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The Impact of Financial Literacy on Family Wealth

Meihua Zhu
Graduate program, Faculty of Economics
Thammasat University
Thailand
zmhd163yx@163.com

Chayanee Chawanote
Assistant Professor
Faculty of Economics
Thammasat University
Thailand
chayanee@econ.tu.ac.th

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ABSTRACT

This study uses the survey data from the China Household Finance Survey (CHFS) to explore the impact of financial literacy on Chinese family wealth. The results show that financial literacy has a positive impact on Chinese family income and assets, in per capita term. Considering the potential endogenous problems, we also apply panel models and an instrumental variable method to test and ensure the robustness of the model results. Moreover, with quantile regressions, the impact of financial literacy is higher at the lower level of income and asset distributions. It can shed light on the policy implication that the improvement of financial literacy can improve family income and assets, especially for the poor.

Keywords: Financial literacy, Household income, Household assets, Chinese family wealth

JEL Classification: G53, O16

1. Introduction

Financial literacy began to be highly concerned by governments and scholars after the global financial crisis in 2008. Most scholars believe that it is precisely because people's lack understanding of many mortgage products or lack of financial literacy affects the stability and development of economy and finance. On the other side, with the development of information technology, more consumers participate in the financial market with more convenient and diverse choices. A variety of financial products and financial information are challenging the financial literacy of consumers. Consumers need to spend a lot of time and energy to judge and analyze financial information and financial products. So many countries have brought financial literacy education into the policy level, and have implemented various financial education projects and measures to improve the level of national financial literacy. Academia has also launched a lot of discussion and research on the issue of consumer financial literacy.

In recent years, the Chinese government has been vigorously carrying out nationwide poverty alleviation. In some areas, especially in poor areas, to improve the economic situation of poor families, the government has carried out various financial education activities, financial consultation and provided preferential credit services. The Chinese government expected to improve the family income and asset level by improving residents' financial literacy. However, there is not enough evidence to show that improving financial literacy can improve the wealth level of Chinese poor families. On the other hand, for the impact of financial literacy on family wealth, most of the existing studies aimed at developed countries, and there are relatively few studies for developing countries. Previous studies in western countries are not

necessarily suitable for Chinese families. At the same time, due to the particularity of China's economy and culture, some previous research conclusions are not in line with China's situation. Hence, the exploration of this issue is a supplement to the research of China's financial literacy.

Therefore, this study aims to discuss the impact of financial literacy on Chinese family wealth using China Household Finance Survey (CHFS), so as to contribute to the empirical research of financial literacy in developing countries. The rest of this thesis is organized as follows: section 2 reviews the relevant literature and explains the differences between this research and other literature. Section 3 presents China Household Finance Survey (CHFS), financial literacy measurements, and methodology of this study. Section 4 presents empirical analyses and the last section is the conclusion.

2. Literature Review

International research on financial literacy mainly focuses on the following three aspects. The first aspect is the connotation, measurement, and evaluation of financial literacy (PACFL, 2008; Remund, 2010; Moore, 2011). The second aspect is to analyze the influencing factors of financial literacy (Agarwal et al., 2010; Herd & Holden, 2010; Lusardi, 2015). The third aspect is to explore the relationship between financial literacy and financial behavior and financial welfare (Burgess & Rohini, 2005; Moretti et al., 2014; Shan Depeng, 2019). However, only a few scholars try to explore the impact of financial literacy on household welfare, such as family wealth. One of the important reasons is that the mechanism of financial literacy is very complex, which is difficult to explore. Financial literacy is a relatively abstract concept, we cannot directly analyze the specific process of the interaction between financial literacy and family wealth. However, we

can use empirical data to analyze the results of their interaction.

Some scholars have used empirical data to explore the relationship between financial literacy and family wealth. Their empirical studies show that financial literacy affects financial behavior, and financial behavior determines income and assets, so financial literacy indirectly affects family wealth. For example, Lusardi and Mitchell (2014) established an empirical test model based on the survey data of various countries. Their studies found that financial literacy has a significant positive correlation with family wealth accumulation. Also, Lusardi and Mitchell (2008) found that this relationship is mainly reflected in the families with high financial knowledge. These families with high financial knowledge often use financial knowledge to analyze financial information to avoid wealth loss or make rational financial behavior, so as to increase family wealth. Gaudecker (2015), Rooij et al. (2012), Ameriks et al. (2003) and Behrman et al. (2012) also proved this relationship, that is, financial literacy indirectly affects family wealth by affecting financial behavior.

Several Chinese scholars have also paid attention to the relationship between financial literacy and household welfare. Tao Weirong (2021), using China Family Panel Studies (CFPS), found that financial literature has a positive effect on family's total income, wage income and property income, but it has a negative impact on family transferred income. He Shengxuan and Li Weijin (2020) used investigation and analysis report on consumer financial literacy released by the People's Bank of China in 2017 to explore the relationship between financial literacy and total income. They found that the improvement of financial literacy can improve the level of personal income and family income. It strengthens the impact of education and occupation on income, so as to affect the

structural changes within different income groups and the mobility between all levels of society. Yin Zhichao and Zhang Haodong (2017) found that financial literacy has a significant positive impact on family wealth. It can significantly narrow the family wealth gap and improve family income, especially the family wealth of low-income people. Wang Zhengwei et al. (2016) used data from 2014 China Consumer Finance Survey (CSCF) to confirm that the improvement of financial literacy helps low-income urban families to transition into high-income class. Some studies also focus more on financial literacy and poverty. After measuring poverty with income and assets, Shan Depeng (2019) found that financial literacy has a positive impact on urban poverty allowance. Lei Hanyun and Chen Qianqian (2021) used 70% of the per capita income and per capita assets of all samples in CHFS as the relative poverty line of income and assets. They found that financial literacy has a significant investment effect on persistent poverty. Cao Ying and Luo Jianchao (2019), using their own survey data, found that when the financial literacy is improved to a certain level, it can improve farmers' enthusiasm for venture financing and improve farmers' income level.

