

Article

How Does Population Aging Impact Household Financial Asset Investment?

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Abstract: The accelerated aging of China's population will inevitably increase the burden of social retirement and significantly impact the development of financial markets, which is not conducive to sustainable social development. A proper allocation of financial assets will enable households to earn more property income and facilitate the appropriate allocation of social capital. The aging of the population is an essential factor affecting the allocation of financial assets to households. This paper examines the impact of an aging population on household financial asset allocation based on data from the 2015, 2017, and 2019 China Household Finance Surveys (CHFS). The study finds that aging significantly negatively affects household risky financial asset participation, depth of participation, and diversity. The findings remain robust after robustness tests using a two-way fixed effects model. In addition, this paper examines the mechanisms of influence from the perspectives of both risk aversion and financial literacy. In terms of mediating variables, aging increases the risk aversion of household heads, and an increase in risk aversion discourages households from investing in risky financial assets. In terms of moderating variables, the dampening effect of aging on investment in risky financial assets diminishes as financial literacy increases. In addition, empirical findings based on heterogeneity find that aging has a stronger negative impact on risky financial asset participation, depth of participation, and diversity in rural areas. Aging has a stronger negative impact on risky financial asset participation for households with children.

Keywords: financial asset; pollution; investment; China



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1. Introduction

China has the largest elderly population in the world. As the elderly grow older, their income through labor capacity will gradually decrease, and their ability to cope with the risks of daily life will weaken. At this stage, the economic sources of the elderly in China mainly come from three aspects, which are family member support, social pension, and property income. Judging from the current situation, the pension method based on family and social pensions will face huge challenges. From the perspective of the source of social pension funds, according to the “2019–2050 China Pension Actuarial Report”, without considering the increase in per capita benefits, the payment pressure of basic pension insurance for urban employees is constantly increasing. In 2019, nearly two contributors were needed to support a retiree; in 2050, almost one contributor will be required to support a retiree. From the perspective of intergenerational transfer within the family, in the context of low birthrate and family planning, the 4-2-1 (four elderly people, one couple and one child) family structure has become a typical family structure in China. This will make it difficult for family children to have enough money and time to support the elderly. In this context, increasing family property income is one of the main measures to ensure that the elderly can enjoy their old age comfortably. Reasonable financial asset allocation is one of the main channels for families to obtain property income. Middle-aged and elderly residents have more social capital and wealth, and a reasonable allocation of financial assets can smooth consumption and enhance family utility and happiness in old age.

What impact does population aging have on household financial asset allocation? What is the mechanism of action? Under the background of China's increasingly aging population, research on the above problems can deepen the understanding of the household financial asset allocation phenomenon and help guide residents to invest rationally and increase property income. At the same time, it is of great significance to formulating relevant policies for developing China's financial market.

This paper empirically studies the relationship between population aging and household financial asset allocation using data from three national micro-household surveys conducted by the China Household Finance Survey (CHFS) of the Southwestern University of Finance and Economics in 2015, 2017, and 2019. These high-quality household survey data can bring the model closer to reality and can test the impact mechanism and the impact of various heterogeneities in a better way.

The possible contributions of this paper are reflected in the following aspects. First, this paper divides the investment behavior of household financial risk assets into three aspects: specific risk financial asset participation, participation depth, and diversity. Empirical tests are carried out with cross-sectional data and panel data, respectively. Secondly, this paper empirically tests the impact mechanism of aging on household financial asset allocation by using the questions about risk attitude and financial literacy in the questionnaire. Finally, this paper examines the heterogeneous impact of aging on household financial asset allocation from urban and rural areas and raising children.

The paper is structured as follows. Section 2 presents the relevant literature and sets out the research hypotheses. Section 3 presents the data sources and variables. Section 4 gives the empirical results and performs robustness tests. Section 5 analyses and tests the impact. Section 6 conducts a heterogeneity analysis. Section 7 provides the conclusions of the paper.

2. Literature Review and Research Hypotheses

The existence of household heterogeneity is an important factor affecting the allocation of household financial assets. Scholars mainly conduct research based on four aspects. First, the impact of background risk on household financial asset allocation [1,2]. Second, financial literacy can affect information processing ability and reduce transaction costs, affecting household financial asset allocation [3,4]. Third, family social network is an important factor influencing family financial investment decisions [5,6]. Fourth, the impact of various demographic characteristics on the allocation of household financial assets, such as age, marriage, and education level [7–11].

With the aging of countries tends to be serious. The source of retirement living for the elderly is increasingly dependent on retirement savings investment. Scholars have gradually begun to pay attention to the impact of population aging on household financial asset allocation. The research on population age and residents' investment decisions can be traced back to the age effect theory and the life cycle hypothesis theory. Age effect theory is based on a multi-period model, which analyzes consumption and investment decision-making problems over the life cycle [12–14]. The theory holds that investment decisions are affected by time but not age and decrease with time, which is not in line with reality. The traditional life cycle hypothesis (LCH) first appeared in the 1950s as a theory for analyzing household consumption functions [15].

