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The Impacts of Digital Inclusive Finance on China's Household Financial Asset Selection

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Abstract. Reasonable choice of financial assets is the basis of family wealth accumulation, and Chinese families generally have the problem of "limited participation" in financial markets in terms of financial asset choice. Against the background of the deep integration of digital technology and the financial industry, how to optimize household financial asset choice with digital inclusive finance as a grip is an issue of widespread concern for the government and academia. Based on the 2019 China Household Finance Survey data and Digital Inclusive Finance Index data from Peking University, this paper constructs Probit and Tobit models to examine the impact of the development of digital inclusive finance on household financial asset choice in terms of both financial market participation rate and participation depth respectively. The findings are as follows: digital inclusive finance significantly promotes household participation in financial markets and increases the proportion of risky financial assets, and the impact is more significant in urban areas, eastern regions and young households; this conclusion still holds after controlling for the endogeneity problem using the spherical distance from each provincial capital to Hangzhou as an instrumental variable.

Keywords: Digital inclusive finance; household financial asset selection; financial market participation; risky financial assets.

1. Introduction

With the sustained rapid development of China's economy, residents' income levels have gradually increased, and household wealth stocks have risen significantly. Household asset allocation demands have also grown accordingly, with more families seeking to manage their wealth through financial products to preserve and increase its value. However, it is noteworthy that participation rates in China's household financial markets remain relatively low, highlighting the phenomenon of the "mystery of limited participation" (Zhou Cong, 2020) [1]. Household asset structures commonly exhibit irrational patterns, with the majority of assets concentrated in savings, crowding out investments in riskier financial assets and resulting in low participation depth in financial assets such as stocks and bonds. Overall, the low participation rate and insufficient participation depth in China's household financial markets are key factors limiting the optimization of household asset allocation (Chen Jinyu and Luo Hehua, 2022) [2].

Meanwhile, digital inclusive finance has been steadily developing in China. By leveraging technological means to develop online financial platforms and services, digital inclusive finance aims to reduce operational costs, expand financial coverage, and enhance service efficiency (Duan Junshan and Shao Jiaoyang, 2022) [3]. It has played a positive role in improving traditional financial services and boosting service efficiency, serving as an effective means to break through traditional financial barriers and broaden market access. Does digitally enabled inclusive finance, with its unique advantages, significantly influence household financial asset choices in China? If so, do these effects vary across different groups? These questions form the research motivation of this paper. We empirically examine the impact of digitally enabled inclusive finance on household financial asset choices in China, focusing on two dimensions: financial market participation rate and participation depth. We also analyze the differential effects across different groups, aiming to provide policy insights for optimizing household financial asset choices through digitally enabled inclusive finance.

The significance of this study manifests in two aspects. First, household financial asset selection is a key research focus in household finance. However, constrained by factors such as wealth accumulation and data availability, academic exploration of household finance in China began relatively late. Examining the impact of digital inclusive finance on household financial asset selection holds theoretical significance for understanding the inefficiencies in China's household financial asset choices from the perspective of financial supply. Second, by empirically examining the impact of digital inclusive finance on household financial asset choices through both financial market participation rate and participation depth, this study offers guidance for further understanding the underlying logic of household financial asset selection in China and for optimizing such choices through digital inclusive finance.

2. Conceptual Definition and Literature Review

2.1. Definition of Related Concepts

2.1.1. Digital Inclusive Finance

Inclusive finance is defined as a new financial model that focuses on serving micro and small enterprises, people in remote areas, rural residents, low-income urban populations, impoverished individuals, persons with disabilities, the elderly, and other groups. Inclusive finance serves as a valuable complement to traditional finance. It not only provides accessible, affordable, and comprehensive financing services to economically disadvantaged groups but also offers broader, more convenient, and affordable financing options to the general public. It expands the coverage of financial services while deepening the reach of quality financial offerings. The concept of digital finance has evolved in recent years through the integration of internet technology and finance, referring to financial institutions leveraging internet technology to digitize financial operations.

Digital inclusive finance, derived from inclusive finance, is a financial model that leverages the internet to advance inclusive finance. By harnessing its unique advantages, it delivers more convenient and extensive financial services to customers. Combining the strengths of digital finance and inclusive finance, it lowers the barriers and costs for households to participate in financial markets, providing stronger momentum for the development of China's financial sector.

2.1.2. Household Financial Assets

Households seek to preserve and increase their wealth by purchasing financial products, resulting in varying proportions of financial assets within their total assets. The China Household Finance Survey questionnaire categorizes household assets into non-financial assets and financial assets. Financial assets constitute a significant portion of Chinese household holdings, referring to assets acquired through participation in financial markets. Common examples include savings, stocks, bonds, and mutual funds. Based on risk levels, financial assets can be further categorized into risky assets and risk-free assets. Most households maintain a risk-averse mindset, leading them to hold substantial amounts of cash, savings, and other risk-free assets. Risk-preferring households, however, tend to favor risk assets like stocks and bonds. Based on the research analysis by Yin Zhichao et al. (2015), this paper defines household risk-bearing financial assets as including stocks, mutual funds, financial bonds, corporate bonds, financial derivatives, financial wealth management products, and loans extended [4].

2.2. Review of Relevant Literature

2.2.1. Research on Digital Inclusive Finance

Research on digital inclusive finance primarily focuses on three areas: development level measurement, current status, and applied studies. Regarding the measurement of digital inclusive finance indicators, Guo Feng and Xiong Yunjun (2021) summarize those three approaches are currently used in China: first, certain indicators included in traditional financial surveys and statistics;

second, regional digital finance or fintech indices released by research or commercial institutions; and third, indicators incorporating digital finance released by certain institutions [5]. Among these, the Peking University Digital Inclusive Finance Index addresses the lack of digitalization in other indices, earning widespread recognition in academic circles. Zhang Xun et al. (2019) note that measuring the digital inclusive finance development index requires first standardizing indicators, then applying the Analytic Hierarchy Process (AHP) and coefficient of variation analysis to derive weights. This establishes a secondary index covering breadth, depth of use, and digitalization levels, with the final China digital inclusive finance index obtained through dimensionless conversion techniques [6].

