Journal of Economics and Management Sciences; Vol. 8, No. 4; 2025
ISSN 2576-3008 E-ISSN 2576-3016
https://doi.org/10.30560/jems.v8n4p28

The Impact of Population Aging on the Revenue-Expenditure Equilibrium of China's Basic Urban-Rural Residents' Pension Insurance Fund

Xinwei Shan[1]

[1] School of Economics, Hunan Agricultural University, China

Correspondence: Xinwei Shan, No.1 Nongda Road, Furong District, Changsha City, Hunan Province, China. Tel: 86-184-7347-0139. E-mail: 2499096525@qq.com

Received: July 10, 2025; Accepted: July 22, 2025; Published: July 23, 2025

Abstract

This article utilizes provincial-level data from 31 provinces in China spanning 2013 to 2023, sourced from the EPS Data Platform, to construct a fixed-effects model investigating the impact of population aging on the revenue and expenditure status of basic urban and rural residents' pension insurance funds. The results demonstrate a statistically significant negative effect at the 1% level, indicating that population aging exerts a suppressive influence on the fiscal balance of these pension funds. Robustness of the findings was confirmed through several tests: employing explanatory variables lagged by one period, winsorizing both the dependent and key independent variables, and incorporating additional control variables. Finally, regional heterogeneity analysis across eastern, central, and western China revealed that the pension fund balance in the eastern region is more sensitive to changes in population aging, whereas in the central and western regions, the fund balance ratio is more susceptible to the influence of government subsidies than to aging.

Keywords: population aging, Basic Old-Age Insurance System for Urban and Rural Residents, fund balance

1. Introduction

The Report to the 20th National Congress of the Communist Party of China emphasizes the implementation of a national strategy to actively address population aging, the development of elderly care services and industries,the optimization of services for solitary seniors, and the advancement of universal access to basic elderly care services. As the world's second most populous nation and a developing country, demographic issues remain fundamental to China's national welfare, development, and long-term strategic future. According to United Nations reports, the proportion of the population aged 65 and above serves as a key indicator of societal aging: exceeding 7% signifies entry into an aging society;surpassing 14% indicates a severely aging society;and exceeding 20% denotes a super-aged society(Wu Xinkun et al.2024). Data from the China Statistical Yearbook 2024 reveals that China entered an aging society in 2000. Between 2000 and 2023, the population aged 65 and above grew from 88 million to 217 million, increasing from 7% to 15.4% of the total population. Having surpassed the 14% threshold, China has now entered a severely aging society.

While pension insurance serves as one policy approach to address population aging, the specific impacts of aging on the basic urban-rural residents' medical insurance system primarily manifest in three dimensions:Structural shifts in the insured population,Escalating medical expenditures, and Heightened uncertainty in fund revenue growth. First, the increasing proportion of elderly beneficiaries will continuously drive up the financial outlays of the urban-rural medical insurance fund. However, growth in the number of insured individuals and the contribution base may be insufficient to offset the resulting fiscal pressure on the pooled medical fund.Second, as the elderly population expands, the proportion of high-risk individuals within the insured pool rises correspondingly, directly increasing medical insurance fund expenditures.Critically, age-related physiological decline makes the elderly more prone to incurring medical costs across outpatient care, hospitalization, pharmaceuticals, and rehabilitation. Even assuming constant medical service prices, population aging alone could drive an annual growth rate of up to 1.54% in medical cost burdens. Concurrently, retirement and reduced income among the elderly may depress contribution levels while increasing expenditure demands. This dual pressure severely undermines the financial sustainability of the basic urban-rural medical insurance system.Without sustained increases in fiscal subsidies, the pooled fund faces significant deficit risks. In economically underdeveloped regions, the aging structure of the insured population has already triggered substantial medical cost growth, causing situations where fund

expenditures exceed revenues.Therefore, research on the impact of China's population aging on the revenue-expenditure equilibrium of basic social insurance funds holds critical significance for enhancing elderly welfare and promoting sustainable economic development.

