

How Does Digital Financial Literacy Affect Family Pension Security?

-- An Empirical Analysis based on CHFS Data

Jianhong Tao *, Lian Lian

School of Economics and Management, Shaanxi University of Science and Technology, Xi'an, Shaanxi 710021, China

* Corresponding author: Jianhong Tao

Abstract: The development of digitalization has raised higher requirements for the elderly care security capabilities of household digital finance. Based on the 2019 China Household Finance Survey (CHFS) data, this paper selects a sample of 29,990 households to evaluate household pension asset allocation from three aspects: types of pension financial assets, proportion of pension assets, and life insurance coverage. Ordered Probit, fractional Logit, and Probit models are respectively constructed to conduct benchmark regression analysis on how digital financial literacy affects household pension. The study finds that digital financial literacy not only promotes households to increase the variety and proportion of pension assets they hold but also encourages them to purchase life insurance for retirement protection. Further research indicates that the use of digital tools and household risk attitudes constitute two pathways through which digital financial literacy influences household pension. However, such effects exhibit heterogeneity in urban-rural structures and household health conditions. The conclusions of this paper provide important insights for empowering household pension through digital finance.

Keywords: Digital Financial Literacy; Retirement Assets; Use of Digital Tools; Life Insurance Coverage; Household Risk Attitudes.

1. Introduction

By the end of 2024, China's population aged 65 and above reached 220 million[1], accounting for 15.6% of the total population. This figure, sourced from the 2024 National Development Bulletin on Aging Affairs, signifies that China has steadily entered an aging society since the early 21st century, with aging becoming a defining feature of contemporary society. Optimizing the allocation of family retirement assets and actively pursuing retirement financial planning undoubtedly represent crucial choices for enhancing household stability and personal well-being in later life.

Digital technologies have spawned numerous emerging business models while driving innovation within the financial sector. Digital financial literacy equips individuals to navigate the digital economy's currents, enabling informed financial decisions [2] that impact economic resilience [3], income [4], consumption [5], and shared prosperity [6]. Where households lack digital financial literacy, they struggle to leverage financial services to boost income or mitigate financial risks, instead becoming prone to economic losses [7]. The rise of digital finance, coupled with the comprehensive penetration of mobile internet, is progressively lowering traditional financial barriers, opening new possibilities for household retirement planning. The deepening of digital finance has expanded the liquidity boundaries of household assets while reshaping risk perception and coping capabilities. Amidst the concurrent rapid advancement of retirement finance and digital finance in China, whether and how digital financial literacy influences household retirement asset allocation remains to be systematically addressed.

In light of this, this paper utilizes data from the Chinese Household Finance Survey (CHFS) to comprehensively measure household retirement asset allocation levels across

three dimensions: types of retirement financial assets, proportion of retirement assets, and life insurance coverage. It analyzes the mechanism through which digital financial literacy influences household retirement planning via two pathways: digital tool usage and household risk attitudes. Furthermore, it examines the heterogeneity of this influence across health status and urban-rural/regional dimensions, systematically dissecting its far-reaching implications.

2. Literature Review and Research Hypotheses

2.1. Digital Financial Literacy and Household Retirement Asset Allocation

The pressing reality of population aging has both catalyzed and deepened research into household retirement provision. Lusardi links retirement asset allocation behavior to retirement wealth, positing that retirement assets generate returns for households, which in turn enhance wealth levels during old age [8]. Domestic discourse on retirement assets emerged somewhat later than internationally; Yang Yansui et al. define it as the aggregate of various pension forms in monetary, equity, and physical assets [9]. Zhu Wenpei proposed that household retirement assets constitute a long-term investment portfolio designed to address future living needs. By measuring the diversification of financial asset allocation, the intensity of holdings in risky financial assets, and the level of life insurance coverage, this three-dimensional approach comprehensively characterizes the configuration of retirement financial assets, thereby expanding the existing theoretical framework. [10]. As aging intensifies and traditional notions of retirement evolve, individuals and households increasingly focus on personalized retirement planning. Beyond basic social and

occupational pension schemes, they now allocate financial assets towards retirement provision. Consequently, research has shifted towards examining household retirement outcomes at the micro level, with individual financial literacy emerging as a key research topic.

