

Financial Market Participation under the Digital Divide

-- An Empirical Study Based on CHFS Data

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Abstract: With the advent of the Internet age, the era of digital economy is drawing closer to us, and it has brought significant changes to our lives, providing us with many conveniences. However, it has also brought about the impact of wealth disparity, commonly known as the digital divide, which refers to the polarization of poverty and affluence caused by the disparities in the access and application of network technology. Using the 2017 China Household Finance Survey (CHFS) data, this study investigates the extent to which the digital divide affects household participation in financial markets. The findings suggest that the digital divide significantly reduces household participation in financial markets. Furthermore, this study divides the financial market into low-risk and high-risk markets and explores the impact of the digital divide on each of them. It is found that the digital divide significantly inhibits participation in both low-risk and high-risk financial markets, with a more pronounced impact on the latter. Additionally, this study explores the mechanism through which the digital divide affects participation in financial markets, revealing that the digital divide reduces household income and consequently decreases their participation in financial markets. This study provides insights into the relationship between the digital divide and household participation in financial markets, sheds light on the negative impacts of the digital divide, and offers useful information for households in making decisions regarding participation in financial markets.

Keywords: Digital divide, Financial market participation, Household income, Risk appetite.

1. Introduction

Currently, we are in the midst of an information society, where rapidly advancing digital technologies are transforming our lives and serving as a major driving force behind economic and social development. According to the 50th Statistical Report on the Development of China's Internet issued by the China Internet Network Information Center, the number of Internet users in China increased by 19.19 million in December 2021, and the Internet penetration rate increased by 1.4 percentage points compared to December 2021. However, despite the continuous growth of the Internet user base, a significant portion of the population remains unconnected to the Internet. The report explicitly points out that although information technology has brought convenience to many people's lives, its development may give rise to new forms of inequality due to differences in economic development, educational level, gender, and other factors across different regions. This may prevent certain individuals or groups from enjoying the benefits of information technology due to their own circumstances or external factors.

The uneven diffusion and development obstacles of digital technology can lead to new financial exclusion among certain disadvantaged groups due to their lack of resources such as internet tools and financial literacy (Beiduo et al., 2017). [1]The use of internet information channels can make it more convenient for households to understand and use financial products and services that are suitable for them, thereby increasing their willingness to participate in financial investments (Wang et al., 2019). [2]However, some households, despite their desire to enjoy digital financial services, are excluded from digital financial models due to factors such as lack of financial knowledge, which is influenced by the impact of the digital divide (Guo & Wang, 2020). [3]The existence of the digital divide significantly

reduces the probability of household financial investment (Zhang & Lu, 2021).

The reviewed literature indicates that while many scholars have focused on the negative impact of the digital divide on households, most of the literature has studied the digital divide at the national or regional level, with only a few studies examining it from a micro-level household perspective (e.g., Wang et al., 2019; Zhang and Lu, 2021). This paper uses micro-level household data to investigate the impact of the digital divide on household participation in the financial market and its mechanisms from both theoretical and empirical perspectives. Building on the work of Zhang and Lu (2021), this paper distinguishes between low-risk and high-risk market participation and explores the impact of the digital divide on both types of participation. Furthermore, this paper analyzes and verifies the mechanisms through which the digital divide affects household participation in the financial market, providing new insights for improving household participation in the financial market.

2. Review of the Literature

Taking a household finance perspective, inadequate development is reflected in the low participation rate and low share of financial assets held by households. Unbalanced development is more evident in the varying degrees of participation in financial markets among households in different regions and between urban and rural areas. Previous literature has mainly examined the factors affecting household participation in financial markets from three aspects: 1) demographic characteristics such as gender, age, family size, and marital status; 2) human capital accumulation, including the education level, health status, and risk preference of household heads; and 3) behavioral economics explanations of financial market participation.

The rapidly expanding digital divide has become a significant obstacle to the healthy and stable development of China's economy. It is not merely a technical issue but also a crucial concern that affects social stability and development. Consequently, in recent years, it has become a focal point of academic research. Its existence has far-reaching impacts on various aspects of household decision-making behavior, such as household consumption, investment, income, and risk preference, thereby affecting household participation in financial markets.

There is currently a lack of sufficient research on the relationship between the digital divide and household participation in financial markets. In their recent study, Zhang and Lu (2021) examined the impact of the digital divide on household financial investment and found that its presence significantly reduces the likelihood of household participation in financial markets[3].