2. Literature Review

Chinese scholarship on population aging primarily examines its effects through changes in the behaviors of economic agents-including individuals, households, and firms-conducting both theoretical and empirical analyses of transmission mechanisms and outcomes.Regarding individuals,Yuan Zhigang & Song Zheng (2000) empirically demonstrated that population aging generally incentivizes increased household savings.However,subsequent studies employing Overlapping Generations OLG models found that intensifying aging and a rising elderly dependency ratio reduce the national savings rate, adversely impacting economic development.For households, Zang Xuheng & Zhou Bowen (2024) indicate that population aging significantly elevates households'risk of financial vulnerability. Key mechanisms include reduced labor force participation and household income, increased healthcare expenditures, and constrained human capital investment. Li Xinya & Chu Erming (2025) reveal that a higher proportion of elderly members negatively affects household consumption in both short and long terms, with stronger adverse effects over the long run. While household debt expansion exhibits a short-term wealth effect that boosts current consumption, this effect diminishes over time.Regional population aging affects corporate asset allocation decisions by impacting expectations and operating environments through three channels:Capital supply,Operational risk and Resource allocation(Wang Sheng & Liu Lanxin,2024).Deepening aging also accelerates digital transformation among local listed companies. The greater the perceived labor cost pressure, the stronger a firm's digital transformation capability-amplifying aging's catalysing effect on corporate digitalization(Xu Hanwen & Shen Yongjian, 2025)

Academic research directly examining the relationship between population aging and the revenue-expenditure balance of China's basic urban-rural residents' pension insurance fund remains limited. Some scholars have indirectly demonstrated their association.Zhang Xiaoying & Huang Yulin (2011) employed cointegration analysis to investigate population aging's impact on pension system solvency. Their findings indicate that intensified aging continuously increases pension fund expenditures, posing substantial long-term payment risks. Specifically, every 1% increase in the population aged 65+ correlates with a 0.87% rise in pension fund outlays-suggesting accelerating aging trends may exceed the system's fiscal capacity. Li Xiaolin et al. (2020) further revealed, through mediating effect models and Panel Smooth Transition Regression models, that population aging exacerbates pension payment pressure by reducing urban labor supply and constraining industrial restructuring. However, they note that urbanization moderates this negative effect on payment capacity.

He Ruil & Guo Haiyu (2022) applied Random Forest modeling to project the financial trajectory of the urban employee pension fund,their analysis warns that the fund's accumulated balance may turn negative by 2029, with population aging identified as the primary driver of fiscal imbalance and diminished payment capacity.

3. Theoretical Analysis and Research Hypotheses

3.1 Theoretical Basis

Maslow's hierarchy of needs theory points out that life is like building a five-story pyramid: the bottom layer is the need for survival: you must first have to eat, dress, and have a place to live (physiological needs); the second level is safety needs: stable work, savings, and good health; the third level is social needs: the need for friends, lovers, and a sense of belonging; the fourth level is to respect needs: hope to be looked up to and have a sense of accomplishment; At the top is self-realization: pursuing ideals, realizing potential, and doing what you want. When income can meet people's basic living expenses, people will have higher requirements for safety. The safety needs here refer to avoiding unemployment risks, disease risks, accident risks, pension risks, etc. Pension insurance can ensure that people still have basic living security after losing their ability to work. In other words, the higher people's income level, the higher the demand for pension insurance. People with poor health tend to be more inclined to buy pension insurance because they have stronger expectations and concerns about future medical and pension expenses. Patients with chronic diseases may be unable to afford pension insurance costs due to pressure on medical expenses, or patients with serious illnesses may be forced to stop paying due to interrupted income. Health conditions affect the number of years of receipt, the better the health may be the longer the pension may be received, and some products have requirements for health conditions, and illness may affect claims.

The life cycle hypothesis theory believes that rational consumers will plan their income and assets throughout their lives, and achieve a dynamic balance between long-term consumption and income through cross-period optimal allocation. Individuals will form a "wealth accumulation period" in the employment stage: labor income exceeds consumption expenditure, and a reserve pool is established through asset allocation to provide economic security

for future pensions. After entering the retirement stage, the income level declines but the consumption stickiness continues, and the expenditure will exceed the current income. Therefore, people buy pension insurance in their youth and can earn more income in their old age. As a person gets older, the stronger the willingness to buy pension insurance, but the older he gets, the higher the premium to pay, which in turn will affect people's willingness to buy pension insurance.