The rapid advancement of digitalisation is driving transformation within the financial sector, where the enhancement of digital financial services renders residents' digital behavioural capabilities particularly crucial. While digital financial literacy has garnered attention from most institutions and scholars, related research remains nascent, lacking a unified conceptual definition[11]. With the emergence and development of digital finance, digital financial literacy has also become a novel factor influencing residents' investment behaviour. The development and use of the internet enhance residents' digital literacy. Individuals searching online for pension product information increase their understanding of retirement financial products, thereby influencing their own digital financial literacy through "learning by doing" and enhancing their willingness to allocate pension products[12]. The advancement of digital technology also improves households' ability to identify and guard against financial risks, subtly influencing residents' financial risk contingency planning and strengthening household economic resilience[13]. Crucially, internet usage enhances older adults' financial recognition capabilities and digital financial proficiency, thereby reducing their susceptibility to fraud and safeguarding their assets [14]. Furthermore, Kumar et al. contend that digital financial literacy alters household retirement behaviours, consequently impacting the quality of life in old age[15]. Based on the foregoing analysis, Hypothesis 1 is proposed:

H1: Digital financial literacy effectively promotes household participation in the allocation of retirement assets.

2.2. Transmission Effects of Household Risk Attitudes

According to modern portfolio theory, improved risk preferences concurrently increase market portfolio weights. Subsequent literature further indicates that higher risk tolerance correlates with greater investment activity. Consequently, digital financial literacy will amplify property income more significantly for risk-seeking groups than for risk-averse groups[16]. CHFS data indicates that 64.3% of Chinese households exhibit risk aversion. This high proportion of risk-averse individuals significantly inhibits financial market participation and asset allocation optimisation, thereby impeding household retirement planning[17]. As the digital economy and finance increasingly influence individual behaviour, enhancing residents' digital financial literacy substantially improves household access to financial information and refines attitudes towards investment risk, consequently elevating the efficiency of household asset portfolios[18]. In the digital economy era, enhancing individuals' digital financial literacy enables society as a whole and individuals to gain a deeper understanding of various insurance products, improve risk attitudes and judgements regarding wealth management products, and make more appropriate asset allocation decisions[19]. In summary, Hypothesis 2 is proposed:

H2: Digital financial literacy can enhance household retirement asset allocation levels by optimising household risk attitudes.

2.3. Transmission Effects of Digital Tool Usage

The utilisation of digital tools propels the advancement of digital finance, while the development of digital finance, in turn, enhances the depth of users' digital tool usage. On one hand, the digitisation of financial services drives service upgrades within the financial sector, improving market conditions and the social financial climate. Simultaneously, it elevates societal digital financial literacy, increasing residents' frequency and depth of digital tool usage, thereby laying the groundwork for promoting household wealth accumulation and asset allocation[20]. On the other hand, progress in digital financial literacy enables deeper understanding of internet tools, thereby enhancing the value and diversity of risk-bearing financial portfolios, lowering professional barriers to investment, and increasing residents' options for pension asset allocation from the supply side.[21]. Moreover, the use of digital tools enhances the efficiency of insurance transactions, simplifies complex procedures, and improves insurance accessibility, thereby increasing households' likelihood of participating in commercial insurance such as life insurance [22]. Simultaneously, scholarly research has revealed that the "digital divide" in rural areas exacerbates information asymmetry and lacks corresponding social interaction, consequently reducing households' propensity to engage in commercial insurance [23]. Based on the above analysis, we propose Research Hypothesis 3:

H3: Digital financial literacy optimises household pension asset allocation by influencing residents' use of digital tools.

