

Does Financial Knowledge Alleviate Risk Attitude and Risk Behavior Inconsistency?

Aslihan Gizem Korkmaz^a, Zhichao Yin^b, Pengpeng Yue^{b,c,*}, Haigang Zhou^c

^a*Dominican University of California, San Rafael, CA 94901-2298, USA*

^b*Capital University of Economics and Business, Beijing 100070, China*

^c*Cleveland State University, Cleveland, OH 44115-2214, USA*

Abstract

In this study, we investigate the relationship between risk preference and risk behavior using the China Household Finance Survey (CHFS). Empirical results suggest the existence of an inconsistency between risk preference and risk behavior; however, financial knowledge affects this inconsistency. Financial knowledge works through two channels. First, it can decrease the inconsistency between risk propensity and risk behavior. Second, it can encourage risk-taking behavior. The results also show that the heterogeneity in the risk sensitivity of households leads to different outcomes. Namely, financial knowledge increases the inconsistency for the risk-averse and decreases it for the risk-seeking by increasing risk-taking behavior.

Keywords: Financial Knowledge, Risk Preference, Risk Behavior, Risk Propensity, Inconsistency

JEL classification: G41, H31, O53, R20

1. Introduction

Is risk preference always consistent with risk behavior? If it is not, then why is there an inconsistency between risk preference and risk behavior, and what is likely to impact this inconsistency? In response to the contradictory findings of studies analyzing the impact of risk on decision-making behavior, [Sitkin and Pablo \(1992\)](#) propose a detailed conceptual model on risk behavior in an effort to conciliate the contradictions in literature. The authors assert that there are indeed clusters of factors that influence a decision maker, but most studies of decision-making behavior focus on single determinants, which is out of touch with

*Corresponding author. Tel.:216-331-8446. Authors are listed in alphabetical order.

Email addresses: aslihan.korkmaz@dominican.edu (Aslihan Gizem Korkmaz), yzc@cueb.edu.cn (Zhichao Yin), yuepengpeng@cueb.edu.cn (Pengpeng Yue), h.zhou16@csuohio.edu. (Haigang Zhou)

reality and thus lead to erroneous conclusions about the drivers of risk behavior.

Analyzing extant literature, they identify three individual characteristics — risk preference, risk perception, and risk propensity — as being related to risk behavior. In their new model, [Sitkin and Pablo \(1992\)](#) put risk propensity and risk perception in a more central role than previous studies, and they posit that risk propensity is the major determinant of risk behavior.

The propositions derived from their model serve as an agenda for future researchers. The decision making is a complex process, and their research falls short of enumerating interaction effects between the variables proposed in their model. Hence, the authors encourage other researchers to focus on smaller sets of their variables based on their specialized subareas of risk behavior to help better understand the risk behavior and enrich the behavior literature.

[Sitkin and Weingart \(1995\)](#) provide initial tests of the key portions of the [Sitkin and Pablo \(1992\)](#) model using data from studies conducted with undergraduate and graduate students. Their findings provide support for the [Sitkin and Pablo \(1992\)](#) model in which risk perception and risk propensity are key mediators,] and clarify the causal relationships. Nevertheless, conducting studies with students provides them with much smaller samples than ours, and this field of literature still needs more empirical studies using large survey data. In our analyses, we follow an approach similar to [Sitkin and Weingart \(1995\)](#) by focusing on a subset of the variables described in the broader model of [Sitkin and Pablo \(1992\)](#) based on our specialized subarea. While [Sitkin and Pablo \(1992\)](#) analyze risk behavior in an organizational decision-making setting, in this study we analyze risk behavior in a household financial decision-making setting. Here, the main variables of interest are risk preference, risk propensity, and risk behavior.

As per [Sitkin and Pablo \(1992\)](#), risk preference indicates whether an individual enjoys risk. [Dohmen et al. \(2011\)](#) and [Almenberg and Dreber \(2015\)](#) measure risk attitude by asking individuals to self-report their willingness to take risks in general. Thus, we use the terms risk attitude and risk preference interchangeably in this study. Risk propensity refers to an

individual’s risk-taking tendency (Sitkin and Pablo, 1992; Sitkin and Weingart, 1995).

Sitkin and Pablo (1992) assert that the decision maker’s experience or familiarity with the situation is another important determinant in decision-making process. The authors argue that experienced individuals may be more likely to take risks that less experienced individuals would avoid. Correspondingly, in a household financial decision-making setting, experience or familiarity with the situation is obtained through financial literacy. Hung et al. (2009) posit that due to the lack of appropriate data, knowledge gaps exist concerning relationships between literacy, education, and behavior. While there are several studies investigating the impact of financial knowledge using data from various countries such as the U.S. (Lusardi and Mitchell, 2007), Portugal (Abreu and Mendes, 2010), the Netherlands (Van Rooij et al., 2011), and Sweden (Almenberg and Dreber, 2015), our study is unique in the way that we use a large dataset that includes microdata on 31,432 households from China.

We start our analyses by dividing our sample into quartiles and quintiles based on financial knowledge and identifying the highest and lowest financial knowledge groups. Then, we perform tests to see whether there are inconsistencies between risk preference and risk behavior, risk propensity and risk behavior, and whether the risk behaviors of the high and low financial knowledge groups are different from each other. The results show that these inconsistencies exist, and financial knowledge works in different ways for people with different risk sensitivities.

After documenting the significant impact of financial knowledge, we further our analyses to shed light on the way financial knowledge works. We investigate the “preference-propensity-behavior” chain and examine the impact of financial knowledge on risk behavior for different risk-attitude groups.

With regard to the “preference-propensity-behavior” chain, our results show that the inconsistency between risk propensity and risk behavior is the major driver of the inconsistency between risk preference and risk behavior.

As for the relationship between financial knowledge and risk behavior for different risk-

attitude groups, we find that financial knowledge stimulates risk-taking behavior for both attitude groups. Our analyses are followed by a battery of robustness tests that help strengthen our empirical findings.

This paper serves as a bridge between psychology and finance literatures. We contribute to the behavioral finance literature by providing empirical evidence from the household financial decision-making setting to the conceptual model drawn in [Sitkin and Pablo \(1992\)](#) using the China Household Finance Survey (CHFS), a new and extensive dataset from China.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 describes survey data and the variables. Section 4 explains the research methods and presents main empirical results. Section 5 details the impact of financial knowledge. Section 6 presents the robustness tests. Section 7 concludes the paper.

2. Literature Review

Financial knowledge is crucial, and the literature is rich with studies showing its effectiveness on household financial decision making. Nevertheless, the scant evidence shows that the average household is not financially literate enough to make good financial decisions (e.g., [Hung et al., 2009](#); [Almenberg and Widmark, 2011](#); [Van Rooij et al., 2011](#); [Lusardi, 2012](#)). [Agarwal and Mazumder \(2013\)](#) assert that despite the role poor household decision-making played in the recent financial crisis by causing a boom and bust in the U.S. housing markets, our current understanding of the causes of suboptimal financial decision making is limited.

Oftentimes, studies use the terms financial literacy and financial knowledge interchangeably. [Hung et al. \(2009\)](#) define financial literacy as “knowledge of basic economic and financial concepts, as well as the ability to use that knowledge and other financial skills to manage financial resources effectively for a lifetime of financial well-being.”

There are various ways to cultivate financial knowledge. School education (e.g., [Bernheim et al., 2001](#); [Lusardi and Mitchell, 2007](#)) and educational programs in the workplace (e.g., [Bernheim and Garrett, 2003](#); [Lusardi and Mitchell, 2007](#)) are some of the ways households

can obtain financial knowledge.

In the literature, financial knowledge has been shown to stimulate personal saving and to help investors make better decisions. [Lusardi and Mitchell \(2007\)](#) study the link between financial literacy and retirement planning using evidence from the Rand American Life Panel, and they find that financial literacy is a key determinant in retirement planning. [Van Rooij et al. \(2011\)](#) is another study that investigates the relationship between financial knowledge and retirement planning. Using the De Nederlandsche (DNB) Household Survey, the authors measure financial literacy and the respondents' propensity to plan for retirement. While they document that most households lack fundamental financial knowledge and that the level of financial knowledge varies greatly among respondents, they also find a strong positive relationship between financial knowledge and retirement planning.

[Bernheim et al. \(2001\)](#) use a cross-sectional household survey to study the long-term effect of high school financial curriculum mandates on personal saving. The authors assert that early exposure to financial concepts increases comfort and familiarity with financial matters and removes psychological barriers to financial decision making. Similarly, [Bernheim and Garrett \(2003\)](#) investigate the effects of employer-based financial education on personal saving both in general and for retirement. Both studies find that financial education stimulates saving.

[Abreu and Mendes \(2010\)](#) study the impact of financial literacy on portfolio diversification using survey data from the Portuguese Securities Commission (CMVM). The authors assert that there is no consensus in literature on either the definition of financial knowledge or how to measure it. Thus, they consider three different dimensions of financial literacy, which include specific knowledge, education level, and information source, and they show that all of them significantly increase diversification.

Several studies further distinguish between basic financial literacy and advanced financial literacy (e.g., [Lusardi and Mitchell, 2007](#); [Almenberg and Dreber, 2015](#)). Other variables that are used as proxies for financial knowledge include education level (e.g., [Abreu and Mendes,](#)

2010), cognitive abilities (e.g., McArdle et al., 2009; Christelis et al., 2010; Almenberg and Widmark, 2011; Lusardi, 2012; Agarwal and Mazumder, 2013), and information source (e.g., Abreu and Mendes, 2010).

