Financial Economics Research; Vol.3, No.2; 2026
E-ISSN: 3006-3663 P-ISSN: 3006-3655
DOI: https://doi.org/10.70267/fer.250302.191207
Published by: Zeus Press

The Impact of Retirement on Urban Residents' Participation in Commercial Pension Insurance: An Empirical Analysis Based on Fuzzy Regression Discontinuity Design

Zilong Zhang*

School of Finance and Trade, Liaoning University, Shenyang 110000, China

**Corresponding author: Zilong Zhang.*

Abstract

As China's population aging accelerates, developing the third pillar of commercial pension insurance has become an important policy issue. However, the participation rate among urban residents remains persistently low. Existing studies mostly focus on static factors and overlook the dynamic impact of retirement—a critical life event. Based on data from the 2019 China Household Finance Survey (CHFS), this paper employs a fuzzy regression discontinuity design (FRDD), using the statutory retirement age as the policy cutoff, to precisely identify the causal effect of retirement on urban male residents aged 50–70 and their participation in commercial pension insurance. The study further examines the underlying mechanisms from three dimensions: income level, risk preference, and financial literacy. The results show that retirement significantly reduces the probability of urban residents participating in commercial pension insurance, decreasing the participation rate by 12.1 percentage points under the optimal bandwidth. Mechanism analysis reveals that retirement exerts a dual inhibitory effect by lowering residents' income levels and risk preferences. Although increased leisure time after retirement improves financial literacy and generates a certain positive effect, this positive influence is offset by the negative effects of income constraints and increased risk aversion. This paper provides rigorous empirical evidence on the causal relationship between retirement and commercial pension insurance participation, offering important policy implications for improving the third pillar of the pension system.

Keywords

retirement, commercial pension insurance, fuzzy regression discontinuity design, income level, risk preference, financial literacy

1. Introduction

With China entering a stage of moderate population aging, the degree of aging continues to deepen, and the societal pension burden is increasing day by day. How to provide for the elderly has become a major challenge facing Chinese society. The Fourth Plenary Session of the 20th Central Committee of the Communist Party of China, in conjunction with the 15th Five-Year Plan, proposed the integrated and coordinated development of the pension industry and the implementation of proactive national strategies to

address population aging. At present, among the "three pillars" of China's pension system, basic social pension insurance covers the vast majority of retired individuals and holds an absolute advantage in the insurance market. However, in recent years, the overall fiscal expenditure on social security has been enormous and the burden has intensified, leading to severe challenges to the adequacy and sustainability of social pension insurance development. As the second pillar, enterprise annuities also face the problem of insufficient coverage, and the "five social insurances and two funds" represent a heavy contribution burden for enterprises that are currently undergoing tax and fee reductions. In this context, the third pillar—personal pensions represented by commercial pension insurance—has become the key to solving China's current pension problems. The 2020 Central Economic Work Conference proposed to "regulate and develop the third pillar of pension insurance." Commercial pension insurance has become an important channel for residents to open up new pension models and meet diversified pension needs.

Although policies have been actively promoted at the governmental level, it must be acknowledged that the participation rate of urban residents in commercial pension insurance in China remains at a relatively low level. The development speed of the pension finance market has not yet fully matched the severe reality of China's population aging. Consequently, the academic community has conducted solid and multi-layered discussions on this issue. Most scholars have systematically and rigorously analyzed, from the perspectives of institutional design, market supply, and household characteristics, how factors such as severe homogenization of pension products, insufficient policy incentives [1], low resident income levels, and conservative risk preferences [2] constrain urban residents' enthusiasm for participating in commercial pension insurance. More notably, some scholars have examined the actual impact of variables such as age and education level [3] and family demographic structure [4] on commercial insurance purchasing behavior. However, upon closer examination of the existing literature, it is not difficult to identify a significant and long-overlooked perspective: retirement, as a major life milestone, exerts a direct and fundamental exogenous shock on residents' pension-related decisions. Retirement inevitably brings about fundamental changes in residents' income structure and consumption patterns, and also alters their perception of their own health, thereby naturally influencing the intensity of their demand for pension security and their risk perception.

Statutory retirement can be regarded as an exogenous shock that has complex effects on commercial pension insurance participation. On the one hand, after retirement, residents' income sources tend to become singular; the sharp decline in income level and the significant reduction in risk preference create a dual negative impact on commercial pension insurance participation. At the same time, retired residents' income shifts to fixed sources such as pensions, and the decline in disposable income directly affects their economic ability to participate in insurance. Retirement also makes residents' risk attitudes more conservative, significantly reducing their acceptance of long-term contribution financial products such as commercial pension insurance. On the other hand, the increase in leisure time among retired groups leads to greater interest in financial knowledge and related information, enhancing their understanding of commercial pension insurance products and potentially promoting participation. In addition, the change in social roles brought about by retirement may also influence residents' information acquisition channels through social networks, indirectly affecting commercial pension insurance purchasing decisions.

Existing literature has not sufficiently discussed the actual effect of retirement on urban residents' participation in commercial pension insurance. More importantly, it lacks rigorous identification of the causal relationship between the two. Traditional regression analysis methods struggle to adequately address sample selection bias and endogeneity issues, making estimation results susceptible to bias. Therefore, this paper makes full use of data from the China Household Finance Survey (CHFS) and adopts a fuzzy regression discontinuity design (FRDD) to conduct a solid and clear empirical analysis of the impact of retirement on urban residents' participation in commercial pension insurance and its underlying mechanisms. Specifically, the fuzzy regression discontinuity design is a typical quasi-natural experiment method that uses retirement age as the policy cutoff. It can naturally and appropriately isolate the causal effect of retirement, making it a powerful econometric tool for identifying the true relationship between retirement and commercial pension insurance participation.

The marginal contributions of this paper are mainly reflected in the following three aspects: First, from the research perspective, this paper focuses on retirement as a key life event, breaking through the static analysis of individual characteristics in existing studies and enriching the research dimensions of factors

influencing commercial pension insurance participation. Second, in terms of research methodology, the use of fuzzy regression discontinuity design effectively addresses endogeneity issues and provides more rigorous empirical evidence for the causal relationship between retirement and commercial pension insurance participation. Third, at the policy level, the conclusions of this study can provide references for formulating differentiated strategies to promote commercial pension insurance and for improving the third pillar of the pension system.

The remainder of this paper is structured as follows: The second section reviews existing literature and proposes the theoretical foundation and research hypotheses. The third section introduces the data sources, research sample, variable measurement, and statistical model. The fourth section presents descriptive statistics, regression analysis, mediation effect tests, endogeneity treatment, robustness checks, and heterogeneity analysis. The final section offers conclusions and discussions.