3. Variable Selection and Model Design

3.1. Data Sources and Processing

The data for this study are sourced from the 2019 China Household Finance Survey (CHFS). Covering multiple regions nationwide with a total sample size of 34,643 households, the survey's comprehensive content provides crucial support for this research. To ensure data validity and reliability, rigorous pre-processing was conducted to remove missing and outlier values for key variables, yielding 29,990 usable observations.

3.2. Variable Measurement

3.2.1. Dependent Variable

Household Pension Financial Asset Allocation (PFA). Focusing on "household pension provision," this study adopts an approach similar to that of Zeng Xiangrui et al.[24], characterising pension preparedness across three dimensions: "what is held," "how much is invested," and "whether life insurance exists." Specifically, this encompasses the types of pension financial assets held, the proportion of pension financial assets, and life insurance coverage.

(1) Types of retirement financial assets. Six investment-oriented asset categories—fixed deposits, equities, funds, bonds, wealth management products, and derivatives—are included in the retirement pool. Each held category earns one point, with the total sum constituting the diversity index.

(2) Proportion of Retirement Assets. Following the conclusion that "income and reserves are proportional" from the China Retirement Finance Survey Report 2023, and drawing on the measurement approach of Shin et al. (2017), the allocation intensity is measured by the proportion of retirement financial assets relative to total household financial assets[25].

(3) Life insurance coverage. Due to limitations in CHFS2019 data, "whether holding life insurance" serves as a proxy variable for commercial pension insurance, coded as 1 for holders and 0 for non-holders.

3.2.2. Explanatory Variables

Digital Financial Literacy (DFL). Based on the four-dimensional framework proposed by the People's Bank of China, the indicator system comprises financial knowledge, attitudes and awareness towards digital finance, digital financial skills, and digital financial behaviour.

The core of financial knowledge centres on understanding inflation and interest rates: respondents' different responses of "correct", "incorrect", or "don't know" are used to reflect varying levels of digital financial literacy [26]. Consequently, this paper introduces two dummy variables: "correct

response" and "direct response". Digital financial attitudes and awareness are then measured through usage of online lending platforms and attention to daily economic and financial information. Skill levels are assessed by the ability to generate profits through digital finance. Finally, specific behaviours are examined via holdings of internet wealth management products and third-party account balances.

For the aforementioned nine indicators, this paper employs factor analysis for dimensionality reduction. The KMO value of 0.6850 indicates strong correlations among the indicators. Subsequently, Bartlett's sphericity test was conducted, yielding a p-value significant at the 1% level, thus meeting the testing criteria.

Subsequently, a composite score for digital financial literacy was calculated using rotated factor weights. Specific indicators are detailed in Table 1.

Table 1. Digital Financial Literacy Indicator System

Variable	Primary Indicator	Secondary Indicator
Digital Financial Literacy	Financial Knowledge	a1 Is the interest rate question calculated correctly: Yes = 1; No = 0
		a2 Interest rate question answered directly: Yes = 1; No = 0
		a3 Is the inflation question calculated correctly: Yes = 1; No = 0
		a4 Was the inflation question answered directly: Yes = 1; No = 0
	Attitudes and Awareness Towards Digital Finance	b1 Use of online lending platforms such as Ant Credit Pay or P2P: Yes = 1; No = 0
		b2 Level of attention paid to economic and financial information: Never pay attention = 0; Pay attention occasionally = 1; Pay close attention = 2
	Digital Financial Skills	c1 Possession of skills required to hold financial products: Did the respondent earn interest from third-party accounts such as Yu'eobao or WeChat last year? If the amount reported is >0, the respondent is deemed capable of generating profit through digital finance and is assigned a value of 1; otherwise, 0.
	Digital Financial Behaviour	d1 Whether holding digital wealth management products. Does your household have third-party payment accounts such as Alipay, WeChat Pay, JD.com e-wallet, Baidu Wallet, etc.: Yes = 1; No = 0 d2 Balance in third-party accounts. If the reported amount > 0, it is deemed that purchasing behaviour exists and is assigned a value of 1; otherwise, 0.