Compared to research of these Chinese scholars, this study has some differences. For example, Tao Weirong (2021), He Shengxuan and Li Weijin (2020) discussed the impact of financial literacy on income and they all use total household income, while this study uses per capita household income to measure family wealth. The CHFS survey data show that many families in China have more than five members. This means that the family's per capita income with high total household income is not necessarily high. Therefore, it is more proper to measure the level of family wealth by per capita amount. Shan Depeng (2019) and Lei Hanyun and Chen Qianqian (2021), also use per capita assets to reflect the asset level. Secondly, Shan Depeng (2019), using

a different data set from CFPS, measured the impact of financial literacy on the incidence of income poverty and asset poverty, focusing only for urban people. This study is to examine the impact of financial literacy on income and asset in the whole range of distribution with financially literacy effect for each different level of income and asset distributions in both urban and rural areas. Although Yin Zhichao and Zhang Haodong (2017) also explored the relationship between financial literacy and family wealth using CHFS data of 2013, they measured the impact of financial literacy on family wealth gap. They constructed an index of family wealth gap of community , which was used as the dependent variable of the model. This research is to measure the impact of financial literacy on per capita household income and per capita household assets respectively.

Existing literatures usually reflect family wealth by family income or assets, such as Zeng, et al. (2015) and Shan Depeng (2019). Since income and assets reflect the characteristics of different dimensions of family wealth, income represents the flow of family wealth, and assets represent the stock of family wealth. Therefore, this study uses household per capita income and household per capita assets to represent the accumulation of household wealth, and estimate the effects of financial literacy on household income and assets.

3. Data and methodology

3.1 China Household Finance Survey (CHFS)

The data used in this paper is from the China Household Finance Survey (CHFS). This survey focuses on the family member who best knows the financial situation of his family (over 16 years old) as the key survey object. The data set collects relevant information about the micro level of family

finance, mainly including: demographic characteristics and employment, assets and liabilities, income and consumption, social security and insurance, subjective attitude and other relevant information. So far, this survey has carried out five survey rounds nationwide once every two years from 2011 to 2019. The research in this study is only based on the survey data set in 2013 and 2015. This choice is based on the following reasons. First, there are no relevant questions about interest rate calculation and investment risk understanding in the 2011 questionnaire, which are important indicators to measure objective financial literacy. Second, in the 2017 questionnaire, only the first batch of respondents were asked about the calculation of interest and inflation, that is, only more than 1200 respondents answered these two questions, and the sample size is too small. In addition, although the questionnaire survey in 2019 has been completed, CHFS has not yet published the survey data set in 2019. In summary, we only use 2013 and 2015 survey data of CHFS to analyze in this study.

There are 27,755 households in 2013 and 33,882 households in 2015 from 29 provinces of China. Among 2015 samples, 19,559 households are the follow-up survey samples of 2013. For household income and assets, CHFS public survey data provide calculated total household income and calculated total household assets. Total household assets in CHFS include financial assets and non-financial assets. Financial assets include deposits, stocks, funds, financial management and bonds, derivatives, non-RMB assets, gold, other financial assets, cash, loans, social security account balance. Non-financial Assets include agricultural assets, industrial and commercial assets, housing assets, shop assets, land assets, vehicle assets and other non-financial assets. Due to the large income gap in different regions of China and the great difference in the number of family members, we use the

family per capita income and family per capita asset as indicators to measure the family income level and asset level.

3.2 Measurement of financial literacy

The measurement of financial literacy needs to give measurement variables, indicators, judgment standards and methods according to their meaning. Therefore, the measurement dimension of financial literacy level is diversified due to the inconsistency of the meaning of financial literacy. The existing research on the measurement of consumer's financial literacy can be divided into two types. The first group is the measurement of the actual level of financial literacy or the objective method; The second category is the measurement of self-evaluation of financial literacy, that is, the measurement of individual's subjective or perceived financial literacy. However, in the face of self-evaluation questions, some questions and answers may appear "overconfidence" or "excessive humility". Influenced by Chinese traditional culture, Chinese families may be too modest in their answers. Therefore, in this study, the first method of measuring the objective financial literacy level will be used.

According to CHFS, there is a module regarding financial knowledge and attitudes. To fit with the objective method, only five questions were selected to measure financial literacy. Questions 1 – 3 ask directly about financial knowledge on interest rate, inflation, and risky assets. We turn answers into correct and incorrect ones for the purpose of making a dummy variable for each question. In Table 1, we find that most respondents do not give the right answer for the calculation of interest rate and the impact of inflation. In the survey of 2013 and 2015, only 22.60% and 28.31% respectively of the respondents can correctly answer Q1.

There were fewer respondents giving right answer in Q2, only 15.75% and 16.39% respectively. Fortunately, comparing the data of 2013 and 2015, we can find that the accuracy of these two questions in the 2015 survey has improved. On the question of investment risk (Q3), the respondents answered better. Especially in 2015, more than half of the respondents (52.02%) answered correctly, which increased significantly compared to only 29.98% in 2013. For such a substantial increase, the possible reason is that the continuous interest rate cuts of banks have reduced the desire of investors for time deposits, making more investors turn to the financial market. At the same time, China's Internet finance grew explosively in 2015, and more investors joined the internet financial market. Compared with the results calculated by Lusardi and Mitchell (2011a) based on the data of 2004 Health and Retirement Study (HRS) in the United States, the accuracy of Chinese families in answering the question of financial literacy is lower than that of American families. This shows that Chinese families lack basic knowledge of Finance and understanding of financial markets.