This paper builds upon existing research that examines the impact of the digital divide on household financial market participation. Specifically, we categorize financial market participation as low-risk and high-risk, and analyze the mechanism by which the digital divide affects household financial market participation from the perspective of household income.

3. Data Variables and Models

3.1. Data

The data used in this study is derived from the fourth round of the China Household Finance Survey (CHFS) conducted by the Southwestern University of Finance and Economics in 2017, which provides an accurate reflection of the current state of Chinese households. The CHFS sample covers 29 provinces (autonomous regions, municipalities) and 353 counties (districts) and 1417 communities (villages) nationwide, excluding Tibet, Xinjiang, Hong Kong, Macao, and Taiwan, and includes microdata from over 40,000 households. The survey collects information on demographic characteristics, assets and liabilities, insurance and protection, income and expenses, financial knowledge, and other aspects of households, providing data support for this study on the impact of the digital divide on financial market participation from the perspective of household income.

3.2. Variable definition

1. Explained variable: financial market participation

Drawing on the work of Yin Zhichao et al. (2019), this study defines financial market participation[4] based on the asset and liability section of the CHFS questionnaire. Households that have current deposits, time deposits, stocks, funds, financial management products, bonds, derivatives, non-RMB assets, precious metals, other financial assets, or loans are considered financial market participants. A value of 1 indicates that a household has participated in financial markets, while a value of 0 indicates that it has not.

2. explanatory variables: digital divide

The central explanatory variable in this study is the digital divide. The digital divide is typically defined as the gap between those who have access to and those who do not have access to information and communication technologies. Following the approach of Yin et al. (2021), we define the digital divide[5] as a binary variable and divide it into two dimensions: access divide and usage divide. Access divide is defined based on the question "Do you own a smartphone?"

in the survey. A response of 1 indicates that the respondent owns a smartphone, while a response of 0 indicates that they do not. Usage divide is defined based on the question "Do you use the Internet?" A response of 1 indicates that the respondent uses the Internet, while a response of 0 indicates that they do not. If the survey respondent owns a smartphone and uses the Internet, they are defined as having no digital divide. Conversely, if they do not own a smartphone or do not use the Internet, they are defined as experiencing the digital divide.

3. Control variables

Drawing from previous literature, this study controls for various variables related to individual, household, and regional characteristics. Specifically, individual-level variables include gender, age, education level, marital status, health status, and risk attitude. Household-level variables include household size, household income, household net assets, urban-rural status, and regional location. Regional-level variables include economic development level.

3.3. Empirical model

This study establishes a linear regression model to estimate the impact of the digital divide on financial market participation. The empirical model is specified as follows:

$$financial_i = a + \beta digital_i + X_i\gamma + C_i + \mu_i \quad (1)$$

The dependent variable $financial_i$ represents the financial market participation of the i household, while the explanatory variable $digital_i$ represents the digital divide of the i household. The control variable X_i includes personal characteristics, household characteristics, and regional characteristics. Coefficient estimate is denoted as a , unobserved variables that do not vary with time are denoted as C_i , and the residual term is denoted as μ_i .

$$financial_i = a + \beta incoming_i + X_i\gamma + C_i + \mu_i \quad (2)$$

The dependent variable $financial_i$ represents the financial market participation of the i household, while the explanatory variable $incoming_i$ represents the incoming of the i household. The control variable X_i includes personal characteristics, household characteristics, and regional characteristics. Coefficient estimate is denoted as a , unobserved variables that do not vary with time are denoted as C_i , and the residual term is denoted as μ_i .

$$financial_i = a + \beta digital2_i + X_i\gamma + C_i + \mu_i \quad (3)$$

The dependent variable $financial_i$ represents the financial market participation of the i household, while the replacement variable $digital2_i$ represents the digital divide of the i household. The control variable X_i includes personal characteristics, household characteristics, and regional characteristics. Coefficient estimate is denoted as a , unobserved variables that do not vary with time are denoted as C_i , and the residual term is denoted as μ_i .

4. Empirical Results and Analysis

4.1. Descriptive statistics

As for the control variables, the sample mean of age was 55.188 years, with a standard deviation of 14.186; the mean of education level was 9.362 years, with a standard deviation

of 4.252; the mean of marital status was 0.852, with a standard deviation of 0.355; the mean of health status was 0.476, with a standard deviation of 0.499; the proportion of households with a preference for high-risk investments was 9%; the proportion of households paying attention to financial information was 9.9%; the mean of household size was 3.162

people, with a standard deviation of 1.543; the proportion of urban households was 68.2%; the mean of household net assets was 1000848 yuan; and the mean of household income was 90958 yuan. Additionally, there were significant differences in economic and financial development levels among different regions.

