The Impact of Supplementary Pension on Household Risky Financial Asset Allocation

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Abstract. With increasingly serious aging problem in China, supplementary pension, as the second pillar of the endowment insurance system, is expected to play an important role to relieve the pension pressure. Nowadays, people in China are exposed to various investment tools, but they still prefer to invest in risk-free financial assets. The allocation of household financial assets is not diversified enough. While supplementary pension is expected to improve financial structure of households. It may enhance the anti-risk ability of households, rational allocation of household assets, the ability of value-adding, and thus reduce the pressure of society to cope with the aging population. This paper selects the 2019 China Household Finance Survey (CHFS) database, using STATA software to investigate the impact of supplementary pension on risky financial asset allocation of Chinese households by applying probit and tobit models. The results show that supplementary pension can significantly increase the willingness of households to purchase risky financial products but has no significant effect on increasing the proportion of risky assets being held.

Keywords: Supplementary pension, household asset allocation, risk financial assets, aging.

1. Introduction

The current endowment insurance system in China includes basic endowment insurance, supplementary pension and commercial endowment insurance. The basic endowment insurance is compulsively implemented by the unified national policy, while the commercial endowment insurance is voluntarily purchased by individuals. The supplementary pension system is initiated by enterprises or public institutions, independently established based on employees' participation in the basic endowment insurance. Enterprises and employees pay insurance premiums according to a certain proportion. In China, supplementary pension has two main types. The one that is initiated by enterprise is called enterprise annuity. The other one that is initiated by public institutions is called occupational annuity. At present, population aging is a serious problem in China. The implementation of supplementary endowment insurance system is an important effort made by the government to ease the public financial pressure and improve the pension system.

On November 11, 2021, the last census released by the National Bureau of Statistics said that at the end of 2020, the elderly population over 65 years old in China reached 190.59 million, accounting for 13.50% of the total population and by 2040, China will enter a period of serious aging. On the other hand, the current population structure of Chinese families presents an "inverted triangle" situation. Population aging and family miniaturization mean that there will be fewer and fewer contributors to the basic endowment insurance, but more and more retirees. In order to tackle the increasingly serious aging problem, China has been constantly reforming and improving the endowment insurance system. Supplementary pension was first mentioned in 1991. The Chinese State Council claimed that the pension system with basic pension, supplementary pension as well as personal pension should be established gradually. In 1995, the supplementary insurance system has entered the stage of practice. Since then, China has gradually established a multi-level pension system with basic pension plans, supplementary pension and commercial pension as three pillars.

However, compared with the complementary pension system developed in Europe and the United States, China is still in its developing stage. Given the expected role that supplementary pension should play as the second pillar of China's pension system, China's supplementary pension system still has broad space for development. By the end of June 2023, 136,100 enterprises nationwide had

established enterprise pensions, with 30,845,800 employees participating. In terms of occupational annuity, the number of participants is about 43 million by the end of 2022. Approximately 74 million people participate supplementary pension now and the total cumulative fund size is about 5.2 trillion yuan. However, compared to China's huge population of 1.4 billion, this participation rate is relatively small. Although it stared late relatively, China's government has issued various policies to encourage its development. Since January 1, 2014, China has implemented individual income tax deferred preferential policy for enterprise annuity. The policy was aimed at promoting the construction of China's supplementary pension and promoting the development of a multi-tiered pension system. The Measures for Enterprise annuity, which came into effect on February 1, 2018, further mentions that "the state encourages enterprises to establish enterprise annuity".

The implementation of the supplementary pension is not only expected to relieve the huge pension pressure under the aging problem in China, but also has a real impact on the economic behavior of every household participating in the plan. This may be reflected in the change of household financial asset allocation. According to Campbell [1], all families are supposed to hold risk assets to some extent to achieve an effective investment. However, according to China household financial asset allocation risk report in 2016, many households have low levels of risk in their financial portfolios and their investment products are simple. Savings remain the dominant financial asset of Chinese households with 45.8% proportion of financial assets. Although the proportion of financial products has shown an obvious upward trend, it's still very low compared to other countries such as the United States, France and the United Kingdom. There is huge space for improvement in the financial asset allocation of Chinese households, especially to increase the proportion of medium-risk asset s [2].

At the household level, whether supplementary pension can promote the rational allocation of household assets has become an important issue. At the social level, the implementation of supplementary pension is to alleviate the pension pressure brought by population aging. If supplementary pension insurance is conducive to increase the allocation of risky financial assets and thus enhancing the appreciation capacity of assets, it can further enhance the ability of the whole society to cope with population aging. Therefore, this paper aims to study the impact of supplementary pension on household asset allocation through empirical analysis.