Table 1 Questions of financial knowledge

Questions	**2013**		**2015**	
	Correct	Incorrect	Correct	Incorrect
Q1: Given a 4% interest rate, how much would you have in total after 1 year if you have 100 yuan deposited?	22.60%	77.40%	28.31%	71.69%

Q2: With an interest rate of 5% and an inflation rate of 3%, the staff you buy with the money you have saved in the bank for 1 year is?	15.75%	84.25%	16.39%	83.61%
Q3: Which one do you think is riskier, stock or fund?	29.98%	70.02%	52.01%	47.99%

Source: CHFS 2013, CHFS 2015

As for the degree of attention to economic or financial information (Q4), we can see from Table 2 that almost 40% of respondents never pay attention to economic or financial information, which explains to a certain extent why the respondents' correct rate of answering Q1, Q2 and Q3 questions is low. In addition, from Table 3, we can also find that most respondents have not received some financial education, which shows that the popularization and publicity of financial knowledge in China is not extensive. Comparing the data of 2013 and 2015, we can find that the survey data results of the past two years are similar on the two issues of financial information attention and financial education. However, what difference from our expectation is that the survey data show that the attention to economic and financial information and financial education participation in 2015 is slightly lower than that in 2013. One possible reason is that such differences are caused by the selection and size of samples.

Table 2 Questions of financial information attention

Question	Year	Very concerned	Generally concerned	Seldom concerned	Not at all
Q4: What is your degree of concern for economic and financial informati on?	2013	11.76%	24.71%	26.93%	36.60%
	2015	10.89%	22.67%	29.27%	37.18%

Source: CHFS 2013, CHFS 2015

Table 3 Questions of financial education

Question	Year	Yes	No
Q5: Have you ever taken economic and financial classes?	2013	8.00%	92.00%
	2015	6.87%	93.13%

Source: CHFS 2013, CHFS 2015

Since the concept and difficulty of each question in the questionnaire used in our study are different, different weights should be given (Askar et al., 2020). We propose to use principal component analysis to calculate financial literacy. However, in order to test the robustness of the analysis results, the direct aggregation from each question is also applied to measure financial literacy. From the above five questions, we first set up dummy variables for the options of each question. For questions Q1 - Q3, besides 1 and 0 to represent correct

and wrong answers, the answer of "Cannot figure out" is represented by 0 as well. For Q4, it is substituted by 0, 0.25, 0.5 and 1 to reflect financial concern from low to high. The original answers have "very concerned" and "extremely concerned", but from our analysis, the scores of Q1 to Q3 between those who answered these Q4 answers are statistically indifferent. Hence, we classify "very concerned" and "extremely concerned" into one category and use score equal to 1 to represent this category. For Q5, we use 1 and 0 to represent whether the respondents have received financial education.

We conduct factor analysis, using principal component factor method, on these five variables, extract the common factor, and calculate the factor score reflecting financial literacy. In order to facilitate the comparison of financial literacy, the original factor score is normalized to have the score between 0 – 1. The factor score represents the level of financial literacy. The higher financial literacy score reflects the higher level of the financial literacy.

On robustness check, the values of the five dummy variables are added into the total score of financial literacy. The financial literacy score calculated by this direct summation method is between 0 – 5. Similarly, the higher the financial literacy score, the higher the financial literacy.

3.3 Empirical framework

In order to measure the impact of financial literacy on family wealth, we applied several regression models to investigate the impact. The main basic models are as follows:

$$\boldsymbol{Ln(incpc_i) = \alpha + \beta finlit_i + \gamma X_i + \varepsilon_i} \qquad (1)$$

$$\boldsymbol{Ln(astpc_i) = \alpha + \beta finlit_i + \gamma X_i + \varepsilon_i} \qquad (2)$$

Where $incpc_i$ represents the average income level per capita of the family i. $astpc_i$ represents the average asset level per capita of the family i. $finlit_i$ is our financial literacy score. X_i represents the control variables, including include gender, location (urban or rural), family members, age, square of age, marital status, a dummy of risk preference, a dummy for each education level of head of household. ε_i is a random error. In the model, the parameter of financial literacy is β, which captures the effect of financial literacy on family wealth.

With the basic model, we will investigate each year and also with pooled data. As we use two years of the CHFS, we will also apply a panel data model as our robustness check. Moreover, the quantile regression model will be applied to explore the impact of financial literacy at different levels of income and asset distributions.

4. Empirical analyses

4.1 Description statistics of financial literacy

Table 4 lists the average financial literacy score by each household characteristic in 2013 and 2015 in two different calculation methods, namely factor analysis (PCF) and direct aggregation (Add-up). From the perspective of overall financial literacy, China's family financial literacy is relatively low, only 0.2582 (out of 1.0) in 2013 and 0.2489 in 2015. The average scores across the two years and characteristics are similar. The results also show that the distribution of financial literacy obtained by these two calculation methods is also consistent. This shows that the distribution characteristics of financial literacy are robust to a certain extent.

In details, Table 4 shows that women's financial literacy is slightly higher than men. However, most research results show that men's financial literacy is higher than women. The

reason could be that although most heads of households are men in Chinese society, male heads of households are not necessarily responsible for managing family wealth. However, if a woman is the head of household, she will generally bear greater economic responsibility at home and master the economic dominance of the family. So, her financial literacy will be better. To be exact, the interpretation would be that the financial literacy of female heads of households is higher than that of male heads of households.

The financial literacy for each age group shows the downward sloping. In other studies, for example, Agarwal et al. (2008) found that the relationship between financial literacy and age was inverted U shape. That is, the financial literacy level of middle-aged people is higher than that of young people and the elderly. However, Table 4 shows that the older the age, the lower the financial literacy. In the past 20 years, due to the constraints of social environment and economic conditions, the education level of China's middle-aged and elderly groups is far lower than that of the younger generation. Hence, it is difficult for them to obtain some financial advice or participate in several financial activities.

Table 4 also shows that the financial literacy of urban groups is significantly higher than that of rural groups. In terms of geographical location, the financial literacy of people in Eastern China is significantly higher than that in Central and Western China. There is also no significant difference between the financial literacy of people in Central and Western China. In the CHFS survey, the eastern region includes Beijing, Shanghai, Guangdong, Zhejiang, Jiangsu and other provinces. These provinces are the most economically and financially developed provinces in China. For the analyses in the regression models, we then decide to control for provincial fixed effects in all models.