McArdle et al. (2009) and Almenberg and Widmark (2011) establish a link between numeric ability and financial skills by positing that the ability to perform numerical skills supports financial literacy. Christelis et al. (2010) investigate the relationship between cognitive abilities and stockholding using the Survey of Health, Aging, and Retirement in Europe (SHARE), which provides data from 11 European countries. The authors find that the propensity to invest in stocks increases with cognitive abilities and assert that the relationship between cognitive abilities and stockholding is shaped by information constraint and not by preferences or psychological traits. Agarwal and Mazumder (2013) investigate cognitive abilities' impact on credit card use and home equity loan applications. They find that consumers with higher math scores are less likely to make suboptimal financial decisions.

3. Data and Variables

3.1. Data

Our data source is the [China Household Finance Survey \(CHFS\)](#)¹, which is similar to the Survey of Consumer Finances (SCF) in the United States. The CHFS offers detailed information about household income, expenses, assets, liabilities, insurance, securities, demographics, employment, and payment history (See [Appendix A](#)). The possible sampling bias in the Chinese census survey is minimized in the CHFS because the households are identified through a random selection process, and the CHFS includes a wide array of households belonging to high-, middle-, and low-income classes.

The CHFS began in 2011 and has been conducted biennially since then, but changes have been made to the survey questions throughout the years. Thus, this study uses the survey conducted in 2017, which is the fourth and final wave. Our approach is similar to [Bernheim](#)

¹<http://www.chfsdata.org/>.

et al. (2001), which also uses a cross-sectional household survey. Table 1 describes the data. Panel A provides coverage information about the four waves of the survey. Since the first wave in 2011, sample size has increased from 8,438 households to 40,011 households. This final wave in 2017 includes data from 29 provinces, 172 cities, 355 counties, 1,417 communities, 40,011 households, and 127,012 individuals.

Panel B of Table 1 presents repeat surveys. The same 4,752 households in the 2011 survey were surveyed again in 2017. The number of repeat surveys increased throughout the years. The 26,842 households surveyed in 2015 were surveyed again in 2017.

Table 1: Description of the CHFS Data

Year	Province	City	County	Community	Household	Individual
2011	25	N.A.	80	320	8,438	29,324
2013	29	168	268	1,021	28,142	97,916
2015	29	172	351	1,362	37,289	133,183
2017	29	172	355	1,417	40,011	127,012

	2011	2013	2015	2017
2011	8,438	6,846	5,753	4,752
2013		28,142	21,775	16,836
2015			37,289	26,842
2017				40,011

This table describes the sample. Our study uses data from the China Household Finance Survey (CHFS), conducted in 2011, 2013, 2015 and 2017. Panel A details the number of Provinces, Cities, Counties, Communities, Households, and Individuals covered in each survey. Panel B details the number of repeated surveys with the same households throughout the years.

As typical in survey data, respondents may sometimes decline to answer a question or skip a question. We treat such cases by dropping the observation from our sample. After we exclude the missing values, the final sample includes 31,432 households. [MacCrimmon](#)

and Wehrung (1990) assert that the measures many studies employ to assess risk propensity have often been weak because such studies used students as subjects. In this study, we aim to contribute to the literature by providing results using a large dataset such as the CHFS.

3.2. Variables

Following Sitkin and Pablo (1992), we analyze the link between risk preference and risk behavior with the mediating mechanism of risk propensity in between. Accordingly, we identify three main inconsistencies, each of which is a combination of two sub-inconsistencies. Table 2 details the variables and reports summary statistics. (See Tables B.1 and C.1 for variable definitions). The three main inconsistencies are ICPref&Prop, ICPref&Beh, and ICProp&Beh. ICPref&RiskProp exists between risk preference and risk propensity. It is the combination of ICPref&Prop1 and ICPref&Prop2. ICPref&Prop1 exists when an individual prefers risk (risk-seeking attitude) but has no risk propensity, whereas ICPref&Prop2 exists when an individual does not prefer risk (risk-averse attitude) but has risk propensity. ICPref&Beh exists between risk preference and risk behavior. It is the combination of ICPref&Beh1 and ICPref&Beh2. ICPref&Beh1 exists when an individual prefers risk (risk-seeking attitude) but does not display risky behavior, whereas ICPref&Beh2 exists when an individual does not prefer risk (risk-averse attitude) but displays risky behavior. ICProp&Beh exists between risk propensity and risk behavior. It is the combination of ICProp&Beh1 and ICProp&Beh2. ICProp&Beh1 exists when an individual has risk propensity but does not display risky behavior whereas ICProp&Beh2 exists when an individual has no risk propensity but displays risky behavior.

Table 2: Summary Statistics

	N	Mean	Std	p10	p50	p90
A. Risk						
Risk preference	31,432	0.2360	0.4246	0	0	1
Risk propensity	31,432	0.1091	0.3118	0	0	1
Risky behavior	31,432	0.3258	0.4687	0	0	1
B. Inconsistency						
ICPref&Prop1	31,432	0.0514	0.2208	0	0	0
ICPref&Prop2	31,432	0.0231	0.1502	0	0	0
ICPref&Prop	31,432	0.0745	0.2626	0	0	0
ICPref&Beh1	31,432	0.5302	0.4991	0	1	1
ICPref&Beh2	31,432	0.0893	0.2852	0	0	1
ICPref&Beh	31,432	0.6195	0.4855	0	1	1
ICProp&Beh1	31,432	0.5102	0.4999	0	1	1
ICProp&Beh2	31,432	0.0977	0.2969	0	0	1
ICProp&Beh	31,432	0.6079	0.4882	0	1	1
C. Financial knowledge						
Financial knowledge	31,432	43.1203	27.0089	9.2700	43.5360	85.5294
Average financial knowledge in community	31,432	41.2966	11.5207	24.9562	42.6590	55.3742
Education time	31,432	9.5683	4.3721	5	9	16
Right ratio	31,432	0.3733	0.2332	0	0.5	0.75
D. Demographic characteristics						
Age	31,432	53.7712	13.8019	35	54	72
$Age^2/100$	31,432	30.8183	15.0169	12.25	29.16	51.84
Male	31,432	0.7985	0.4011	0	1	1
Marriage	31,432	0.8607	0.3463	0	1	1
Health	31,432	0.4937	0.5000	0	0	1
Work	31,432	0.6409	0.4798	0	1	1
House	31,432	0.9071	0.2903	0	1	1
Non-finance-asset	31,432	1,032,314	1,777,393	14,000	366,000	2873,000
Debt	31,432	53,191	155,161	0	0	150,000
Consumption	31,432	61,285	55,966	14,856	46,301	120,842
Income	31,432	88,512	107,388	5,405	59,414	191,888
Family size	31,432	3.2150	1.5124	2	3	5
Rural	31,432	0.2972	0.4570	0	0	1

This table details the variables and reports summary statistics. Variable definitions are given in Tables [B.1](#) and [C.1](#).

4. Research Methods

Table 3 reports Pearson correlations. The correlation values are low, and we do not expect multicollinearity to be an issue among our variables.

Next, we divide our sample into deciles and quintiles based on the level of respondents' financial knowledge and perform mean comparison tests between the highest and lowest financial knowledge groups. Table 4 presents the results. The first part (Columns (2), (3), and (4)) shows the results from grouping our sample into deciles. The second part (Columns (5), (6), and (7)) shows the results from grouping our sample into quintiles. In both parts, Q1 represents the lowest financial knowledge group. The highest financial knowledge group is represented by Q10 in the first part and Q5 in the second part. Panel A presents the results for the inconsistency between risk preference and risk behavior. The results show that the inconsistency between risk preference and risk behavior, which we label as ICPref&Beh, significantly decreases with financial knowledge. When we look into the decomposition of this inconsistency, the results show that higher financial knowledge scores decrease ICPref&Beh1, and increase ICPref&Beh2. These results indicate that financial knowledge increases risky behavior for both risk-seeking and risk-averse households. ICPref&Beh is the main focus of our research because it links risk preference and risk behavior.

Panel B presents the results for the inconsistency between risk propensity and risk behavior. The results show that the inconsistency between risk propensity and risk behavior, which we label as ICPprop&Beh, significantly decreases with financial knowledge. When we look into the decomposition of this inconsistency, the results show that higher financial knowledge scores decrease ICPprop&Beh1 and increase ICPprop&Beh2. These results indicate that financial knowledge increases risky behavior for both households with and without risk propensity.

Panel C presents the results for risk behavior. The first row presents the results for the entire sample. Then, we look at the subsamples of risk-seeking and risk-averse households. The results show that financial knowledge increases risky behavior for both groups.

Table 3: Pearson Correlations

	Fin knowledge	Age	$Age^2/100$	Male	Marriage	Health	Work	House	ln(Non-Fin-asset)	ln(Debt)	ln(Consump)	ln(Income)	Family size	Rural
Fin knowledge	1.000													
Age	-0.204***	1.000												
$Age^2/100$	-0.188***	0.988***	1.000											
Male	-0.053***	-0.042***	-0.053***	1.000										
Marriage	-0.010	-0.049***	-0.091***	0.335***	1.000									
Health	0.126***	-0.238***	-0.224***	0.030***	0.046***	1.000								
Work	0.028***	-0.496***	-0.515***	0.208***	0.127***	0.165***	1.000							
House	-0.043***	0.056***	0.030***	0.078***	0.149***	-0.003	0.048***	1.000						
ln(Non-Fin-asset)	0.186***	-0.131***	-0.139***	0.010	0.153***	0.185***	0.047***	0.465***	1.000					
ln(Debt)	0.010	-0.264***	-0.270***	0.050***	0.069***	-0.012*	0.184***	0.087***	0.110***	1.000				
ln(Consump)	0.258***	-0.304***	-0.298***	-0.012*	0.150***	0.180***	0.057***	0.010	0.454***	0.137***	1.000			
ln(Income)	0.165***	-0.090***	-0.087***	0.003	0.106***	0.147***	0.042***	0.056***	0.328***	-0.010	0.370***	1.000		
Family size	-0.050***	-0.198***	-0.224***	0.171***	0.313***	0.016**	0.193***	0.162***	0.112***	0.222***	0.229***	0.123***	1.000	
Rural	-0.267***	0.094***	0.073***	0.166***	0.049***	-0.145***	0.164***	0.125***	-0.260***	0.093***	-0.356***	-0.243***	0.169***	1.000

This table reports Pearson correlations. *** indicates significance at 1% level, ** at 5% level, and * at 10% level.