2. Literature review

At present, there are few studies on the impact of supplementary pension insurance on household portfolio in China, but some researches in other countries could provide reference for China. A study [3] found that American households covered by pension plans in which employees could choose investment method are more likely to hold stocks than those covered by pension plans in which they do not have a choice of investment method. Chinese scholars have also studied the impact of pension on households' investment in risky financial assets. It shown that social pensions can significantly increase the likelihood of households holding risky financial assets [4].

The influencing factors of household financial asset allocation are the focus of much scholars' research. At present, it is generally believed that the main factors affecting household financial asset allocation include housing risk, labor income risk, health status, income, age, risk preference, the number of children and the elderly in the family. Kullmann and Siegel [5] as well as Flavin and Yamashita [6] all pointed that housing investment has a "crowding-out" effect on risky financial assets. Health risks also have a negative impact on the investment in risky assets. Edwards [7] believed that health risk will encourage safer investment and health risk has the greatest impact on single elderly people. Crainich et al. [8] reached a similar conclusion. Their research proved that when individuals' health status becomes risky, the share of risky assets decreases. In terms of the impact of labor income risk, Angerer and Lam [9] found that when people face long-term income uncertainty, they will reduce their investment in risky financial assets to reduce their risk exposure, but short-term income uncertainty has no effect.

Generally, risk-loving individuals are more likely to invest in risky financial assets than risk-averse individuals. According to Khan et al. [10], partners' risk preferences have an important impact on household portfolio. Risk-averse men and their partners tend to reduce their investment in risky assets. Education level also plays an important role in household financial asset choices. Bertaut and Starr-McCluer [11] found that people with higher education tend to invest more in risky financial products because they have lower entry costs.

In addition, age of the household head, the number of children, the number of elderly, total assets and total liabilities of the household also affect the allocation of household financial assets. Coile and Milligan [12] examined the impact of aging and health shocks on the asset allocation of U.S. households and concluded that increasing age reduces holdings of risky financial assets such as stocks and bonds. Under the background of aging population in China, Kang and Hu [13] investigated the influence of age structure on household portfolio and drew a similar conclusion. An increase in the proportion of infants in a family will crowd out risky assets and deposits, while an increase in the proportion of elderly family members will promote the substitution of savings for risky assets.

To sum up, the research on the influencing factors of household financial asset allocation is relatively mature. The main influencing factors include labor income risk, health status, income, age, risk preference, the number of children and the elderly in the family. These indicators will provide reference for the study of this paper. However, there are few studies on the impact of supplementary pension on the allocation of household financial assets. Therefore, this paper will refer to the indicators given in the above literature, investigating the impact of supplementary pension on households holding of risky financial assets through quantitative analysis.

3. Data collection and variable selection

3.1. Data source

The study is based on data from 2019 China Household Finance Survey (CHFS2019) conducted by China Household Finance Survey and Research Center. It is a public welfare academic research institution established by Southwestern University of Finance and Economics in 2010, which integrates data collection and data research. This paper selects the latest data from 2019. The sample covers 50000 households across 29 provinces in China. After preliminary screening indicators as well as deleting incomplete answers and accurate data, the final effective sample number is 31312.

3.2. Selection of variables

In this study, there are two independent variables: whether to hold risky financial assets and the proportion of risky financial assets. Financial assets in the CHFS database include current deposits, time deposits, stocks, funds, wealth management products, bonds, derivatives, non-currency assets and gold. In probit model, if the household holds risky financial assets, the independent variable, named "*riskfina_dummy*", is denoted as 1; If the household does not hold risky financial assets, it is denoted as 0. In the tobit model, the independent variable is the ratio of all risky financial assets to total financial assets, which is named as "*risk_rate".*

The main dependent variable is whether to hold supplementary pension. According to the CHFS questionnaire, "Do you have supplementary pension, occupational annuity or other enterprise supplementary pension?". If the answer is "yes", the dependent variable "*annuity*" is denoted as 1; Otherwise, it equals to 0. The control variables in this paper include age of the household head, total income, total debt, health status of the household head, whether to participate in commercial insurance, risk preference of the household head, the number of the elderly in the family, the number of children in the family and education level of the household head. Specifically, this study took log of total income and total debt. Variable "*age*" indicate the age of household head. "*health*" shows the health status of household head, and the higher the value, the worse the health status. A higher value of the variable "*risk_preference*" indicates that the household is more risk averse. Variable "*edu*" indicates the education level of household head. A higher value means that the household head is more educated.