3.2.3. Mediating Variables

(1) Household Risk Attitude. The CHFS2019 questionnaire posed: "If you had funds to invest, which option would you most prefer?" The choices were: 1) High risk, high return; 2) Slightly higher risk, slightly higher return; 3) Average risk, average return; 4) Slightly lower risk, slightly lower return; 5) Unwilling to bear any risk. This study defines respondents selecting 6) as risk-averse, assigning a value of 1; all other options are classified as non-risk-averse, assigned a value of 0.

(2) Digital tool usage. CHFS2019 did not directly inquire about internet usage. Following the methodology of Zhou et al. (2018)[26], digital tool usage is measured by whether the household head owns a smartphone or computer: ownership is coded as 1, absence as 0.

3.2.4. Control Variables

Control variables are organised into two levels: individual-level variables include age, marital status, gender, and educational attainment; household-level variables comprise

income, total assets, and property value. Furthermore, to account for potential omitted variable bias arising from regional economic disparities, an instrumental variable controlling for the sample's regional location is incorporated into subsequent regressions. Table 2 and Table 3 present variable definitions and descriptive statistics respectively.

Table 3 reports descriptive statistics for the variables. The results indicate significant disparities in digital financial literacy among household members of respondents. Regarding the dependent variable, the mean for types of retirement financial assets held stands at 0.3087, accounting for merely 0.0266 of total household assets, with life insurance coverage rates generally low. This suggests considerable scope for improvement in household retirement asset allocation.

Table 2. Variable Definitions

Variable Type	Variable	Variable Symbol	Variable Definition
Dependent Variable	Types of Pension Financial Assets Held	PFA1	Measured by six asset types: fixed-term deposits, equities, funds, bonds, financial wealth management products, and derivatives. For each financial asset, a value of "1" is assigned if held by the household, and "0" if not held. The sum of these scores represents the number of pension financial asset types held by the household.
	Proportion of Pension Financial Assets	PFA2	The proportion of pension financial assets relative to total financial assets
	Life Insurance Coverage	PFA3	1 if commercial life insurance is purchased, 0 otherwise
Explanatory variable	Digital financial literacy	DFL	Calculated using the rotated factor-weighted composite score method
Mediating	Digital tool usage	dtu	Whether a smartphone or computer is used. Yes = 1, No = 0
	Household risk attitude	hra	Risk averse = 1, non-averse = 0
Control Variable	Head of household age	age	Head of household age
	Age 2	age2	Age squared/100
	Marital status	marriage	Married 1, Unmarried 0
	Gender Status	gender	Female 0, Male 1
	Educational level	degree	1. No schooling 2. Primary school 3. Junior secondary school 4. Senior secondary school 5. Technical
	Household size	size	Total number of household members
	Household income level	ln_income	Natural logarithm of total household assets
	Total household debt	ln_debt	Natural logarithm of total household debt
	Housing assets	ln_house	Natural logarithm of housing assets
	Number of Properties	housenum	Number of properties owned

Table 3. Descriptive Statistics of Variables

Variable type	Variable	Sample size	Mean value	SD	min	max
Dependent Variable	PFA1	29990	0.3087	0.6353	0	5
	PFA2	29990	0.0266	0.0788	0	0.9437
	PFA3	29990	0.0479	0.2137	0	1
Explanatory variable	DFL	29990	-0.0001	0.6892	-0.7359	1.9486
Mediating	dtu	29990	0.6706	0.4700	0	1.0000
	hra	29990	0.5034	0.5000	0	1
Control Variable	age	29990	55.4868	13.3014	15	100
	age2	29990	32.5571	14.8167	2.2500	100
	marriage	29990	0.8617	0.3452	0	1
	gender	29990	0.7649	0.4241	0	1
	degree	29990	3.3463	1.6137	1	9
	size	29990	3.1630	1.5481	1	15
	ln_income	29990	10.6242	1.4320	0.1402	16.3106
	ln_debt	29990	3.4863	5.1831	0	16.4578
	ln_house	29990	12.4234	1.8931	0.6931	17.3300
	housenum	29990	1.2160	0.5263	0	21