The financial literacy of unmarried people exhibits the highest score. Also, the financial literacy of cohabiting couple is higher than that of married people. For education level, similar to the research results of Delavande et al. (2008), Lusardi & Mitchell (2011) and Grohmann et al. (2015), education level has a positive relationship with individual's financial literacy level. The data in Table 4 show that the higher the education level of respondents, the higher their financial literacy. We can also find the higher the education level of respondents' parents, the higher their financial literacy.

In addition, different risk preference groups have different financial literacy. We can see that there are also great differences in financial literacy among people with different risk preferences. The financial literacy of those who are unwilling to bear any risk is far lower than those who are willing to choose average risk or slightly higher risk. However, it is interesting that the group of highest degree of risk lover does not have the highest score of financial literacy.

Table 4 Distribution characteristics of financial literacy

Characteristics	**The Average Financial Literacy**			
	PCF		**Add-up**	
	2013	**2015**	**2013**	**2015**
Whole Sample	27,755	33,882	27,755	33,882
	0.2582	0.2489	1.0717	1.3350
Gender				
Male	0.2538	0.2439	1.0508	1.3055
Female	0.2719	0.2644	1.1369	1.4266
Age				
16-30years	0.3487	0.3819	1.5730	2.0437
31-45years	0.2905	0.3091	1.2721	1.6672

Characteristics	The Average Financial Literacy			
	PCF		Add-up	
	2013	2015	2013	2015
46-60years	0.2467	0.2348	1.0219	1.2626
61-75years	0.2173	0.1943	0.8181	1.0324
76years or older	0.2018	0.1767	0.6617	0.9378
Location				
Urban	0.2944	0.2928	1.2476	1.5767
Rural	0.1810	0.1543	0.6959	0.8138
Region				
east	0.2708	0.2715	1.1215	1.4613
midland	0.2391	0.2255	1.0277	1.2124
west	0.2584	0.2287	1.0306	1.2127
Marital status				
Unmarried	0.3521	0.3509	1.5401	1.8541
Cohabitation/Married/Separated	0.2578	0.2503	1.0747	1.3437
Divorced/Widowed	0.2169	0.1903	0.8199	1.0204
Education (household head)				
No schooling at all	0.1367	0.0949	0.3775	0.4966
Primary school	0.1741	0.1528	0.6443	0.8203
Junior high school	0.2247	0.2218	0.9597	1.2069
High school/Technical high school	0.2979	0.3009	1.2831	1.6237

Characteristics	The Average Financial Literacy			
	PCF		Add-up	
	2013	2015	2013	2015
College/Vocational school/University	0.4434	0.4464	1.9130	2.3562
Master's degree and above	0.5622	0.5896	2.6784	3.0776
Education (mother)				
No schooling at all	0.2054	0.2059	0.7949	1.1117
Primary school	0.2902	0.3102	1.2561	1.6744
Junior high school	0.3456	0.3721	1.5424	1.9869
High school/Technical high school	0.4097	0.4288	1.8213	2.2716
College/Vocational school/University and above	0.4473	0.4934	1.9892	2.5444
Education (father)				
No schooling at all	0.1913	0.1707	0.7195	0.9180
Primary school	0.2594	0.2802	1.0932	1.5209
Junior high school	0.3067	0.3364	1.3563	1.8047
High school/Technical high school	0.3592	0.4062	1.5812	2.1533

Characteristics	The Average Financial Literacy			
	PCF		Add-up	
	2013	2015	2013	2015
College/Vocational school/University and above	0.4005	0.4810	1.7265	2.5067
Risk Preference				
Project with high-risk and high-return	0.3274	0.3520	1.4510	1.8445
Project with slightly high-risk and slightly high-return	0.4294	0.4759	1.8846	2.4637
Project with average risk and return	0.3284	0.3443	1.4487	1.8366
Project with slight risk and return	0.2850	0.2939	1.2138	1.5890
Unwilling to carry any risk	0.2004	0.1779	0.7731	0.9671

Source: CHFS 2013, CHFS 2015

4.2 Basic regression models

Firstly, we use the basic regression model to measure the relationship between financial literacy and per capita family income and assets. The results are shown in Tables 5 and 6, respectively. Models (1) – (6) test the relationship between financial literacy and family income per capita. Here, we multiply our financial literacy calculated by PCF method with

100 in order to get an appropriate magnitude of impact for one score increase of financial literacy. Models (1) – (3) show the relationship of financial literacy and per capita family income with only provincial fixed effects to control for difference of financial literacy across provinces. We can also interpret that one score increase (out of 100) of financial literacy compared to average of each province will correlate with 1.8% statistically significant increase in per capita family income in 2013, 2.08% in 2015, and average of 1.96% in the pooled data. When controlling for other characteristics as in columns (4) – (6), we find that the impacts of financial literacy on per capita family income are around 0.69% – 0.98% with statistically significant at the significance level of 1%. The magnitude has dropped around half as some of these characteristics correlate to financial literacy as we can see in Table 4. It still reflects that financial literacy has a significant positive correlation on family income.