Table 4: Mean Comparison Tests Between the Highest and Lowest Financial Knowledge Groups

	(1)			(2)		
	Q10	Q1	Diff	Q5	Q1	Diff
Panel A: The inconsistency between risk preference and risk behavior						
ICPref&Beh	0.4475 (0.4974)	0.6828 (0.4655)	-0.2353*** [0.0000]	0.5533 (0.4972)	0.6658 (0.4718)	-0.1125*** [0.0000]
ICPref&Beh1	0.1249 (0.3307)	0.5994 (0.4901)	-0.4744*** [0.0000]	0.3122 (0.4634)	0.6072 (0.4884)	-0.2950*** [0.0000]
ICPref&Beh2	0.3225 (0.4676)	0.0834 (0.2766)	0.2391*** [0.0000]	0.2412 (0.4278)	0.0586 (0.2350)	0.1825*** [0.0000]
Panel B: The inconsistency between risk propensity and risk behavior						
ICProp&Beh	0.4256 (0.4946)	0.6550 (0.4755)	-0.2293*** [0.0000]	0.5459 (0.4979)	0.6500 (0.4770)	-0.1041*** [0.0000]
ICProp&Beh1	0.0701 (0.2553)	0.5711 (0.4950)	-0.5010*** [0.0000]	0.2855 (0.4517)	0.5802 (0.4936)	-0.2946*** [0.0000]
ICProp&Beh2	0.3556 (0.4788)	0.0839 (0.2772)	0.2717*** [0.0000]	0.2603 (0.4389)	0.0698 (0.2549)	0.1905*** [0.0000]
Panel C: Risk behavior						
Risky behavior	0.4600 (0.4986)	0.2206 (0.4147)	0.2394*** [0.0000]	0.4580 (0.4983)	0.2018 (0.4014)	0.2563*** [0.0000]
Risky behavior: risk-seeking	0.5239 (0.5001)	0.2581 (0.4380)	0.2659*** [0.0000]	0.5243 (0.4996)	0.2115 (0.4087)	0.3128*** [0.0000]
Risky behavior: risk-averse	0.4373 (0.4963)	0.2105 (0.4078)	0.2267*** [0.0000]	0.4357 (0.4959)	0.1993 (0.3995)	0.2364*** [0.0000]

This table reports the mean comparison tests between the highest and lowest financial knowledge groups. We divide our sample into deciles and quintiles based on the level of respondents' financial knowledge. The first part (Columns (2), (3), and (4)) shows the results from grouping our sample into deciles. The second part (Columns (5), (6), and (7)) shows the results from grouping our sample into quintiles. In both parts, Q1 represents the lowest financial knowledge group. The highest financial knowledge group is represented by Q10 in the first part and Q5 in the second part. We perform t-tests to test the significance of differences between the highest and lowest financial knowledge groups. Standard deviations are given in parentheses. P-values are given in square brackets. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Equation 1 is the baseline model we use in our tests. Y_i represents inconsistency variables, whereas X_i represents control variables.

$$Probit(Y_i|X_i) = Probit(\alpha FinancialKnowledge_i + X_i\beta + \varepsilon_i > 0|X_i) \quad (1)$$

Lusardi and Mitchell (2007) explain that those who attempt to plan for retirement become more financially knowledgeable in the process, which creates an endogeneity problem when testing for the relationship between financial literacy and retirement planning. A similar endogeneity concern could apply to our baseline model as well. In order to address such concerns, we employ a two-stage least squares (2SLS) approach by using the mean of financial-knowledge scores from other respondents in the same community as an instrumental variable.

Table 5 reports the main regression results and 2SLS results for our paramount consistency variable, ICPref&Beh, between risk preference and risk behavior, and the two sub-inconsistencies it is comprised of.

Using the entire sample, the first two columns show that financial knowledge has a significant negative effect on the inconsistency between risk preference and risk behavior.

As explained in Section 3, ICPref&Beh is made up of two sub-inconsistencies. In Columns (3) and (4), our dependent variable is ICPref&Beh1. Households that show consistency between risk preference and risk behavior are taken as a control group, and those that show ICPref&Beh1 (risk-seeking without risky behavior) are used as the test group. The negative significant coefficient on financial knowledge variable shows that financial knowledge helps decrease ICPref&Beh1, meaning it increases risky behavior for risk-seeking households. In Columns (5) and (6), our dependent variable is ICPref&Beh2. Similar to Columns (3) and (4), households that show consistency between risk preference and risk behavior are taken as a control group, and households that show ICPref&Beh2 (risk-averse with risky behavior) are used as the test group. The positive significant coefficient on financial knowledge shows that financial knowledge increases ICPref&Beh2, meaning it increases risky behavior for risk-averse households. These results are consistent with those in Panel A of Table 4.

Table 5: The Impact of Financial Knowledge on the Inconsistency Between Risk Preference and Risk Behavior

	ICPref&Beh		ICPref&Beh1		ICPref&Beh2	
	Probit	Ivprobit	Probit	Ivprobit	Probit	Ivprobit
Financial knowledge	-0.0004*** (0.0001)	-0.0197*** (0.0015)	-0.0018*** (0.0001)	-0.0296*** (0.0012)	0.0021*** (0.0001)	0.0292*** (0.0017)
Age	-0.0034** (0.0014)	-0.0251*** (0.0037)	0.0038** (0.0016)	-0.0130*** (0.0039)	-0.0066*** (0.0015)	-0.0010 (0.0060)
Age ² /100	0.0055*** (0.0013)	0.0234*** (0.0033)	0.0003 (0.0014)	0.0130*** (0.0034)	0.0043*** (0.0014)	0.0016 (0.0054)
Male	-0.0029 (0.0076)	-0.0232 (0.0191)	0.0065 (0.0084)	-0.0042 (0.0198)	-0.0082 (0.0078)	-0.0062 (0.0279)
Marriage	0.0196** (0.0094)	0.0497** (0.0235)	0.0146 (0.0103)	0.0215 (0.0240)	0.0253** (0.0107)	0.0773** (0.0373)
Health	-0.0291*** (0.0060)	-0.0447*** (0.0155)	-0.0377*** (0.0065)	-0.0515*** (0.0157)	0.0153** (0.0068)	0.0258 (0.0240)
Work	0.0149** (0.0072)	0.0259 (0.0185)	0.0076 (0.0078)	-0.0013 (0.0186)	-0.0005 (0.0086)	0.0016 (0.0305)
House	0.0912*** (0.0122)	0.1562*** (0.0317)	0.1291*** (0.0137)	0.1856*** (0.0333)	-0.0431*** (0.0137)	-0.0646 (0.0489)
ln(Non-finance-asset)	-0.0233*** (0.0020)	-0.0367*** (0.0055)	-0.0303*** (0.0022)	-0.0390*** (0.0056)	0.0104*** (0.0025)	0.0115 (0.0090)
ln(Debt)	0.0015** (0.0006)	0.0021 (0.0015)	0.0015** (0.0006)	0.0004 (0.0015)	-0.0020*** (0.0006)	-0.0049** (0.0022)
ln(Consumption)	-0.0809*** (0.0045)	-0.1193*** (0.0152)	-0.1117*** (0.0050)	-0.1405*** (0.0161)	0.0359*** (0.0054)	0.0360 (0.0232)
ln(Income)	-0.0088*** (0.0016)	-0.0087** (0.0041)	-0.0124*** (0.0018)	-0.0116*** (0.0042)	0.0054*** (0.0020)	0.0053 (0.0066)
Family size	0.0160*** (0.0022)	0.0144** (0.0062)	0.0290*** (0.0024)	0.0330*** (0.0064)	-0.0184*** (0.0029)	-0.0316*** (0.0112)
Rural	0.0882*** (0.0075)	0.0514** (0.0257)	0.0861*** (0.0080)	-0.0244 (0.0241)	-0.0128 (0.0105)	0.1663*** (0.0416)
Province	control	control	control	control	control	control
Obs	31,432	31,432	28,624	28,624	14,767	14,767
Wald	2,543.73	3,780.58	3,981.72	8,676.90	970.27	2,507.78
Pseudo R ² /R ²	0.0660	0.5901	0.1211	0.5102	0.0830	0.0557
First Stage F		59.45		89.80		17.20
Cragg-Donald F		646.371		593.118		192.344

This table reports the results from testing the impact of financial knowledge on the inconsistency between risk preference and risk behavior. The dependent variables ICPref&Beh (inconsistency between risk preference and risk behavior), ICPref&Beh1 (risk-seeking without risky behavior), and ICPref&Beh2 (risk-averse with risky behavior) are regressed on financial knowledge and other household characteristics. For each dependent variable, the first column reports the results for the baseline model (Probit) and the second column reports the results for the 2SLS model (Ivprobit). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

5. The Role of Financial Knowledge

As documented in the previous section, financial knowledge decreases the overall inconsistency between risk preference and risk behavior, but how exactly does financial knowledge work? In this section, we try to answer this question by investigating the “preference-propensity-behavior” chain. Next, we offer explanations as to why financial knowledge decreases ICPref&Beh1 for risk-seeking households but increases ICPref&Beh2 for risk-averse households by analyzing the relationship between financial knowledge and risk behavior for different risk-attitude groups.