3.3. Model Specification

To investigate the impact of digital financial literacy on household retirement planning, this study employs an ordered Probit specification for benchmark estimation, addressing the ordered variable "types of retirement financial assets held". The model form is as follows:

$$PFA_i = \alpha_i + \beta_1 DFL + \gamma_1 X_i + \lambda_p + \mu_i \quad (1)$$

Where PFA_i represents the type of retirement financial assets held; DFL denotes the digital financial literacy indicator constructed via factor analysis; X_i encompasses individual and household characteristic control variables; μ_i constitutes the random error term aggregating unobserved factors; λ_p serves as the region dummy variable reflecting geographical variation; α_i represents the constant term; β_1 and γ_1 denote the parameters to be estimated.

For the dependent variable "proportion of financial assets allocated to retirement", a fractional logit model was employed for benchmark regression analysis, as follows:

$$PFA_i = \Lambda(\beta_0 + \beta_3 DFL + \gamma_3 X_i + \lambda_p) + \mu_i \quad (2)$$

Where PFA_i represents the proportion of household retirement financial assets, $\Lambda(z) = 1/(1 + e^{-z})$ denotes the logit function, and the remaining variables align with model (1).

For the binary discrete variable "life insurance coverage", a probit model is established for regression analysis, with the specific model as follows:

$$PFA_i = 1(\beta_2 DFL + \gamma_2 X_i + \lambda_p + \mu_i > 0) \quad (3)$$

Where PFA_i denotes whether households hold life insurance (purchased = 1, not purchased = 0). The remaining variables are consistent with Model (1).

Furthermore, to explore the mechanism through which digital financial literacy influences household retirement planning, drawing upon Jiang Ting's analytical

framework[28], the following model is constructed to examine the role of the mediating variable:

$$\text{Mediator}_i = \alpha + \beta_0 DFL + \gamma_1 X_i + \lambda_p + \mu_i \quad (4)$$

Where Mediator_i denotes the mediating variables, specifically comprising digital tool usage and household risk attitude, and β_0 represents the regression coefficients of digital financial literacy with respect to each mediating variable. The remaining variables are consistent with Model (1).

4. Empirical Analysis

4.1. Benchmark Regression Analysis

Table 4 presents the benchmark regression results for digital financial literacy's impact on household retirement asset allocation. Columns (1) and (2) indicate that digital financial literacy exhibits a significant positive correlation with retirement asset allocation at the 1% level. Households with higher literacy possess more diverse retirement financial assets and allocate a greater proportion to them. Further examination of Column (3) reveals similarly positive and significant regression coefficients, confirming that digital financial literacy correlates positively with households' willingness to hold life insurance. It is evident that enhanced digital financial literacy significantly strengthens households' willingness and capacity to allocate assets towards retirement, encouraging deeper and more proactive engagement in retirement planning. This confirms the validity of Hypothesis H1. A plausible explanation lies in the fact that digital financial literacy heightens households' awareness of financial planning and fosters recognition of potential risks in later life. Consequently, households are motivated to establish long-term retirement financial strategies to bolster household financial stability and prepare economically for their later years.

Table 4. Benchmark Regression Results

	Types of Retirement Financial Assets Held	Proportion of Retirement Financial Assets	Life insurance protection
Variable	(1)	(2)	(3)
	PFA1	PFA2	PFA3
	Ordered probit	probit	Fractional logit
DFL	0.434*** (0.0134)	0.200*** (0.0215)	0.582*** 0.029
Individual characteristics	YES	YES	YES
Household Characteristics	YES	YES	YES
Regional Fixed Effects	YES	YES	YES
Observed values	29990	29990	29990

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively; figures in parentheses represent robust standard errors of marginal effects.