Table 1. Descriptive statistics of the variables

Variables	Sample size	Average value	Standard deviation	Minimum value	Maximum value
Digital Divide	38442	0.549	0.498	0	1
Low risk market participation	38442	0.910	0.287	0	1
High-risk market participation	38442	0.085	0.279	0	1
Financial Market Participation	38442	0.914	0.280	0	1
Education level	38442	9.362	4.253	0	22
Male	38442	0.794	0.405	0	1
Age	38442	55.188	14.186	18	117
Health Status	38442	0.476	0.499	0	1
Marital Status	38442	0.852	0.355	0	1
Personal risk appetite	38442	0.090	0.287	0	1
Level of financial information concern	38442	0.099	0.299	0	1
Family size	38442	3.162	1.543	1	15
City	38442	0.682	0.466	0	1
Household Net Worth	38442	1000848.411	1721758.256	-80227.000	9794016.000
Household income	38442	90958.220	128555.532	-17097.322	1096070.000
GDP	38442	35932.440	24411.723	2624.830	89705.230

4.2. Baseline estimation results and analysis

This study examines the impact of the digital divide on financial market participation. The empirical results of Model (1) are presented in Table 2. The first column estimates the effect of the digital divide on financial market participation using a linear regression model, while the second and third columns estimate the effects of the digital divide on low-risk and high-risk financial market participation, respectively. Based on the first column, the marginal effect of the digital divide on financial market participation is 0.061, which is significant at the 1% level. This implies that households with a digital divide are 6.1% less likely to participate in financial markets. Based on the second and third columns, the marginal effects of the digital divide on low-risk and high-risk financial market participation are 0.064 and 0.081, respectively, both significant at the 1% level. This suggests that households with a digital divide are 6.4% and 8.1% less likely to participate in low-risk and high-risk financial markets, respectively. The results from Table 2 indicate that the digital divide significantly reduces the likelihood of household participation in financial markets. [5] This may be due to the decrease in household income that is associated with the digital divide (Yin et al., 2021).

Next, we conducted an analysis on some control variables. The marginal effects of gender on financial market participation were 0.016, 0.015, and -0.020, significant at the 1% confidence level. This suggests that males are more inclined to participate in low-risk financial markets, while females tend to participate in high-risk financial markets. Education level had a positive and significant impact on financial market participation. This indicates that individuals with higher education levels possess more financial knowledge and have greater ability and capital to invest in financial markets, which is consistent with the findings of Zhou et al. (2019) and Zhang & Lu (2021). The marginal effect of financial information attention on financial market participation was 0.010, significant at the 1% confidence level. This implies that increasing financial information attention can significantly improve the likelihood of household participation in financial markets. The marginal effect of household net assets on financial market participation was 0.005, significant at the 1% confidence level. This suggests that an increase in net assets can significantly increase the likelihood of household participation in financial markets. Moreover, the regional economic development level had a significant positive impact on household participation in financial markets, which is in line with expectations.

Table 2. Baseline regression results

Variables	(1) Financial Market Participation OLS	(2) Low risk market participation OLS	(3) High risk market participation OLS
Digital Divide	-0.061*** (0.003)	-0.064*** (0.003)	-0.081*** (0.003)
Male	0.016*** (0.004)	0.015*** (0.004)	-0.020*** (0.004)
Age squared	-0.001*** (0.000)	-0.0010*** (0.000)	0.001*** (0.000)
Education level	0.007*** (0.000)	0.007*** (0.000)	0.010*** (0.000)
Health Status	0.005* (0.003)	0.006** (0.003)	-0.007*** (0.003)
Marital Status	0.015*** (0.005)	0.016*** (0.005)	0.029*** (0.004)
Personal risk appetite	0.002 (0.004)	0.002 (0.004)	0.102*** (0.007)
Level of financial information concern	0.010*** (0.004)	0.009** (0.004)	0.133*** (0.006)
Family size	0.008*** (0.001)	0.009*** (0.001)	-0.004*** (0.001)
Household net worth(ln)	0.005*** (0.000)	0.005*** (0.000)	0.003*** (0.000)
Household income(ln)	0.007*** (0.001)	0.007*** (0.001)	0.001 (0.001)
City	-0.002 (0.004)	-0.002 (0.004)	0.024*** (0.002)
ln_GDP	0.026* (0.015)	0.033** (0.016)	0.319*** (0.018)
Province	Control	Control	Control
Sample size	38442	38442	38442
R-squared	0.081	0.080	0.181

4.3. Heterogeneity results and analysis

As revealed by the previous analysis, the digital divide indeed affects household participation in financial markets. However, due to variations in household education level, income, and regional location, the impact of the digital divide on household financial market participation may differ. Therefore, it is necessary to conduct further heterogeneity analysis.

