apart from the objective financial score, other variables also affect stock market participation. (1) The number of children in each household is positively correlated to stock market participation; (2) Households which are risk averse are less likely to participate in the stock market; (3) Total asset is associated with stock market participation. The relationship between asset and stock market participation is U shaped.

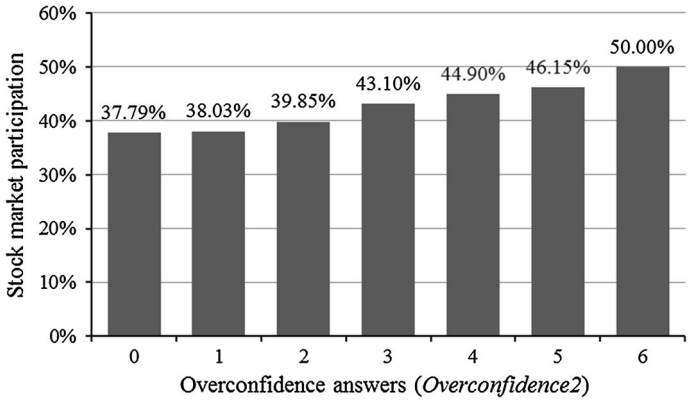

Fig. 4 Overconfidence answers and stock market participation

In the second probit model, *overconfidence* was added as an explanatory variable. As we can see from the results, the addition of *overconfidence* has drastically increased the explanatory power of the model. This is evident by comparing the pseudo R^2 value from model 1 and 2 (18.74–20.41 %). The rise in explanatory power shows the effect of financial literacy overconfidence on stock market participation. *Overconfidence* has the coefficient of 0.522 and is significant at the 1 % level. It is interesting to point out that the marginal impact factor of *overconfidence* is 0.1967. The effect of overconfidence on stock market participation can be calculated by subtracting Pr(*stock_p* | *overconfidence* = 0) from Pr(*stock_p* | *overconfidence* = 1), while all other control variables are kept at mean levels. According to our model, we calculated Pr(*stock_p* | *overconfidence* = 0) as 32.17 % and Pr(*stock_p* | *overconfidence* = 1) as 52.36 %. This means that a unit change in *overconfidence* will result in a 20.19 % increase in stock market participation. This result suggests that higher overconfidence may lead to higher investment in risky assets.

In the third probit model we added under-confidence into the regression. Pseudo R^2 of the regression slightly increases after this addition, indicating that under-confidence can affect stock market participation. We calculated Pr(*stock_p* | *under-confidence* = 0) as 38.83 % and Pr(*stock_p* | *under-confidence* = 1) as 28.74 %. Therefore, being under-confident can decrease stock market participation by 10.09 %. This result implies that not only do we need to increase the overall financial literacy of consumers, but also raises the confidence of consumers.

In the fourth probit model, *overconfidence* is replaced with *overconfidence2*. The coefficient of *overconfidence2* is 0.142 and is significant at the 1 % level. This result further suggests the importance of overconfidence in stock market participation. The marginal impact of *overconfidence2* is 0.0534. We calculated Pr(*stock_p* | *overconfidence2* $= \bar{x} - 0.5\sigma$) as 33.65 % and Pr(*stock_p* | *overconfidence2* $= \bar{x} + 0.5\sigma$) as 40.19 %. Where $\bar{x}$ is the mean of *overconfidence2* and σ is the standard deviation. This means that a one-standard-deviation change in *overconfidence2* would increase the likelihood of stock market participation by 6.54 %. The reason that we look at the change standard deviation is because overconfidence2 is not a binary variable.