Table 5 Financial literacy and family income

Model	(1)	(2)	(3)	(4)	(5)	(6)
	2013	2015	Pooled	2013	2015	Pooled
Financial literacy	0.0180***	0.0208***	0.0196***	0.0069***	0.0098***	0.0085***
	(0.0009)	(0.0009)	(0.0009)	(0.0005)	(0.0005)	(0.0004)
Age				0.0043	0.0037	0.0039
				(0.0049)	(0.0047)	(0.0039)
Age2				0.00003	-0.00001	0.000005
				(0.0000)	(0.0000)	(0.0000)
Members				-0.0774***	-0.108***	-0.0951***
				(0.0085)	(0.0096)	(0.0074)
Rural (=1 if rural, =0 urban)				-0.441***	-0.411***	-0.426***
				(0.0313)	(0.0495)	(0.0370)
Female (=1 if female,				0.0809**	0.0342	0.0565**

=0 man)	(0.0239)	(0.0218)	(0.0196)
Risk preference			
Project with high-risk and high-return (base case)			
Project with slightly high-risk and slightly high-return	0.134*	0.138*	0.137***
	(0.0582)	(0.0514)	(0.0356)
Project with average risk and return	0.0336	-0.0252	0.0016
	(0.0375)	(0.0432)	(0.0274)
Project with slight risk and return	0.00130	-0.0393	-0.0176
	(0.0437)	(0.0377)	(0.0254)
Unwilling to carry any risk	-0.0859*	-0.153***	-0.122***
	(0.0347)	(0.0382)	(0.0193)
Marital status			
Unmarried (base case)			
Cohabitation/Married/Separated	-0.0577	0.124*	0.0373
	(0.0413)	(0.0549)	(0.0384)
Divorced/Widowed	-0.205***	-0.0735	-0.140**
	(0.0490)	(0.0671)	(0.0426)
Education			
No schooling at all (base case)			
Primary school	0.249***	0.254***	0.252***
	(0.0348)	(0.0328)	(0.0284)
Junior high school	0.548***	0.494***	0.520***
	(0.0363)	(0.0402)	(0.0333)
High school/Technical high school	0.814***	0.687***	0.745***
	(0.0415)	(0.0386)	(0.0354)
College/Vocational school/University	1.291***	1.065***	1.169***
	(0.0556)	(0.0481)	(0.0433)
Master's degree and above	1.725***	1.342***	1.514***
	(0.0939)	(0.0838)	(0.0764)

year dummy 2015			0.0755**			0.0778**
			(0.0259)			(0.0224)
constant	8.815***	8.804***	8.766***	8.686***	8.890***	8.761***
	(0.0230)	(0.0217)	(0.0279)	(0.137)	(0.146)	(0.107)
N	26,833	32,705	59,538	26,493	31,826	58,319
R^2	0.181	0.165	0.169	0.301	0.247	0.267

Standard errors in parentheses are clustered at provincial level. All models control for provincial fixed effects.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Similarly, as shown in Table 6, models (7) – (12) test the relationship between financial literacy and per capita family asset. The results of models (7) – (9) all show that one score increase (out of 100) of financial literacy compared to average of each province will correlate with 2.35% – 2.63% statistically significant increase in per capita family asset. After adding control variables to the model, the coefficient impacts of financial literacy reduce about half to 1.05% – 1.25% with statistically significant at the significance level of 1%. It also reflects that financial literacy has a significant positive correlation on family asset with a higher impact than family income.

In addition, from the results in both Tables 5 and 6, we can also find that the coefficients of other control variables such as family members, rural, and education, are significant in all models. It reflects that the greater the number of family members, the lower the family income and asset. The income and asset of rural families is lower than that of urban families. Given the same conditions, people with higher education tend to have higher income level and higher asset level than those with lower education. These conclusions are similar to most existing research results.

Table 6 Financial literacy and family Asset

Model	(7)	(8)	(9)	(10)	(11)	(12)
	2013	2015	Pooled	2013	2015	Pooled
Financial literacy	0.0235*** (0.0011)	0.0263*** (0.0012)	0.0252*** (0.0011)	0.0105*** (0.0004)	0.0125*** (0.0006)	0.0117*** (0.0005)
Age				0.0388*** (0.0070)	0.0301*** (0.0067)	0.0336*** (0.0062)
Age2				-0.00033*** (0.0001)	-0.00023*** (0.0001)	-0.00027*** (0.0001)
Members				-0.111*** (0.0073)	-0.125*** (0.0074)	-0.119*** (0.0067)
Rural (=1 if rural, =0 urban)				-0.635*** (0.0528)	-0.674*** (0.0472)	-0.658*** (0.0453)
Female (=1 if female, =0 man)				0.0282 (0.0275)	0.0427 (0.0231)	0.0367 (0.0228)
Risk preference						
Project with high-risk and high-return (base case)						
Project with slightly high-risk and slightly high-return				0.111 (0.0643)	0.0283 (0.0357)	0.0675 (0.0377)
Project with average risk and return				0.0094 (0.0397)	-0.135** (0.0386)	-0.0648* (0.0287)
Project with slight risk and return				-0.108* (0.0468)	-0.145*** (0.0371)	-0.121*** (0.0314)
Unwilling to carry any risk				-0.234*** (0.0416)	-0.352*** (0.0369)	-0.297*** (0.0304)
Marital status						
Unmarried (base case)						
Cohabitation/Married/Separated				0.501*** (0.0640)	0.509*** (0.0590)	0.509*** (0.0479)

Divorced/Widowed				0.337***	0.310***	0.324***
				(0.0788)	(0.0695)	(0.0560)
Education						
No schooling at all(base case)						
Primary school				0.322***	0.310***	0.318***
				(0.0469)	(0.0379)	(0.0363)
Junior high school				0.671***	0.607***	0.639***
				(0.0488)	(0.0416)	(0.0398)
High school/Technical high school				0.921***	0.861***	0.890***
				(0.0526)	(0.0486)	(0.0439)
College/Vocational school/University				1.400***	1.322***	1.357***
				(0.0717)	(0.0820)	(0.0711)
Master's degree and above				1.584***	1.578***	1.579***
				(0.144)	(0.124)	(0.129)
year 2015			0.180***			0.175***
			(0.0279)			(0.0227)
constant	10.73***	10.82***	10.68***	9.551***	10.03***	9.723***
	(0.0276)	(0.0287)	(0.0362)	(0.193)	(0.243)	(0.200)
N	27,749	33,861	61,610	27,395	32,931	60,326
R^2	0.216	0.248	0.233	0.327	0.364	0.346

Standard errors in parentheses are clustered at provincial level. All models control for provincial fixed effects.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For the robustness of the test results, the financial literacy is also calculated by direct aggregation method with score between 0 – 5. The estimated coefficients of financial literacy are shown in models (a.1) – (a.12) of Table 7. Even with using different financial literacy measurement indicators, the coefficients of financial literacy are still significant and show

a positive correlation with family income and family assets. We can say that these impacts are robust. On the other note, the coefficients of financial literacy on the per capital family asset are higher than that on the per capita family income. Hence, it can be concluded that the impact of financial literacy on assets seems greater than that on income.

