

The Impact of Digital Financial Literacy on Household Financial Vulnerability: Evidence from China Household Finance Survey Data

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Abstract. With the development of the digital economy and the continuous increase in household debt, financial literacy for the public has been widely discussed. According to the data in the China Household Finance Survey (CHFS), indicators for digital financial literacy and household financial vulnerability (HHF) have been developed in this paper, and the effect of digital financial literacy on household financial vulnerability and its mechanism of action have been empirically studied. According to the above analysis, the addition of digital financial literacy can reduce the financial risk faced by households, and this result remains unchanged after adjusting for endogeneity and other checks. Based on the above analysis, digital financial literacy has improved the household's asset-liability structure, reduced credit constraints and strengthened risk control. Heterogeneity analysis shows that this effect is relatively stronger for high-income households, and a certain digital divide has appeared. Provide empirical support and policy suggestions in this paper for strengthening the financial resilience of households and addressing micro-financial risks.

Keywords: Household finance, Vulnerability, Digital financial literacy

1. Introduction

Financial literacy refers to the ability of individuals to manage their financial resources reasonably and enjoy life happily in old age through knowledge and skills [1]. These days, they have developed at a rapid pace and gained the public's attention; various online wealth management and credit products have now become common in daily life. At the same time, the problems of rising household debt and unreasonable asset allocation have gradually become more serious. Households have weaker resistance to financial risk and are becoming increasingly financially vulnerable. Highly financially vulnerable households generally have features such as low income or non-liquid assets, a high asset-liability ratio, and a weak capacity to handle financial pressure and shocks [2]. In 2021, the proportion of household debt to GDP in China reached 62.3% and has stayed at a relatively high level [3]. Digital Financial Literacy Directly Affects Households' Financial Decisions. Therefore, this paper will now explore how digital financial literacy relates to housing insecurity at home.

Most of the research on traditional financial literacy and behaviour in using digital finance has been done so far. Family financial vulnerability is affected to varying degrees by a variety of reasons, such as financial literacy and debt, the development of digital finance, and risk preference [4]. However, few studies have specifically defined the connotations of digital financial literacy, and in-depth discussions on its internal influence pathways of household financial risk are lacking; also, analyses of heterogeneity have not been carried out.

Using the data from the China Household Finance Survey (CHFS), this paper will study how high the level of digital financial literacy is at the household level and how it connects to financial vulnerability. Based on the above results, the improvement of digital financial literacy can help reduce the risk of financial distress for various groups in the household. Strengthen the measurement system for digital financial literacy, add research on micro-level impact mechanisms, and provide a reference for popularizing financial education and preventing or controlling household financial risks. Therefore, improving the financial literacy of vulnerable groups will help them face many kinds of financial risks in life better and secure their financial future.

2. Theoretical analysis and research hypothesis

2.1. Theoretical analysis

The life-cycle consumption theory offers the basic support for the study of the relationship between the two [5]. Explain the generation logic of vulnerability and provide the functional path for digital financial literacy. Based on the above research, many scholars believe that households' consumption, saving and borrowing behaviour are affected by different life-cycle incomes. Digital financial services are not limited by time and place and can be used by the public to manage their funds at any time. A lack of digital financial literacy among the people has led to different ways in which they manage household finances. High-literacy groups are able to use digital financial tools to manage income and expenses in various ways; therefore, they do not suffer financial shocks from short-term capital fluctuations and are less exposed to investment risks [6]. Households with low literacy cannot learn to plan their finances in the future and are often short on savings or engage in poor borrowing behaviour. They have relatively weak financial resilience in the face of a sudden economic downturn and are thus more financially vulnerable.

2.2. Research hypothesis

In the context of the digital economy, the popularity of online payment, Internet loans, and digital investments has made digital financial literacy a necessary skill for households to participate in financial activities.

Empirical evidence indicates that inadequate financial knowledge and operational skills increase the financial risks faced by households [7]. In contrast, possessing sufficient digital financial literacy aids households in making rational financial choices, avoiding risky behaviors, and thereby improving their overall financial situation. Existing research indicates that social interaction can reduce the financial vulnerability of families [8]. Figure 1 shows the research mechanism of this paper. Based on this, this paper proposes the following hypothesis:

H1: There is a significant negative correlation between digital financial literacy and household financial vulnerability. In other words, the higher the digital financial literacy, the lower the financial vulnerability of the family.