2. Literature Review and Research Hypotheses

2.1 Literature Review

Against the backdrop of population aging, the construction of China's multi-pillar pension system has entered a critical stage. As the core of the third pillar, commercial pension insurance serves as an important support for alleviating the pressure on basic social pension insurance and meeting residents' diversified pension needs. However, according to data from the 2019 China Household Finance Survey (CHFS), the participation rate in commercial pension insurance among urban male residents aged 50–70 is only 7.5%, which severely constrains the functioning of the third pillar. Existing studies have mostly focused on static factors such as income, financial literacy, and traditional conceptions, while neglecting the dynamic impact of retirement—a key life event. Retirement not only signifies withdrawal from the labor market but also directly influences pension-related decision-making by reshaping income structure, risk preferences, time allocation, and information channels.

International research on the impact of retirement on individual financial decision-making started earlier and has become increasingly sophisticated in recent years in terms of research methods and mechanism identification. Early studies were largely based on the life-cycle theory, suggesting that increased income stability but limited growth potential after retirement would prompt individuals to reduce the proportion of risky assets in their portfolios. However, with the widespread application of quasi-natural experimental methods, scholars have achieved more rigorous identification of the causal effects of retirement. Shah and Flaherty [5] pointed out in their study that retirement, as an exogenous institutional cutoff, provides an ideal "quasi-experimental" setting for identifying behavioral differences in individuals' pension plan choices. Their research framework is consistent with the fuzzy regression discontinuity design adopted in this paper.

Regarding the dynamic relationship between retirement and risk preferences, scholars have found that retirement status significantly alters individuals' risk perception and asset allocation decisions. Lin et al. [6] constructed an optimal consumption and investment portfolio model for retirees under inflation and pension default risk, finding that retirees' degree of risk aversion is the core determinant of their asset allocation decisions. Particularly when facing longevity risk and market uncertainty, individuals exhibit a stronger conservative tendency. Wang and Jia [7] further deepened this line of research by analyzing equilibrium investment strategies in defined contribution pension plans under the assumption of stochastic risk aversion. They explicitly stated that ignoring the stochastic changes in risk preferences before and after retirement would lead to significant welfare losses. This finding provides solid theoretical support for understanding the decline in individuals' risk preferences after retirement and its inhibitory effect on pension participation.

In addition, existing studies have also deeply explored individuals' participation decisions in pension financial products from the perspective of risk-return trade-offs after retirement. Li and Wei [8] examined the optimal management strategies for defined contribution pension plans under the dual constraints of financial risk and mortality risk, emphasizing the trade-off process between fund security and long-term returns that individuals face after retirement. These studies indicate that retirement is not merely the termination of labor supply but a complex process that reshapes individuals' financial goals, risk tolerance, and decision-making capacity. Its ultimate impact on the demand for long-term financial products such as

commercial pension insurance depends on the combined effect of multiple factors, including income shocks, changes in risk preferences, and financial knowledge reserves.

Domestic research on the impact of retirement on financial behavior has mainly concentrated on two areas: asset allocation and consumption structure. Direct studies linking retirement with commercial pension insurance participation remain relatively scarce.

In terms of retirement and financial asset allocation, Jia Nan [9], using CHFS 2013 data and the FRDD method, found that male retirees do not change the allocation ratio between financial and non-financial assets but adjust the internal structure of financial assets—reducing the proportion of risky assets such as cash and stocks while increasing the proportion of low-risk assets such as bank deposits and wealth management products. The core mechanisms are the shift toward risk-averse attitudes, income shocks, and changes in financial knowledge caused by retirement. Feng Jin et al. [10] further revealed gender heterogeneity: after retirement, women, due to increased family caregiving responsibilities, show a stronger preference for liquid and low-risk financial assets.

In terms of retirement, consumption, and security needs, Zhao Xindong and Wang Hao [11], based on CHARLS data and using FRDD, found that China does not exhibit a universal "retirement consumption puzzle." However, the proportion of enjoyment-oriented consumption such as entertainment and travel increases significantly, reflecting heightened attention to quality of life and risk protection after retirement. Wang Zhen et al. [12] discovered gender differences in post-retirement lifestyles: women utilize medical services to a greater extent and exhibit stronger health risk perception, providing evidence for gender differentiation in commercial pension insurance participation.

Regarding the influencing factors of commercial pension insurance participation, existing studies have mostly focused on static variables. Zheng Lu et al. [13] confirmed that traditional family concepts such as "raising children for old-age support" indirectly reduce urban residents' participation rate by weakening financial trust and inhibiting financial literacy. Zhang Qiang et al. [14] found that income, education, and household wealth have significant positive effects on participation behavior. Chen Qifang [15] pointed out that rural residents' awareness of commercial pension insurance and their attitude toward "raising children for old-age support" are key subjective factors.

Synthesizing the existing research findings, the academic community has conducted certain explorations into the influencing factors of commercial pension insurance participation and the economic and financial effects of retirement. However, targeted studies combining the two remain clearly insufficient, mainly manifested in three aspects: First, in terms of research perspective, most studies focus on the impact of static characteristic factors on commercial pension insurance participation, neglecting the shock effect of retirement as a dynamic life event, making it difficult to reveal the intrinsic relationship between retirement and commercial pension insurance participation. Second, in terms of mechanism analysis, the transmission pathways through which retirement affects commercial pension insurance participation have not been systematically and deeply explored. Existing studies sporadically mention the roles of income and risk preference but have not incorporated income level, risk preference, and financial literacy into a unified analytical framework, nor have they systematically tested the mediating effects of these three factors or identified their relative strengths using empirical data. Third, in terms of research methods and samples, there is a lack of precise causal identification and targeted sample selection. Most existing studies employ ordinary regression methods without adequately addressing endogeneity issues, and some fail to focus on groups near the retirement age, resulting in limited relevance and reliability of conclusions and making it difficult to accurately reflect the true impact of retirement on urban residents' participation in commercial pension insurance.

2.2 Research Hypotheses

Retirement influences urban residents' participation in commercial pension insurance through changes in core factors such as income status, risk perception, and financial knowledge reserves, operating at both direct and indirect levels. Drawing on existing theoretical and empirical logic, this paper first proposes the core hypothesis regarding the direct impact of retirement on urban residents' participation in commercial pension insurance, and then puts forward corresponding mediating effect hypotheses centered on the three mechanisms of income level, risk preference, and financial literacy.

2.2.1 Core Hypothesis: The Direct Impact of Retirement on Urban Residents' Participation in Commercial Pension Insurance

Retirement marks the end of most residents' professional careers and directly alters their economic status, pension expectations, and financial decision-making objectives. In terms of participation ability, post-retirement wage income declines significantly. Even with pension income, the overall reduction in disposable income lowers residents' ability to pay for commercial pension insurance. In terms of participation willingness, after retirement, residents' life focus shifts toward the actual realization of pension security, moving from the "accumulation period" to the "consumption period" in pension planning, which reduces their willingness to participate in commercial pension insurance. In terms of institutional substitution, after retirement, residents begin to receive benefits from basic social pension insurance, and some treat it as the primary source of pension security, creating a substitution effect on commercial pension insurance.