5.1. Preference-Propensity-Behavior Chain

How does financial knowledge work? Following the theoretical model in [Sitkin and Pablo \(1992\)](#) and [Sitkin and Weingart \(1995\)](#). Figure 1 explains the link between risk preference (attitude) and risk behavior. The figure decomposes the inconsistency between risk preference and behavior into two parts. The first one is the inconsistency between risk preference and propensity; the second one is the inconsistency between risk propensity and risk behavior. We find that the inconsistency between risk preference and risk behavior is 61.95% (See Table 2, ICPref&Beh). Following the chain, the inconsistency between risk preference and risk propensity is 7.45% (See Table 2, ICPref&Prop), and the inconsistency between risk propensity and risk behavior is 60.79% (See Table 2, ICProp&Beh). These results show that the latter part of the chain is the main source of the inconsistency between risk preference and risk behavior.

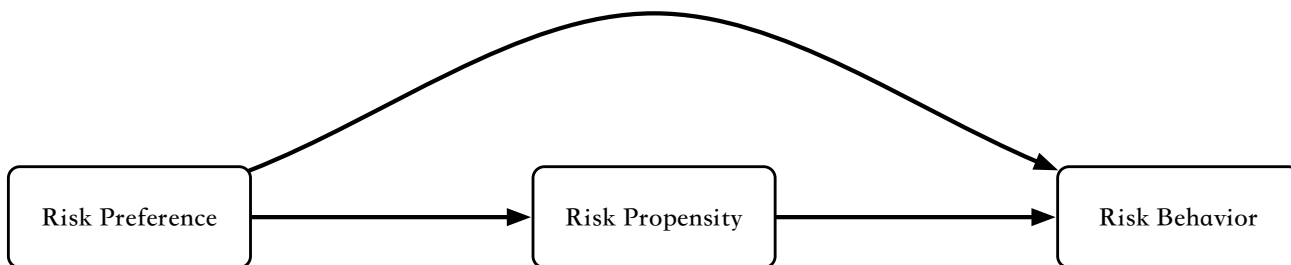


Figure 1: **Preference-Propensity-Behavior Chain.** How does financial knowledge work? This figure, based on [Sitkin and Pablo \(1992\)](#) and [Sitkin and Weingart \(1995\)](#), explains the link between risk preference and risk behavior.

More specifically, the inconsistency between risk propensity and risk behavior is the major contributor to the inconsistency between risk preference and risky behavior. In [Table 6](#), we investigate this further.

[Table 6](#) reports the main regression results and 2SLS results for our consistency variable, ICProp&Beh, between risk propensity and risk behavior and the two sub-inconsistencies it is comprised of.

The first two columns show that financial knowledge has a significant negative effect on the inconsistency between risk propensity and risk behavior.

As explained in [Section 3](#), ICProp&Beh is made up of two sub-inconsistencies. In [Columns \(3\) and \(4\)](#), the dependent variable is ICProp&Beh1. Households that show consistency between risk propensity and risk behavior are taken as a control group, and those that show ICProp&Beh1 (risk propensity without risky behavior) are used as the test group. The negative significant coefficient on financial knowledge shows that financial knowledge helps decrease ICProp&Beh1, meaning it increases risky behavior for households with risk propensity.

In [Columns \(5\) and \(6\)](#), our dependent variable is ICProp&Beh2. Similar to [Columns \(3\) and \(4\)](#), households that show consistency between risk propensity and risk behavior are taken as a control group, and those that show ICProp&Beh2 (no risk propensity with risky behavior) are used as the test group. The positive significant coefficient on financial

knowledge shows that financial knowledge increases ICProp&Beh2, meaning it increases risky behavior for households with no risk propensity.

Table 6: The Impact of Financial Knowledge on the Inconsistency Between Risk Propensity and Risk Behavior

	ICProp&Beh		ICProp&Beh1		ICProp&Beh2	
	Probit	Ivprobit	Probit	Ivprobit	Probit	Ivprobit
Financial knowledge	-0.0002* (0.0001)	-0.0205*** (0.0015)	-0.0018*** (0.0001)	-0.0312*** (0.0011)	0.0022*** (0.0001)	0.0294*** (0.0016)
Age	-0.0039*** (0.0014)	-0.0270*** (0.0036)	0.0041** (0.0016)	-0.0138*** (0.0038)	-0.0069*** (0.0015)	-0.0002 (0.0058)
Age ² /100	0.0058*** (0.0013)	0.0243*** (0.0032)	0.0001 (0.0015)	0.0130*** (0.0034)	0.0046*** (0.0014)	0.0012 (0.0052)
Male	0.0010 (0.0076)	-0.0153 (0.0189)	0.0063 (0.0085)	-0.0119 (0.0196)	-0.0025 (0.0079)	0.0059 (0.0270)
Marriage	0.0102 (0.0094)	0.0272 (0.0232)	0.0103 (0.0105)	0.0116 (0.0238)	0.0054 (0.0106)	0.0120 (0.0354)
Health	-0.0311*** (0.0060)	-0.0461*** (0.0153)	-0.0404*** (0.0066)	-0.0488*** (0.0156)	0.0163** (0.0068)	0.0246 (0.0232)
Work	0.0134* (0.0073)	0.0209 (0.0182)	0.0067 (0.0079)	-0.0059 (0.0183)	-0.0034 (0.0086)	-0.0101 (0.0292)
House	0.0818*** (0.0122)	0.1254*** (0.0311)	0.1274*** (0.0138)	0.1748*** (0.0327)	-0.0533*** (0.0135)	-0.0924* (0.0474)
ln(Non-finance-asset)	-0.0198*** (0.0020)	-0.0261*** (0.0053)	-0.0273*** (0.0022)	-0.0301*** (0.0054)	0.0117*** (0.0025)	0.0138 (0.0087)
ln(Debt)	0.0012** (0.0006)	0.0014 (0.0014)	0.0016** (0.0006)	0.0008 (0.0015)	-0.0027*** (0.0006)	-0.0065*** (0.0022)
ln(Consumption)	-0.0767*** (0.0045)	-0.0999*** (0.0148)	-0.1099*** (0.0050)	-0.1225*** (0.0156)	0.0418*** (0.0054)	0.0433* (0.0231)
ln(Income)	-0.0085*** (0.0016)	-0.0069* (0.0040)	-0.0120*** (0.0018)	-0.0074* (0.0041)	0.0048** (0.0019)	0.0027 (0.0063)
Family size	0.0193*** (0.0022)	0.0193*** (0.0062)	0.0328*** (0.0025)	0.0346*** (0.0064)	-0.0141*** (0.0028)	-0.0169 (0.0103)
Rural	0.0981*** (0.0075)	0.0589** (0.0255)	0.0949*** (0.0080)	-0.0313 (0.0237)	-0.0045 (0.0104)	0.1997*** (0.0392)
Province	control	control	control	control	control	control
Obs	31,432	31,432	28,361	28,361	15,394	15,394
Wald	2,362.27	3,666.68	3,942.28	9,503.62	1,056.98	2,817.67
Pseudo R^2/R^2	0.0599	0.5631	0.1189	0.4563	0.0840	0.0578
First Stage F		53.60		83.66		18.38
Cragg-Donald F		646.371		582.762		195.696

This table reports the results of testing the impact of financial knowledge on the inconsistency between risk propensity and risk behavior. The dependent variables ICProp&Beh (inconsistency between risk propensity and risk behavior), ICProp&Beh1 (risk propensity without risky behavior), and ICProp&Beh2 (no risk propensity with risky behavior) are regressed on financial knowledge and other household characteristics. For each dependent variable, the first column reports the results for the baseline model (Probit), and the second column reports the results for the 2SLS model (Ivprobit). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

5.2. Financial Knowledge Encourages Risk-taking Behavior

In this section, we try to offer explanations as to why financial knowledge decreases ICPref&Beh1 (increased risky behavior for risk-seeking households) but increases ICPref&Beh2 (increased risky behavior for risk-averse households). Figure 2 is used to demonstrate these two types of inconsistencies that exist between risk preference and risk behavior.

To explain this, we assume that risk attitude is constant. Attitudes are hard to change. If this is the case, financial knowledge could have an impact on the inconsistency by changing the behavior. As explained previously, the inconsistency between risk preference and risk behavior is a combination of two sub-inconsistencies. The first type of inconsistency occurs when households are risk-seeking but do not display risky behavior. These make up almost 85.59% of our sample (See Table 2, ICPref&Beh1/ICPref&Beh). The second type of inconsistency occurs when households are risk-averse but display risky behaviors. These make up about 14.41% of our sample (See Table 2, ICPref&Beh2/ICPref&Beh). Based on our assumption that financial knowledge can change risk behavior and not risk attitude, we conduct an empirical test to see if financial knowledge has a positive effect on risk behavior.