Regarding the current state of digital inclusive finance development, from a domestic Chinese perspective, Guo Feng et al. (2020) examined disparities in China's digital inclusive finance from multiple angles, finding significant progress between 2011 and 2018 [7]. Qian Haizhang et al. (2020) reached similar conclusions [8]. Zhang Xun et al. (2020) found that China's eastern regions exhibit the highest level of digital inclusive finance development, with regional disparities narrowing [9]. From an international perspective, Fungáčová and Weill (2015) analyzed 2011 World Bank Findex data, revealing that China demonstrates higher financial inclusion compared to other BRICS nations, manifested through greater use of formal accounts and formal savings [10].

The application of digital financial inclusion indices is concentrated in two areas: household economic activities and business economic activities. Regarding household economic activities, digital financial inclusion improves residents' consumption structure by providing online transaction platforms (Yi Xingjian and Zhou Li, 2018) [11]; It offers investors greater access to financial products, enhancing residents' investment opportunities (Liao Jinglin and Zhou Li, 2020) [12]; and it provides residents with more employment information, thereby increasing job opportunities to some extent and boosting household income (Yu Jiang et al., 2018) [13]. Regarding corporate economic activities, Wanjia Yu et al. (2020) found that digital inclusive finance effectively reduces liquidity constraints for small and medium-sized enterprises [14]; Xie Ping (2014) similarly confirmed the positive role of digital inclusive finance in broadening corporate funding channels [15].

2.2.2. Research on Household Financial Asset Selection

In existing literature examining household financial asset choices, Cooper and Zhu (2017) employed a life-cycle model to investigate China's high savings rate, low stock market participation rate, and low share of stocks in household wealth. They found that China's high savings rate is primarily driven by high labor market risk [16]. Dimmock and Kouwenberg (2010), using household survey data, calculated each respondent's household loss aversion coefficient and found that higher loss aversion correlates with lower participation probability. This heightened loss aversion reduces the likelihood of direct stock ownership [17]. Numerous domestic Chinese scholars have reached similar conclusions. For instance, Guo Jiaojiao (2021) notes that Chinese households exhibit both low participation rates and limited exposure to risky financial markets, meaning most residents do not invest in risky assets. Even when investing in risky financial assets, the diversification of household financial portfolios falls far short of ideal levels [18]. He Guosheng and Geng Liping (2021) observed that Chinese households maintain relatively low levels of financial asset allocation, significantly below those in developed economies [19].

Within existing literature examining determinants of household financial asset selection, Chen Binkai and Li Tao (2011) adopted a micro perspective, finding that both the head of household's age and years of education influence asset choices, while household income positively promotes asset accumulation [20]. Wei Xianhua et al. (2014) employed structural equation modeling to explain Chinese households' financial asset allocation behavior through substitution effects, crowding-out effects from housing investment, and life-cycle effects [21]. From a macro perspective, Liu Fengyu et al. (2019) found that economic uncertainty affects the proportion of household financial asset allocation, suggesting households should consider external factors like national economic policies and economic conditions when investing in financial markets [22]. Lu Xiaomeng et al. (2019)

discovered that financial market development can effectively increase household income and reduce market friction, thereby encouraging households to diversify their asset allocation [23].

2.2.3. Research on the Impact of Digital Inclusive Finance on Household Financial Asset Selection

In the literature examining the impact of digital inclusive finance on household financial asset choices, Lu et al. (2021) found that most Chinese households face extreme portfolio risk, which is significantly mitigated by digital financial inclusion [24]. An Qiangsheng and Bai Lu (2022) discovered that Chinese households' financial asset choices are significantly influenced by digital inclusive finance, with this effect being more pronounced in first- and second-tier cities than in third-tier cities [25]. Liu Yunpu (2022), examining the context of population aging, argued that under conditions of developing digital inclusive finance, the inhibitory effect of population aging on household financial asset choices would be mitigated [26]. Concurrently, household financial asset choices are also promoted by the development of digital inclusive finance (Hu Ningning and Hou Guanyu, 2022) [27]. Regions with higher development levels exhibit a greater likelihood of households holding risky financial assets (Zhang Jiantong, 2021) [28]. Liu Yu (2021) found that households with longer years of education and urban households are more effectively influenced by digital inclusive finance [29].

In literature examining the mechanisms through which digital inclusive finance impacts household financial asset choices, Wu Yu et al. (2021) discovered that digital inclusive finance effectively enhances the diversification of household financial assets. This is primarily due to increased investment convenience, reduced difficulty in accessing financial information, and heightened risk tolerance among residents [30]. Yang Yudan (2020) indicates that digital inclusive finance can increase household returns by lowering investment barriers and promoting financial literacy [31]. Zhang Hongwei and He Guanlin (2022) also propose that digital inclusive finance can facilitate household financial asset choices by reducing financial service costs [32].

2.2.4. Further Reflections on Existing Literature

A review of the literature reveals that scholars both domestically and internationally have conducted detailed and insightful research on the relationship between digital inclusive finance and household asset allocation. However, there remains room for further exploration: First, existing studies primarily focus on analyzing the correlation between the two by examining household financial market participation rates, with limited consideration given to the depth of financial market participation. Second, most studies examining the impact of digital inclusive finance development on household financial asset choices rely on data from 2017 or earlier, resulting in certain lag in research conclusions. Third, analyses of the heterogeneity in how digital inclusive finance development influences household financial asset choices remain relatively one-sided, particularly lacking differential analysis across different age groups of household heads, which hinders a comprehensive assessment of the impact of digital inclusive finance development.