Considering the actual situation of urban residents in China, post-retirement commercial pension insurance participation is subject to multiple negative influences from the above factors. Based on this, the paper proposes the core hypothesis:

H1: Retirement significantly reduces the probability of urban residents participating in commercial pension insurance.

2.2.2 Mediating Effect Hypothesis of Income Level

Income level is a core economic factor affecting residents' participation in commercial pension insurance and serves as an important transmission channel for the impact of retirement. On the one hand, there is a direct causal relationship between retirement and residents' income level. Retirement means the termination of wage income, while pension income is typically lower than pre-retirement wage income, leading to a significant decline in overall income level—this is the most direct economic shock of retirement. On the other hand, income level directly determines residents' ability to purchase pension financial products. As a non-essential financial consumption, participation in commercial pension insurance highly depends on disposable income. A decline in income level directly reduces residents' payment capacity, thereby inhibiting participation.

Thus, income level may play a mediating role between retirement and urban residents' participation in commercial pension insurance. That is, retirement indirectly suppresses participation by reducing residents' income level. Based on this, the paper proposes the following hypotheses:

H2.a: Retirement significantly reduces urban residents' income level.

H2.b: Income level plays a mediating role in the impact of retirement on urban residents' participation in commercial pension insurance; that is, retirement inhibits participation by lowering residents' income level.

2.2.3 Mediating Effect Hypothesis of Risk Preference

Risk preference is an important subjective characteristic in residents' financial decision-making and changes significantly across different life stages. It is also a key transmission mechanism through which retirement affects commercial pension insurance participation. On the one hand, retirement significantly alters residents' risk preference. During employment, residents are in the wealth accumulation stage with stable wage income support, resulting in stronger risk-bearing capacity and relatively higher risk preference. After retirement, income sources become more stable but decline overall, wealth accumulation enters a stagnation phase, and the rigid demand for pension security leads residents to focus more on wealth preservation than appreciation. Consequently, risk aversion increases and risk preference decreases significantly. On the other hand, risk preference is positively correlated with commercial pension insurance participation. As a financial product combining security and investment attributes, participation in commercial pension insurance requires a certain level of risk acceptance. Individuals with higher risk preferences are more willing to engage with it, while a decline in risk preference reduces participation willingness.

Therefore, risk preference exerts a mediating effect between retirement and urban residents' participation in commercial pension insurance. That is, retirement indirectly inhibits participation by lowering residents' risk preference. Based on this, the paper proposes the following hypotheses:

H3.a: Retirement significantly reduces urban residents' risk preference.

H3.b: Risk preference plays a mediating role in the impact of retirement on urban residents' participation in commercial pension insurance; that is, retirement inhibits participation by lowering residents' risk preference.

2.2.4 ediating Effect Hypothesis of Financial Literacy

Financial literacy represents important human capital for residents to understand and participate in the pension finance market, and its mechanism between retirement and commercial pension insurance participation is distinctive. On the one hand, after retirement, residents experience a substantial increase in leisure time, allowing them more energy to focus on and learn financial knowledge. At the same time, to better preserve and increase pension wealth, residents actively enhance their financial knowledge reserves. Therefore, retirement may significantly improve urban residents' financial literacy. On the other hand, the level of financial literacy is significantly positively correlated with commercial pension insurance participation. Higher financial literacy helps residents better understand product features, protection value, and operational mechanisms of commercial pension insurance, reducing decision-making costs caused by information asymmetry and thereby increasing participation probability.

Thus, financial literacy plays a special mediating role between retirement and urban residents' participation in commercial pension insurance. That is, retirement indirectly promotes participation by enhancing residents' financial literacy. This mediating effect partially offsets the negative impact of retirement on commercial pension insurance participation, forming a suppression (masking) effect. Based on this, the paper proposes the following hypotheses:

H4.a: Retirement significantly improves urban residents' financial literacy.

H4.b: Financial literacy plays a mediating role in the impact of retirement on urban residents' participation in commercial pension insurance; that is, retirement promotes participation by enhancing residents' financial literacy, thereby partially offsetting the negative impact of retirement.

3. Model Specification

Commercial pension insurance is an important tool for improving the quality of retirement and managing risks. Although commercial pension insurance serves as a significant supplement to China's pension security system, the participation rate in commercial pension insurance in China has remained at a relatively low level for a long time. Jia Nan (2022) pointed out that retirement, as a major exogenous shock, causes significant changes in the composition of household risky assets, with households showing a stronger preference for investing in low-risk financial products. As an important component of low-risk financial products, the impact of retirement on participation in commercial pension insurance can be divided into two aspects: On the one hand, the economic shock caused by retirement may lead to a substantial decline in disposable income, thereby reducing households' participation rate in commercial pension insurance. On the other hand, retirement increases residents' leisure time, which improves their ability to acquire financial knowledge and may stimulate their participation in commercial pension insurance. Therefore, the actual net effect of retirement on the participation rate in commercial pension insurance remains to be empirically tested.

The household decision to participate in commercial pension insurance can be characterized using a discrete choice model. Let busi_insure denote household participation in pension insurance and Retire indicate whether the household head is retired. The impact of retirement on whether a household holds commercial pension insurance can be estimated using Equation (1):

$$busi\_insure_i = \alpha + \beta \cdot retire_i + \gamma \cdot X_i + \varepsilon_i \quad (1)$$

where X_i represents control variables, including household characteristics, individual characteristics, and regional characteristics; ε_i is the error term; β captures the effect of retirement on household participation in commercial pension insurance; and γ denotes the coefficients of the control variables.

In the above model specification, the parameters may suffer from endogeneity bias. Certain unobservable omitted variables may simultaneously affect both retirement behavior and commercial pension insurance participation, such as health status and job characteristics. Traditional OLS regression has difficulty isolating the interference of these factors, making the estimation results prone to bias. At the same time, age is highly correlated with retirement, so direct regression cannot effectively distinguish the age effect from the retirement effect on commercial pension insurance participation.

Drawing on the approach of Jia Nan (2020) and other studies examining the economic effects of retirement, this paper adopts the fuzzy regression discontinuity design (FRDD) as the core research method. Its core logic lies in the fact that China's statutory retirement age policy creates an exogenous policy cutoff, which allows the exogenous shock of retirement behavior to be separated from the continuous effect of age, thereby achieving precise identification of the causal effect of retirement on commercial pension insurance participation. China implements a statutory retirement age system. Relevant policies stipulate that the normal retirement age for men working in government agencies, public institutions, state-owned enterprises, and collective enterprises is 60 years. The retirement ages for female workers and female cadres are 50 and 55 years, respectively. However, some workers and cadres may retire early or delay retirement due to special circumstances. Therefore, the decision of whether to retire is not determined solely by the running variable "age" but is also influenced by other unobservable factors, such as individual health status, position, and job nature. Overall, the probability of retirement for individuals above the statutory retirement age is substantially higher than for those below it. Hence, this constitutes a classic fuzzy regression discontinuity design.