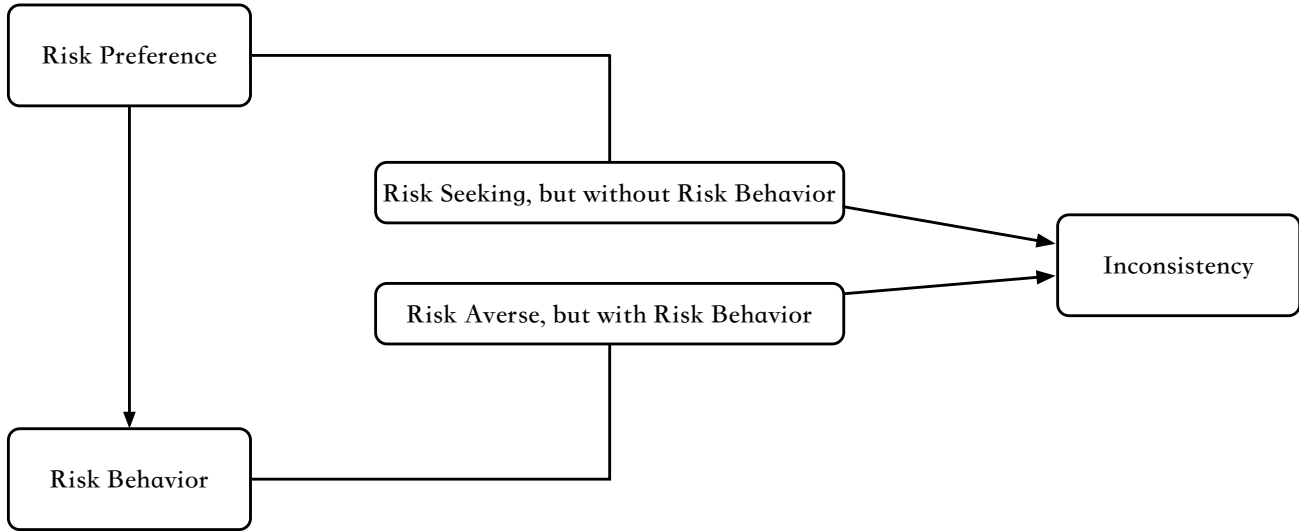


Figure 2: **Two types of inconsistencies.** This figure is used to demonstrate the two types of inconsistencies that exist between risk preference and risk behavior.

Table 7 reports the main regression results and 2SLS results for the entire sample and the two sub-samples: risk-seeking and risk-averse.

Looking at the entire sample, the first two columns show that financial knowledge has a significant positive effect on risk behavior.

In Columns (3) and (4), we use the sample of risk-seeking households, and in Columns (5) and (6), we use the sample of risk-averse households. Similar to the results for the entire sample, the positive and significant coefficient on financial knowledge shows that financial knowledge increases risky behavior for both risk-seeking and risk-averse households.

In sum, the results in Table 7 present evidence that financial knowledge has a significant positive effect on risky behavior, regardless of the risk attitude of households.

Table 7: The Impact of Financial Knowledge on Risk Behavior

	Whole sample		Risk-seeking		Risk-averse	
	Probit	Ivprobit	Probit	Ivprobit	Probit	Ivprobit
Financial knowledge	0.0013*** (0.0001)	0.0207*** (0.0017)	0.0013*** (0.0002)	0.0233*** (0.0036)	0.0012*** (0.0001)	0.0200*** (0.0019)
Age	-0.0037*** (0.0014)	0.0059 (0.0042)	-0.0006 (0.0030)	0.0164** (0.0083)	-0.0045*** (0.0015)	0.0028 (0.0050)
$Age^2/100$	-0.0010 (0.0013)	-0.0124*** (0.0037)	-0.0047 (0.0029)	-0.0224*** (0.0075)	0.0000 (0.0014)	-0.0093** (0.0043)
Male	0.0246*** (0.0074)	0.0798*** (0.0207)	0.0030 (0.0164)	0.0409 (0.0426)	0.0284*** (0.0082)	0.0889*** (0.0239)
Marriage	-0.0321*** (0.0094)	-0.0886*** (0.0260)	-0.0619*** (0.0204)	-0.1469*** (0.0514)	-0.0212** (0.0106)	-0.0640** (0.0304)
Health	0.0282*** (0.0058)	0.0545*** (0.0167)	0.0173 (0.0130)	0.0200 (0.0338)	0.0304*** (0.0065)	0.0640*** (0.0193)
Work	0.0195*** (0.0072)	0.0597*** (0.0203)	0.0114 (0.0159)	0.0095 (0.0410)	0.0208*** (0.0080)	0.0721*** (0.0235)
House	-0.0939*** (0.0127)	-0.1967*** (0.0357)	-0.0954*** (0.0282)	-0.1698** (0.0715)	-0.0941*** (0.0141)	-0.2077*** (0.0412)
$\ln(\text{Non-finance-asset})$	0.0420*** (0.0023)	0.0949*** (0.0070)	0.0462*** (0.0052)	0.0885*** (0.0150)	0.0408*** (0.0026)	0.0968*** (0.0080)
$\ln(\text{Debt})$	-0.0017*** (0.0006)	-0.0032** (0.0016)	-0.0021* (0.0012)	-0.0031 (0.0031)	-0.0016*** (0.0006)	-0.0034* (0.0018)
$\ln(\text{Consumption})$	0.1432*** (0.0047)	0.3180*** (0.0200)	0.1701*** (0.0104)	0.3377*** (0.0445)	0.1336*** (0.0052)	0.3085*** (0.0223)
$\ln(\text{Income})$	0.0229*** (0.0019)	0.0498*** (0.0051)	0.0187*** (0.0035)	0.0366*** (0.0092)	0.0248*** (0.0023)	0.0566*** (0.0062)
Family size	-0.0266*** (0.0022)	-0.0496*** (0.0072)	-0.0204*** (0.0049)	-0.0308** (0.0137)	-0.0282*** (0.0025)	-0.0557*** (0.0085)
Rural	-0.0408*** (0.0075)	0.0365 (0.0272)	-0.0784*** (0.0169)	-0.0077 (0.0617)	-0.0301*** (0.0084)	0.0537* (0.0304)
Province	control	control	control	control	control	control
Obs	31,432	31,432	7,417	7,417	24,015	24,015
Wald	5,334.34	8,224.40	1,502.89	2,372.37	3,793.40	5,840.78
Pseudo R^2/R^2	0.1885	0.3941	0.2105	0.4411	0.1802	0.3748
First Stage F		173.12		46.63		123.74
Cragg-Donald F		646.371		123.196		520.527

This table reports the results of testing the impact of financial knowledge on risk behavior. For each group, the first column reports the results for the baseline model (Probit), and the second column reports the results for the 2SLS model (Ivprobit). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

6. Robustness Tests

6.1. Education as a Proxy for Financial Knowledge

Atkinson and Messy (2012) assert that there is a positive relationship between financial

literacy and education. Thus, in this section, we use education as one of the control variables to avoid a possible endogeneity problem in our main empirical results. We repeat our empirical tests in Tables 5, 6, and 7, using education residual (See Appendix C) to proxy for financial knowledge. Table 8 reports the empirical results.

Looking at Column (2) in the first section, the results for the entire sample, the impact of education is marginal and it is not statistically significant. A possible reason for this result could be that the positive and negative effects on different sides of the “preference-propensity-behavior” chain offset each other. When we look at the subsamples on the other hand, education residual is significant. For risk-seeking households, financial knowledge, proxied by education residual still has a negative significant effect on the inconsistency between risk preference and risk behavior. For risk-averse households education residual has a positive significant effect on the inconsistency between risk preference and risk behavior. These results are consistent with Table 5.