Table 5 Results of probit regressions on stock market participation

	Model(1)	Model(2)	Model(3)	Model(4)
Objective FL	0.120*** (6.516)	0.182*** (9.011)	0.213*** (9.790)	0.201*** (8.175)
Overconfidence		0.522*** (8.357)	0.484*** (7.671)	
Under-confidence			−0.277*** (−3.908)	
Overconfidence2				0.142*** (5.190)
Age	−0.028 (−1.194)	−0.019 (−0.797)	−0.021 (−0.891)	−0.027 (−1.170)
Age^2	0.000 (1.044)	0.000 (0.683)	0.000 (0.776)	0.000 (1.050)
Marriage	0.014 (0.189)	−0.008 (−0.098)	−0.020 (−0.252)	0.014 (0.185)
Sex	0.062 (1.137)	0.065 (1.162)	0.060 (1.084)	0.057 (1.030)
Children	0.352*** (7.414)	0.335*** (6.988)	0.335*** (6.972)	0.341*** (7.129)
Education dummies (base group: college diploma)				
<High school	−0.416 (−1.449)	−0.350 (−1.195)	−0.362 (−1.240)	−0.256 (−0.876)
High school	−0.165* (−1.866)	−0.110 (−1.222)	−0.113 (−1.252)	−0.137 (−1.534)
Graduate school	0.000 (0.003)	−0.030 (−0.389)	−0.047 (−0.599)	−0.002 (−0.023)
Risk_aversion	−0.313*** (−12.558)	−0.301*** (−11.907)	−0.296*** (−11.684)	−0.296*** (−11.745)
Health	−0.032 (−0.648)	−0.039 (−0.786)	−0.034 (−0.675)	−0.035 (−0.702)
ln_income	1.021 (1.532)	1.179* (1.754)	1.210* (1.797)	1.083 (1.619)
$(ln\_income)^2$	−0.048 (−1.364)	−0.057 (−1.607)	−0.059* (−1.652)	−0.052 (−1.456)
ln_wealth	2.632*** (3.697)	2.777*** (3.851)	2.747*** (3.811)	2.662*** (3.742)
$(ln\_wealth)^2$	−0.080*** (−3.165)	−0.086*** (−3.344)	−0.085*** (−3.316)	−0.082*** (−3.233)
Constant	−25.520*** (−4.667)	−27.634*** (−4.984)	−27.505*** (−4.958)	−26.497*** (−4.844)
Pseudo R^2	0.1874	0.2041	0.2078	0.1940
Observations	3,122	3,122	3,122	3,122

z-Statistics in parentheses. *** $p < 0.01$; * $p < 0.1$

5 Conclusion

Research into the motivations behind stock market participation is important, because non-participation has serious economic implications. One such implication is the welfare loss that arises when a consumer chooses not to participate in the stock market. Cocco et al. (2005) found that the welfare loss resulting from non-participation can exceed 2 % of annual consumption.

Our study contributes to the existing literature by providing an additional determinant to why individuals choose to participate in the stock market. We have showed that over-confident individuals are more likely to participate in the stock market. Being overconfident will increase the likelihood of stock market participation by around 20 %. From our data, we can see that the rate of stock market participation of overconfident respondents is similar to respondents who have high objective and subjective financial literacy. However, in reality, participation in the stock market is a risky behavior. Overconfident traders with low objective financial literacy may not possess adequate ability to generate positive performances in the stock market. Therefore, participation may also result in welfare loss. Hence, from an investor protection perspective, more effort is needed to enhance the financial education of investors who are overconfident about their financial literacy.

On the other hand, individuals who are under-confident are less likely to participate. Our result showed that being under confident will decrease the likelihood of stock market participation by around 10 %. In our opinion these individuals will suffer the greatest loss from not participating in the stock market. Compared to overconfident traders, these individuals have a higher probability of generating positive stock market returns. However, by not participating, under confident individuals may suffer losses additional to the 2 % predicted by Cocco et al. (2005).

The contributions made by this paper can be summarized into two main areas. First, by studying the effect of overconfidence on stock market participation, this study establishes an association between overconfidence and stock market participation. Second, this paper extends current research on the effects of financial literacy on stock market participation. Through this study, we have shown that not only do consumers need to have high financial knowledge for stock market participation, but they also need to have confidence about their level of knowledge.

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