In this study, the running variable is age (Age), the treatment variable is retirement status (Retire), and the outcome variable is participation in commercial pension insurance (Busi_insure). The constant c represents the cutoff value of age. $\text{Retire}_i = 1$ if $\text{Age}_i \geq c$, and $\text{Retire}_i = 0$ if $\text{Age}_i < c$. According to Lee and Lemieux (2010), the local average treatment effect (LATE) of the fuzzy regression discontinuity design can be expressed as Equation (2):

$$\text{LATE} \text{马} E\left[Y_1 - Y_0 \middle| \text{age} = c\right] = \frac{\lim_{\varepsilon \downarrow 0} E\left(busi\_insure \middle| age = c + \varepsilon\right) - \lim_{\varepsilon \uparrow 0} E\left(busi\_insure \middle| age = c - \varepsilon\right)}{\lim_{\varepsilon \downarrow 0} E\left(retire \middle| age = c + \varepsilon\right) - \lim_{\varepsilon \uparrow 0} E\left(retire \middle| age = c - \varepsilon\right)} \tag{2}$$

To estimate the above local average treatment effect, this paper employs local linear regression to fit the samples near the cutoff and constructs the following model:

$$busi\_insure_i = \alpha + \beta_1 age_i^* + \beta_2 D_i + \beta_3 D_i \times age_i^* + \mu_i \tag{3}$$

where busi_insure_i is a binary variable indicating whether individual i participates in commercial pension insurance (1 = participates, 0 = otherwise); age^*_i is the centered age variable; D_i is the age dummy variable, which equals 1 if $\text{age}_i \geq 60$ and 0 otherwise. Its coefficient β_2 reflects the average treatment effect of retirement on commercial pension insurance participation. The interaction term $D_i \times \text{age}^*_i$ controls for the difference in the marginal effects of age on commercial pension insurance participation on either side of the cutoff. μ_i is the random error term.

In actual estimation, weighted local linear regression is applied to the above model, with weights determined by the kernel function $K(\cdot)$. The core idea is to assign higher weights to samples near the cutoff and lower weights to samples farther away. The parameter estimates are obtained by minimizing the weighted sum of squared residuals. The objective function is:

$$\min_{\alpha,\beta_1,\beta_2,\beta_3} \sum_{i=1}^{n} K\left(\frac{age_i^*}{h}\right)\left[busi\_insure_i - \alpha - \beta_1 age_i^* - \beta_2 D_i - \beta_3 D_i \times age_i^*\right]^2 \tag{4}$$

where h is the bandwidth, reflecting the range of samples near the cutoff included in the estimation, and $K\left(\frac{age_i^*}{h}\right)$ is the kernel function used to calculate sample weights.

Following Imbens and Kalyanaraman (2012), this paper uses the IK algorithm to determine the optimal bandwidth. This algorithm achieves optimal bandwidth selection by minimizing the mean squared error

(MSE) of the regression function at the cutoff, effectively balancing estimation bias and variance. The baseline model adopts the triangular kernel function, which is the most widely used in regression discontinuity designs and provides a more reasonable weight distribution for samples near the cutoff. To test the robustness of the results, subsequent estimations will also employ quadratic and uniform kernel functions, and report results under 0.5 times and 2 times the optimal bandwidth.

4. Data, Variables, and Model Specification

4.1 Data Sources and Sample Construction

The core data used in this paper come from the 2019 China Household Finance Survey (CHFS). The survey employs a stratified, three-stage, probability proportional to size (PPS) sampling design, covering 29 provinces (autonomous regions and municipalities) across China. It provides a comprehensive, systematic, and high-quality reflection of Chinese households' assets, liabilities, income, consumption, and demographic characteristics, offering a solid micro-level data foundation for studying household financial behavior.

To precisely identify the causal effect of retirement as an exogenous shock on commercial pension insurance participation, this study applied strict screening and sample construction to the raw data. The specific steps are as follows: First, to align with the research theme and eliminate interference from urban-rural institutional differences, only samples with urban household registration (*hukou*) were retained. Second, to clearly capture the policy cutoff effect at the statutory retirement age of 60 and following common practice in relevant studies, the sample was restricted to male urban residents aged 50–70. This choice is based on two main considerations: (1) the statutory retirement age for urban male employees in China is primarily 60 years, providing a clear and single cutoff point, which avoids the identification complications caused by multiple retirement ages for women (50 for female workers and 55 for female cadres); (2) focusing on individuals near the retirement age allows for more effective control of pure life-cycle age effects, making the identified "jump" more likely to stem from the transition in retirement status rather than natural aging. Third, to eliminate the "age heaping" effect at the cutoff—where individuals exactly aged 60 may be in a transitional retirement period and their financial decisions mix pre- and post-retirement information—this paper excluded samples with an exact age of 60, a treatment consistent with mainstream literature. Fourth, to ensure estimation validity, observations with missing values in key variables were deleted. Finally, to avoid distortion of non-parametric estimation results by extreme values, all continuous variables were winsorized at the 1% and 99% percentiles. After the above rigorous data processing procedures, a balanced sample containing 6,214 valid observations was obtained, providing data support for subsequent fuzzy regression discontinuity analysis.

4.1.1 Variable Definitions and Descriptive Statistics

The variable system of this paper is constructed around the core dependent variable, key treatment variable, mechanism variables, and a series of control variables. Detailed definitions and measurement methods are presented in Table 4-1.

Commercial pension insurance participation (busi_insure): This is the core outcome variable of this study. It is defined based on whether the household owns any commercial pension insurance products according to the CHFS questionnaire. If the household holds any type of commercial pension insurance (including annuity insurance, endowment insurance, or other insurance products with pension savings functions), it is assigned a value of 1; otherwise, 0. This variable directly measures households' market-based pension reserve behavior beyond formal social pension insurance.

Retirement status (retire): This is the core treatment variable. It is defined as a complete transition in work status. Specifically, if the respondent is currently "not working" and the reason is "retired, early retired, or internally retired," the individual is considered retired and assigned a value of 1. If the respondent is currently engaged in any income-generating work (including employed, self-employed, or farming), they are considered not retired and assigned a value of 0. This definition captures the essential feature of retirement as an interruption in labor market participation.

4.1.2 Mechanism Variables

To deeply explore the transmission channels through which retirement affects commercial pension insurance participation, this paper constructs three potential mediating variables:

Income level (wage): Measured by the natural logarithm of the individual's annual wage income. Retirement typically implies a shift from stable labor income to relatively fixed pension income, which is expected to generate a significant negative income shock.

Risk preference (risk): Constructed based on the CHFS survey item regarding investment risk attitudes. Individuals who choose "high risk, high return" or "slightly higher risk, slightly higher return" are defined as risk-preferring and assigned a value of 1. Those who choose "average risk, average return," "slightly lower risk, slightly lower return," or "unwilling to take any risk" are defined as risk-averse and assigned a value of 0. Theoretically, risk-taking willingness is expected to decline after retirement.