The life cycle theory divides the life of residents into youth, middle age, and old age. When residents enter old age, they will use the savings they have accumulated before for consumption, resulting in a relatively low marginal propensity to consume and a relatively low savings rate. Individuals will face different income status and consumption needs at different life cycle stages, which will impact their asset allocation. Subsequently, Bakshi and Chen [16] believed that people in different age groups would choose different investment targets. Before the age of 40, people mainly invest in real estate; after the age of 40, with the increase in income, they start to invest in securities such as stocks; in old age, with the rise

in risk aversion, they start to invest in low-risk financial products mainly. It can be seen that the life cycle is an important factor affecting people's investment decisions.

Many studies have shown that with age, the proportion of households holding risky assets shows a hump shape that first increases and then decreases [17,18]. In addition, many Chinese scholars have reached similar empirical conclusions using Chinese data. As the proportion of the elderly in the total population increases, the probability of the family participating in risky asset investment will decrease significantly, and the proportion of risky asset allocation will decrease [10,19,20]. These findings confirm that household financial risk asset allocation has obvious life cycle effects. Only a few studies have concluded that aging does not reduce the share of households' risky asset holdings [21]. Based on the above analysis, we propose the first hypothesis of this paper.

Hypothesis 1. *Aging has a negative impact on households' investments in risky financial assets.*

Age is an important factor influencing risk-averse attitudes. The life-cycle risk aversion hypothesis suggests that risk aversion increases with age [16]. This paper presents that there are several reasons for this. Firstly, people have a more stable source of income when they are younger, but aging brings with its income risk. The instability of income will reduce the willingness of individuals and households to take risks. Secondly, aging brings health risks, i.e., deteriorating health will reduce the willingness of individuals and households to take risks. In addition, people can develop cognitive impairments as they get older. Cognitive impairment can affect people's asset allocation in two ways [22]. The first pathway is that cognitive impairment can increase the cost of information for people to access. For older people, the increased cost of information can hinder their participation in the stock market. The second pathway of influence is the emotional instability of investors with cognitive impairments, such as impatience and a focus on short-term losses. These emotions can affect an investor's ability to take risk.

In China, the head of household is generally the decision maker of household behavior, i.e., the head of household determines the household's financial asset allocation behavior. When a household head experiences background risk, that household head's aversion to risky assets increases, thereby influencing the household's financial asset investment decisions. In addition, families with a larger proportion of elderly people have a heavier burden of support. Households are also exposed to increased livelihood protection and medical expenses, thereby increasing the risk to the household. This increased risk factor will inevitably weaken the household's risk-taking capacity, thus prompting it to choose safer financial assets. We propose a second hypothesis for this paper based on the above analysis.

Hypothesis 2. *Aging affects households' risky financial asset allocation by influencing the degree of their risk appetite.*

It is well known that finance is a complex and specialized market. Good financial literacy enhances the ability to process information and reduces transaction costs [3]. People are averse to uncertain returns as opposed to specific returns. Risky assets have the characteristics of high risk and high return. However, when people are more familiar with and knowledgeable about risk, they are more capable of facing uncertainty and will show a stronger risk appetite [23]. Increased financial literacy enhances people's understanding of risky assets, leading to more informed decision-making. As a result, financial literacy can promote household participation in risky assets and the proportion of risky financial assets in household financial assets [4,24]. In addition, many scholars have also studied the relationship between financial literacy and household financial asset diversification. The study found that financial literacy positively correlated with household financial asset diversification [25]. We propose a third hypothesis for this paper based on the above analysis.

Hypothesis 3. *Financial literacy can moderate the relationship between aging and investment in household financial assets.*

3. Data Sources and Selection of Variables

3.1. Data Sources

In social science, many studies focused on human behavior and attitude to adopt a technology [26–28]. However, this study emphasized financial behavior. High-quality micro household financial data are crucial to characterizing household economy and financial behavior. The data used in this paper are mainly from the national household sample data of the China Household Finance Survey (CHFS) in 2015, 2017 and 2019. The survey originally covered 343 districts and counties in 29 provinces in China. The family assets of CHFS statistics are complete and the information is very specific, which is suitable for the empirical research of this paper. In addition, since 2013, the data of many households have been continuously tracked and accessed, and these household samples can be integrated into panel data.

In order to mitigate the impact of outliers and missing values on the empirical study, the following treatment has been applied to the full sample. In the first step, income outliers were removed from the sample of households whose household income was in the top 1% and bottom 1%. In the second step, samples with missing data are removed. After processing, this paper obtained data for a sample of 35,645 households in 2015, 39,197 households in 2017, and 33,125 households in 2019. This is because only a proportion of the households surveyed by CHFS each year are continuously followed up. Therefore, after data processing, this paper yields data from 11,808 households for a three-year follow-up period, for a total sample of 35,424.