H2: Digital financial literacy can influence social activities, thereby affecting household financial vulnerability.

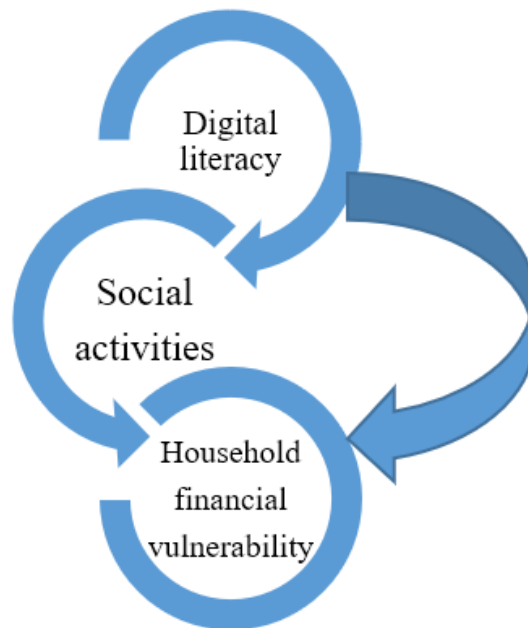


Figure 1. Research flow chart (Photo credit: original)

3. Methodology

3.1. Evaluation of digital financial literacy

This study mainly collected basic research information by issuing and collecting questionnaires. The whole analysis relies on the real data of China's household finance survey. According to the actual research needs, this paper divides the survey questions into two basic dimensions: financial knowledge and financial skills, which are divided into six specific sub categories, three questions for each dimension. All answers collected from respondents will be graded according to the fixed scoring rules. Table 1 shows the overall structure of the digital financial literacy evaluation system applied in this paper.

In this article, the value of digital financial literacy DFL is defined as the sum of the assigned values corresponding to the answers to six questions. Obviously, $DFL_i \in [0,6]$.

Table 1. Digital financial literacy evaluation index

Evaluation dimension	Evaluation field	Questions of CHFS	Result assignment
Financial knowledge	inflation	[H3106] Assuming that the annual interest rate of the bank is 5% and the inflation rate is 8% per year, The change in the situation of buying things after a year of depositing 100 yuan in the bank?	Right=1 Wrong=0

Table 1. (continued)

Financial knowledge	Interest rate	[H3105] Assuming that the bank's annual interest rate is 4%, if you deposit 100 yuan for 1 year, what is the principal and interest obtained after 1 year?	Right=1 Wrong=0
	Interest rate	[E3005dg] If you borrow or borrow 10,000 yuan, at a compound interest rate of 10% annual interest, how much is the total principal and interest you need to repay after 2 years?	Right=1 Wrong=0
Financial skills	Account opening	[D7106d] Has your family opened Alipay, WeChat Pay, JD Online Banking Wallet, Baidu Wallet and other third-party accounts?	Yes=1 No=0
	Financial products	[D7109] Does your family have financial products?	Yes=1 No=0
	Cash balance	[D7106ha] How much cash balance does your family have in the above third-party payment account?	Answer=1 No answer=0

3.2. Model establishment

The resistance of family finance stems from vulnerability. Vulnerability refers to the ability of families to effectively manage, respond, bear risks and recover their financial status through rational allocation of financial assets in the face of external economic shocks, such as liabilities or sudden changes [9]. Therefore, household financial vulnerability is affected by multiple factors.

Combining current mainstream research with the practical characteristics of household operations, this paper sets digital financial literacy as the core explanatory variable, while introducing characteristics such as household head gender, age, household size, and education level as control variables, to explore the impact of various factors on household financial vulnerability. Among them, there is a significant difference in the magnitude of data between debt and income. This article does not perform direct calculations on the original data. According to the established assignment rules, S_{debt} and S_{income} are converted into corresponding assignment scores based on their ranges. The assigned scores are then used to calculate the vulnerability index, which measures the level of household financial vulnerability.

$$HFF = \frac{S_{debt}+1}{S_{income}} \quad (1)$$

When $HFF \rightarrow 0$, the Household financial vulnerability is considered to be financially stable; The higher the HFF, the weaker the family's resilience to external financial shocks.