Financial literacy (finance): Following the construction method of Yin Zhichao et al. (2014), this variable is generated by summing the number of correct answers to three questions on interest rate calculation, inflation understanding, and investment risk perception. The value ranges from 0 to 3, with higher values indicating richer financial knowledge. Increased leisure time after retirement may promote the learning and accumulation of financial knowledge.

4.1.3 Control Variables

To control for other factors that may influence commercial pension insurance participation, this paper introduces two categories of control variables: individual characteristics and household characteristics. Individual characteristic variables include years of education (edu) (converted from highest educational attainment), marital status (marriage) (married = 1, unmarried = 0), and self-assessed health status (health) (1–5 scale, higher values indicate better health). Household characteristic variables include family size (familysize), annual household income (income) (natural logarithm), total household assets (asset) (natural logarithm), and homeownership (house) (owns = 1, otherwise = 0). These variables control for households' resource constraints, wealth levels, and basic security conditions.

Table 1: Variable Definitions

Variable Type	Variable Name	Symbol	Variable Definition
Core Variables	Commercial pension insurance participation	busi_insure	1 if participates in commercial pension insurance, 0 otherwise
	Retirement status	retire	1 if not working and retired/early retired, 0 otherwise
	Age	age	Continuous variable
Mechanism Variables	Income level	wage	Natural log of wage income
	Risk preference	risk	1 if prefers high or slightly higher risk, 0 otherwise
	Financial literacy	finance	1–5 scale, higher values indicate greater financial knowledge
Individual Controls	Years of education	edu	Converted from education level: 0 (no schooling), 6 (primary), 9 (junior high), 12 (senior high), 13 (technical secondary), 15 (junior college), 16 (bachelor), 19 (master), 22 (PhD)
	Marital status	marriage	1 if married, 0 if unmarried, divorced, or widowed
	Health status	health	1–5 scale, higher values indicate better health
Household Controls	Family size	familysize	Total number of family members
	Household income	income	Natural log of annual household income
	Household assets	asset	Natural log of total household assets
	Homeownership	house	1 if owns home, 0 otherwise

*Note: Full sample N=6,214; left-side sample: ages 50–59; right-side sample: ages 61–70. **

Table 2 presents the descriptive statistics, which preliminarily reveal the sample characteristics and differences on either side of the cutoff. First, the retirement rate exhibits the expected sharp jump at the cutoff, surging from 4.1% on the left side to 65.5% on the right side. This provides evidence of the strong enforcement of China's statutory retirement age policy and serves as a key prerequisite for the validity of the subsequent fuzzy regression discontinuity design. Second, the overall participation rate in commercial pension insurance is 7.5%, indicating that, as a market-based pension tool, its penetration among urban households still needs improvement. More importantly, the participation rate is 10.5% on the left side of the

age-60 cutoff (ages 50–59, predominantly working) and drops sharply to 3.0% on the right side (ages 61–70, predominantly retired), intuitively showing a significant downward trend. The mean values of other control variables are generally similar on both sides of the cutoff, preliminarily satisfying the "local randomization" assumption of regression discontinuity design. However, strict validation through subsequent continuity tests is still required.

Table 2: Descriptive Statistics

Variable Name	Symbol	Full Sample	Left Side (50–59)		Right Side (61–70)	
		Mean	Mean	SD	Mean	SD
Commercial pension insurance participation	busi_insure	0.075	0.105	0.307	0.03	0.17
Retirement status	retire	0.288	0.041	0.199	0.655	0.476
Age	age	58.715	54.356	2.781	65.205	2.817
Years of education	edu	10.028	10.084	3.23	9.944	3.58
Marital status	marriage	0.937	0.939	0.24	0.934	0.249
Health status	health	3.277	3.334	0.974	3.192	0.962
Family size	familysize	2.732	2.882	1.038	2.507	0.984
Household income	income	10.687	10.583	2.275	10.843	1.585
Household assets	asset	13.273	13.242	1.483	13.32	1.555
Homeownership	house	0.915	0.92	0.272	0.908	0.289

5. Empirical Results and Analysis

5.1 Baseline Regression Results: The Causal Effect of Retirement on Commercial Pension Insurance Participation

Table 3 reports the local average treatment effect (LATE) of retirement on commercial pension insurance participation estimated using the fuzzy regression discontinuity design. We successively present the estimation results under 0.5 times the optimal bandwidth, the optimal bandwidth (IK bandwidth), and 2 times the optimal bandwidth to examine the robustness of the conclusions across different bandwidth selections.

Table 3: The Impact of Retirement on Commercial Pension Insurance Participation: Baseline Regression Results

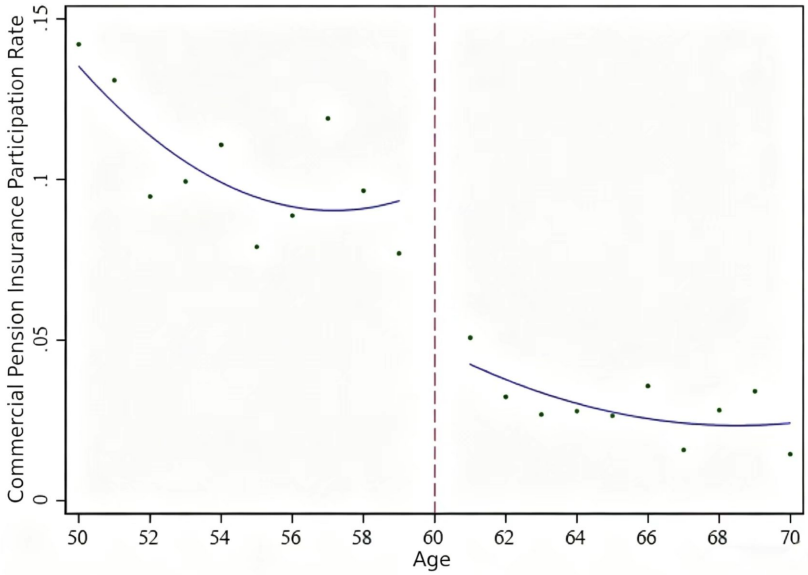
	(1)	(2)	(3)
	0.5× Bandwidth	Optimal Bandwidth	2× Bandwidth
Retirement Shock	-0.052	-0.121***	-0.099***
	(0.081)	(0.045)	(0.036)
Covariates	No	No	No

*Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Estimations use the triangular kernel function without additional covariates.*

Although the negative impact of retirement on the participation rate is not statistically significant under 0.5 times the optimal bandwidth, under both the optimal bandwidth and 2 times the optimal bandwidth, the estimated coefficients on the retirement variable are significantly negative at the 1% statistical level. Specifically, under the optimal bandwidth, retirement leads to an average significant decline of 12.1 percentage points in the probability of urban male residents participating in commercial pension insurance. Given that the overall participation rate in commercial pension insurance in the sample is only 7.5%, this magnitude of decline is economically substantial, implying that the retirement shock reduces the participation probability by more than 160% in relative terms. The insignificance of the coefficient under 0.5 times the optimal bandwidth is typically due to the sharp reduction in sample size caused by the excessively narrow bandwidth, which increases estimation variance—a common phenomenon in regression discontinuity analysis and does not undermine the core conclusions drawn from the optimal bandwidth.