Table 7 Robustness check for different financial literacy calculation: aggregation method

Y: ln(avgincome)	(a.1)	(a.2)	(a.3)	(a.4)	(a.5)	(a.6)
Data	2013	2015	Pooled	2013	2015	Pooled
Financial literacy (Add-up)	0.344***	0.390***	0.371***	0.138***	0.181***	0.161***
	(0.0182)	(0.0162)	(0.0167)	(0.0106)	(0.0085)	(0.0074)
N	26,833	32,705	59,538	26,493	31,826	58,319
R^2	0.177	0.164	0.167	0.301	0.247	0.266

Y: ln(avgasset)	(a.7)	(a.8)	(a.9)	(a.10)	(a.11)	(a.12)
Data	2013	2015	Pooled	2013	2015	Pooled
Financial literacy (Add-up)	0.462***	0.492***	0.481***	0.220***	0.229***	0.226***
	(0.023)	(0.021)	(0.022)	(0.0093)	(0.0105)	(0.0084)
N	27,749	33,861	61,610	27,395	32,931	60,326
R^2	0.215	0.246	0.231	0.329	0.363	0.347

Standard errors in parentheses are clustered at provincial level. All models control for provincial fixed effects. Models (a4) – (a6) and (a10) – (a12) include the same control variables as in Table 5 and 6. Coefficients on these control variables are also similar to Table 5 and 6.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.3 Panel model

Since the control variables in the model are limited, some factors determining family income and family assets might not

be included in the model. That is, there may be the problem of unobservables. Using panel data, we can solve the problem of individual time-invariant unobservables and the problem of missing variables that do not change with individuals but change with time. The four models in Table 8 additionally include individual fixed effect and time fixed effect. The regression results of models (13) – (14) show that after controlling for the household fixed effects, although the coefficient of financial literacy decreases compared the basic regression models before, the coefficient is still statistically significant. We can still conclude that with the improvement of financial literacy, household income and assets will increase accordingly. In order to test the robustness of this result, we also use the direct aggregation method of financial literacy in Models (a.13) and (a.14). The results show that the financial literacy calculated by the direct aggregation method still has a statistically significant positive impact on per capita household income and assets. Therefore, the impact of financial literacy on income and assets is robust. We also observe in the panel model that the impact of financial literacy on family wealth is higher than that on family income.

Table 8 Regression results of panel model

	PCF		ADD-UP	
	(13)	(14)	(a.13)	(a.14)
	ln_avgincome	ln_avgasset	ln_avgincome	ln_avgasset
Financial literacy	0.0031***	0.0041***	0.0570***	0.0924***
	(0.0005)	(0.0003)	(0.0085)	(0.0077)
Age	0.0526**	-0.0037	0.0530**	-0.0035
	(0.0147)	(0.0112)	(0.0147)	(0.0113)
Age2	-0.0005***	-0.0001	-0.0005***	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)

Members	-0.0749***	-0.1263***	-0.0748***	-0.1265***
	(0.0158)	(0.0214)	(0.0160)	(0.0212)
Rural (=1 if rural, =0 urban)	-0.3279*	0.1259	-0.3200*	0.1376
	(0.1355)	(0.1326)	(0.1297)	(0.1397)
Female (=1 if female, =0 man)	-0.3754**	-0.1672	-0.3765**	-0.1679
	(0.1101)	(0.1053)	(0.1092)	(0.1043)
Risk preference				
Project with high-risk and high-return (base case)				
Project with slightly high-risk and slightly high-return	0.1420*	-0.0182	0.1439*	-0.0174
	(0.0534)	(0.0373)	(0.0531)	(0.0368)
Project with average risk and return	0.0925*	-0.0173	0.0933*	-0.0150
	(0.0436)	(0.0297)	(0.0435)	(0.0296)
Project with slight risk and return	0.0711	-0.0328	0.0723	-0.0278
	(0.0415)	(0.0278)	(0.0410)	(0.0275)
Unwilling to carry any risk	0.0421	-0.1255***	0.0428	-0.1182***
	(0.0378)	(0.0271)	(0.0376)	(0.0271)
Marital status				
Unmarried (base case)				
Cohabitation/Married/Separated	0.0488	0.3921***	0.0451	0.3875***
	(0.0901)	(0.0898)	(0.0899)	(0.0896)
Divorced/Widowed	-0.0454	0.3699**	-0.0465	0.3686**

	(0.0912)	(0.1025)	(0.0909)	(0.1016)
Education				
No schooling at all (base case)				
Primary school	-0.0461	0.4173	-0.0508	0.4100
	(0.2458)	(0.2138)	(0.2466)	(0.2144)
Junior high school	0.1491	0.3414	0.1451	0.3349
	(0.2183)	(0.1964)	(0.2183)	(0.1956)
High school/Technical high school	-0.0476	0.3370	-0.0500	0.3276
	(0.2837)	(0.2712)	(0.2833)	(0.2699)
College/Vocational school/ University	0.1212	0.2740	0.1217	0.2707
	(0.3165)	(0.2579)	(0.3149)	(0.2597)
Master's degree and above	1.0721	1.3010	1.0771	1.2980
	(1.2808)	(0.7005)	(1.2789)	(0.7045)
year 2015	0.0917***	0.1936***	0.0914***	0.1933***
	(0.0179)	(0.0230)	(0.0180)	(0.0230)
constant	8.3318***	11.4886***	8.3244***	11.4825***
	(0.5650)	(0.4125)	(0.5617)	(0.4148)
N	37,141	38,347	37,141	38,347
R^2	0.1141	0.0625	0.1117	0.0630