Therefore, this paper utilizes the 2019 Digital Inclusive Finance Index and China Household Finance Survey data. It considers both the probability of household participation in financial markets and the depth of market participation to empirically examine the impact of digital inclusive finance on household financial asset allocation. Robustness tests are conducted using replacement explanatory variables and instrumental variable methods. Furthermore, a comprehensive heterogeneity analysis is performed across three dimensions: urban-rural, regional, and head-of-household age.

3. Theoretical Analysis and Research Hypotheses

3.1. Relevant Theoretical Foundations

3.1.1. Precautionary Savings Theory

Precautionary savings represent a form of savings adopted by consumers to mitigate risk. Leland (1968) employed a two-stage consumption model to demonstrate the existence of precautionary

savings, arguing that its primary cause stems from uncertainty surrounding future income [33]. This theory posits that consumers exhibit risk-averse behavior; consequently, when households perceive potential instability in income, they reduce consumption levels and increase bank deposits. Household consumption and savings levels fluctuate with the uncertainty of income risk. The more unstable future income appears, the more households tend to save, accumulating greater deposits to guard against future risks and safeguard future consumption levels. Thus, when current household income declines, consumers increase precautionary savings and reduce consumption to mitigate risk.

Leveraging unique technological advantages, digital inclusive finance reduces future uncertainty. It enables consumers to decrease precautionary savings and invest their wealth in the present, thereby profoundly influencing household financial asset allocation.

3.1.2. Liquidity Constraint Theory

When households borrow to meet their consumption needs, they may encounter varying degrees of restrictions known as liquidity constraints. This theory posits: First, when consumers face liquidity constraints while borrowing, their current consumption exhibits a significant correlation with their current income. Zeldes (1989) also confirmed through research that for households subject to liquidity constraints, consumption promotes income [34]. When income is low, consumers facing high liquidity constraints or lacking credit channels will adopt a low-consumption strategy based on their existing income. Second, consumption levels vary among consumers due to differing liquidity constraints, with liquidity constraints exerting a negative impact on consumption in the long run. Third, anticipated future liquidity constraints also influence current consumption expenditures. If consumers expect future liquidity constraints, they reduce current consumption levels and increase bank deposits to avoid future low consumption caused by liquidity constraints.

Benefiting from the expansion of online services, the development of digital inclusive finance reduces transaction costs in financial services and enhances financial accessibility. Consequently, it alleviates liquidity constraints in household finances, leading families to reduce savings, increase consumption, and influence household asset allocation.

3.1.3. Life Cycle Theory

Life cycle theory, proposed by American economists Modigliani and Brumberg (1954) [35], posits that individuals plan their consumption expenditures over the long term to achieve optimal allocation of consumption throughout their entire life cycle. Household investment, savings, or consumption decisions are determined by the income available to the household. According to the life cycle consumption theory, when determining the structure of household asset allocation, residents consider factors such as the wealth the household possesses and current income to reasonably arrange necessary expenditures.

The development of digital inclusive finance has improved credit accessibility, making it easier for households to obtain funds in the future. Therefore, residents reduce savings behavior intended for planning future consumption expenditures and allocate more wealth to current investments.

3.2. Mechanism Analysis and Research Hypotheses

3.2.1. Breaking Down Financial Service Barriers to Enhance Financial Accessibility

On one hand, traditional financial models rely on in-person services, resulting in high financial service costs and information asymmetry issues. On the other hand, the fundamental reason finance is often called a “game for the wealthy” lies in the high barriers to accessing financial products and services. Financial institutions tend to prioritize clients with higher asset levels, leaving ordinary households unable to meet the asset thresholds required by these institutions. Consequently, they lack access to a broader range of financial products and services, leading to low financial accessibility. This situation contributes to the relatively low allocation of household assets in China's financial markets.

The development of digital inclusive finance has enabled the online operation of numerous financial services, enhancing transparency between financial institutions and investors and mitigating information asymmetry to some extent. Furthermore, users can access more efficient financial services and a wider range of financial products through digital inclusive finance platforms. Consequently, digital inclusive finance will help break down financial barriers, enhance accessibility, and enable more households to participate in financial markets.

3.2.2. Alleviating Household Liquidity Constraints

Households face varying degrees of liquidity constraints. To mitigate liquidity risks, they tend to reduce consumption expenditures, including investments in financial markets, resulting in low participation rates among Chinese households in financial markets. Therefore, household participation in financial markets is closely tied to the level of household liquidity. The development of China's financial markets can reduce household liquidity risks, encouraging more families to participate. Against the backdrop of rapid growth in digital inclusive finance, China's financial markets have become more developed, enabling households to access a wider range of financial services and products. Thus, the advancement of China's financial markets and digital inclusive finance are mutually reinforcing. For households, the expansion of digital inclusive finance will ease liquidity constraints and provide more investment opportunities.

3.2.3. Enhancing Social Interaction

Social interaction refers to households engaging in social communication and exchange. During the development of digital inclusive finance, financial institutions have created numerous websites encouraging households to use these platforms to learn financial knowledge, accumulate others' investment experiences, and enhance their financial literacy. This helps households build relevant knowledge in daily life and apply it effectively, enabling better interpretation of economic news and timely identification and capture of investment opportunities. The digitization of financial services and products brought by digital inclusive finance enables residents to engage in social interactions more conveniently, thereby promoting household participation rates and depth in the financial market. Based on the above theoretical analysis, this paper proposes Hypothesis 1.

Hypothesis 1: Digital inclusive finance will promote household participation rates and depth in the financial market.