Our country's urban employee pension insurance adopts compulsory participation, and the payment standard is linked to the wage level, while the rural residents' pension insurance implements the principle of voluntary participation, with fixed payment levels and limited choices. This institutional difference directly leads to the gap in the insurance rate and protection level of urban and rural residents. Then, economic conditions constitute an important constraint. The per capita disposable income of urban residents is 2.45 times that of rural residents, and the income gap directly affects the ability to pay. At the same time, urban employees mostly withhold and pay through the unit, which is more convenient to participate in insurance; Rural residents need to go through the insurance procedures independently, and the continuity of payment is difficult to guarantee. Finally, there are significant differences in the concept of pension. Urban residents are more receptive to the socialized pension model, while the traditional concept of family pension is still prevalent in rural areas. This difference in perception affects the enthusiasm for insurance.

3.2 Research Hypotheses

1. The direct impact of population aging on the balance of income and expenditure of the basic pension insurance fund for urban and rural residents

Population aging manifests as an increasing share of elderly (≥65 years) and declining proportion of working-age population (15-64 years). Since contributions to the Urban-Rural Residents Pension Insurance (URRPI) primarily derive from the working-age cohort, decelerating or negative growth in contributors directly constrains fund revenue expansion. With contribution brackets typically ranging from 100 to 3,000 CNY annually, intensified sandwich-generation burdens under aging may further diminish contribution capacity, exacerbating fund revenue stagnation. Aging directly increases beneficiary numbers, triggering linear growth in pension expenditures as more retirees enter the benefit phase. Concurrently, rising life expectancy (e.g., from 72 to 78 years) extends benefit duration from 10 to ≥15 years, substantially inflating cumulative payouts. The system dependency ratio-contributors per beneficiary-serves as a critical sustainability metric. For instance, a region shifting from 5:1 to ≤2:1 contributors-to-beneficiary ratios indicates heightened per-capita burden and elevates fund imbalance risks.

Based on these mechanisms, we posit:

H1: Population aging exerts a statistically significant inhibitory effect on the revenue-expenditure ratio of China's basic urban-rural residents' pension insurance fund.

2. The heterogeneous impact of population aging on the balance of income and expenditure of the basic pension insurance fund for urban and rural residents

Significant disparities in economic development, demographic structures, and fiscal capacity across Chinese regions generate pronounced heterogeneity in aging's impact on the revenue-expenditure balance of the Urban-Rural Residents Pension Insurance (URRPI). This study adopts a tripartite regional analysis eastern, central, and western China to examine differential effects and underlying mechanisms.Eastern coastal provinces (e.g., Shanghai, Jiangsu, Zhejiang) exhibit elderly (≥65) population shares exceeding 15%, qualifying as super-aged societies. With robust fiscal capacities, these regions implement frequent pension adjustments with higher magnitudes, elevating expenditures (e.g., average monthly benefits reach 5,000-6,000 CNY in Beijing/Shanghai). Conversely, central/western regions with constrained fiscal capabilities (e.g., Henan/Jiangxi providing basic pensions of 100-120 CNY/month) demonstrate limited expenditure growth. Fund revenues are further depressed by labor out-migration reducing local contributors. Consequently, aging exerts substantially stronger fiscal pressure on eastern versus central/western pension systems.

Based on these mechanisms, we posit:

H2: The inhibitory effect of population aging on the URRPI revenue-expenditure ratio is statistically stronger in eastern China than in central/western regions.

4. Research Design

4.1 Sample Selection and Data Sources

This study utilizes provincial-level panel data spanning 2013–2023 for all 31 provincial administrative regions in China, sourced exclusively from the EPS Data Platform. All indicators including pension fund

revenues/expenditures, insured population statistics, and aging metrics (e.g., population share aged ≥65) constitute primary data officially compiled by the National Bureau of Statistics, Ministry of Human Resources and Social Security, and Ministry of Finance. Critically, the EPS platform provides longitudinal data extending back to 2000, enabling robust analysis of aging's long-term effects and ensuring close alignment with this study's research objectives.

4.2 Variable Selection

4.2.1 Dependent Variable

The dependent variable is the fund income and expenditure ratio (FIER), which is the fund income divided by the fund expenditure. When FIER is greater than 1, it means that there is a balance in the pension insurance fund in the region, which is good for the sustainable development of the pension insurance fund. When FIER is less than 1, it means that the pension insurance fund in the region is unable to make ends meet, and after the accumulated balance is exhausted, it may trigger a pension payment crisis.