Table 1 provides statistics on the financial asset allocation of Chinese households. Table 1 shows that cash and demand deposits are the two financial assets in which Chinese households are most involved in investing. In addition, the participation of stocks and funds is only 3.22% and 1.35%. In terms of investment size, deposits are the largest and financial derivatives are the smallest.

Table 1. Household financial asset allocation in China.

Asset Class	Participation (%)	Investment Size	Asset Class	Participation	Investment Size
Cash	100	6393	Stocks	3.22	3129
Demand Deposit	76.55	19,378	Funds	1.35	946
Fixed Deposit	16.94	18,791	Bonds	0.27	307
Wealth Management	50.66	12,735	Non-RMB assets	0.14	32
Financial Derivatives	0.02	12	Gold	0.20	287

3.2. Selection of Variables

3.2.1. Dependent Variable

This paper classifies the financial assets of Chinese households into risky financial assets and risk-free financial assets based on the classification of financial assets by the CHFS questionnaire over the years. The risky financial assets include stocks, funds, wealth management, non-RMB assets, gold, bonds (corporate bonds and financial bonds), and financial derivatives. Risk-free financial assets include deposits, cash, bonds (government bonds and local government bonds). Since bonds were not classified in the questionnaires in 2017 and 2019, this paper does not count bonds in the process of measuring financial asset-related indicators.

This paper measures household financial asset allocation behavior from three dimensions. The first dimension is whether the household is involved in investing in risky financial assets. A household is considered to be involved in investing in risky financial assets if it holds any of the risky financial assets. In this case, the dependent variable is a dummy variable (0, 1 variable), which is assigned a value of 1 if the household holds a risky

financial asset and 0 if not. The second dimension is the depth of household participation in risky financial assets. This indicator is expressed in terms of total household holdings of risky financial assets as a proportion of all financial assets. The third dimension is the diversity of investments in risky financial assets. This indicator is expressed in terms of the number of types of risky financial assets that households invest in.

3.2.2. Core Explanatory Variable

Considering that the data selected in this paper are a family micro-data set, on the basis of referring to the other literature, this paper selects two indicators to measure the degree of population aging. The first indicator is the proportion of households over the age of 65 to the total household population. The second indicator is the age of the head of the household. The head of the household is the main bearer of the family's economic resources or the decision maker in family affairs, and has an important influence on the family's investment decision making.

3.2.3. Mediator Variable

This paper measures the family risk attitude tendency based on the answers to the risk attitude questions in the questionnaire. The question about risk attitude in the questionnaire is "If you have a fund for investment, which investment project would you choose?". The answer options are "1. High risk, high reward project; 2. Slightly higher risk, slightly higher reward project; 3. Average risk, average return project; 4. Slightly lower risk, slightly lower return project; 5. Unwilling to take any risks; 6. Don't know". Referring to the treatment of Lu and Yin (2021), this paper classifies households choosing the first and second options as risk-averse and assigns a value of 3; those choosing the third option as risk-neutral and assigns a value of 2; and those choosing the fourth, fifth and sixth options as risk-averse and assigns a value of 1.

3.2.4. Moderator Variable

This paper selects financial literacy as a moderator variable. Financial knowledge and financial literacy possessed by households are important factors in participating in financial markets. In this paper, two questions from the 2019 CHFS questionnaire on calculating interest rates and inflation were selected to examine the level of financial literacy of respondents, considering the availability of data. In addition, because the questions on financial literacy in the CHFS questionnaire have varied over the years and some questions were only asked of new households surveyed. Therefore, relevant data from 2015 and 2017 were not used to calculate financial literacy indicators in this paper.

The current study argues that respondents answering incorrectly do not represent the same level of financial literacy as those answering "don't know". Therefore, two dummy variables are set for each question, that is, whether the answer is correct and whether it is a direct answer (if the answer cannot be counted, it is regarded as an indirect answer). According to two questions and four variables, the iterative principal factor method was used for factor analysis. In addition, this paper treats missing values due to refusal to answer and not knowing how to answer as indirect answers.

3.2.5. Control Variables

(1) Household net worth, child rearing ratio, gender of the household head, health status of the household head, and marital status of the household head are selected as control variables at the household level.

(2) The GDP per capita of the province where the household is located and the share of financial sector in GDP of the province where the household is located are selected as control variables at the regional level. The data are obtained from the National Statistical Yearbook of China.

The specific variable names and variable descriptions are shown in Table 2.

Table 2. Variable Description.