Standard errors in parentheses are clustered at provincial level. All models control for provincial fixed effects.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.4 Robustness check with instrumental variables

The previous analyses show that financial literacy has a significant positive impact on family wealth, and the

improvement of financial literacy will increase family wealth. After changing different financial literacy measurement methods, the results of the model are still significant and robust. After using panel data to control the problem of household's time-invariant unobservables, the results of the model are still significant and robust. However, there could be an endogenous problem in the model. When exploring the relationship between financial literacy and family wealth, previous studies also found that there was a two-way causal relationship between financial literacy and family wealth. For example, the increase of income and the accumulation of assets make resident families more able to pay the fixed cost of stock investment, so as to promote their participation in the stock market, the participation in the financial market further affects the improvement of financial literacy (Monticone, 2010). At the same time, poverty may limit the possibility of the poor to participate in the financial market, thus affecting the improvement of financial literacy, this reverse causality may bias the results obtained from estimating model (Shan Depeng, 2020). Moreover, the model may also have other endogenous problems, such as the deviation of sample selection. In order to ensure the preciseness and effectiveness of the empirical results, we need to test these endogenous problems. One of the main methods to solve endogenous problems is an instrumental variable method.

In this study, we use two instrumental variables, which are "mother's education level" and "father's education level". Lusardi et al (2010) found that highly educated parents can generally help children improve their financial literacy. Differences in children's endowments and education will lead to differences in their financial literacy. Monticone (2010) also found that family background can also affect children's interest in finance, thus affecting the improvement of their financial literacy. The higher the parents' education level, the

more opportunities for their children to learn financial knowledge and to be exposed to financial activities. Therefore, parents' education level will have an impact on their children's financial literacy. Of course, theoretically speaking, the educational level of parents will also affect the income status of families. However, our survey sample data show that more than 93% of the respondents are older than 30, more than 88% are older than 35, and more than 80% are older than 40. We can infer that most of the respondents' parents are over 60 years old, excluding a few possible special cases. As most of the people over 60 have low or no income, the contribution rate of the elderly over 60 to the family income is very low in a family. Therefore, according to the survey data we used, the correlation between the current respondents' parents' education level and family income is much smaller than that between the respondents' financial literacy and their own income. Therefore, we believe that using parental financial knowledge as an instrument variable can alleviate the endogenous problem of variables.

We then test instrumental variable method with the pooled data that combined 2013 data set and 2015 data set. The Hausman test is performed, which confirms that there are endogenous explanatory variables and instrumental variable method is more efficient. We also conducted weak instrumental variable tests, and the test results show that these two variables do not exhibit weak instrumental variable problem. Also, the over-identification test on these two variables shows that they are exogenous. They are also statistically significant in the first stage of regression (see an appendix).

Table 9 shows the regression results obtained by using the 2SLS method. The second stage regression results show that the coefficients of financial literacy in models (15) and (16) are significantly positive. The results confirm that the positive

impact of financial literacy on family wealth is robust. However, it should be noted that the coefficients of financial literacy in models (15) and (16) are much higher than those in previous models. Here, using the PCF method, we find that one score increase (out of 100) of financial literacy compared to average of each province will increase per capita family income by 5.1% and increase per capita family assets by 7.75%. The reasons (Askar, Ouattara, and Zhang, 2020) behind the larger impacts could be that IV estimates tend to assess the local average treatment effect, while OLS estimates measure the average treatment effect over the whole population. Moreover, if individuals affected by the instruments have large responses, then the IV estimates become larger than the OLS ones.

Table 9 IV regression results

	PCF	
	(15) ln_avgincome	(16) ln_avgasset
Financial literacy	0.0510***	0.0775***
	(0.0048)	(0.0069)
Age	-0.0053	0.0335***
	(0.0068)	(0.0090)
Age2	0.0001	-0.0003***
	(0.0001)	(0.0001)
Members	-0.0520***	-0.0903***
	(0.0092)	(0.0088)
Rural (=1 if rural, =0 urban)	-0.2559***	-0.3660***
	(0.0381)	(0.0519)
Female (=1 if female, =0 man)	0.0463	0.0077

	(0.0283)	(0.0315)
Risk preference		
Project with high-risk and high-return (base case)		
Project with slightly high-risk and slightly high-return	-0.1207	-0.2692**
	(0.0714)	(0.0923)
Project with average risk and return	0.0918*	0.0909
	(0.0455)	(0.0655)
Project with slight risk and return	0.1832**	0.1824*
	(0.0583)	(0.0709)
Unwilling to carry any risk	0.3294***	0.4304***
	(0.0583)	(0.0886)
Marital status		
Unmarried (base case)		
Cohabitation/Married/Separated	-0.1063	0.6368***
	(0.0633)	(0.0856)
Divorced/Widowed	-0.2088**	0.5176***
	(0.0692)	(0.0994)
Education		
No schooling at all (base case)		
Primary school	0.1162***	0.1049*
	(0.0344)	(0.0500)
Junior high school	0.2239***	0.2232***
	(0.0521)	(0.0653)
High school/Technical high school	0.2217***	0.0908
	(0.0667)	(0.0869)

College/Vocational school/ University	0.1393 (0.1271)	-0.2179 (0.1794)
Master's degree and above	0.1212 (0.2084)	-0.6432* (0.2866)
year 2015	0.4234 (0.3948)	0.3700 (0.3786)
constant	8.3217*** (0.2112)	8.6971*** (0.3240)
N	29,292	30,343
Wald Chi-square	5471.47***	9294.18***

Standard errors in parentheses are clustered at provincial level. All models control for provincial fixed effects. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.5 Impacts of financial literacy at different levels of income and asset distributions

The above analyses investigate the impact of financial literacy on average of the whole range of income and asset distributions. To understand the impacts of financial literacy at the different levels of income and asset, we apply quantile regressions at the 25th, 50th, and 75th quantiles. Table 10 shows only the coefficients of financial literacy on different outcomes of income and assets. Each model uses the same control variables as in the pooled data models and also use the pooled data for these quantile regressions. The results show that financial literacy provides more impact on lower income level compared to the higher income levels. Similar patterns are also observed for asset distribution with higher impacts compared to each income quantile. We can infer from the higher impacts at the lower level of income and assets that if we improve financial literacy of the poor or lower income

households, it will help reduce the gap between the rich and the poor to some extent.