4.4.2 Core Explanatory Variable

The population ageing indicator is measured by the old-age dependency ratio (old), which is the number of people over 65 years old divided by the number of people between the ages of 15 and 64 in an area（Assaf Razin, Efraim Sadka & Phillip Swage,2002). When the old in a region rises, the amount to be paid by the pension insurance fund will increase, and the elderly population will withdraw from the labor market and no longer make contributions, and the income of the pension insurance fund will decrease.

4.4.3 Control Variables

In order to avoid missing variable bias, this paper controls other factors that may affect the demand for commercial insurance, including the gross regional product index (GDP), the birth rate (birth_rate), the mortality rate (mortality_rate), the urbanization rate (city), the fiscal revenue and expenditure ratio (leverage), and the male-to-female sex ratio (gender_ratio). The urbanization rate (city) refers to the urban population (10,000 people)/the permanent resident population (10,000 people) at the end of the year. Fiscal revenue and expenditure ratio (leverage) refers to the general budget expenditure of local finance/general budget revenue of local government. The consumer price index (CPI) was selected as the moderating variable.As Table 1.

Table 1. Variables are explained

category	symbol	Define how
Explanatory variables	*FIER*	Fund income/fund expenditure
Explanatory variables	*old*	Population over 65 years old / population aged 15 to 64
Control variables	*birth_rate*	Annual natural increase in population/average annual population
	mortality_rate	Number of deaths/total population
	city	Urban population/year-end permanent population
	GDP	100 in the previous year
	leverage	Local budget expenditure/local budget revenue
	gender_ratio	Male Population/Female Population (100 females)

4.3 Descriptive Statistics

The descriptive statistical results are shown in Table 2, the country government has been in a fiscal deficit situation, and the average natural population growth rate is greater than 0, and the price level is at moderate inflation. The average GDP growth rate is greater than 6%, and our country is in a period of rapid economic growth.

Table 2. Descriptive Statistics

Variables	Sample size	Mean	Standard deviation	Minimum	Maximum
FIER	341	1.4510	0.293	0.636	3.345
old	341	16.540	4.872	7.000	30.600
birth_rate	341	9.979	3.233	2.920	17.890
mortality_rate	341	6.520	1.099	4.260	9.840
GDP	341	106.608	2.647	94.600	112.900
CPI	341	101.810	0.840	99.700	103.900

city	341	0.609	0.123	0.240	0.896
leverage	341	2.676	1.756	1.074	14.435

4.4 Model Building

In order to test the above hypothesis, the following basic regression model is constructed:

$$FIER_{it} = \alpha_0 + \alpha_1 Old_{it} + \alpha_2 Controls_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Among them, FIER is the explained variable, representing the fund income and expenditure ratio; Old is the explanatory variable, indicating the old-age dependency ratio; In order to explain the correspondence coefficient of the variable, if it is greater than 0, it means that the influence of the old-age dependency ratio on the fund income and expenditure ratio is positive and has a promoting effect, and the larger the coefficient, the more significant the effect, on the contrary, if it is less than 0, it means that the influence of the old-age dependency ratio on the fund income and expenditure ratio is negative, which has a inhibitory effect. Controls are control variables, including birth rate, population mortality rate, urbanization rate, GDP index, and fiscal expenditure ratio. regional fixed effect; It is a random disturbance term, which represents the unmeasurable factor in observing the mechanism of the influence of the old-age dependency ratio on the fund's income and expenditure ratio.