Based on existing research findings and this paper's descriptive statistical analysis, household financial asset selection behavior may exhibit significant regional and urban-rural disparities. Additionally, this paper observes notable differences in current household age structures, where varying values and attitudes across age groups may influence financial asset selection decisions. Thus, Hypothesis 2 is proposed.

Hypothesis 2: The impact of digital inclusive finance development on household financial asset selection exhibits heterogeneity across urban-rural areas, regions, and household head age.

4. Research Design

4.1. Sample Selection and Data Sources

This study utilizes data from the Digital Inclusive Finance Index and the 2019 China Household Finance Survey (CHFS). The Peking University Digital Inclusive Finance Index provides a detailed portrayal of digital inclusive finance development across China's provinces, cities, and counties, encompassing a primary indicator—the Digital Inclusive Finance Composite Index—and a series of secondary indicators. The CHFS data originates from the China Household Finance Survey and Research Center at Southwestern University of Finance and Economics. This dataset covers 29 provinces (autonomous regions and municipalities), 43 districts and counties, and 1,360 village (neighborhood) committees, encompassing a total of 34,643 households. This study performed provincial-level matching of the aforementioned data.

4.2. Model Construction

When examining the impact of digital inclusive finance development on financial market participation rates, it was found that the dependent variable—financial market participation rate—assumes values of either 0 or 1, exhibiting characteristics of a binary dummy variable. Therefore, this study employs a Probit model to depict the extent of digital inclusive finance's influence on household financial market participation. The specific model specification is as follows:

$$Y^* = \beta_0 + \beta_1 X_i + \beta_2 C_i + u_i \tag{4.1}$$

$$Y_i = \begin{Bmatrix} 1, Y_i^* > 0 \\ 0, Y_i^* \le 0 \end{Bmatrix} \tag{4.2}$$

In equations (4.1) and (4.2), Y_i denotes the binary dummy variable indicating whether a household participates in financial markets, where =1 if participating and =0 otherwise; Y_i^* represents the latent variable; X_i signifies the overall digital inclusive finance index for a given locality; C_i represents control variables; u_i denotes the random disturbance term; β_0, β_1, and β_2 are the coefficients to be estimated.

Empirical analysis of the impact of digital inclusive finance development on participation depth reveals that most households do not invest in any risky financial assets. Consequently, the proportion of risky assets exhibits numerous zero values, indicating left-censoring. Therefore, this study employs a Tobit model for empirical analysis, with the specific model specification as follows:

$$Y_i^* = \beta_0 + \beta_1 X_i + \beta_2 C_i + u_i \tag{4.3}$$

$$Y_i = \begin{Bmatrix} 0, Y_i^* \le 0 \\ Y_i^*, 0 < Y_i^* < 1 \\ 1, Y_i^* \ge 1 \end{Bmatrix} \tag{4.4}$$

In equations (4.3) and (4.4): Y_i^* denotes the latent variable; Y_i represents the proportion of household risk-bearing financial assets relative to total financial assets; X_i is the overall digital inclusive finance index for a given region; C_i is the control variable; u_i is the random disturbance term; β_0, β_1, and β_2 are the coefficients to be estimated.

4.3. Indicator Selection and Definition

4.3.1. Dependent Variables

This study selects household participation in financial markets as the first dependent variable, designated as *Participation*. The second dependent variable is the ratio of households' risky financial assets to their total financial assets, designated as *Riskratio*. Based on the characteristics of the CHFS data, a household is considered to have participated in the financial market when it holds one or more types of risk assets, with a value of 1; otherwise, it is considered non-participating, with a value of 0.

The total value of a household's risk financial assets is obtained by summing the values of all types of risk financial assets.

4.3.2. Independent Variables

The 2019 Provincial Digital Inclusive Finance Composite Index is used to measure the level of digital inclusive finance development. To address heteroscedasticity, the composite index is log-transformed, with the variable named *lnindex*.

4.3.3. Control Variables

Control variables are selected from three dimensions: individual characteristics, household wealth characteristics, and external environment. Among these: The gender variable assigns a value of 1 to males and 0 to females; The age control variable is treated as a continuous variable. The head of household's education level is also treated as continuous, with higher values indicating greater education attainment. For marital status, married is coded as 1 and unmarried as 0. Health status is measured such that lower values indicate better health. Regarding risk preference, lower values indicate greater risk tolerance. For household characteristic variables: - Logarithms are applied to total household income and total household assets; - Household registration status is coded as 1 for rural households and 0 for others; - Regional location is categorized as East, Central, or West, with values assigned as follows: East is 1, Central is 2 and West is 3.

4.4. Descriptive Statistical Analysis

Descriptive statistics for relevant variables are presented in Table 1 Based on sample distributions, the average participation rate in China's household financial market stands at 10.9%. Among these households, risky financial assets account for 12.2% of total financial assets held. Regarding the development level of digital inclusive finance, the average logarithm of the overall digital inclusive finance index across the country is 5.791, while the average logarithm of the coverage breadth index is 5.736 and the average logarithm of the usage depth index is 5.761. Regarding household characteristics, male heads of household predominate in China, accounting for over 70%. The average age is 56, with most heads being married. Overall health status is generally above average, and the average educational attainment is junior high or high school level. Risk preferences tend to be low. Regarding household wealth, the standard deviation and extreme values indicate a significant wealth gap in China. In terms of external environment, 34.6% of households originate from rural areas, with the majority hailing from central and eastern regions.