4.2. Robustness Tests

4.2.1. Treatment of Endogeneity

Given that household decisions regarding elderly care are susceptible to interference from difficult-to-quantify factors such as traditional beliefs and geographical environment, potentially leading to endogeneity issues, this paper adopts the methodology proposed by Song, Quanyun et al.[29]. Table

5 results demonstrate that after incorporating the "mean digital financial literacy of other rural households in the same community" as an instrumental variable into the estimation, the F-values for the first-stage regression were all significantly greater than 10. This fully validates the high

correlation between the instrumental variable and the core explanatory variable, effectively mitigating the issue of weak instrumentality. The second-stage estimation results

maintained consistency with the benchmark regression in both direction and significance, further confirming the robustness and reliability of the core conclusions.

Table 5. Instrumental Variables Regression Results

	Digital Financial Literacy	Types of Pension Financial Assets Held	Proportion of Retirement Financial Assets	Life Insurance Coverage
Variable	(1)	(2)	(3)	(4)
	DFL	PFA1	PFA2	PFA3
DFL		0.3515***	0.0221***	0.0418***
		(0.0273)	-0.0031	(0.0081)
instrumental variable	0.6704 ***			
	(0.0110)			
First stage F value	1367.6471 ***			
Waldtest		2125.70***	1340.60***	705.32***
personal feature	YES	YES	YES	YES
Family characteristics	YES	YES	YES	YES
Regional fixed effects	YES	YES	YES	YES
observed value	29990	29990	29990	29990

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively; figures in parentheses represent robust standard errors of marginal effects.

4.2.2. Replacing Explanatory Variables and Adjusting the Regression Model

To test the robustness of the findings, this study remeasured household digital financial literacy using the direct

summation method and re-estimated the effect of digital financial literacy on household pension asset allocation using classical OLS. The results remained consistent with the original findings, confirming that the research conclusions are unaffected by the method of variable measurement.

Table 6. Results of Variable Substitution and Model Testing

	Types of Pension Financial Assets Held	Proportion of Retirement Financial Assets	Life insurance protection
Variable	(1)	(2)	(3)
	PFA1	PFA2	PFA3
DFL	0.0747***	0.0063***	0.0096***
	(0.0026)	(0.0003)	(0.0009)
Individual characteristics	YES	YES	YES
Household characteristics	YES	YES	YES
Regional Fixed Effects	YES	YES	YES
Observed values	29990	29990	29990

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively; figures in parentheses represent robust standard errors of marginal effects.

4.2.3. Propensity Score Matching Method

To mitigate selection bias, this study employs propensity score matching. Following the methodology of Luo Hehua et al. (2025), the mean value of digital financial literacy serves as the threshold: households scoring above the mean are assigned a value of 1, while those below receive a value of 0.

Table 7 presents the ATT and T-values for four matching methods (nearest neighbour, radius, kernel, and Mahalanobis). All results demonstrate statistically significant positive effects at the 1% level, further validating the robustness of digital financial literacy's positive impact on household pension asset allocation.

Table 7. PSM Propensity Score Matching Results

	Types of Pension Financial Assets Held		Proportion of Retirement Financial Assets		Life insurance protection	
Variable	(1)		(2)		(3)	
	PFA1		PFA2		PFA3	
	ATT	T	ATT	T	ATT	T
Nearest Neighbour Matching	0.1946***	22.19	0.0168***	12.93	0.0199***	6.04
Radius matching	0.2617***	25.93	0.0183***	17.67	0.0326***	8.94
Nuclear Matching	0.2534***	23.94	0.0183***	17.52	0.0303***	7.81
Marr's matching	0.2565***	20.46	0.0192***	16.31	0.0315***	7.05

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively; figures in parentheses represent robust standard errors of marginal effects.