Based on the CHFS, the assignment indicators for debt and income are as follows:

$$S_{debt} = \begin{cases} 0, & \text{if } totaldebt = 0 \\ 1, & \text{if } 0 < totaldebt \leq 50000 \\ 2, & \text{if } 50000 < totaldebt \leq 100000 \\ 3, & \text{if } 100000 < totaldebt \leq 500000 \\ 4, & \text{if } 500000 < totaldebt \leq 1000000 \\ 5, & \text{others} \end{cases} \quad (2)$$

$$S_{income} = \begin{cases} 1, & \text{if } 0 < income \leq 50000 \\ 2, & \text{if } 50000 < income \leq 150000 \\ 3, & \text{if } 150000 < income \leq 300000 \\ 4, & \text{if } 300000 < income \leq 500000 \\ 5, & \text{others} \end{cases} \quad (3)$$

The aforementioned model is used for the most basic HFF calculation, and it is far from sufficient to define household financial vulnerability solely based on this. This paper employs an ordered logistic model to verify the relationship between vulnerability and various factors. Next, the relationship between HFF and control variables are constructed.

$$HFF = \beta_0 + \beta_1 DFL_i + \beta_2 Gender + \beta_3 edu + \beta_4 Age + \beta_5 Hhsize + \varepsilon_0 \quad (4)$$

HFF is the unobservable potential level of household financial vulnerability, and ε follows a logistic distribution.

$$\ln \left(\frac{P(HFF \leq j)}{1 - P(HFF \leq j)} \right) = \alpha_i - \beta_0 - \beta_1 DFL - \beta_2 Gender - \beta_3 edu - \beta_4 Age - \beta_5 Hhsize \quad (5)$$

Due to the significant difference in the value of age compared to other variables in (4), in order to better establish a significant model, age is assigned values based on the $Age_{0.33}$ and $Age_{0.66}$. Meanwhile, assign a value of 1 to males and 0 to females.

$$Age = \begin{cases} 1, & Age \leq Age_{0.33} \\ 2, & Age_{0.33} < Age \leq Age_{0.66} \\ 3, & Age > Age_{0.66} \end{cases} \quad (6)$$

$$gender = \begin{cases} 0, & \text{female} \\ 1, & \text{male} \end{cases} \quad (7)$$

According to the analysis of experimental results, household financial vulnerability and digital financial literacy are negatively correlated to a certain extent. Therefore, with an increase in digital financial literacy, people are more likely to live financially, adjust their daily life and financial planning more flexibly, and respond to the economic challenges outside their families more effectively. As shown in Table 2, household financial vulnerability is negatively correlated with both age and education level. Therefore, it can be concluded that with increasing age and education, people's financial literacy is also gradually increasing, thus reducing the risk of financial difficulties in old age.

Table 2. Regression analysis model results

VARIABLES	HFF
age1	-0.013*** (0.000)
edu	-0.099*** (0.003)
gender	0.045*** (0.010)
DFL	-0.010*** (0.003)
hhsize	0.014*** (0.003)
Constant	2.159***
Observations	34,592
R-squared	0.060

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Figure 2 is a scatter plot of HFF and DFL. As shown in the figure, an increase in DFL is associated with a decline in the number of high-value points of HFF, and the distribution of low-value points tends to concentrate, thus exhibiting a negative correlation. Based on the heterogeneity analysis, the above results are more pronounced among high-income families. As shown in Table 3. Therefore, the second problem can be identified: a higher risk of financial difficulties for the family.

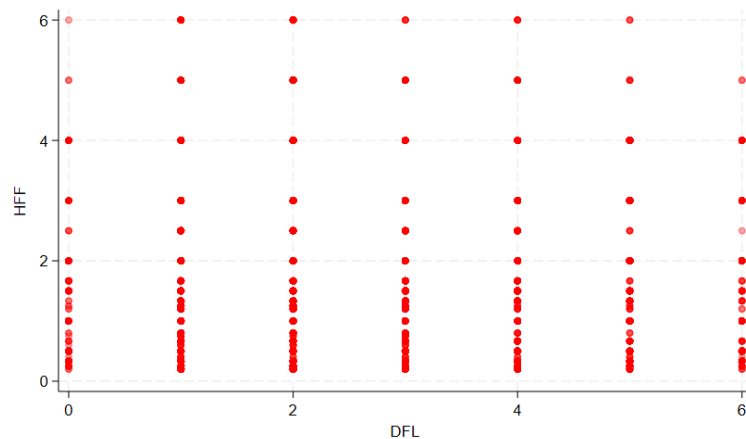


Figure 2. The dot plot of HFF against DFL (Photo credit: original)