Table 1. Descriptive Statistics for Variables

Variable Name	Variable Description	Sample Size	Mean	Standard	Deviation	Minimum	Maximum
Participation	Participation in financial markets	32416	0.109	0.312	0	1	32416
Riskratio	Proportion of risk-bearing financial assets in portfolio	32416	0.122	0.235	0	1	32416
lnindex	Logarithm of Digital Inclusive Finance Index	32416	5.791	0.096	5.644	6.017	32416
lnbreadth	Logarithm of coverage breadth	32416	5.736	0.091	5.609	5.952	32416
lndepth	Logarithm of usage depth	32416	5.761	0.144	5.487	6.087	32416
Riskpref	Risk preference	32416	4.595	1.155	1	6	32416
Sex	Gender	32416	0.754	0.431	0	1	32416
Age	Age	32416	56.091	13.693	18	101	32416
Age2	Age squared	32416	3334	1539	324	10201	32416
Edu	Education level	32416	3.397	1.628	1	9	32416
Marriage	Marital status	32416	0.967	0.178	0	1	32416
Health	Health status	32416	2.719	0.995	1	5	32416
lntotalincome	Logarithm of total household income	32416	10.642	1.439	-1.894	16.311	32416
lntotalasset	Logarithm of total household assets	32416	12.811	1.692	2.303	21.471	32416
rural	Rural household registration status	32416	0.346	0.476	0	1	32416
region	Region of household residence	32416	1.883	0.840	1	3	32416

Table 2 presents descriptive statistics on household financial asset selection behavior. It can be observed that households in urban areas exhibit higher financial market participation rates and participation depth than those in rural areas. Financial market participation rates and the proportion of risky financial assets show a stepwise decline across eastern, central, and western regions. As age increases, both the participation rate and participation depth of households in financial markets decrease progressively. Younger households hold a high proportion of risky assets at 19.6%, while older households hold only 9%.

Table 2. Descriptive Statistics of Household Financial Asset Selection Behavior

	Financial Market Participation Rate	Financial Market Participation Depth
Urban	0.158	0.141
Rural	0.018	0.086
Eastern	0.166	0.135
Central	0.070	0.113
Western	0.068	0.112
Youth	0.146	0.196
Middle-aged	0.115	0.140
Elderly	0.097	0.090

Table 3 presents the descriptive statistics for digital inclusive finance. It reveals that the eastern region exhibits the highest development level, with a logarithmic mean of the composite index reaching 5.864. The central and western regions demonstrate lower development levels, though the difference

is not significant. The coverage breadth index shows a marked disparity between the eastern region and the central and western regions. Meanwhile, the usage depth index gradually decreases across the eastern, central, and western regions.

Table 3. Descriptive Statistics for Numerical Values Across Digital Inclusive Finance Indices

	Logarithmic value of total index	Logarithmic value of coverage breadth	Logarithmic value of usage depth
Eastern	5.864	5.806	5.868
Central	5.754	5.689	5.725
Western	5.723	5.683	5.645

5. Empirical Results and Analysis

5.1. Benchmark Regression Results and Analysis

This study conducted Probit and Tobit model regressions by progressively adding individual, household, and external environment-related control variables. The benchmark regression results are presented in Tables 4 and 5.

The Probit model results indicate that, without controlling variables, the marginal effect of the explanatory variable lnindex on household financial market participation is 0.574, significant at the 1% level. This suggests that digital financial inclusion significantly increases household financial market participation when other factors are not considered. After incorporating individual characteristic control variables, the marginal effect decreased to 0.389 but remained positively significant at the 1% level. Further inclusion of household variables and external environment variables reduced the marginal effect to 0.136, yet it remained statistically significant at the 1% level. The Tobit model regression results show that without control variables, the marginal effect of the explanatory variable lnindex is 0.131, significant at the 1% level. This indicates that, absent other factors, digital inclusive finance significantly increases participation depth. After successively adding individual, household, and external environment control variables, the marginal effect declines to 0.028 but remains significant. Thus, Hypothesis 1 is confirmed.

The regression results with control variables show negative coefficients for gender, health status, and risk preference, indicating a suppressing effect on the dependent variable. Positive coefficients for age, education level, and marital status suggest a positive promotion of the dependent variable. Both total income and total assets exhibit positive coefficients, indicating a promotional role in the model. After incorporating external environment variables, both urban and rural control variables exhibited significantly negative coefficients, indicating that rural households show notable deficiencies in financial market participation and investment in risky financial assets. This may stem from the relatively underdeveloped financial markets in rural areas and insufficient financial accessibility for rural households. Regional control variables exerted a negative influence on household financial market participation but a positive promotional effect on household investment in risky financial assets, both significant at the 5% level.

Table 4. Estimation Results of the Probit Model for Household Participation in Financial Markets

	(1)	(2)	(3)	(4)
Variable Name	Participation	Participation	Participation	Participation
lnindex	0.574***	0.389***	0.141***	0.136***
	(0.017)	(0.015)	(0.015)	(0.020)
Sex		-0.038***	-0.031***	-0.025***
		(0.003)	(0.003)	(0.003)
Age		0.010***	0.010***	0.010***
		(0.001)	(0.001)	(0.001)
Age2		-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)
Edu		0.043***	0.025***	0.022***
		(0.001)	(0.001)	(0.001)
Marriage		0.022**	-0.023**	-0.023**
		(0.001)	(0.001)	(0.001)
Health		-0.011***	-0.002	-0.002
		(0.002)	(0.002)	(0.002)
Riskpref		-0.040***	-0.033***	-0.032***
		(0.001)	(0.001)	(0.001)
lntotalincome			0.019***	0.018***
			(0.002)	(0.002)
lntotalasset			0.039***	0.036***
			(0.001)	(0.001)
rural				-0.057***
				(0.005)
region				-0.001**
				(0.001)
N	32416	32416	32416	32416
R^2	0.055	0.239	0.304	0.311

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% significance levels, respectively; standard errors are shown in parentheses, as in the table below.