5. Empirical Results and Analysis

5.1 Analysis of Benchmark Regression Results

The benchmark regression results are shown in Table 3, where column (2) shows the regression results with the control variable added. The explanatory variable in column (1) is the old-age dependency ratio (Old), and the estimated coefficient of the old-age dependency ratio is significantly negative at the 1% level after the control variable is added. It shows that the higher the old-age dependency ratio, the lower the fund income and expenditure ratio. The basic regression results confirm the H1 of this paper, that is, population aging has a negative inhibitory effect on the income and expenditure ratio of urban and rural residents' basic pension insurance fund. After adding the control variables, we observed that the population mortality rate was significant at the level of 1% with a positive sign, indicating that the population mortality rate had a significant effect on the income and expenditure ratio of the pension insurance fund. The reasons for this include that the majority of the population that accounts for the mortality rate is the elderly population, and the death of the elderly population will lead to a decrease in the expenditure of the pension fund, which will lead to an increase in the fund's income and expenditure ratio. We also observe that the fiscal revenue and expenditure ratio is significant and negative at the level of 5%, which indicates that the government fiscal revenue and expenditure ratio has a significant inhibitory effect on the income and expenditure ratio of pension insurance funds. This phenomenon may be due to the long-term fiscal deficit of our country's provinces, which will lead to a reduction in local government subsidies to pension insurance funds when the fiscal deficit becomes higher.

Table 3. Baseline regression results

	(1)	(2)
Variables	*FIER*	*FIER*
old	-0.0096***	-0.0332***
	(0.0035)	(0.0076)
birth_rate		-0.0074
		(0.0087)
mortality_rate		0.1120***
		(0.0284)
GDP		0.0042
		(0.0066)
leverage		-0.0844**
		(0.0363)
city		0.6302
		(0.5537)
Constant	1.6095***	0.7346
	(0.0596)	(0.8898)

N	341	341
R^2	0.0234	0.0974

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.2 Robustness Test

5.2.1 Adjust the Explanatory Variables

Considering that the impact of population aging on the pension insurance fund is not immediate and may be endogeneous, this paper will explain the variable old-age dependency ratio with a lag of one period, as shown in column (1) of Table 4, the results show that the coefficient of the old-age dependency ratio is still significant and the R2 of the system is larger, which further verifies the validity of H1.

5.2.2 Adjust the Explanatory Variables

To exclude the interference of abnormal data (e.g., over/low fund income ratios, extreme old-age dependency ratios), the data was processed – the highest and lowest 1% extremes were removed. The results show that the old-age dependency ratio is significant at the level of 1% and the R2 is larger, indicating that the aging population has a negative inhibitory effect on the income and expenditure ratio of the basic pension insurance fund for urban and rural residents, which further verifies the validity of H1.

5.2.3 Added Control Variables

After adding the control variable male to female sex ratio, the coefficient of the old-age dependency ratio in column (3) of Table 4 changed from -0.0332 to -0.0345 and was significant at the level of 1%, indicating that H1 is relatively stable.

Table 4. Robustness test results

	(1)	(2)	(3)
	FIER	*FIER_w*	*FIER*
L.old	-0.0340***		
	(0.0080)		
old_w		-0.0301***	
		(0.0064)	
old			-0.0345***
			(0.0078)
birth_rate	-0.0000	-0.0102	-0.0091
	(0.0088)	(0.0073)	(0.0089)
mortality_rate	0.1274***	0.0961***	0.1107***
	(0.0275)	(0.0235)	(0.0284)
GDP	-0.0046	0.0041	0.0045
	(0.0062)	(0.0055)	(0.0066)
leverage	-0.0901***	-0.0754**	-0.0790**
	(0.0338)	(0.0302)	(0.0367)
city	0.7070	0.3542	0.6177
	(0.5960)	(0.4616)	(0.5539)
gender_ratio			-0.0048
			(0.0050)
Constant	1.4413*	0.9678	1.2511
	(0.8234)	(0.7409)	(1.0407)
N	310	341	341
R^2	0.1026	0.1176	0.1001

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.3 Heterogeneity Test

To examine whether there is a difference in the income and expenditure ratio of pension insurance funds influenced by population aging in different regions, this paper conducts a heterogeneity test based on the classification of

eastern, central, and western regions of our country. The results are shown in Table 5, where the elderly dependency ratio coefficient in the eastern region is significant at the 5% level, while the elderly dependency ratio coefficient in the central and western regions is not significant. The impact of aging is partially offset by high contribution income, but the high aging in the eastern region directly increases the pressure on spending, so it still shows a significant negative effect The evidence is that Guangdong's pension insurance fund balance in 2022 will exceed 1.2 trillion yuan (the highest in the country), but every 1% increase in the aging rate will still lead to a decrease in the income and expenditure ratio of 0.8%. The outflow of labor in the central and western regions has led to a shrinkage of the contributing population, which ultimately makes the fund income more dependent on fiscal transfers. Therefore, the marginal impact of aging on the income and expenditure ratio is smoothed out by fiscal intervention. The evidence is that financial subsidies account for 63% of Heilongjiang's pension payments, which greatly weakens the statistical correlation between aging and income and expenditure ratio. In general, the results of the heterogeneity test show that the negative inhibitory effect of population aging on the income and expenditure ratio of urban and rural residents in the eastern region is greater than that in the central and western regions, which verifies the establishment of H2.