Table 8: Robustness Test: Education Residual

	Main Regression			Explanation 1			Explanation 2		
	ICPref&Beh	ICPref&Beh1	ICPref&Beh2	ICProp&Beh	ICProp&Beh1	ICProp&Beh2	Whole sample	Risk-seeking	Risk-averse
Education residual	-0.0001 (0.0001)	-0.0013*** (0.0001)	0.0020*** (0.0001)	0.0000 (0.0001)	-0.0013*** (0.0001)	0.0021*** (0.0001)	0.0008*** (0.0001)	0.0008*** (0.0002)	0.0007*** (0.0001)
Age	-0.0032** (0.0014)	0.0046*** (0.0016)	-0.0074*** (0.0015)	-0.0037*** (0.0014)	0.0049*** (0.0016)	-0.0078*** (0.0015)	-0.0044*** (0.0014)	-0.0013 (0.0030)	-0.0052*** (0.0015)
Age ² /100	0.0054*** (0.0013)	-0.0001 (0.0014)	0.0048*** (0.0014)	0.0057*** (0.0013)	-0.0004 (0.0015)	0.0052*** (0.0014)	-0.0006 (0.0013)	-0.0042 (0.0029)	0.0004 (0.0014)
Male	-0.0027 (0.0076)	0.0055 (0.0084)	-0.0081 (0.0078)	0.0012 (0.0076)	0.0054 (0.0085)	-0.0020 (0.0079)	0.0245*** (0.0074)	0.0029 (0.0164)	0.0283*** (0.0082)
Marriage	0.0194** (0.0094)	0.0133 (0.0103)	0.0274** (0.0107)	0.0102 (0.0094)	0.0089 (0.0104)	0.0077 (0.0106)	-0.0311*** (0.0094)	-0.0609*** (0.0204)	-0.0201* (0.0106)
Health	-0.0294*** (0.0060)	-0.0392*** (0.0065)	0.0164** (0.0068)	-0.0314*** (0.0060)	-0.0420*** (0.0065)	0.0175** (0.0068)	0.0294*** (0.0058)	0.0185 (0.0130)	0.0315*** (0.0065)
Work	0.0150** (0.0072)	0.0080 (0.0078)	0.0002 (0.0086)	0.0134* (0.0073)	0.0071 (0.0079)	-0.0027 (0.0086)	0.0192*** (0.0072)	0.0118 (0.0159)	0.0203** (0.0080)
House	0.0921*** (0.0122)	0.1316*** (0.0137)	-0.0451*** (0.0138)	0.0826*** (0.0122)	0.1296*** (0.0138)	-0.0551*** (0.0135)	-0.0963*** (0.0127)	-0.0980*** (0.0283)	-0.0964*** (0.0141)
ln(Non-finance-asset)	-0.0237*** (0.0020)	-0.0315*** (0.0022)	0.0118*** (0.0026)	-0.0200*** (0.0020)	-0.0284*** (0.0022)	0.0132*** (0.0025)	0.0430*** (0.0024)	0.0472*** (0.0052)	0.0417*** (0.0026)
ln(Debt)	0.0015** (0.0006)	0.0016*** (0.0006)	-0.0020*** (0.0006)	0.0012** (0.0006)	0.0017*** (0.0006)	-0.0027*** (0.0006)	-0.0017*** (0.0006)	-0.0022* (0.0012)	-0.0017*** (0.0006)
ln(Consumption)	-0.0820*** (0.0045)	-0.1153*** (0.0050)	0.0398*** (0.0054)	-0.0776*** (0.0045)	-0.1135*** (0.0050)	0.0459*** (0.0054)	0.1462*** (0.0047)	0.1732*** (0.0104)	0.1365*** (0.0052)
ln(Income)	-0.0090*** (0.0016)	-0.0133*** (0.0018)	0.0066*** (0.0020)	-0.0087*** (0.0016)	-0.0129*** (0.0018)	0.0060*** (0.0019)	0.0236*** (0.0019)	0.0192*** (0.0035)	0.0256*** (0.0023)
Family size	0.0164*** (0.0022)	0.0307*** (0.0024)	-0.0210*** (0.0029)	0.0195*** (0.0022)	0.0345*** (0.0025)	-0.0168*** (0.0028)	-0.0280*** (0.0022)	-0.0217*** (0.0049)	-0.0296*** (0.0025)
Rural	0.0906*** (0.0075)	0.0934*** (0.0079)	-0.0227** (0.0105)	0.1001*** (0.0075)	0.1025*** (0.0080)	-0.0144 (0.0103)	-0.0478*** (0.0075)	-0.0863*** (0.0168)	-0.0366*** (0.0083)
Province	control	control	control	control	control	control	control	control	control
Obs	31,432	28,624	14,767	31,432	28,361	15,394	31,432	7,417	24,015
Wald	2,529.81	3,890.68	934.90	2,355.45	3,849.88	1,027.46	5,246.36	1,483.36	3,726.75
Pseudo R ²	0.0657	0.1189	0.0789	0.0598	0.1166	0.0809	0.1863	0.2086	0.1779

Atkinson and Messy (2012) assert that there is a positive relationship between financial literacy and education. We repeat our empirical tests in Tables 5, 6, and 7, using education residual (See Appendix C) to proxy for financial knowledge. This table reports the results. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

The second section of Table 8, repeats the tests in Table 6 using education residual to proxy for financial knowledge. Looking at the results for education residual in Columns (5), (6), and (7), they are mostly in line with Table 6 with the exception of Column (5). The coefficient of the education residual for ICPProp&Beh is zero instead of negative.

Finally, the third section of Table 8, repeats the tests in Table 7 using education residual to proxy for financial knowledge. The results are consistent with Table 7.

6.2. Alternative Measure for Financial Knowledge

Following Fernandes et al. (2014), we also measure financial knowledge by the percentage of correct answers as an alternative proxy to our original method. Our empirical tests in Tables 5, 6, and 7 are repeated using this ratio that we label as right ratio (See Appendix D). The results are presented in Table 9. The results are consistent with our main empirical results in Tables 5, 6, and 7.

Table 9: Robustness Test: Right Ratio

	Main Regression			Explanation 1			Explanation 2		
	ICPref&Beh	ICPref&Beh1	ICPref&Beh2	ICProp&Beh	ICProp&Beh1	ICProp&Beh2	Whole sample	Risk-seeking	Risk-averse
Right ratio	-0.1753*** (0.0131)	-0.4459*** (0.0149)	0.4101*** (0.0148)	-0.1755*** (0.0131)	-0.4723*** (0.0151)	0.4104*** (0.0149)	0.2333*** (0.0126)	0.2397*** (0.0278)	0.2296*** (0.0140)
Age	-0.0039*** (0.0014)	0.0039** (0.0016)	-0.0061*** (0.0014)	-0.0044*** (0.0014)	0.0042*** (0.0016)	-0.0067*** (0.0014)	-0.0038*** (0.0014)	-0.0010 (0.0030)	-0.0045*** (0.0015)
Age ² /100	0.0057*** (0.0013)	-0.0002 (0.0015)	0.0039*** (0.0014)	0.0060*** (0.0013)	-0.0004 (0.0015)	0.0044*** (0.0014)	-0.0008 (0.0013)	-0.0041 (0.0029)	0.0001 (0.0014)
Male	-0.0029 (0.0076)	0.0092 (0.0084)	-0.0054 (0.0077)	0.0008 (0.0077)	0.0087 (0.0086)	-0.0004 (0.0078)	0.0242*** (0.0074)	-0.0004 (0.0164)	0.0289*** (0.0082)
Marriage	0.0195** (0.0094)	0.0138 (0.0104)	0.0270*** (0.0104)	0.0101 (0.0094)	0.0100 (0.0106)	0.0061 (0.0105)	-0.0312*** (0.0094)	-0.0615*** (0.0205)	-0.0200* (0.0106)
Health	-0.0263*** (0.0060)	-0.0333*** (0.0065)	0.0081 (0.0067)	-0.0282*** (0.0060)	-0.0357*** (0.0066)	0.0092 (0.0067)	0.0254*** (0.0058)	0.0149 (0.0131)	0.0273*** (0.0065)
Work	0.0149** (0.0072)	0.0071 (0.0079)	-0.0010 (0.0085)	0.0134* (0.0073)	0.0068 (0.0080)	-0.0030 (0.0085)	0.0199*** (0.0072)	0.0144 (0.0159)	0.0205** (0.0080)
House	0.0845*** (0.0122)	0.1172*** (0.0138)	-0.0369*** (0.0137)	0.0747*** (0.0122)	0.1150*** (0.0139)	-0.0468*** (0.0135)	-0.0877*** (0.0127)	-0.0888*** (0.0285)	-0.0880*** (0.0142)
ln(Non-finance-asset)	-0.0217*** (0.0020)	-0.0280*** (0.0022)	0.0089*** (0.0025)	-0.0180*** (0.0020)	-0.0247*** (0.0022)	0.0103*** (0.0024)	0.0408*** (0.0024)	0.0451*** (0.0052)	0.0395*** (0.0026)
ln(Debt)	0.0014** (0.0006)	0.0014** (0.0006)	-0.0022*** (0.0006)	0.0012** (0.0006)	0.0016** (0.0006)	-0.0028*** (0.0006)	-0.0017*** (0.0006)	-0.0022* (0.0012)	-0.0016** (0.0006)
ln(Consumption)	-0.0760*** (0.0045)	-0.1069*** (0.0051)	0.0275*** (0.0053)	-0.0712*** (0.0045)	-0.1045*** (0.0051)	0.0345*** (0.0053)	0.1394*** (0.0047)	0.1662*** (0.0104)	0.1297*** (0.0052)
ln(Income)	-0.0079*** (0.0016)	-0.0112*** (0.0018)	0.0047** (0.0019)	-0.0075*** (0.0016)	-0.0106*** (0.0018)	0.0040** (0.0019)	0.0221*** (0.0019)	0.0179*** (0.0035)	0.0240*** (0.0023)
Family size	0.0141*** (0.0022)	0.0269*** (0.0024)	-0.0148*** (0.0028)	0.0172*** (0.0022)	0.0305*** (0.0025)	-0.0105*** (0.0028)	-0.0250*** (0.0022)	-0.0185*** (0.0049)	-0.0267*** (0.0025)
Rural	0.0844*** (0.0075)	0.0846*** (0.0080)	-0.0125 (0.0104)	0.0931*** (0.0075)	0.0931*** (0.0081)	-0.0052 (0.0103)	-0.0417*** (0.0076)	-0.0796*** (0.0169)	-0.0306*** (0.0084)
Province	control	control	control	control	control	control	control	control	control
Obs	31,432	28,624	14,767	31,432	28,361	15,394	31,432	7,417	24,015
Wald	2713.49	4494.16	1248.93	2535.11	4499.00	1312.73	5398.94	1505.46	3858.66
Pseudo R ²	0.0702	0.1396	0.1160	0.0642	0.1395	0.1121	0.1936	0.2150	0.1856

Following [Fernandes et al. \(2014\)](#), we measure financial knowledge by percentage of correct answers as an alternative proxy to our original method. Our empirical tests in Tables 5, 6, and 7, are repeated using this ratio that we label as right ratio (See [Appendix D](#)). This table reports the results. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

6.3. Using an Age Threshold

[Christelis et al. \(2010\)](#) study the relationship between cognitive abilities and stockholding using the Survey of Health, Ageing and Retirement in Europe. The authors draw attention to the decreasing tendency of people older than 65 to hold stocks and split their sample into two groups using this age as the threshold. Accordingly, we repeat our tests in [Tables 5, 6](#) and [7](#), restricting our sample to only respondents who are younger than 65. The results are presented in [Tables 10, 11](#), and [12](#). The results are mostly in line with [Tables 5, 6](#), and [7](#).