Variables	Code	Measurement Method
Dependent Variables		
Risky financial asset participation	RFAP	Whether the family participates in risky financial assets
Depth of participation in risky financial assets	RFAD	The proportion of risky financial assets to household financial assets
Risky Assets Diversity	RAD	The number of types of risky financial assets that households invest in
Independent Variables		
Aging Population	PEP	Proportion of people aged 65+ in household to total household size
	AGE	Age of household head
Control Variables		
Child Rearing Ratio	CRR	The proportion of the population aged 14 and below in the total household population
Family Net Worth	FNW	Total household assets minus total household liabilities
Gender	HHG	Gender of the household head
Health Status	HS	Health status of the household head
Marital Status	MS	Marital status of the household head
GDP per capita	GPC	GDP per capita in the province where the household is located
Financial sector as a share of GDP	FSG	Proportion of the financial sector in GDP in the province where the household is located
Moderator variable		
Financial Literacy	FL	Financial literacy level constructed by factor analysis
Mediator variable		
Risk Attitude	RA	Risk Preference = 3; Risk Neutral = 2; Risk Aversion = 1

3.3. Descriptive Statistics of Variables

To reflect the timeliness of the variables, this paper uses cross-sectional data from 2019 to report descriptive statistics for the study variables. Table 3 provides a statistical description of the variables. As can be seen from Table 3, 51% of households are involved in investing in risky financial assets, and the mean value of the depth of involvement in risky financial assets for Chinese households is only 0.14. In terms of indicators of ageing, the average proportion of people aged over 65 in Chinese households to the total household size is 0.28 and the average age of the head of household is 56.59.

Table 3. Descriptive statistics of variables.

Variables	Obs	Mean	SD	Min	Max
RFAP	33,125	0.51	0.50	0	1
RFAD	33,125	0.14	0.27	0	1
RAD	33,125	0.56	0.59	0	5
PEP	33,125	0.28	0.39	0	1
AGE	33,125	56.59	13.67	18	101
CRR	33,125	0.09	0.16	0	0.83
FNW	33,125	100	1232.88	−1339	209,957
HHG	33,125	0.75	0.43	0	1
HS	33,125	0.39	0.49	0	1
MS	33,125	0.84	0.36	0	1
GPC	33,125	6.84	3.09	3.30	16.42
FSG	33,125	7.85	3.05	4.93	18.50

4. Benchmark Regression Results

4.1. Aging and Investment in Risky Household Financial Assets

Because whether a family participates in risky financial asset investment is a binary choice, this paper selects the Probit model for empirical research. The Probit model is as follows. Where Y is a dummy variable equal to 1 indicating household participation in risky

financial assets and 0 indicating no participation. PEP and AGE are the core explanatory variables and X indicates the control variable.

$$Y = 1(\alpha PEP + \beta X + \varepsilon > 0)$$

$$Y = 1(\alpha AGE + \beta X + \varepsilon > 0)$$

The regression results are shown in Table 4. The Probit estimates in this paper show that population ageing has a significant negative impact on household participation in risky financial assets, whether using the age of the head of household or the proportion of elderly people to total household size as a proxy. Judging from the average marginal effect of the impact, for every one percentage point increase in the proportion of the elderly population in 2019, the probability of households participating in risky financial asset investment will decrease by -0.43% . For every one-year increase in the age of the head of the household, the probability of a household participating in risky financial assets investment decreases by -1.5% . The given error term (ε) is assumed to be normally distributed at zero mean value and constant variance [29–31].

Table 4. Aging and Household Participation in Risk Financial Asset Investment.

	(1) 2019 Probit	(2) 2017 Probit	(3) 2015 Probit	(4) 2019 Probit	(5) 2017 Probit	(6) 2015 Probit
PEP	−1.311 *** (−60.72)	−0.144 *** (−5.26)	−0.274 *** (−8.18)			
AGE				−0.049 *** (−68.30)	−0.007 *** (−9.94)	−0.013 *** (−17.17)
GPC	0.007 ** (2.07)	−0.024 *** (−4.70)	0.049 *** (11.16)	0.002 (0.62)	−0.025 *** (−4.89)	0.050 *** (11.26)
FSG	−0.028 *** (−8.35)	−0.016 *** (−3.38)	0.027 *** (8.01)	−0.031 *** (−8.82)	−0.017 *** (−3.43)	0.028 *** (8.46)
CRR	0.933 *** (18.35)	−0.331 *** (−5.15)	−0.226 *** (−3.47)	0.466 *** (8.30)	−0.488 *** (−7.38)	−0.494 *** (−7.38)
HHG	−0.198 *** (−10.77)	−0.198 *** (−8.41)	−0.210 *** (−9.52)	−0.176 *** (−9.39)	−0.199 *** (−8.52)	−0.198 *** (−9.00)
MS	0.160 *** (7.33)	0.149 *** (4.97)	0.124 *** (4.14)	0.185 *** (8.03)	0.163 *** (5.51)	0.170 *** (5.66)
HS	0.451 *** (29.64)	0.191 *** (10.22)	0.170 *** (8.80)	0.329 *** (20.86)	0.162 *** (8.44)	0.118 *** (5.94)
FNW	0.000 (0.95)	0.002 *** (24.53)	0.002 *** (21.00)	0.000 (0.87)	0.002 *** (24.45)	0.002 *** (20.83)
N	33,125	39,197	35,645	33,125	39,197	35,645

Note: Robust standard errors are given in parentheses. ***, and ** indicate statistical significance at the 1%, and 5% levels, respectively.