"*com_insurance*" is a dummy variable. It equals to 1 if the household holds commercial insurance. Otherwise, it equals to 0. The details are listed in Table 1.

Table 1. Variable definition

Type	Variable	Description
Dependent Variables	riskfina_dummy	Household owns risk fiance or not (yes=1, no=0)
	risk_rate	Ratio of risky financial assets to total finance assets
Independent Variable	annuity	Household owns supplementary pension or not (yes=1, no=0)
Controlled Variables	age	Age of the head of household
	total_income	Total household income
	total_debt	Total household debt
	health	Health status of the head of household (The higher the value, the worse the health status)
	com_insurance	Household owns commercial insurance or not (yes=1, no=0)
	risk_preference	Risk preference of the head of household (The higher the value, the more risk averse)
	olderNum	Number of the older in household
	childNum	Number of children in household
	edu	Education level of the head of household (The higher the value, the higher the education level)

3.3. Descriptive statistics

The results of descriptive statistics show that only 14% of the households in the sample hold risky financial assets and the average risky financial assets ratio is only 3.5%. This indicates that Chinese households tend to invest in risk-free financial assets and the allocation of household financial assets is far from diversified. In addition, only 2.7% of the households in the sample hold supplementary pension. It is obvious that China's supplementary pension is not widespread, which may imply its limited influence power. The details are listed in Table 2.

Table 2. Descriptive statistic

Type	Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent Variablet	risk_rate	31312	.035	.129	0	1
	riskfina_dummy	31312	.14	.347	0	1
Independent Variable	annuity	31312	.027	.161	0	1
Control Variable	age	31312	56.028	13.646	16	101
	total_income	3131	79374.436	190385.54	-5493190	12122418
	total_debt	31312	56627.467	346756.25	.1	40658344
	risk preference	31312	4.615	1.145	1	6
	health	31312	2.73	.998	1	5
	edu	31312	3.344	1.594	1	9
	com_insurance	31312	.094	.291	0	1
	childNum	31312	.556	.84	0	7
	olderNum	31312	.861	.89	0	4

4. Mpirical analysis

4.1. Benchmark regression

This paper uses probit and tobit models to study the impact of supplementary pension on household risky financial asset allocation. The explained variable of the probit model is whether the household chooses to invest in risky financial assets. The probit model is set as follows: 0 1

$$Y_i^*=\beta_0+\beta_1 \text{ annuity}_i+\beta_2 X_i+\varepsilon_i \quad (1)$$

$$Y_i\begin{cases}0, Y_i^* <= 0\\ 1, Y_i^* > 0\end{cases} \quad (2)$$

Y_i* is an unobservable latent variable; "*annuity*" is whether to hold supplementary pension; X_i is the control variable; The dependent variable Y_i represents whether the household i holds risky financial assets and is determined by the latent variable Y_i*, Y_i=1 indicates the household i holds risky financial assets, otherwise it is 0. ε_i is the random error term.

The explained variable of tobit model is the degree of household participation in risky financial assets investment, which is expressed as risky financial assets divided by total financial assets. The tobit model is set as follows:

$$Y_i^*=\beta_0+\beta_1 \text{ annuity}_i+\beta_2 X_i+\varepsilon_i \quad (3)$$

$$y_i\begin{cases}0, Y_i^* <= 0\\ y^*, y_i^* > 0\end{cases} \quad (4)$$

Similarly, y_i* is the latent variable; y represents proportion of household risk assets.

4.2. Results analysis

Table 3 represents estimated results. Probit model shows that the average marginal coefficient of "*annuity*" is 0.148, which is significant at 1% level. Therefore, holdings of supplementary pension significantly affect the decision of whether to invest in risky financial assets. To be specific, the probability of holding risky financial assets is 14.8% higher for households with supplementary pension than those without supplementary pension. However, in tobit model, "annuity" is not significant, with an average marginal coefficient of 0.03. Although holding supplementary pension can encourage households to hold risky financial assets, it cannot significantly increase the ratio of risky financial assets to total financial assets. Compared with households without supplementary pension, the proportion of risky financial assets for household with supplementary pension is only 3% higher. In general, supplementary pension has a positive effect on households' investment in risky financial assets.

We can also derive the impact of other indicators on household risky financial assets. As the age of the household head increases, the household tend to participate less in risky financial markets. Both total income and total debt have significant effects on household financial asset allocation. The results show that an increase in total income encourages households to invest in risky financial assets while total debt does the opposite. Moreover, the investment strategy tends to be conservative if the household head is risk-averse and unhealthy.