Figure 1 provides a more intuitive illustration of this causal effect. The horizontal axis represents age centered at 60 years, and the vertical axis represents the local mean of the commercial pension insurance participation rate. It is clearly visible that on the right side of the cutoff (at 0), the fitted curve exhibits a distinct downward jump. This visual "discontinuity" precisely reflects the local average treatment effect induced by the exogenous shock of retirement, corroborating the numerical results in Table 3.

Figure 1: Relationship Between Age and Commercial Pension Insurance Participation

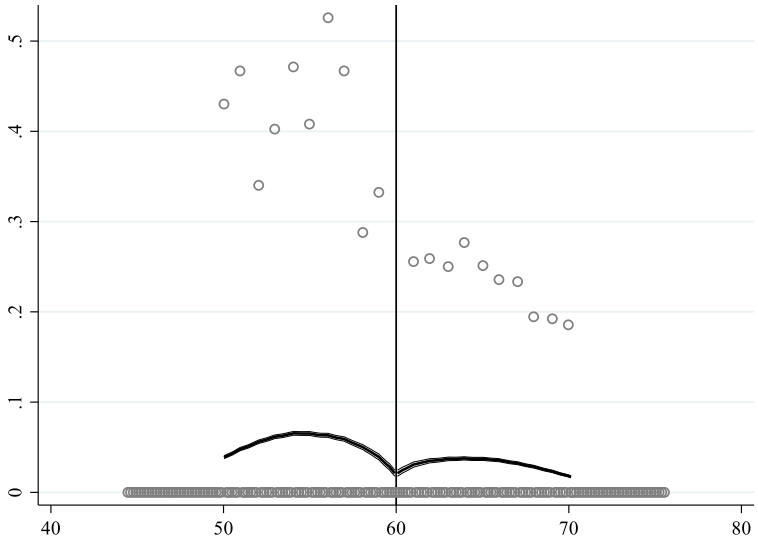


5.2 Robustness Tests

To ensure the reliability of the baseline regression results, we conduct a systematic and rigorous set of robustness tests.

The primary prerequisite for the validity of a regression discontinuity design is the absence of manipulation of the running variable (age) near the cutoff. If individuals could precisely choose to retire around age 60, it would undermine the "local randomness" near the cutoff. We plot the density distribution of sample age centered at 60 (Figure 2). The results show that the density function curve is smooth and continuous at the cutoff, with no obvious bunching or dips. Further, the McCrary test statistic is 0.044 with a standard error of 0.122, failing to reject the null hypothesis that the density function is continuous at the cutoff. This indicates that there is no systematic manipulation of birth timing or retirement timing by individuals in the sample to obtain retirement benefits. The distribution of the running variable is exogenous, satisfying the identification assumptions.

Figure 2: Changes in the Density Distribution of Sample Age Before and After the Cutoff



5.3 Sensitivity Analysis with Different Kernel Functions and Bandwidths

We test the robustness of the results by changing the kernel function specification in the estimation. As shown in Table 4, after replacing the baseline triangular kernel with quadratic and uniform kernels, the estimated coefficients on retirement remain significantly negative at the 1% level under both the optimal bandwidth and 2 times the optimal bandwidth, with magnitudes highly consistent with the baseline results. This indicates that our core finding—that retirement significantly reduces commercial pension insurance participation—does not depend on the choice of a specific kernel function, demonstrating high robustness of the conclusion.

Table 4: Robustness Tests with Alternative Kernel Functions

	Quadratic Kernel Function			Uniform Kernel Function		
	0.5× BW	Optimal BW	2× BW	0.5× BW	Optimal BW	2× BW
Retirement Shock	-0.064	-0.124***	-0.096***	-0.149**	-0.093***	-0.093***
	(0.078)	(0.043)	(0.035)	(0.067)	(0.034)	(0.034)
Covariates	No	No	No	No	No	No

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

5.4 Continuity Tests of Covariates and Conditional Independence

This paper conducts a systematic and rigorous test of the smoothness of all selected control variables at the cutoff by using each covariate as the outcome variable in a regression discontinuity estimation and observing the coefficient at the cutoff. According to theoretical logic, if the treatment and control groups are comparable in other characteristics at the cutoff, all coefficients should be insignificant. As clearly shown in Table 5, the coefficients on marital status, health status, family size, household assets, and homeownership are all insignificant. In clear contrast, years of education (edu) and household total income (income) both exhibit highly significant jumps at the cutoff. A reasonable explanation naturally follows: there may exist some selection in the sample, such that individuals with higher education levels and higher household income are more likely to choose early or delayed retirement, leading to systematic differences in these two variables on either side of the policy cutoff.

Table 5: Continuity Tests of Covariates at the Cutoff

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	edu	marriage	health	familysize	income	asset	house
Retirement Shock	0.422**	-0.013	0.032	-0.045	0.296**	0.046	-0.019
	(0.203)	(0.016)	(0.064)	(0.065)	(0.117)	(0.096)	(0.018)

*Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

To ensure that the estimation results are not contaminated by variables that violate the continuity assumption, in subsequent regressions that include covariates, we exclude `edu` and `income` and retain only the other smooth covariates.

5.5 Regression Results with Smooth Covariates Included

Since this paper first controls for various smooth covariates near the cutoff (marital status, health, family size, household assets, and homeownership), we re-estimate the model accordingly. The results are presented in Table 6. They are highly consistent with the baseline results: whether under the optimal bandwidth or 2 times the optimal bandwidth, the negative effect of retirement remains highly significant. Therefore, we can naturally and appropriately conclude that retirement has a clear inhibitory effect on commercial pension insurance participation.

Table 6: Regression Results with Covariates Included

	(1)	(2)	(3)
	0.5× BW	Optimal BW	2× BW
Retirement Shock	-0.045	-0.127***	-0.110***
	(0.082)	(0.046)	(0.036)
Covariates	Yes	Yes	Yes

*Note: Control variables include marital status, health, family size, household assets, and homeownership. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

5.6 Placebo Tests

To demonstrate that the significance of the baseline results is not due to chance or specific model specifications, we conduct placebo tests. Specifically, we construct two fictitious cutoffs where no retirement policy shock should exist—age 55 and age 65—and repeat the baseline model estimation at these hypothetical cutoffs. The results in Table 7 show that, whether using age 55 or 65 as the fictitious cutoff, the estimated coefficients on "retirement" become insignificant across all bandwidth settings, and their magnitudes change dramatically compared with the baseline results (even turning positive in some cases). This strongly confirms that the significant effect observed at the true age-60 cutoff is indeed caused by the statutory retirement policy shock at age 60, rather than being a spurious result driven by the data or model.