This paper measures households' participation in risky financial assets in three dimensions. The second dimension is the depth of household participation in risky financial assets. By counting data for 2019, 49% of households in China have an investment proportion of risky financial assets of 0. That is, for many of the observed variables, the explanatory variables are pressed into a single point. Therefore, the Tobit model was selected for empirical study in this paper. The regression results are presented in Table A1 (see Appendix A). The Tobit estimation results indicate that population ageing has a significant negative effect on the depth of household participation in risky financial asset investments.

The third dimension is the diversity of households' investments in risky financial assets. Since the types of investments in risky financial assets are non-negative integers and there are many zero values in them. Therefore, Zero-inflated Poisson Regression (ZIP) is chosen to conduct the empirical study. The regression results are presented in Table A2

(see Appendix A). The results of the ZIP estimation indicate that population ageing has a significant negative effect on household participation in risky financial asset diversification.

4.2. Regression Based on a Two-Way Fixed Effects Model

Two-way fixed effects models can eliminate both time fixed effects and individual fixed effects, thereby reducing the endogeneity problems caused by omitted variables. Therefore, this paper uses a robustness test using a two-way fixed effects model and using clustering robust standard errors.

The specific regression results are presented in Table 5. The regression results suggest that. Ageing has a significant negative impact on household financial risk asset participation, investment depth and diversification, whether using the proportion of elderly people or the age of the head of household as a proxy for ageing. This confirms the robustness of the empirical results in this paper.

Table 5. The estimation results of the Two-way Fixed Effects model, 2015–2019.

	(1) RFAP	(2) RFAD	(3) RAD	(4) RFAP	(5) RFAD	(6) RAD
PEP	−0.275 *** (−26.19)	−0.015 *** (−3.35)	−0.292 *** (−22.98)			
AGE				−0.003 *** (−9.43)	−0.001 *** (−3.75)	−0.003 *** (−8.99)
GPC	0.003 *** (2.79)	−0.001 * (−1.79)	0.003 *** (2.95)	0.003 *** (3.14)	−0.001 * (−1.86)	0.004 *** (3.26)
FSG	−0.002 ** (−1.98)	0.001 ** (2.22)	−0.004 *** (−2.68)	−0.002** (−2.10)	0.001 ** (2.19)	−0.004 *** (−2.77)
CRR	0.074 *** (3.11)	0.038 *** (3.94)	0.084 *** (3.14)	0.157 *** (6.60)	0.041 *** (4.26)	0.170 *** (6.41)
HHG	0.017 ** (2.17)	−0.002 (−0.49)	0.018 * (1.93)	0.020 *** (2.62)	−0.002 (−0.43)	0.022 ** (2.33)
MS	0.038 *** (3.83)	0.002 (0.44)	0.045 *** (3.89)	0.043 *** (4.25)	0.002 (0.36)	0.049 *** (4.23)
HS	0.004 (0.76)	−0.002 (−0.73)	0.009 (1.57)	0.001 (0.11)	−0.002 (−1.00)	0.005 (0.89)
FNW	0.000 (0.50)	0.000 (0.95)	0.000 (0.69)	0.000 (0.58)	0.000 (0.96)	0.000 (0.73)
2015.time	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2017.time	0.014 *** (5.43)	−0.000 (−0.06)	0.017 *** (4.78)	0.004 (1.63)	−0.000 (−0.18)	0.006 * (1.82)
2019.time	0.415 *** (83.08)	0.017 *** (8.22)	0.438 *** (75.99)	0.398 *** (81.24)	0.016 *** (8.16)	0.420 *** (73.99)
N	35,424	35,424	35,424	35,424	35,424	35,424

Note: Cluster robust standard errors are given in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

5. Mechanism Analysis

5.1. Mediating Effect of Risk Preference

The regression results of population aging on risk attitudes are shown in Table 6. Because the 2017 questionnaire only asked new respondent households so this paper only reports regression results for 2015 and 2019. the Poisson estimation and Negative Binomial (NB2) estimation results indicate that population ageing has a significant negative effect on risk attitudes. The investor's risk appetite attitude is an important factor affecting investment decisions. Many research conclusions show that there is a positive correlation between risk-taking willingness and risky asset investment [32–34].

Table 6. Aging and Risk Attitudes.