4.3. Mechanism Testing

4.3.1. Mediating Effect of Household Risk Attitude

Table 8. Mediating Effect Test Results

Variable	(1)	(2)
	Household Risk Attitude	Digital Tool Usage
	hra	dtu
DFL	-0.2007***	0.3895***
	(0.0125)	(0.0150)
Individual characteristics	YES	YES
Household characteristics	YES	YES
Regional Fixed Effects	YES	YES
Observations	29990	29,990

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively; figures in parentheses represent robust standard errors of marginal effects.

4.3.2. Mediating Effect of Digital Tools

Column (2) in Table 8 presents the results of the mechanism test for digital tool usage. The regression coefficient for digital financial literacy on digital tool usage is positively significant at the 1% level, indicating that higher digital financial literacy correlates with greater household propensity to use digital tools, thereby validating the mediating pathway. Digital financial literacy increases households' willingness and frequency of using digital tools. Through the use of internet tools, it enhances understanding of household pension arrangements and market financial products, thereby transforming household perceptions. This gradually fosters recognition of the importance and necessity of pension planning, strengthens control over financial assets, and further drives households to deepen their pension asset allocation. This supports Hypothesis H3.

Existing literature primarily employs Sobel tests for analysis, yet this method is suited to continuous dependent variables. Given the discrete nature of the dependent variable, this study further utilises KHB decomposition to measure effects after testing the mediation model, supplemented by 1000 bias-corrected Bootstrap samples. The results remain consistent with the aforementioned findings, effectively mitigating estimation bias.

5. Heterogeneity Analysis

5.1. Urban-Rural Structure

Digital financial literacy may influence household pension asset allocation differently across urban-rural distribution and health status. This study examines heterogeneity in these dimensions. Considering disparities in educational attainment, internet penetration, and financial service coverage between urban and rural areas, separate regression analyses were conducted for each group. Table 9 presents the corresponding results.

Regarding the types of retirement financial assets held, the promotional effect of digital financial literacy is more pronounced among urban residents. This may stem from urban households' relatively higher incomes and more stable economic circumstances, making them more inclined to hold diverse retirement assets to diversify risks and enhance returns. In terms of life insurance protection, urban households tend to purchase commercial pension insurance and are willing to pay higher premiums to comprehensively plan their retirement security. Regarding the proportion of financial assets allocated to retirement, may stem from relatively scarce financial services in rural areas and a traditional preference for relying on property. Consequently, urban households demonstrate a stronger inclination towards holding financial assets for retirement purposes.

Table 9. Heterogeneity Analysis by Urban-Rural Structure

	Types of Retirement Financial Assets Held		Proportion of Retirement Financial Assets		Life insurance protection	
Variable	(1)		(2)		(3)	
	PFA1		PFA2		PFA3	
Category	Town	Rural	Urban	Rural	Urban	Countryside
DFL	0.4606***	0.3538***	0.0176***	0.0132***	0.2323***	0.2110***
	(0.0159)	(0.0267)	(0.0009)	(0.0013)	(0.0258)	(0.0415)
Individual characteristics	YES	YES	YES	YES	YES	YES
Family characteristics	YES	YES	YES	YES	YES	YES
Regional fixed effects	YES	YES	YES	YES	YES	YES
Observation value	18845	11145	18845	11145	18845	11145

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively, with robust standard errors of marginal effects indicated in parentheses.

5.2. Household Health Status

The health status of household members often influences families' anticipated planning for future elderly living. Based on household health status, families responding with "1", "2"

or "3" were categorised as good or excellent, while those responding with "4" or "5" were categorised as poor or very poor, enabling grouped regression analysis. The results are shown in Table 10.