Table 10: Robustness Test: Main Regression, Age Less than 65

	ICPref&Beh		ICPref&Beh1		ICPref&Beh2	
	Probit	Ivprobit	Probit	Ivprobit	Probit	Ivprobit
Financial knowledge	-0.0002 (0.0001)	-0.0160*** (0.0019)	-0.0018*** (0.0001)	-0.0276*** (0.0015)	0.0024*** (0.0001)	0.0300*** (0.0017)
Age	-0.0096*** (0.0026)	-0.0373*** (0.0067)	0.0021 (0.0030)	-0.0147** (0.0072)	-0.0118*** (0.0028)	-0.0128 (0.0102)
Age ² /100	0.0128*** (0.0029)	0.0396*** (0.0072)	0.0023 (0.0033)	0.0165** (0.0077)	0.0106*** (0.0031)	0.0157 (0.0109)
Male	-0.0027 (0.0089)	-0.0276 (0.0223)	0.0108 (0.0099)	-0.0017 (0.0234)	-0.0126 (0.0089)	-0.0053 (0.0308)
Marriage	0.0221* (0.0116)	0.0608** (0.0290)	0.0127 (0.0129)	0.0239 (0.0299)	0.0374*** (0.0128)	0.1083** (0.0432)
Health	-0.0261*** (0.0069)	-0.0459*** (0.0178)	-0.0329*** (0.0075)	-0.0477*** (0.0182)	0.0148* (0.0078)	0.0233 (0.0263)
Work	0.0076 (0.0084)	0.0168 (0.0213)	-0.0042 (0.0092)	-0.0146 (0.0216)	0.0114 (0.0099)	0.0288 (0.0334)
House	0.0948*** (0.0145)	0.1715*** (0.0376)	0.1373*** (0.0165)	0.1995*** (0.0403)	-0.0391** (0.0155)	-0.0300 (0.0528)
ln(Non-finance-asset)	-0.0263*** (0.0024)	-0.0458*** (0.0068)	-0.0352*** (0.0027)	-0.0492*** (0.0072)	0.0091*** (0.0030)	0.0042 (0.0100)
ln(Debt)	0.0015** (0.0006)	0.0024 (0.0016)	0.0015** (0.0007)	0.0006 (0.0016)	-0.0019*** (0.0007)	-0.0046** (0.0023)
ln(Consumption)	-0.0775*** (0.0053)	-0.1258*** (0.0176)	-0.1127*** (0.0059)	-0.1529*** (0.0190)	0.0386*** (0.0061)	0.0357 (0.0253)
ln(Income)	-0.0082*** (0.0017)	-0.0113** (0.0045)	-0.0120*** (0.0019)	-0.0145*** (0.0045)	0.0044** (0.0021)	0.0011 (0.0068)
Family size	0.0189*** (0.0026)	0.0217*** (0.0076)	0.0330*** (0.0029)	0.0385*** (0.0079)	-0.0201*** (0.0033)	-0.0272** (0.0126)
Rural	0.0871*** (0.0086)	0.0783*** (0.0299)	0.0843*** (0.0091)	-0.0101 (0.0280)	-0.0098 (0.0117)	0.1851*** (0.0439)
Province	control	control	control	control	control	control
Obs	24,123	24,123	21,684	21,684	12,144	12,144
Wald	1,721.97	2,258.36	2,921.72	5,715.78	817.25	2,238.76
Pseudo R^2/R^2	0.0569	0.5849	0.1158	0.5012	0.0844	0.0565
First Stage F		41.82		68.97		14.29
Cragg-Donald F		485.362		444.833		164.764

Christelis et al. (2010) study the relationship between cognitive abilities and stockholding using the Survey of Health, Ageing and Retirement in Europe (SHARE). Following them, we repeat our tests in Table 5, restricting our sample to only respondents who are younger than 65. This table reports the results. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 11: Robustness Test: Explanation 1, Age Less than 65

	ICProp&Beh		ICProp&Beh1		ICProp&Beh2	
	Probit	Ivprobit	Probit	Ivprobit	Probit	Ivprobit
Financial knowledge	-0.0001 (0.0001)	-0.0171*** (0.0018)	-0.0019*** (0.0001)	-0.0299*** (0.0014)	0.0024*** (0.0001)	0.0306*** (0.0016)
Age	-0.0115*** (0.0027)	-0.0423*** (0.0066)	0.0024 (0.0031)	-0.0151** (0.0072)	-0.0147*** (0.0028)	-0.0170* (0.0100)
Age ² /100	0.0145*** (0.0029)	0.0437*** (0.0071)	0.0018 (0.0033)	0.0156** (0.0076)	0.0137*** (0.0031)	0.0214** (0.0107)
Male	0.0012 (0.0089)	-0.0202 (0.0221)	0.0092 (0.0100)	-0.0137 (0.0231)	-0.0043 (0.0090)	0.0121 (0.0295)
Marriage	0.0140 (0.0116)	0.0414 (0.0287)	0.0091 (0.0130)	0.0133 (0.0296)	0.0232* (0.0128)	0.0593 (0.0409)
Health	-0.0317*** (0.0069)	-0.0559*** (0.0177)	-0.0386*** (0.0076)	-0.0494*** (0.0181)	0.0126 (0.0078)	0.0103 (0.0253)
Work	0.0095 (0.0084)	0.0206 (0.0211)	-0.0026 (0.0093)	-0.0139 (0.0213)	0.0112 (0.0099)	0.0269 (0.0318)
House	0.0866*** (0.0145)	0.1418*** (0.0370)	0.1384*** (0.0167)	0.1909*** (0.0397)	-0.0464*** (0.0153)	-0.0450 (0.0508)
ln(Non-finance-asset)	-0.0227*** (0.0024)	-0.0343*** (0.0066)	-0.0319*** (0.0027)	-0.0382*** (0.0069)	0.0096*** (0.0029)	0.0034 (0.0094)
ln(Debt)	0.0012** (0.0006)	0.0017 (0.0016)	0.0015** (0.0007)	0.0009 (0.0016)	-0.0024*** (0.0007)	-0.0056** (0.0022)
ln(Consumption)	-0.0722*** (0.0053)	-0.1032*** (0.0172)	-0.1097*** (0.0059)	-0.1299*** (0.0184)	0.0449*** (0.0061)	0.0409 (0.0250)
ln(Income)	-0.0081*** (0.0017)	-0.0097** (0.0044)	-0.0117*** (0.0019)	-0.0103** (0.0045)	0.0037* (0.0020)	-0.0013 (0.0064)
Family size	0.0221*** (0.0026)	0.0261*** (0.0076)	0.0367*** (0.0029)	0.0379*** (0.0079)	-0.0158*** (0.0033)	-0.0130 (0.0115)
Rural	0.0962*** (0.0086)	0.0827*** (0.0297)	0.0926*** (0.0091)	-0.0230 (0.0276)	-0.0046 (0.0115)	0.2133*** (0.0412)
Province	control	control	control	control	control	control
Obs	24,123	24,123	21,473	21,473	12,623	12,623
Wald	1,604.52	2,192.83	2,910.91	6,446.86	877.57	2,648.19
Pseudo R^2/R^2	0.0521	0.5605	0.1148	0.4443	0.0850	0.0358
First Stage F		37.87		64.15		14.75
Cragg-Donald F		0.5605		432.229		160.748

Christelis et al. (2010), study the relationship between cognitive abilities and stockholding using the Survey of Health, Ageing and Retirement in Europe (SHARE). Following them, we repeat our tests in Table 6 restricting our sample to only respondents who are younger than 65. This table reports the results. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 12: Robustness Test: Explanation 2, Age Less than 65

	All sample		Risk seeking		Risk averse	
	Probit	Ivprobit	Probit	Ivprobit	Probit	Ivprobit
Financial knowledge	0.0013*** (0.0001)	0.0190*** (0.0020)	0.0013*** (0.0003)	0.0221*** (0.0045)	0.0013*** (0.0001)	0.0181*** (0.0022)
Age	-0.0026 (0.0027)	0.0080 (0.0074)	0.0007 (0.0055)	0.0194 (0.0138)	-0.0037 (0.0031)	0.0041 (0.0088)
Age ² /100	-0.0028 (0.0029)	-0.0163** (0.0078)	-0.0070 (0.0061)	-0.0277* (0.0148)	-0.0013 (0.0034)	-0.0123 (0.0092)
Male	0.0215** (0.0089)	0.0758*** (0.0236)	-0.0123 (0.0189)	0.0156 (0.0483)	0.0293*** (0.0101)	0.0932*** (0.0275)
Marriage	-0.0332*** (0.0119)	-0.0919*** (0.0313)	-0.0509** (0.0243)	-0.1333** (0.0583)	-0.0256* (0.0137)	-0.0741** (0.0372)
Health	0.0218*** (0.0070)	0.0390** (0.0188)	0.0044 (0.0147)	-0.0052 (0.0366)	0.0263*** (0.0079)	0.0532** (0.0219)
Work	0.0297*** (0.0087)	0.0766*** (0.0231)	0.0153 (0.0182)	0.0145 (0.0454)	0.0334*** (0.0099)	0.0940*** (0.0269)
House	-0.1043*** (0.0154)	-0.2080*** (0.0409)	-0.0993*** (0.0317)	-0.1743** (0.0790)	-0.1070*** (0.0175)	-0.2241*** (0.0480)
ln(Non-finance-asset)	0.0482*** (0.0029)	0.1043*** (0.0084)	0.0506*** (0.0058)	0.0966*** (0.0175)	0.0475*** (0.0034)	0.1075*** (0.0097)
ln(Debt)	-0.0019*** (0.0006)	-0.0037** (0.0017)	-0.0026** (0.0013)	-0.0045 (0.0033)	-0.0017** (0.0007)	-0.0036* (0.0020)
ln(Consumption)	0.1573*** (0.0057)	0.3383*** (0.0228)	0.1812*** (0.0119)	0.3536*** (0.0518)	0.1475*** (0.0064)	0.3291*** (0.0254)
ln(Income)	0.0216*** (0.0021)	0.0460*** (0.0053)	0.0172*** (0.0037)	0.0335*** (0.0095)	0.0236*** (0.0025)	0.0525*** (0.0065)
Family size	-0.0331*** (0.0027)	-0.0603*** (0.0087)	-0.0201*** (0.0057)	-0.0273* (0.0156)	-0.0370*** (0.0031)	-0.0721*** (0.0104)
Rural	-0.0452*** (0.0088)	0.0186 (0.0308)	-0.0888*** (0.0189)	-0.0363 (0.0717)	-0.0321*** (0.0099)	0.0395 (0.0344)
Province	control	control	control	control	control	control
Obs	24,123	24,123	6,103	6,103	18,020	18,020
Wald	4,080.43	5,973.00	1,199.21	1,817.92	2,865.71	4,171.79
Pseudo R ² /R ²	0.1765	0.4349	0.1912	0.0953	0.1707	0.4169
First Stage F		132.45		36.31		94.22
Cragg-Donald F		485.362		81.511		404.099