	(1) 2019 Poisson	(2) 2019 Poisson	(3) 2019 NB2	(4) 2019 NB2	(5) 2015 Poisson	(6) 2015 Poisson
PEP	−0.154 *** (−28.27)		−0.154 *** (−28.27)		−0.222 *** (−31.72)	
AGE		−0.007 *** (−35.95)		−0.007 *** (−35.95)		−0.008 *** (−45.40)
GPC	0.005 *** (4.53)	0.004 *** (3.55)	0.005 *** (4.53)	0.004 *** (3.55)	−0.006 *** (−5.25)	−0.006 *** (−5.47)
FSG	−0.003 *** (−3.20)	−0.003 *** (−3.02)	−0.003 *** (−3.20)	−0.003 *** (−3.02)	0.002 ** (2.21)	0.003 *** (2.79)
CRR	0.141 *** (8.51)	0.022 (1.29)	0.141 *** (8.51)	0.022 (1.29)	0.149 *** (8.76)	0.031 * (1.82)
HHG	0.001 (0.22)	0.005 (0.92)	0.001 (0.22)	0.005 (0.92)	0.029 *** (4.87)	0.035 *** (6.22)
MS	−0.037 *** (−5.26)	−0.031 *** (−4.62)	−0.037 *** (−5.26)	−0.031 *** (−4.62)	−0.086 *** (−11.54)	−0.065 *** (−9.12)
HS	0.064 *** (13.12)	0.038 *** (7.81)	0.064 *** (13.12)	0.038 *** (7.81)	0.075 *** (15.06)	0.042 *** (8.50)
FNW	0.000 (1.21)	0.000 (1.11)	0.000 (1.21)	0.000 (1.11)	0.000 *** (21.77)	0.000 *** (21.13)
N	33,125	33,125	33,125	33,125	35,650	35,644

Note: Robust standard errors are given in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

5.2. Moderating Effects of Financial Literacy

The regression results of the moderating effect of financial literacy are shown in Table 7. In order to estimate the moderating effect this paper uses a regression model with a cross product term. In addition, the cross-product term is decentered in order to facilitate the reader's understanding of the coefficients. The empirical regression results largely validate the hypothesis put forward in this paper that the disincentive effect of ageing on investment in risky financial assets diminishes as financial literacy increases.

Table 7. Moderating Effects of Financial Literacy, 2019.

	(1) RFAP	(2) RFAD*100	(3) RAD
AGE	−0.048 *** (−63.86)	−0.922 *** (−16.40)	−0.072 *** (−35.04)
FL	0.325 *** (48.60)	23.039 *** (46.81)	0.511 *** (15.12)
AGE#FL	0.002 *** (2.78)	0.233 *** (6.79)	0.008 *** (8.96)
GPC	0.011 *** (3.16)	−0.855 *** (−2.98)	0.029 *** (3.00)
FSG	−0.034 *** (−9.39)	−2.558 *** (−8.17)	−0.060 *** (−10.80)
CRR	0.582 *** (9.98)	−12.274 *** (−3.02)	0.592 *** (7.07)
HHG	−0.150 *** (−7.73)	−17.503 *** (−12.03)	−0.225 *** (−4.22)
MS	0.150 *** (6.27)	10.475 *** (5.57)	0.250 *** (4.04)
HS	0.279 *** (17.01)	12.703 *** (9.98)	0.370 *** (8.16)
FNW	0.000 (0.87)	0.002 (1.35)	0.002 (1.23)
N	33125	33125	33125

Note: Robust standard errors are given in parentheses. *** indicate statistical significance at the 1% level.

6. Heterogeneity Analysis

6.1. Heterogeneity Test in Urban and Rural Areas

China's long-standing urban-rural dual pattern has led to huge differences in the distribution of financial resources between urban and rural areas. Such differences in financial resources may lead to heterogeneity in the impact of aging on household financial asset investment. To this end, this paper introduces a binary selection variable (RURAL) representing urban or rural areas, where a value of 1 indicates that the family is in the countryside, and a value of 0 indicates that it is in a town. The regression results of urban-rural heterogeneity are shown in Table 8. It can be seen that the coefficients of all the multiplication terms are significantly negative at the 1% level. This suggests that in rural areas, aging has a stronger inhibitory effect on investment in risky financial assets. The development of the city has brought more prosperous financial formats and more financial resources, and residents can more easily access financial knowledge and financial products, which eases the aging population's inhibition of investment in risky financial assets. The development of the financial industry has a Matthew effect, but the economic level of rural areas is relatively backward, and agriculture is the mainstay. This makes it difficult for residents in rural areas to gain access to financial literacy and products and services. This phenomenon leads to stronger inhibition.

Table 8. Heterogeneity analysis based on Urban and Rural Areas, 2019.