Table 10. Heterogeneity Analysis of Household Health Status

	Types of Financial Assets Held for Retirement		Proportion of Retirement Financial Assets		Life Insurance Coverage	
Variable	(1)		(2)		(3)	
	PFA1		PFA2		PFA3	
Health Status Category	Excellent	Poor	Excellent	Poor	Excellent	Poor
DFL	0.4313***	0.4206***	0.0166***	0.0118***	0.2215***	0.1891***
	(0.0146)	(0.0369)	(0.0008)	(0.0016)	(0.0231)	(0.0683)
Individual characteristics	YES	YES	YES	YES	YES	YES
Family characteristics	YES	YES	YES	YES	YES	YES
Regional fixed effects	YES	YES	YES	YES	YES	YES
Observation value	23982	6008	23982	6008	23982	6008

Note: ***, **, * denote significance levels of 1%, 5%, and 10% respectively, with robust standard errors of marginal effects indicated in parentheses

Regarding the proportion of pension financial assets, digital financial literacy promotes this proportion in both households with good and poor health status, with a more pronounced effect in households with good health. This may be because when household members are in poor physical condition, they hold more cash to ensure liquidity, considering anticipated medical expenditures. The promotion of digital financial literacy in the variety of retirement financial assets held and life insurance coverage is more pronounced among households with good health. This may stem from the fact that members of such households, being in good physical health, face fewer unexpected future healthcare expenditures and possess greater risk-bearing capacity. Furthermore, they demonstrate stronger willingness and capacity for planning their retirement, leading to the holding of diverse retirement financial assets and the purchase of life insurance coverage.

6. Conclusion and Recommendations

6.1. Research Findings

Based on the CHFS2019 microdata, this study systematically examines the underlying mechanisms through which digital financial literacy drives household retirement asset allocation. Estimation results indicate that enhanced digital financial literacy significantly promotes household retirement planning, manifesting in increased diversity of retirement financial assets, higher allocation proportions, and greater likelihood of life insurance participation – findings exhibiting high consistency. Further analysis reveals that digital financial literacy enhances household retirement preparedness by optimising risk attitudes and strengthening the use of digital tools. It is additionally found that the marginal benefit of digital financial literacy in optimising retirement asset structures becomes more pronounced as

household health status improves, with this promotional effect being particularly evident among urban households.

6.2. Recommendations

Based on these findings, the following recommendations are proposed:

Firstly, enhance digital financial literacy education to rationalise household retirement asset allocation. Governments should intensify digital financial education for residents through diverse channels such as social media and offline seminars. This will guide households in embracing digital financial products and services, mitigate risk aversion, and leverage digital financial literacy's crucial role in household retirement planning.

Secondly, guide the rational use of digital platforms and enhance financial risk resilience. Digital tool usage influences household retirement choices. Relevant authorities should leverage digital platforms to provide greater access to financial knowledge and retirement information, thereby improving households' risk attitudes towards financial assets. This will encourage more families to engage in retirement planning and make more appropriate retirement asset allocation decisions.

Finally, attention should be paid to urban-rural disparities and household health conditions to support family pension planning. Relevant institutions should strengthen internet access and financial education for rural populations, helping households enhance their digital financial literacy. Concurrently, economic subsidies and other support measures should be implemented for households with poorer health conditions to alleviate the financial pressure of digital pensions, enabling them to better prepare for retirement.

6.3. Research Limitations and Outlook

This paper enriches existing research by measuring household retirement asset allocation across multiple dimensions and analysing the pathways through which digital financial literacy influences retirement planning. However, as the CHFS data is only publicly available up to 2019, recent developments remain underrepresented. Furthermore, as this study utilises secondary data without direct household interviews on retirement asset allocation, there remains scope for refinement in measuring household retirement security capabilities. Future research may integrate more recent survey data to explore refined methodologies for measuring household retirement provision and investigate the dynamic mechanisms through which digital financial literacy influences retirement decisions across different life stages.

Author Profile

Tao Jianhong (born July 1980), male, Han ethnicity, native of Tianshui, Gansu Province, currently serves as Professor and Master's Supervisor at the School of Economics and Management, Shaanxi University of Science and Technology. Professor and Master's Supervisor, Doctor of Philosophy, Research Focus: Household Finance;

Lian Lian (October 2001–), Female, Han ethnicity, native of Jincheng, Shanxi, Master's candidate at the School of Economics and Management, Shaanxi University of Science and Technology, research focus: household finance and retirement finance.

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