In this study, an interaction term between the digital divide and education level was constructed to examine the heterogeneous effect of the digital divide on financial market participation based on education level. The estimation results are shown in Table 3. As indicated in columns (1), (2), and (3), the estimated coefficients of the interaction term between the digital divide and low education level on financial market participation are -0.049, -0.047, and 0.119, respectively, which are significant at the 1% confidence level. This suggests that the negative impact of the digital divide on financial market participation is more pronounced in low education households than in high education households. Specifically, low education households exhibit a weak risk awareness and blindly participate in high-risk financial markets.

5. Mechanism Testing

Based on the above analysis, this study confirms the impact of the digital divide on household participation in the financial market, but the underlying mechanisms of this impact require further investigation. As Yin et al. (2021) found, [5]the digital divide is an important factor that affects household income. Therefore, the presence of the digital divide may reduce the probability of household participation in the financial market by influencing household income.

The regression results are reported in Table 4, where column (1) estimates the impact of household income on financial market participation using a linear regression model, and columns (2) and (3) respectively estimate the effect of household income on participation in low-risk and high-risk financial markets. The estimated coefficients are significant at the 1% confidence interval and are 0.008, 0.008, and 0.002, indicating that household income significantly increases financial market participation. As found by Yin et al. (2021), [5]the digital divide significantly reduces household income. Therefore, our mechanism test confirms that the digital divide reduces financial market participation by decreasing household income.

Table 3. Impact of the digital divide on heterogeneity of financial market participation

Variables	(1) Financial Market Participation OLS	(2) Low risk market participation OLS	(3) High risk market participation OLS
Digital divide x low education	-0.049*** (0.006)	-0.047*** (0.006)	0.119*** (0.006)
Digital Divide	-0.031*** (0.005)	-0.034*** (0.005)	-0.158*** (0.006)
Low Education	0.053*** (0.005)	0.052*** (0.005)	-0.096*** (0.006)
Male	0.013*** (0.004)	0.013*** (0.004)	-0.016*** (0.004)
Age squared	-0.001*** (0.000)	-0.000*** (0.000)	0.001*** (0.000)
Education level	0.010*** (0.001)	0.010*** (0.001)	0.006*** (0.000)
Health Status	0.006** (0.003)	0.006** (0.003)	-0.007*** (0.003)
Marital Status	0.014*** (0.005)	0.014*** (0.005)	0.032*** (0.004)
Personal risk appetite	0.004 (0.004)	0.004 (0.004)	0.098*** (0.007)
Financial literacy concern level	0.012*** (0.004)	0.011*** (0.004)	0.130*** (0.006)
Family size	0.007*** (0.001)	0.008*** (0.001)	-0.003*** (0.001)
Household net worth(ln)	0.005*** (0.000)	0.005*** (0.000)	0.003*** (0.000)
Household income(ln)	0.007*** (0.001)	0.007*** (0.001)	0.001 (0.001)
City	-0.002 (0.004)	-0.002 (0.004)	0.025*** (0.002)
ln_GDP	0.030** (0.015)	0.036** (0.015)	0.312*** (0.017)
Province	Control	Control	Control
Sample size	38442	38442	38442
R-squared	0.084	0.082	0.192

Table 4. Mechanism test

Variables	(1) Financial Market Participation OLS	(2) Low risk market participation OLS	(3) High risk market participation OLS
Household income	0.008*** (0.001)	0.008*** (0.001)	0.002*** (0.001)
Male	0.012*** (0.004)	0.011*** (0.004)	-0.025*** (0.004)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)
Education level	0.009*** (0.000)	0.009*** (0.000)	0.012*** (0.000)
Health Status	0.009*** (0.003)	0.010*** (0.003)	-0.002 (0.003)
Marital Status	0.015*** (0.005)	0.016*** (0.005)	0.028*** (0.004)
Personal risk appetite	0.007* (0.004)	0.007* (0.004)	0.109*** (0.007)
Level of financial information concern	0.015*** (0.004)	0.014*** (0.004)	0.139*** (0.006)
Family size	0.008*** (0.001)	0.009*** (0.001)	-0.004*** (0.001)
Household net worth(ln)	0.005*** (0.000)	0.005*** (0.000)	0.004*** (0.000)
City	0.008** (0.004)	0.008** (0.004)	0.037*** (0.002)
ln_GDP	0.028* (0.015)	0.035** (0.016)	0.322*** (0.018)
Province	Control	Control	Control
Observations	38,442	38,442	38,442
R-squared	0.073	0.072	0.168