Table 10 Quantile regression results

Model	(1) PCF			(2) Add-up		
dependent variable:	ln_avgincome			ln_avgincome		
quantile:	q25	q50	q75	q25	q50	q75
Financial literacy	0.0069***	0.0055***	0.0052***	0.1379***	0.1058***	0.0985***
	(0.0004)	(0.0002)	(0.0002)	(0.0057)	(0.0045)	(0.0041)
Pseudo R^2	0.1535	0.1690	0.1773	0.1540	0.1690	0.1770

Model	(3) PCF			(4) Add-up		
dependent variable:	ln_avgasset			ln_avgasset		
quantile:	q25	q50	q75	q25	q50	q75
Financial literacy	0.0105***	0.0080***	0.0062***	0.2066***	0.1590***	0.1237***
	(0.0004)	(0.0003)	(0.0004)	(0.0078)	(0.0063)	(0.0068)
Pseudo R^2	0.1606	0.1902	0.1982	0.1611	0.1906	0.1987

Standard errors in parentheses are bootstrapped. All models control for provincial fixed effects. Other control variables include gender, location (urban or rural), family members, age, square of age, marital status, a dummy of risk preference, a dummy for each education level of head of household.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Conclusion

This study has explored the impact of financial literacy on Chinese family income and assets based on the survey data of the China Household Finance Survey (CHFS) in 2013 and 2015. The results show that financial literacy has a positive

and statistically significant impact on Chinese family wealth, both income and assets. Either with factor analysis for measuring financial literacy or direct aggregation measurement shows the positive impact. Moreover, considering the potential endogenous problems, we also apply the panel model and instrumental variable method to test and ensure the robustness of the model results. The increase of financial literacy can improve family income and family assets, but the impact of financial literacy on family assets seems to be greater than that of family income. It could be that assets represent the cumulative wealth of household. If financial literacy helps increase income, then cumulatively it will help increase more assets. However, the real reasons for such differences and process need to be further investigate.

Besides, the impact of financial literacy is higher at the lower level of income and asset distribution. Considering the impact of financial literacy on family wealth and the relatively low average financial literacy of Chinese families, the Chinese government should pay attention to the improvement of residents' financial literacy as a tool to increase family wealth of the poor, narrowing the gap between the rich and the poor. The improvement of residents' financial literacy could be done through relevant financial education or financial services. In addition, from the distribution characteristics of financial literacy in our paper, we can see that there are great differences in financial literacy between different provinces and regions, different age groups, and different educational levels. This requires the local government to fully consider the regional characteristics and population characteristics when formulating poverty reduction policies, so as to formulate effective poverty reduction policies.

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Appendix: First stage regression for instrumental variable method

First stage regression dependent: finlit_pcf100	(15) **income**	(16) **asset**
Age	0.2945***	0.2867***
	(0.0711)	(0.0687)
Square Of age	-0.0023***	-0.0022***
	(0.0006)	(0.0006)
Family Members	-0.5453***	-0.5179***
	(0.0554)	(0.0566)
Rural (=1 if rural, =0 urban)	-2.7208***	-2.6796***
	(0.2681)	(0.2716)
Female (=1 if female, =0 man)	0.0572	-0.0098
	(0.3087)	(0.3017)
Risk preference		
Project with high-risk and high-return (base case)		
Project with slightly high -risk and slightly high-return	5.1045***	4.6049***
	(0.8264)	(0.7592)
Project with average risk and return	-1.7189**	-2.0254***
	(0.5580)	(0.5186)
Project with slight risk and return	-4.5581***	-4.8253***
	(0.6047)	(0.5744)
Unwilling to carry any risk	-9.9644***	-10.2120***
	(0.6053)	(0.5940)
Marital status		

Unmarried (base case)		
Cohabitation/Married/Separated	0.6655	0.6923
	(0.6987)	(0.6619)
Divorced/Widowed	-0.0348	-0.0503
	(0.7038)	(0.6624)
Education		
No schooling at all(base case)		
Primary school	2.9716***	3.0486***
	(0.3049)	(0.3200)
Junior high school	6.2651***	6.3352***
	(0.3982)	(0.4006)
High school/Technical high school	11.5579***	11.6179***
	(0.4604)	(0.4580)
College/Vocational school/University	22.9419***	23.1129***
	(0.5549)	(0.5420)
Master's degree and above	32.7892***	32.9930***
	(1.7323)	(1.6174)
Year 2015	0.4234	0.3700
	(0.3948)	(0.3786)
Education of mother		
No schooling at all (base case)		
Primary school	1.6741***	1.7010***
	(0.2740)	(0.2762)
Junior high school	2.4940***	2.5084***
	(0.4764)	(0.4583)
High school/Technical high school	3.2834***	3.2481***

	(0.7205)	(0.7210)
College/Vocational school/University and above	3.7666**	3.6442**
	(1.4178)	(1.3924)
Education of father		
No schooling at all (base case)		
Primary school	2.4447***	2.4472***
	(0.2982)	(0.2866)
Junior high school	3.0946***	3.1224***
	(0.3882)	(0.3595)
High school/Technical high school	4.1519***	4.2400***
	(0.5771)	(0.5689)
College/Vocational school/University	4.3930***	4.4082***
	(0.8828)	(0.8794)
constant	15.3252***	15.5378***
	(2.0946)	(2.0142)
N	29292	30343
R^2	0.3121	0.3119

Standard errors in parentheses are clustered at provincial level. All models control for provincial fixed effects. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$