Table 5. Tobit Model Estimation Results for the Proportion of Risky Financial Assets in Household Portfolios

	(1)	(2)	(3)	(4)
Variable Name	Riskratio	Riskratio	Riskratio	Riskratio
lnindex	0.131***	0.118***	0.015*	0.028***
	(0.008)	(0.008)	(0.008)	(0.011)
Sex		-0.006***	-0.004**	-0.001
		(0.001)	(0.001)	(0.001)
Age		0.001**	-0.001*	-0.001
		(0.001)	(0.000)	(0.000)
Age2		-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)
Edu		0.011***	0.002***	0.001*
		(0.001)	(0.001)	(0.001)
Marriage		0.016***	-0.007	-0.007*
		(0.004)	(0.004)	(0.004)
Health		-0.010***	-0.005***	-0.005***
		(0.001)	(0.001)	(0.001)
Riskpref		-0.017***	-0.014***	-0.014***
		(0.001)	(0.001)	(0.001)
lntotalincome			0.008***	0.008***
			(0.001)	(0.001)
lntotalasset			0.018***	0.018***
			(0.001)	(0.001)
rural				-0.016***
				(0.001)
region				0.002**
				(0.001)
N	32416	32416	32416	32416
R^2	0.007	0.137	0.178	0.180

5.2. Robustness Checks

This paper first employs the instrumental variables method to test for endogeneity, using the spherical distance from each provincial capital to Hangzhou as the instrumental variable for second-order regression. Subsequently, a robustness check is conducted by replacing the digital inclusive finance composite index with coverage breadth and usage depth as new explanatory variables.

5.2.1. Endogeneity Test

Endogeneity issues may arise in the benchmark regression model for the following reasons: First, a bidirectional causal relationship may exist between the dependent variable and the core explanatory variable. Households with higher financial market participation exhibit stronger investment demand and access to more investment opportunities, making them more likely to engage in the digital financial market. Second, household financial asset choices are influenced by numerous factors, including many difficult-to-measure variables such as customs and habits. Consequently, omitted variable bias may exist among the factors affecting household financial asset choices.

Therefore, this study employs the spherical distance from each provincial capital to Hangzhou as an instrumental variable for endogeneity testing. The rationale is as follows: the construction of the Digital Inclusive Finance Index relies on data from Ant Financial Group, whose headquarters are located in Hangzhou. Consequently, Hangzhou leads nationally in digital inclusive finance development. It is reasonable to infer that: The greater the distance from Hangzhou, the lower the

level of digital inclusive financial development. This has been demonstrated in the literature; for example, Guo Feng et al. (2017) found that the Digital Inclusive Finance Index indeed exhibits a diffusion pattern radiating outward from Hangzhou as the center [36]. Consequently, the spherical distance between Hangzhou and provincial capitals exhibits a significant correlation with the digital inclusive finance index. Moreover, distance data between regions is largely immune to subjective influences and lacks direct ties to household financial asset selection behaviors. Thus, the spherical distance from each provincial capital to Hangzhou is deemed an appropriate instrumental variable. This study adopts Yuan Hui's (2018) two-step approach to address endogeneity issues [37], with results presented in Table 6.

Table 6 reports the results of the two-step approach: the first column presents the regression results of spherical distance from provincial capitals to Hangzhou on digital inclusive finance, the second column shows the results of the ivprobit model, and the third column displays the results of the ivtobit model. The Wald tests for endogeneity in the above models all yield significant results, indicating that digital inclusive finance is an endogenous variable. The critical value for the i-weak test is 10 when the AR value exceeds 10%. Since the AR values in the table all exceed 10, this suggests that the spherical distance from provincial capitals to Hangzhou is not a weak instrumental variable. After incorporating the distance variable into the model, the effects of digital inclusive finance on household financial market participation rate and participation depth remained consistent with the benchmark regression results and were significant at the 1% level. This further supports the study's conclusion that the development of digital inclusive finance significantly promotes household financial asset selection.

Table 6. IV-Probit and IV-Tobit Model Regression Results After Including Instrumental Variables

	Phase I Results	IV-Probit Model	IV-Tobit Model
Variable Name	lnindex	Participation	Riskratio
distance	-0.002***		
	（0.000）		
lnindex		2.731***	0.656***
		（0.678）	（0.146）
Exogenous control variables	Yes	Yes	Yes
F-value	2900.231***		
Wald test for endogeneity		5.150**	14.251***
AR test		15.841***	20.342***
N	32416	32416	32416

5.2.2. Replacing Core Explanatory Variables

To verify the robustness of the above conclusions, this study replaced the explanatory variables with secondary indicators: coverage breadth (*lnbreadth*) and usage depth (*lndepth*). The regression results are shown in Table 7.

The results indicate that the marginal utility coefficients for both secondary indicators are significantly positive, suggesting that usage depth and coverage breadth also effectively influence the probability of household participation in financial markets and the diversification of asset choices. The regression results after replacing the explanatory variables align with the empirical conclusions presented earlier, confirming the robustness of the prior estimation results.

Table 7. Estimation Results of Probit and Tobit Models After Replacing Core Explanatory Variables

	Probit Model		Tobit Model	
	(1)	(2)	(3)	(4)
Variable Name	Participation	Participation	Riskratio	Riskratio
lnbreadth	0.107***		0.023**	
	(0.019)		(0.011)	
lndepth		0.104***		0.019**
		(0.013)		(0.007)
Sex	-0.025***	-0.024***	-0.001	-0.001
	(0.003)	(0.003)	(0.001)	(0.001)
Age	0.007***	0.007***	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)
Age2	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.022***	0.022***	0.001*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
Marriage	-0.023***	-0.022**	-0.008*	-0.007*
	(0.009)	(0.009)	(0.004)	(0.004)
Health	-0.001	-0.001	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Riskpref	-0.032***	-0.032***	-0.014***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
lntotalincome	0.018***	0.017***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)
lntotalasset	0.036***	0.036***	0.018***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)
rural	-0.056***	-0.056***	-0.016***	-0.016***
	(0.004)	(0.004)	(0.001)	(0.001)
region	-0.004**	0.000	0.001*	0.002*
	(0.002)	(0.002)	(0.001)	(0.001)
N	32416	32416	32416	32416
R^2	0.310	0.311	0.180	0.180