6. Robustness Test

In this study, the explanatory variable "digital divide" was replaced with alternative variables to further test the robustness of empirical results. Specifically, "access divide" was replaced with "broadband coverage" where a value of 1 indicates broadband coverage and 0 indicates no coverage. "Use divide" was replaced with "electronic payment" where a value of 1 indicates the presence of electronic payment and 0 indicates no electronic payment. If a household has broadband coverage and uses electronic payment, it is defined as having no digital divide; otherwise, it is defined as having a digital divide.

The empirical results of Model (3) are presented in Table 5.

In Table 5, the first column reports the linear regression results for the impact of the replaced variable of the digital divide on financial market participation, and the second and third columns respectively estimate the impact of the replaced variable of the digital divide on low-risk and high-risk financial market participation. As shown in the first, second, and third columns, the replaced variable of the digital divide still significantly reduces household financial market participation at the 1% confidence level. Through the robustness checks described above, it is found that the digital divide has a significant negative effect on financial market participation, which confirms the robustness of the estimation results.

Table 5. Robustness tests

Variables	(1) Financial Market Participation OLS	(2) Low risk market participation OLS	(3) High risk market participation OLS
Digital Divide	-0.030*** (0.003)	-0.033*** (0.003)	-0.110*** (0.004)
Male	0.013*** (0.004)	0.012*** (0.004)	-0.022*** (0.004)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	0.000*** (0.000)
Education level	0.008*** (0.000)	0.008*** (0.000)	0.010*** (0.000)
Health Status	0.007*** (0.003)	0.008*** (0.003)	-0.007** (0.003)
Marital Status	0.017*** (0.005)	0.017*** (0.005)	0.034*** (0.004)
Personal risk appetite	0.004 (0.004)	0.004 (0.004)	0.097*** (0.007)
Level of financial information concern	0.013*** (0.004)	0.012*** (0.004)	0.132*** (0.006)
Family size	0.008*** (0.001)	0.008*** (0.001)	-0.006*** (0.001)
Household net worth(ln)	0.005*** (0.000)	0.005*** (0.000)	0.003*** (0.000)
Household income(ln)	0.008*** (0.001)	0.008*** (0.001)	0.001 (0.001)
City	0.004 (0.004)	0.004 (0.004)	0.023*** (0.002)
ln_GDP	0.023 (0.015)	0.030* (0.015)	0.304*** (0.017)
Province	Control	Control	Control
Sample size	38442	38442	38442
R-squared	0.075	0.074	0.189

7. Conclusion

This study utilizes microdata from the 2017 China Household Finance Survey to measure the digital divide at the household level in terms of access and use. The impact of the digital divide on household participation in the financial market is empirically analyzed. The findings show that: first, the digital divide significantly reduces household participation in the financial market and has a negative impact on both low-risk and high-risk financial market participation. This conclusion remains robust even after conducting a robustness test with replacement variables; second, the negative impact of the digital divide on financial market

participation is more pronounced in households with lower education levels; and third, the digital divide may lower household participation in the financial market by reducing household income.

The above empirical findings provide important policy implications for further promoting household participation in financial markets and enhancing financial market activity.

Overall, in order to increase household participation in financial markets, it is necessary to reduce the negative impact of the digital divide. To address the issue of access barriers, the government should continue to increase investment in network infrastructure, further improve internet penetration rates, and ensure that every household has access

to the internet to meet their online needs. To address usage barriers, relevant government departments should increase efforts in education and training, and enhance residents' skills in using digital tools. Given the significant differences in the impact of the digital divide on financial market participation between urban and rural areas, the government should improve the accessibility of digital tools for rural households, promote the use of the internet, enhance rural households' digital skills, support the production of smart agriculture-related products and the digital transformation of agriculture, and increase household income to enhance household participation in financial markets.

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