Table 7: Placebo Tests: Changing the Cutoff Position

	Age 55 as Cutoff			Age 65 as Cutoff		
	0.5× BW	Optimal BW	2× BW	0.5× BW	Optimal BW	2× BW
Retirement Shock	2.142	-0.129	-0.242	0.339	-0.272	0.161
	(3.657)	(0.307)	(0.519)	(0.910)	(0.183)	(0.225)
Covariates	No	No	No	No	No	No

Note: Robust standard errors are in parentheses. All estimated coefficients are insignificant.

5.7 Preliminary Discussion of Heterogeneity Analysis

Although the local average treatment effect identified by the fuzzy regression discontinuity design has excellent internal validity, a full and rigorous examination of the complexity of retirement's impact naturally requires heterogeneity analysis of the results (note that strict subsample regression discontinuity designs impose high requirements on sample size; thus, this section serves as an extended discussion). From a theoretical perspective, there are clear and logically supported conjectures: the impact of the retirement shock is likely a function of heterogeneity in household financial literacy and initial wealth levels. Specifically, households with richer financial knowledge are more aware of the importance of long-term pension planning and are therefore less affected by short-term income shocks in their insurance decisions. Meanwhile, households with greater assets have stronger capacity to withstand the decline in retirement income, resulting in more stable participation rates in commercial pension insurance. Therefore, subsequent research should systematically examine these heterogeneity channels using grouped regressions or by introducing interaction terms.

6. Mechanism Tests

The baseline regression has confirmed the significant inhibitory effect of retirement on commercial pension insurance participation. The question then arises: through which specific channels does this effect operate? This section examines the mechanisms through three pathways: income shock, change in risk preference, and change in financial literacy. Following the fuzzy regression discontinuity framework, we estimate each of the three mechanism variables as the outcome variable.

Mechanism 1: Negative Income Shock from Retirement

The most direct and fundamental economic consequence of retirement is a sharp change in income sources and levels. Individuals shift from relying on labor wages to depending on pensions, usually accompanied by a sudden drop in disposable income. This negative income shock may suppress the demand for commercial pension insurance in two ways: first, the "budget constraint effect," whereby the household's cash flow available for insurance premiums decreases; second, the "priority reallocation effect," whereby, after income declines, households prioritize limited resources for basic living consumption, thereby crowding out investment in long-term pension savings.

The results in Table 8 provide clear and strong evidence for the discussed mechanism. When the natural logarithm of individual wage income is used as the dependent variable, retirement yields statistically highly significant negative coefficients under 0.5 times, the optimal, and 2 times the optimal bandwidth. Specifically, under the optimal bandwidth, retirement reduces individual wage income by an average of 7.3 log units, meaning actual income declines by approximately 98%. Therefore, the post-retirement income

reality naturally becomes the fundamental constraint causing retired households to cut spending on non-essential, long-term financial products.

Table 8: Mechanism Test: The Impact of Retirement on Income Level

	(1)	(2)	(3)
	0.5× BW	Optimal BW	2× BW
Retirement Shock	-7.920***	-7.322***	-7.074***
	(1.476)	(0.789)	(0.621)
Covariates	No	No	No

Mechanism 2: Decline in Risk Preference Induced by Retirement

Life-cycle theory offers a clear and logically rigorous view: as individuals age and income sources become more fixed, risk aversion naturally increases. Retirement, as the endpoint of one's career, both fixes future income streams and substantially alters individuals' perceptions of future uncertainty. Consequently, financial decisions after retirement generally become more conservative. In line with this, although commercial pension insurance is relatively stable, it is undeniably still a financial contract with evident risks (such as insurer operational risk and inflation risk) and relatively low liquidity. Therefore, when risk preference declines, households' willingness to hold such assets correspondingly decreases.

The results in Table 9 rigorously confirm the existence of this mechanism: retirement has a statistically highly significant negative impact on the risk preference indicator. Under the optimal bandwidth, retirement reduces the probability of individuals exhibiting risk-preferring behavior by 9.0 percentage points. It can thus be naturally and appropriately concluded that individuals indeed become more risk-averse after retirement. This also naturally leads to changes in asset allocation: a greater willingness to hold risk-free or low-risk assets such as cash and bank deposits, while reducing allocation to higher-uncertainty financial assets such as commercial pension insurance.

Table 9: Mechanism Test: The Impact of Retirement on Risk Preference

	(1)	(2)	(3)
	0.5× BW	Optimal BW	2× BW
Retirement Shock	-0.136***	-0.090***	-0.075***
	(0.051)	(0.027)	(0.022)
Covariates	No	No	No

Mechanism 3: Changes in Financial Literacy Accompanying Retirement

From the current mechanism tests, an interesting yet somewhat contradictory phenomenon emerges quite naturally: Table 10 clearly shows that retirement has a distinct positive effect on financial literacy. Under the optimal bandwidth, retirement increases individuals' financial literacy score by an average of 0.86 points (out of a full score of 3). This paper offers the following explanation: the "leisure substitution effect." After retirement, individuals are freed from busy work and have more leisure time to pay attention to financial information and learn financial knowledge, which is also conducive to managing their savings and pensions.

However, the impact of this mechanism has two clearly logical sides. In theory, higher financial literacy helps individuals understand the importance of pension planning and the functions of insurance products, which should facilitate participation. Yet, when combined with the first two mechanisms, it can be naturally and appropriately observed that the "promoting effect" of increased financial literacy is actually completely overwhelmed by the more prominent and direct negative effects of income constraints and risk aversion. Therefore, for newly retired groups, the immediate financial realities and psychological adjustments remain the primary factors dominating their decisions. Even if they objectively possess more financial knowledge, it is extremely difficult for them to translate it into actual long-term pension investment actions. In other words, this reflects the typical "knowing is easy, doing is difficult" problem regarding financial literacy among China's retired population. It also suggests that existing commercial pension insurance products have not yet adequately met the specific expectations of post-retirement groups regarding liquidity, security, and returns.

Synthesizing the tests of the above three mechanisms, we can outline a clear pathway diagram of how retirement influences commercial pension insurance decisions. As an exogenous shock, retirement first directly generates a severe negative income shock, tightening household budget constraints. Second, it induces a systematic decline in risk preference, altering households' psychological thresholds for asset

allocation. These two factors form a powerful combined force that suppresses demand. Although retirement may incidentally produce a modest increase in financial literacy through increased leisure time, this positive effect is completely offset under the dominance of the dual negative effects of income and risk. Ultimately, the net effect manifests as a substantial decline in the probability of commercial pension insurance participation.