5.3. Heterogeneity Analysis

5.3.1. Urban-Rural Heterogeneity Analysis

Significant disparities exist between China's rural and urban areas in terms of financial entities, economic development conditions, and human resources. Consequently, the development of financial markets in these two regions exhibits pronounced differences. Specifically, compared to urban areas, rural regions exhibit lower financial accessibility, higher barriers to financial services and products, and generally lower financial literacy among most rural households. This results in less effective financial asset allocation for rural families. Given the objective differences in urban-rural financial development and household financial decision-making in China, this study divides the sample data into urban and rural segments for separate analysis, with results shown in Table 8.

It can be observed that the choice of financial assets by urban households is more significantly influenced by digital inclusive finance, consistent with the actual situation. In urban areas, the development of digital inclusive finance is relatively mature, enabling households to access more convenient financial services and products. Residents also have higher incomes, resulting in a higher

proportion of residents investing in financial markets. In rural areas, the development of digital inclusive finance primarily manifests as promoting residents' savings and consumption, with a less significant impact on participation in financial markets.

Table 8. Regression results for sample heterogeneity by place of household registration

	Rural Areas		Urban Areas	
	(1)	(2)	(1)	(2)
	Probit Model	Tobit Model	Probit Model	Tobit Model
Variable Name	Participation	Riskratio	Participation	Riskratio
lnindex	0.006	-0.038*	0.201***	0.070***
	(0.017)	(0.020)	(0.028)	(0.013)
Sex	-0.001	0.005	-0.036***	-0.004*
	(0.003)	(0.003)	(0.004)	(0.002)
Age	-0.001	-0.000	0.011***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Age2	0.000	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.004***	0.002**	0.031***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Marriage	0.007	0.000	-0.039***	-0.013**
	(0.011)	(0.008)	(0.012)	(0.005)
Health	-0.003**	-0.004***	-0.001	-0.004***
	(0.001)	(0.001)	(0.002)	(0.001)
Riskpref	-0.004***	-0.007***	-0.047***	-0.018***
	(0.001)	(0.001)	(0.001)	(0.001)
lntotalincome	0.004***	0.012***	0.024***	0.005***
	(0.001)	(0.001)	(0.002)	(0.001)
lntotalasset	0.008***	0.019***	0.050***	0.016***
	(0.001)	(0.001)	(0.002)	(0.001)
region	-0.001	-0.004**	-0.001	0.006***
	(0.001)	(0.002)	(0.003)	(0.001)
N	11218	11218	21198	21198
R^2	0.156	0.185	0.261	0.150

5.3.2. Regional Heterogeneity Analysis

Significant disparities exist across China's regions in terms of resource endowments, historical development, and cultural customs. This has resulted in a tiered pattern of financial market development across the eastern, central, and western regions. In regions where digital inclusive finance lags behind, financial services fail to meet investor demands, and financial products remain limited. Consequently, household choices regarding financial assets face certain constraints. Therefore, this study categorizes the sample based on the region where households reside and conducts separate analyses, with results presented in Table 9.

It can be observed that the coefficient of the explanatory variable for the eastern region is positive, indicating that digital inclusive finance positively influences household financial asset choices. In contrast, the central region shows a strong impact only on the depth of financial market participation, while the western region significantly affects only the household financial market participation rate. This may be because the western region lags most in financial market development, where digital inclusive finance primarily impacts household participation rates in financial markets but has yet to influence the depth of such participation.

Table 9. Regression Results for Heterogeneity in Samples by Region

	Eastern Region		Central Region		Western Region	
	(1)	(2)	(1)	(2)	(1)	(2)
	Probit Model	Tobit Model	Probit Model	Tobit Model	Probit Model	Tobit Model
Variable Name	Participation	Riskratio	Participation	Riskratio	Participation	Riskratio
lnindex	0.197***	0.066***	-0.007	-0.078***	0.118**	0.026
	(0.030)	(0.014)	(0.049)	(0.029)	(0.048)	(0.030)
Sex	-0.027***	-0.004	-0.015***	0.001	-0.027***	0.001
	(0.005)	(0.002)	(0.005)	(0.003)	(0.005)	(0.003)
Age	0.009***	5.26e-05	0.002**	-0.001	0.007***	-7.53e-05
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age2	-0.000**	-0.000	-0.000	-0.000	-0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.030***	0.002***	0.014***	0.001	0.017***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Marriage	-0.036**	-0.013*	-0.015	-0.002	-0.009	-0.008
	(0.016)	(0.007)	(0.014)	(0.009)	(0.014)	(0.008)
Health	0.001	-0.005***	-0.003	-0.007***	-0.004*	-0.002
	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Riskpref	-0.046***	-0.018***	-0.021***	-0.010***	-0.022***	-0.011**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
lntotalincome	0.026***	0.009***	0.010***	0.010***	0.012***	0.005***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
lntotalasset	0.047***	0.015***	0.031***	0.019***	0.025***	0.020***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
rural	-0.076***	-0.010***	-0.051***	-0.013***	-0.033***	-0.022**
	(0.009)	(0.003)	(0.007)	(0.003)	(0.006)	(0.003)
N	13528	13528	9104	9104	9784	9784
R^2	0.312	0.171	0.235	0.184	0.280	0.190

5.3.3. Age Heterogeneity Analysis

Against the backdrop of ongoing demographic shifts in China, the age of household heads may influence their financial literacy, income, risk preferences, and life experience. This heterogeneity has become a significant factor that warrants inclusion in analytical frameworks examining household financial asset choices within the context of digital inclusive finance development. This study divides the sample data into three age groups: youth (≤40 years old), middle-aged (40–55 years old), and elderly (≥55 years old), conducting separate regressions for each. The results are presented in Table 10.