In addition, education level of the household head has a positive effect on the fact that household participation in the risky financial market, which may be explained by the individuals with higher education level are more likely to master the relevant knowledge of investment. Similarly, holding commercial insurance has a positive effect. Compared with households without commercial insurance, those with commercial insurance are 37% more likely to invest in risky financial assets, and the proportion of risky financial assets in total financial assets is 14% higher.

Table 3. Probit and Tobit models

	(1) riskfina_dummy (Probit)		(2) risk_rate (Tobit)	
	Coef.	Std.Err.	Coef.	Std.Err.
annuity	0.148**	(3.05)	0.030	(1.57)
age	-0.004**	(-3.84)	-0.0003	(-0.83)
logtotal_income	0.242***	(25.15)	0.101***	(24.5)
logtotal_debt	-0.007***	(-4.43)	-0.004***	(-5.37)
risk_preference	-0.216***	(-25.08)	-0.090***	(-24.39)
health	-0.049***	(-4.33)	-0.017***	(-3.68)
edu	0.174***	(25.77)	0.073***	(25.54)
com_insurance	0.370***	(12.82)	0.142***	(11.99)
childNum	-0.059***	(-4.38)	-0.029***	(-5.02)
olderNum	-0.009	(-0.64)	0.00	(1.23)
_cons	-3.098***	(-24.18)	-1.404***	(-25.28)

Note: * p<0.05, ** p<0.01, *** p<0.001

On the contrary, the number of children in the family has a negative effect on the investment in risky financial assets. Addition of one kid in the family reduces the probability of investing in risky financial assets by 5.9% on average and reduces the proportion of risky financial assets by 2.9%. However, the number of elderly people in the family has little impact on the allocation of risky financial assets.

5. Robustness test

This paper uses probit and tobit models to study the impact of supplementary pension on households' holding and holding ratio of risky financial asset holdings. In order to verify whether the model is stable when the variables are changed, this chapter conducts robustness tests by changing the explanatory variables. At present, only a few households in China hold supplementary pension, but most households have basic endowment insurance. As an important supplement to the basic endowment insurance, supplementary pension plays the same role as the basic one in reducing the uncertainty of future income and securing the retirement life. Therefore, the explanatory variable "whether to hold supplementary pension" is changed to "whether to hold basic endowment insurance or supplementary pension". According to table 4, the marginal effect does not change much, so the model in this paper is relatively robust.

Table 4. Robust test

	(1) riskfina_dummy(Probit)		(2) risk_rate(Tobit)	
	Coef.	Std.Err.	Coef.	Std.Err.
annuity	0.176***	(5.82)	0.061***	(4.75)
age	-0.005***	(-4.76)	-0.0007	(-1.62)
logtotal_income	0.239***	(24.69)	0.099***	(24.04)
logtotal_debt	-0.007***	(-4.43)	-0.004***	(-5.31)
risk_preference	-0.217***	(-25.20)	-0.090***	(-24.45)
health	-0.049***	(-4.33)	-0.017***	(-3.69)
edu	0.172***	(25.61)	0.072***	(25.27)
com_insurance	0.368***	(12.74)	0.141***	(11.93)
childNum	-0.059***	(-4.26)	-0.028***	(-4.92)
olderNum	-0.011	(-0.75)	0.007	(1.19)
_cons	-3.133***	(-24.48)	-1.411***	(-25.44)

Note: * p<0.05, ** p<0.01, *** p<0.001

6. Conclusion

Under the background of aging population in China, this study uses data from CFHS 2019 to investigate the impact of supplementary pension on household portfolio by applying tobit and probit models. The research results of this study are as follows: First of all, holding supplementary pension can significantly affect the households' investment decisions of risky financial asset. Households with supplementary pension were 14.8% more likely to invest in risky financial assets than those without supplementary pension. However, this paper does not find sufficient evidence proving that supplementary pension can remarkably increase the proportion of risky financial assets held by households.

At present, the popularity of supplementary pension in China is relatively small which may limit its role in reducing uncertainty of future income. Therefore, even though household that holds supplementary pension may be encouraged to purchase risky financial assets as they have double securities for retirement life, they will not immediately increase the risk ratio of their portfolios aggressively. On the other hand, the allocation of financial assets of ordinary households in China tends to be conservative, focusing on savings, and lacking holdings of risky assets. Therefore, it is necessary for China to further promote the development of supplementary pension to increase the diversification of household portfolio. This is expected to increase the family's ability of risk resistance and value adding. From a social point of view, a more rational asset allocation of every household could reduce the burden of supporting the elders and thus enhance the capacity to cope with population aging issue.

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