Table 3. Comparative analysis of income classification

	income=1	income=2	income=3	income=4	income=5
df1	-0.003 (0.005)	-0.006 (0.003)	-0.009 (0.006)	0.015 (0.012)	0.001 (0.014)

Table 3. (continued)

edu	0.001 (0.004)	-0.002 (0.003)	0.000 (0.005)	-0.011 (0.010)	-0.005 (0.011)
age1	-0.015*** (0.001)	-0.010*** (0.000)	-0.011*** (0.001)	-0.011*** (0.001)	-0.011*** (0.001)
hhsz	0.111*** (0.005)	0.040*** (0.003)	0.034*** (0.006)	0.034*** (0.012)	0.030** (0.013)
gender	-0.015 (0.015)	-0.007 (0.011)	0.024 (0.020)	0.094** (0.037)	0.001 (0.040)
N	17975	12346	3105	707	459

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The results of Table 3 fully verify that H1 is correct. Next is to verify H2. Introduce the mediating variable social activities to measure H2. Social activities are divided into two types: Offline and online. Indicators of offline social interaction include monthly catering expenses, monthly local transportation expenses, clothing and footwear purchases, cultural and entertainment expenses, travel expenses and gift expenses [10, 11]; while online social interaction indicators include monthly mobile phone expenses, monthly postal communication expenses, online shopping expenses, frequency of socializing through the internet, business internet usage time, whether to use a computer to access the internet, and the number of days per week when logging into email [12, 13]. Table 4 presents the questions used to evaluate social activities.

Table 4. Social activities evaluation index

Evaluation dimension	Questions of CHFS
Offline social interaction	[G1008] Last year, on average, how much did your family spend on local transportation per month?
	[G1011] Last year, how much did all members of your family spend on purchasing or maintaining clothing and footwear, including dry cleaning?
	[G1018] Last year, what was the total amount of your family's travel expenses, including various dining fees, transportation fees, admission fees, tour guide fees, accommodation fees, etc., incurred both locally and abroad?
Online social interaction	[G1023d] Last year, how much did your family spend on online shopping?
	[G1009] Last year, on average, how much did your family spend on communication expenses such as phone bills, internet fees, and postal service fees per month?

For the evaluation of social activities, the processing method is similar to the previous one.

$$HFF = \theta_{social\ activities} + \beta \sum control + \delta \quad (8)$$

Social activities represents the variable of social activities, *control* represents the variable of other family factors, and δ denotes the random disturbance term.

By establishing linear models for social activities and DFL, as well as between HFF and social activities, significant relationships were obtained on the basis of a large sample. DFL is significantly positively correlated with social activities, while the latter is significantly negatively correlated. With the improvement of social activities, household financial vulnerability will be significantly

reduced [14]. This indicates that DFL indeed reduces household financial vulnerability by enhancing social activities. H2 is confirmed. The results are shown in Table 5.

Table 5. Significance test

VARIABLES	(1) DFL	(2) HFF
sa	0.000027*** (0.0000)	-0.000001*** (0.0000)
Constant	2.080466*** (0.0071)	1.152974*** (0.0048)
Observations	34,643	34,643
R-squared	0.123847	0.000405

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Conclusions

Based on the CHFS 2019 data, a well-organised logistics model and a linear regression model have been constructed to show that digital financial literacy significantly reduces the risk of financial difficulties for households. It studies whether financial literacy reduces the risks for vulnerable groups through social participation. Improve their financial literacy to help the family plan for the future more realistically and be better prepared to deal with risks. It also tested for a connection with other family issues. Based on the above analysis of differences, high-income families show a relatively larger impact. Provide a theoretical basis for families and offer rich material for future research in this area.

A weakness of this paper is that it only uses the 2019 data and does not include data from the past three years. With the development of society in recent years, there may be some unaddressed problems in this paper. If the data from the past three years are available, they will strengthen the support for this paper. This paper provides strong theoretical support for the field of financial literacy and family financial vulnerability, and other scholars can expand upon this work. The model in this paper is relatively simple and limited. In the future, a suitable model can be adopted in this paper to explore the underlying reasons for the impact more deeply and extend the scope of research.

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