It is evident that the development of digital inclusive finance exerts a more pronounced influence on the financial asset choices of young households compared to middle-aged and elderly households. This may stem from middle-aged and elderly household heads bearing greater responsibilities for supporting their families and facing higher household expenditures, leading to reluctance to invest in higher-risk financial products and resulting in lower rates and depths of financial market participation.

Table 10. Regression Results for Heterogeneity in Samples by Region

	Youth		Middle Age		Old Age	
	(1)	(2)	(1)	(2)	(1)	(2)
	Probit Model	Tobit Model	Probit Model	Tobit Model	Probit Model	Tobit Model
Variable Name	Participation	Riskratio	Participation	Riskratio	Participation	Riskratio
lnindex	0.192***	0.083**	0.018	0.007	0.182***	0.022
	(0.064)	(0.035)	(0.036)	(0.020)	(0.025)	(0.015)
Sex	-0.021**	-0.004	-0.023***	0.004	-0.026***	-0.007**
	(0.010)	(0.005)	(0.005)	(0.003)	(0.004)	(0.002)
Age	0.007	-0.008	0.009	0.013*	0.014***	-0.001
	(0.013)	(0.006)	(0.015)	(0.007)	(0.003)	(0.002)
Age2	-0.000	0.000	-0.000	-0.000**	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.025***	0.008***	0.022***	-0.001*	0.020***	0.009***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Marriage	-0.046***	-0.023**	0.017	0.014	-0.032	0.004
	(0.016)	(0.008)	(0.024)	(0.009)	(0.023)	(0.012)
Health	0.014**	-0.004	-0.001	-0.004**	-0.003*	0.004***
	(0.006)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Riskpref	-0.034***	0.016***	-0.028***	-0.011**	-0.034***	0.018***
	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
lntotalincome	0.024***	0.001	0.013***	0.007***	0.019***	0.013***
	(0.004)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
lntotalasset	0.036***	0.011***	0.048***	0.017***	0.028***	0.018***
	(0.004)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
rural	-0.033*	0.028***	-0.047***	0.012***	-0.060***	0.012***
	(0.018)	(0.007)	(0.007)	(0.003)	(0.006)	(0.002)
region	-0.019**	0.005	-0.004	0.002	0.005	0.001
	(0.007)	(0.003)	(0.004)	(0.002)	(0.003)	(0.001)
N	4431	4431	11197	11197	16788	16788
R^2	0.241	0.063	0.314	0.100	0.339	0.179

The above results indicate that the promotional effect of developing digital inclusive finance on households' selection of risky financial assets exhibits heterogeneity across urban and rural areas, regions, and household head age. This is primarily manifested in the following aspects: In terms of household financial market participation, digital inclusive finance exerts a more significant promotional effect on urban households, households in eastern and western regions, and younger households. Regarding the allocation of risky financial assets, the development of digital inclusive finance demonstrates a more pronounced promotional effect on urban households, households in eastern and central regions, and younger households. Thus, Hypothesis 2 is confirmed.

6. Conclusions and Recommendations

Chinese households generally exhibit limited participation in financial markets when selecting financial assets. Against the backdrop of deep integration between digital technology and the financial sector, exploring how digital inclusive finance can optimize household financial asset choices warrants further investigation. This study utilizes 2019 China Household Finance Survey data and Peking University's Digital Inclusive Finance Index data to construct Probit and Tobit models. By examining both financial market participation rates and participation depth, it investigates the impact

of digital inclusive finance development on household financial asset choices, yielding the following conclusions:

(1) The development of digital inclusive finance significantly promotes household financial market participation rates. The overall index of digital inclusive finance, along with its secondary indicators of coverage breadth and usage depth, consistently demonstrate a positive effect on household financial market participation rates. This effect is more pronounced for urban households, households in eastern regions, and young households.

(2) The development of digital inclusive finance significantly increases household financial market participation depth. The overall index of digital inclusive finance, along with its secondary indicators of coverage breadth and usage depth, all promote households' selection of more risky financial assets. This effect is more pronounced for urban households, households in eastern regions, and young households.

After correcting for endogeneity using the spherical distance from each provincial capital to Hangzhou as an instrumental variable, the above conclusions remain valid.

Based on these findings, the following policy recommendations are proposed to optimize household financial asset selection through digital inclusive finance:

(1) Strengthen digital inclusive finance development in central-western regions and rural areas.

Governments should enhance digital infrastructure in these areas to ensure truly “inclusive” digital finance, expanding financial service coverage and depth. Financial institutions should deepen reforms, integrate fintech, and drive financial innovation. For instance, financial institutions can innovate products tailored to regional preferences in household financial asset selection, particularly enhancing the innovation capacity of inclusive financial products for central-western and rural areas, while establishing effective management mechanisms for such products.

(2) Prioritize the financial health of middle-aged and elderly households and elevate residents' financial literacy.

Governments and financial institutions should focus on the financial asset selection behaviors and financial health levels of middle-aged and elderly households, designing reasonable borrowing and wealth management plans through digital financial innovations. Simultaneously, the rapid development of digital inclusive finance has led to greater diversity in financial products and services. The complex financial market environment places higher demands on households' financial literacy levels, making its enhancement an essential path to optimizing household financial asset choices. Governments should strengthen the construction of financial education systems, providing targeted financial education across different regions and age groups. Financial institutions should enhance residents' financial literacy through measures such as increasing financial consultation windows, organizing financial knowledge lectures, and conducting training sessions.

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