Christelis et al. (2010) study the relationship between cognitive abilities and stockholding using the Survey of Health, Ageing and Retirement in Europe (SHARE). Following them, we repeat our tests in Table 7 restricting our sample to only respondents who are younger than 65. This table reports the results. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

7. Conclusion

This study provides evidence of the existence of an inconsistency between risk preference and risk behavior. Main regression results show that financial knowledge helps alleviate

the inconsistency between risk preference and risk behavior. We find that financial knowledge decreases the inconsistency between risk preference and risk behavior for risk-seeking households, but it increases this inconsistency for risk-averse households.

In order to further investigate the impact of financial knowledge, we focus on two mechanisms. First, we analyze the preference-propensity-behavior chain. We find that propensity plays a significant role in the link between risk preference and risk behavior. The inconsistency between risk propensity and risk behavior is the main reason for the existence of the inconsistency between risk preference and risk behavior.

By impacting the inconsistency between risk propensity and risky behavior, financial knowledge alleviates the inconsistency between risk preference and risky behavior, which is the main hypothesis of our study. Second, financial knowledge has a positive effect on risky behavior, whether households are risk-seeking or risk-averse. In other words, financial knowledge encourages risky behavior. Hence, financial knowledge decreases the inconsistency between risk preference and risk behavior for risk-seeking households, but it increases this inconsistency for risk-averse households.

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Authors are listed in alphabetical order.

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Data Reference

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Appendix A. Outline of China Household Finance Survey

Part One: Demographic Characteristics

1. Follow-up visit
2. Filter Questionnaire
3. Basic Family Member Information
4. Work & Income Information of Household Member

Part Two: Assets and Debts

1. Non-Financial Assets
 - (1) Production and Operation
 - (2) Housing and Land
 - (3) Vehicles
 - (4) Other Non-Financial Assets
2. Financial Assets
 - (1) Demand Deposits
 - (2) Deposits
 - (3) Stocks
 - (4) Funds
 - (5) Financial Products
 - (6) Bonds
 - (7) Derivatives
 - (8) Non-RMB Assets
 - (9) Precious Metal
 - (10) Other Financial Assets
 - (11) Cash
 - (12) Lent-out Money
3. Other Debts

Part Three: Insurance and Security

1. Social Security
2. Commercial Insurance

Part Four: Expenditures and Incomes

1. Nonproductive Expenditures
2. Transfer Expenditures
3. Other Expenditures
4. Transfer Income
5. Other Income

Part Five: Financial Knowledge, Local Governance and Subject Evaluation

1. Financial Knowledge
2. Local Governance
3. Environment Protection
4. Tax
5. Birth
6. Exposition to Financial Crime
7. Voluntary Service

Appendix B. Questions in China Household Financial Survey

Table B.1: Questions

This table lists questions from the China Household Financial Survey (CHFS) used in this study.

Variables	Questions and Choice
Risk preference	What would you choose between a lottery with 100% shot at 4,000 yuan and another with 50% shot at 10,000 yuan and 50% chance for nothing? 1. The former; 2. The latter.
Risk propensity	Which of the choices below do you prefer to invest if you have adequate money? 1. Project with high-risk and high-return; 2. Project with slightly high-risk and slightly high-return; 3. Project with average risk and return; 4. Project with slight risk and return; 5. Unwilling to carry any risk.
Risky behavior	
Stock	Does your family have any stock accounts? 1. Yes; 2. No.
Fund	Does your family have any funds? 1. Yes; 2. No.
Financial products	Does your family have any bank financial products? 1. Yes; 2. No. Does your family have any internet (financial) products, such as Yuebao, Wechat Finance, JD Finance, Baidu Financemicro-channels, and Shopkeeper Wallet? 1. Yes; 2. No.
Others	Does your family have any of following financial products in addition to the aforementioned bank deposits, stocks, fund or financial products? (Choose all that apply) 1. Bonds; 2. Derivatives; 3. Precious metals (gold, etc); 4. Non-RMB assets (including overseas fixed assets).
Lend-out money	Has your family lent money to “other people” which is yet to be returned ?1.Yes; 2.No.
Financial knowledge	
Question1	What is level of interest in economics and finance? 1. Extremely interested; 2. Very interested; 3. Interested; 4. Somewhat interested; 5. Not interested at all.
Question2	Do you agree with the statement that the higher the risk the higher will be the return? 1. Yes; 2. No.
Question3	Which one in your opinion is riskier, stock or fund? 1. Stock; 2. Fund; 3. Havent heard about stock; 4. havent heard about fund; 5. Havent heard about any of them; 6. Equally risky.
Question4	Do you agree with the statement that investing in multiple financial assets is less risky than investing in one financial asset? 1. Yes; 2. No.

Table B.1 (Cont'd)

Variables	Questions and Choice
Education time	[Head of household]'s educational level is? 1. No schooling at all; 2. Primary school; 3. Junior high; 4. High school; 5. Technical high school; 6. College/Vocational school; 7. Bachelor's degree; 8. Master's degree; 9. Doctorate degree.
Age	[Head of household]'s birth year?
Male	[Head of household]'s gender? 1. Male; 2. Female.
Marriage	Whats the marital status of [Head of household] at present? 1. Unmarried; 2. Married; 3. Cohabitation; 4. Separated; 5. Divorced; 6. Widowed.
Health	How is [Head of household]'s health at present compared to peers? 1. Very good; 2. Good; 3. Fair; 4. Poor; 5. Very poor.
Work	Do you have a job, including individual business, online-shop, farming, helping with the family business or agricultural production, freelancer? 1. Yes; 2. No.
House	Is the house the family lives in right now is owned by family members, rented, or free? 1. Owned by family members; 2. Rented; 3. Neither owned, nor rented. Do you have your own house? 1. Yes; 2. No.
Family size	Aside from the respondent, how many family members live with the respondent?

Appendix C. Definitions of Variables Used in This Study

Table C.1: Variable Definitions

This table lists variable definitions.

Variable	Definition
Risk preference	1: if respondent chooses the 50% chance for nothing; 0: if respondent chooses the 100% shot.
Risk propensity	1: if respondent chooses Project with high-risk and high-return or Project with slightly high-risk and slightly high-return; 0: otherwise.
Risky behavior	1: holding stock, fund, financial products, bonds, derivatives, precious metals (gold, etc), non-RMB assets, or lend-out money; 0:None of mentioned assets.
ICPref&Prop1	1: risk preference without risk propensity
ICPref&Prop2	1: risk-averse with risk propensity
ICPref&Prop	1: ICPref&Prop1 or ICPref&Prop2
ICPref&Beh1	1: risk preference without risky behavior
ICPref&Beh2	1: risk-averse with risky behavior
ICPref&Beh	1: ICPref&Beh1 or ICPref&Beh2
ICProp&Beh1	1: risk propensity without risky behavior
ICProp&Beh2	1: no risk propensity with risky behavior
ICProp&Beh	1: ICProp&Beh1 or ICProp&Beh2
Financial knowledge	Factor analysis with four questions using iterated principal factor method
Education time	0: if respondent chooses 1; 5: if respondent chooses 2; 9: if respondent chooses 3; 12:if respondent chooses 4 or 5; 16: if respondent chooses 6 or 7; 19:if respondent chooses 8; 22: if respondent chooses 9.
Education residual	Residual obtained by regressing education time on financial knowledge
Right ratio	Percent of correct answers to financial knowledge questions in the survey
Age	[Head of household]'s age
Male	1: if [Head of household] is male
Marriage	1: if [Head of household] is married
Health	1: if respondent chooses 1 or 2
Work	1: if respondent chooses 1
House	1: if household owns house
Non-finance-asset	Difference between the Amount of total assets and the amount of financial assets
Debt	Sum of all debt of household
Consumption	Sum of all consumption of household
Income	Sum of all income of household
Family size	Number of family members
Rural	1: if household in rural; 0: if household in urban

Appendix D. Detail of Four Factors of Financial Knowledge

Table D.1: Factor Analysis and Right Ratio

This table reports summary statistics for factor analysis of financial knowledge ([Van Rooij et al., 2011](#)) and right ratio ([Christelis et al., 2010](#)).

	Mean	Std	KMO	Factor loadings
Question1	0.0339	0.1811	0.6180	0.1047
Question2	0.7470	0.4348	0.5905	0.5815
Question3	0.1573	0.3641	0.6228	0.2069
Question4	0.5548	0.4970	0.5905	0.5514
KMO overall			0.6028	
Right ratio	0.3733	0.2332		