	(1) RFAP	(2) RFAD	(3) FAD
PEP	−1.316 *** (−51.75)	−0.205 *** (−9.93)	−2.104 *** (−46.59)
RURAL	−0.716 *** (−37.36)	−0.505 *** (−27.50)	−1.164 *** (−39.86)
RURAL#PEP	−0.146 *** (−3.15)	−0.435 *** (−8.71)	−0.395 *** (−4.90)
GPC	0.015 *** (4.27)	−0.011 *** (−3.73)	0.031 *** (3.22)
FSG	−0.026 *** (−7.48)	−0.023 *** (−7.15)	−0.047 *** (−8.32)
CRR	1.024 *** (19.70)	0.045 (1.15)	1.331 *** (15.91)
HHG	−0.056 *** (−2.98)	−0.120 *** (−7.94)	−0.099 ** (−2.43)
MS	0.155 *** (6.97)	0.109 *** (5.62)	0.203 *** (3.29)
HS	0.397 *** (25.38)	0.174 *** (13.63)	0.575 *** (14.32)
FNW	0.000 (0.75)	0.000 (1.20)	0.002 (1.24)
N	33,125	33,125	33,125

Note: Robust standard errors are given in parentheses. ***, and ** indicate statistical significance at the 1%, and 5% levels, respectively.

6.2. Heterogeneity Tests for Household Child Populations

The upbringing and education of children by Chinese families is regarded as an investment behavior, and parents expect their children to take on the responsibility of intergenerational care when they grow up. Therefore, supporting the elderly and raising children in China is an important obligation for every family. Children's spending is an important part of household spending. According to the "2020 Children's Economic Insights Report" released by QuestMobile, children's spending accounts for 30–50% of the total household spending. If a family has to support the elderly and raise children, it will inevitably increase the financial burden of the family, thereby affecting the family's risk appetite and decision making. In order to study whether raising children leads to

heterogeneity in the impact of aging on household financial asset investment, this paper introduces a binary choice variable (CHILD) that indicates whether there are children in the household. A value of 1 indicates that the family has children, and a value of 0 indicates that the family has no children.

Heterogeneous regression results for child rearing are shown in Table 9. You can see that the multiplication term in the first column is significantly negative at the 1% level. This suggests that if a family raises children while supporting the elderly, this inhibits the family's risk appetite for investing and reduces the chance of the family participating in risky financial assets. The multiplication terms of the second and third columns are negative but not significant. From the control variables, the probability and diversity of families with children participating in venture financial investment are significantly positive at the 1% level. This may be because, compared with families without children, most adults in families with children were born after the reform and opening up, are more literate, and are the main force in social work and money. This will cause them to have a stronger investment demand.

Table 9. Heterogeneity analysis based on Child, 2019.

	(1) RFAP	(2) RFAD	(3) FAD
PEP	−1.284 *** (−58.00)	−0.276 *** (−13.69)	−2.149 *** (−37.67)
CHILD	0.382 *** (19.58)	0.024 (1.50)	0.487 *** (16.27)
CHILD#PEP65	−0.269 *** (−2.86)	−0.022 (−0.26)	−0.008 (−0.06)
GPC	0.007 ** (2.11)	−0.015 *** (−4.81)	0.025 *** (2.58)
FSG	−0.029 *** (−8.55)	−0.025 *** (−7.68)	−0.052 *** (−9.60)
HHG	−0.203 *** (−11.04)	−0.213 *** (−13.79)	−0.287 *** (−5.73)
MS	0.144 *** (6.61)	0.113 *** (5.66)	0.153 *** (2.63)
HS	0.451 *** (29.59)	0.224 *** (17.25)	0.641 *** (15.40)
FNW	0.000 (0.96)	0.000 (1.26)	0.003 * (1.79)
N	33,125	33,125	33,125

Note: Robust standard errors are given in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

7. Conclusions

This paper selects household micro-data in 2015, 2017, and 2019 to empirically tests the participation, depth, and diversity of aging and household risk financial assets. The conclusions are as follows. First, this paper uses the Probit model, the Tobit model, and the ZIP model to empirically test that aging has a significant negative impact on the participation, depth, and diversity of household risky financial assets. The results of the empirical tests of the two-way fixed effects model also support these findings. Secondly, from the perspective of intermediary variables, the increase in the age of the household head and the increase in the proportion of the elderly in the household will enhance the risk aversion of the household head, and the increase in the degree of risk aversion will inhibit the household investment in risky financial assets. In terms of moderating variables, with the improvement of financial literacy, the inhibitory effect of aging on investment in risky financial assets gradually weakens. Finally, considering urban–rural heterogeneity, in rural areas, aging has a stronger negative impact on risk financial asset participation, depth of participation, and diversity, all of which are significant at the 1% level. Considering the

heterogeneity of family raising children, for families with children, aging has a stronger negative impact on the participation of risky financial assets, and it is significant at the 1% level.