Table 10: Mechanism Test: The Impact of Retirement on Financial Literacy

	(1)	(2)	(3)
	0.5× BW	Optimal BW	2× BW
Retirement Shock	0.862***	0.859***	0.898***
	(0.311)	(0.170)	(0.136)
Covariates	No	No	No

7. Conclusion

Based on data from the 2019 China Household Finance Survey and employing a fuzzy regression discontinuity design, this paper precisely identifies the causal effect of retirement on commercial pension insurance participation among urban male residents aged 50–70 and examines the roles of three mediating mechanisms: income level, risk preference, and financial literacy. The core conclusion is that retirement exerts a significant negative impact on urban residents' participation in commercial pension insurance. Under the optimal bandwidth, retirement reduces the participation probability of urban male residents by a significant 12.1 percentage points. This result remains robust after various robustness checks.

From the mechanism perspective, the impact of retirement on commercial pension insurance participation can be analyzed clearly and hierarchically: retirement leads to a sharp decline in wage income and a marked reduction in risk preference levels. Thus, retirement itself constitutes the dual core driving force inhibiting commercial pension insurance participation. Although the increased leisure time brought by retirement raises residents' financial literacy levels and theoretically has a potential promoting effect on participation, this positive effect is completely offset by the dual negative effects of income constraints and risk aversion. The final outcome is still a decline in participation probability. Therefore, this paper breaks through the static analytical framework of influencing factors on commercial pension insurance participation in existing literature. By adopting a quasi-natural experimental method, it properly addresses endogeneity issues, clarifies the intrinsic logic between retirement and participation behavior, and provides highly valuable empirical insights for the construction of the third pillar of the pension system.

This study has certain limitations: since the sample is restricted to urban males aged 50–70, it does not include females, rural residents, or different occupational groups; thus, the generalizability of the conclusions is somewhat limited. Additionally, because cross-sectional data are used, the study can only estimate the short-term impact of retirement and cannot directly examine its dynamic effects. Moreover, the measurement of commercial pension insurance participation is limited to whether or not one participates and does not consider deeper participation indicators such as premium expenditure or product types. Future research should expand the sample scope, adopt panel data, and improve the measurement dimensions.

Based on the research conclusions, the following targeted policy recommendations are proposed to increase the participation rate of retired groups in commercial pension insurance and improve the multi-pillar pension security system: First, implement differentiated policy incentives for retired groups, optimize measures such as tax-deferred pension insurance and premium subsidies to alleviate their income constraints. Second, innovate commercial pension insurance products tailored to the low-risk preferences of retired groups, focusing on developing low-risk, stable-return, and liquidity-matched products to lower participation thresholds. Third, leverage the foundation of improved financial literacy among retired groups to carry out targeted pension financial education, address the "knowing is easy, doing is difficult" problem, and promote the transformation of financial knowledge into actual participation behavior. Fourth, provide early pension planning education for working groups to guide them to participate during the wealth accumulation stage and avoid the income and psychological shocks after retirement.

In summary, retirement is the most direct and significant exogenous shock affecting urban residents' pension-related financial decisions and can also be regarded as the core factor constraining the development of the third pillar of pension insurance. Therefore, in the context of deepening population aging, to activate

the commercial pension insurance market, it is essential first to clarify the financial characteristics, psychological preferences, and pension needs of retired groups. Only by addressing the practical constraints on retired groups' participation through policy incentives, product innovation, and financial education can commercial pension insurance form genuine synergies with basic social pension insurance and enterprise annuities, thereby systematically and solidly building China's multi-pillar pension security system.

References

[1] Dong, K. Y., & Zhang, D. (2017). China's pension finance: Practical dilemmas, international experiences, and response strategies. *Administrative Management Reform*, (08), 16-21. https://doi.org/10.14150/j.cnki.1674-7453.2017.08.004.

[2] Ba, S. S., & Huang, K. H. (2025). Evaluation of Chinese residents' retirement preparation and the impact of delayed retirement. *Population and Economics*, (01), 1-19.

[3] Li, D., Ding, J. S., & Ma, S. (2019). The impact of social interaction on household commercial insurance participation: An empirical analysis based on data from the China Household Finance Survey (CHFS). *Journal of Financial Research*, (07), 96-114.

[4] Fan, G. Z., & Wang, H. Y. (2015). Family demographic structure and household demand for commercial life insurance: An empirical study based on data from the China Household Finance Survey (CHFS). *Journal of Financial Research*, (07),170-189.

[5] Shah G. G. ,Flaherty C. M. (2013). Incorporating employee heterogeneity into default rules for retirement plan selection. *The Journal of Human Resources*, 48(1), 198-235.

[6] Lin, Z., Lai, C., & Li, R. (2025). Optimal consumption and portfolio selection for retirees under inflation and pension default risk. *North American Journal of Economics and Finance*, 79102446-102446. DOI:10.1016/J.NAJEF.2025.102446.

[7] Wang, L., & Jia, B. (2025). Equilibrium investment strategies for a defined contribution pension plan with random risk aversion. *Insurance: Mathematics and Economics*, 125103140-103140. DOI:10.1016/J.INSMATHECO.2025.103140.

[8] Li, W., & Wei, P. (2024). Optimal defined-contribution pension management with financial and mortality risks. *ASTIN Bulletin: The Journal of the IAA*, 54(3), 621-658.

[9] Jia, N. (2020). The impact of retirement on urban household financial asset allocation in the context of aging: Evidence from a fuzzy regression discontinuity design. *Statistical Research*, 37(04), 46-58. https://doi.org/10.19343/j.cnki.11-1302/c.2020.04.004.

[10] Feng, J., & Han, X. (2017). The impact of retirement age policy on family caregiving and labor force participation. *The World Economy*, 40(06), 145-166. https://doi.org/10.19985/j.cnki.cassjwe.2017.06.008.

[11] Zhao, X. D., & Wang, H. (2018). The impact of retirement on household consumption: Evidence from a fuzzy regression discontinuity design. *Wuhan University Journal (Philosophy & Social Sciences)*, 71 (01), 167-174. https://doi.org/10.14086/j.cnki.wujss.2018.01.015.

[12] Wang, Z., & Zeng, Z. (2022). The impact of retirement on the utilization of medical and health services: An empirical study based on regression discontinuity. *Modern Preventive Medicine*, 49(16), 2992-2997. https://doi.org/10.20043/j.cnki.MPM.202202325.

[13] Zheng, L., & Xu, M. X. (2021). Do traditional family values inhibit urban residents' participation in commercial pension insurance? An empirical analysis from the perspectives of financial trust and financial literacy. *Journal of Financial Research*, (06), 133-151.

[14] Zhang, Q., & Yang, Y. (2017). Analysis of influencing factors on participation in commercial pension insurance. *Journal of Huazhong Agricultural University (Social Sciences Edition)*, (05), 138-143+150. https://doi.org/10.13300/j.cnki.hnwkxb.2017.05.018.

[15] Chen, Q. F. (2016). Analysis of influencing factors on rural residents' willingness to purchase commercial pension insurance. *Theory and Practice of Finance and Economics*, 37(01), 59-63+109. https://doi.org/10.16339/j.cnki.hdxbcjb.2016.01.009.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

Copyrights