Based on the empirical results, this paper proposes the following recommendations. First, lack of financial literacy and low financial literacy can significantly inhibit older adults from investing in risky financial assets. Therefore, the government should strengthen the popularization of financial knowledge and risk education, and residents themselves should also strengthen their understanding of relevant financial knowledge and improve their ability to make independent judgments. Second, the increased burden of family support will inhibit the probability of families participating in risky financial asset investment. In addition, the increase in the burden of support will also increase the background risk that the family takes, thereby inhibiting the family's willingness to take risks. Therefore, the government should speed up the reform of the social security system, such as the improvement of the medical security system, the reform of the pension system, and the reform of the rational allocation of educational resources. A good social security system can reduce households' uncertain expectations for the future and thus promote households to invest in financial assets of various types and risk levels. Finally, the disparity in the distribution of financial resources between urban and rural areas aggravates the inhibition of aging on investment in risky financial assets. Therefore, the government should increase policy support for rural areas, promote the inflow of financial resources in rural areas, and expand the channels for obtaining financial resources in rural areas.

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Appendix A

Table A1. Aging and Depth of Households Holding Risky Financial Assets.

	(1) 2019 Tobit	(2) 2017 Tobit	(3) 2015 Tobit	(4) 2019 Tobit	(5) 2017 Tobit	(6) 2015 Tobit
PEP	−0.280 *** (−14.30)	−0.520 *** (−19.38)	−0.247 *** (−11.98)			
AGE				−0.012 *** (−22.68)	−0.021 *** (−33.82)	−0.011 *** (−25.76)
GPC	−0.014 *** (−4.80)	−0.020 *** (−4.75)	0.032 *** (12.15)	−0.016 *** (−5.37)	−0.021 *** (−5.15)	0.032 *** (11.78)
FSG	−0.025 *** (−7.68)	−0.025 *** (−5.91)	0.018 *** (9.40)	−0.025 *** (−8.11)	−0.026 *** (−6.30)	0.019 *** (9.85)
CRR	0.039 (0.98)	0.080 (1.64)	−0.118 *** (−3.14)	−0.186 *** (−4.25)	−0.319 *** (−6.17)	−0.350 *** (−8.81)
HHG	−0.212 *** (−13.77)	−0.119 *** (−6.08)	−0.141 *** (−10.99)	−0.204 *** (−13.53)	−0.129 *** (−6.88)	−0.131 *** (−10.39)
MS	0.114 *** (5.75)	−0.115 *** (−4.76)	0.010 (0.60)	0.138 *** (7.08)	−0.021 (−0.94)	0.060 *** (3.52)
HS	0.224 *** (17.28)	0.280 *** (17.74)	0.134 *** (11.91)	0.180 *** (13.55)	0.182 *** (11.53)	0.085 *** (7.44)
FNW	0.000 (1.26)	0.001 *** (28.94)	0.001 *** (26.18)	0.000 *** (5.75)	0.001 *** (37.38)	0.001 *** (36.59)
N	33,125	39,197	35,645	33,125	39,197	35,645

Note: Robust standard errors are given in parentheses. *** indicate statistical significance at the 1% level.

Table A2. Aging and Diversity of Households Holding Risky Financial Assets.

	(1) 2019 ZIP	(2) 2017 ZIP	(3) 2015 ZIP	(4) 2019 ZIP	(5) 2017 ZIP	(6) 2015 ZIP
PEP	−1.178 *** (−44.81)	−0.210 *** (−4.15)	−0.408 *** (−6.69)			
AGE				−0.031 *** (−65.46)	−0.011 *** (−7.94)	−0.019 *** (−14.20)
GPC	0.009 *** (3.63)	−0.064 *** (−6.11)	0.098 *** (12.21)	0.007 *** (2.85)	−0.067 *** (−6.29)	0.099 *** (12.15)
FSG	−0.026 *** (−10.29)	−0.040 *** (−4.15)	0.041 *** (7.74)	−0.027 *** (−10.80)	−0.041 *** (−4.13)	0.043 *** (8.04)
CRR	0.457 *** (16.47)	−0.414 *** (−3.42)	−0.450 *** (−3.81)	0.048 (1.56)	−0.650 *** (−5.16)	−0.872 *** (−7.15)
HHG	−0.158 *** (−11.64)	−0.349 *** (−7.84)	−0.343 *** (−8.82)	−0.131 *** (−9.96)	−0.349 *** (−7.86)	−0.329 *** (−8.58)
MS	0.133 *** (6.80)	0.294 *** (5.40)	0.260 *** (4.64)	0.245 *** (12.90)	0.314 *** (5.90)	0.348 *** (6.24)
HS	0.279 *** (25.25)	0.352 *** (10.05)	0.325 *** (9.33)	0.179 *** (15.91)	0.303 *** (8.55)	0.245 *** (6.92)
FNW	0.000 *** (5.23)	0.001 *** (18.56)	0.002 *** (22.15)	0.000 *** (4.94)	0.001 *** (18.05)	0.002 *** (21.48)
N	33,125	39,197	35,645	33,125	39,197	35,645

Note: Robust standard errors are given in parentheses. *** indicate statistical significance at the 1% level.

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