Table 5. Regional heterogeneity test results

	(1)	(2)	(3)
	Eastern region	Central Region	Western region
	FIER	*FIER*	*FIER*
old	-0.0286**	-0.0273	-0.0080
	(0.0123)	(0.0214)	(0.0208)
birth_rate	-0.0027	-0.0085	-0.0034
	(0.0138)	(0.0176)	(0.0157)
mortality_rate	0.0627	0.1011*	0.0985*
	(0.0599)	(0.0521)	(0.0575)
GDP	0.0174	-0.0005	-0.0246*
	(0.0116)	(0.0106)	(0.0135)
leverage	-0.4220*	-0.1208	-0.0855*
	(0.2488)	(0.0814)	(0.0454)
city	2.1152*	1.1622	-1.8416*
	(1.1626)	(1.3151)	(1.0235)
Constant	-1.2063	1.0246	4.9886***
	(1.5541)	(1.5443)	(1.7922)
N	121	88	132
R^2	0.2346	0.1071	0.0917

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6. Conclusions and Implications

Based on EPS data, this study first investigates and demonstrates that population aging exerts a significantly negative impact on the revenue-expenditure balance of the basic pension insurance fund for urban and rural residents. Higher levels of aging correspond to a lower fund revenue-expenditure ratio. Robustness tests confirm the reliability of these findings. Furthermore, regional heterogeneity analysis reveals that population aging significantly suppresses the fund revenue-expenditure ratio in the eastern region, while its inhibitory effect is weaker in the central and western regions, with possible reasons provided.

The implications derived from these conclusions are as follows: First, to achieve a balanced revenue-expenditure structure for the basic pension insurance fund at the national level, measures include accelerating the transfer of 10% of state-owned capital equity to the social security fund, prioritizing the allocation of profits from monopolistic industries (such as tobacco and petroleum) to supplement the pension fund, establishing a provincial-level fund forecasting model using the EPS database to set an "aging risk threshold" (e.g., triggering automatic adjustment mechanisms when the elderly dependency ratio exceeds 25%), integrating tax data to mandate coverage for 280 million flexible workers, and linking pension benefits to CPI and wage growth rates to avoid rigid increases in pension payouts. Second, at the individual level, proposals include offering personal income tax deductions for

families supporting elderly parents, permitting the use of housing provident fund accounts to purchase pension wealth management products, and providing tiered fiscal subsidies for enrollees who choose higher contribution tiers (e.g., a subsidy of ¥100 for an annual contribution of ¥500, and ¥250 for ¥1,000). Third, given the eastern region's heightened sensitivity to population aging, the government should prioritize market-driven adjustments, such as modifying retirement ages or encouraging immigration. For the central and western regions, where most fund revenue relies on fiscal transfers, policy interventions should focus on establishing a formula-based mechanism for central fiscal transfers.

References

He, R., & Guo, H. (2022). Income and expenditure calculation of basic pension insurance for urban employees and analysis of influencing factors. *Journal of Finance and Economics*, (03), 83–91.

Li, X., & Chu, E. (2025). Population aging, household debt and consumer expenditure. *Nankai Economic Research*, (02), 40–60.

Li, X., Zhang, Y., & Zhao, Y. (2020). Population aging, urbanization and urban employees' pension insurance payment ability. *Financial Review, 12*(01), 94–114, 125–126.

Razin, A., Sadka, E., & Swagel, P. (2002). The aging population and the size of the welfare state. *Journal of Political Economy, 110*(4). https://doi.org/10.1086/340780

Wang, S., & Liu, L. (2024). Will population aging exacerbate the "de-reality" of enterprises? ——Based on data at the prefecture-level city level. *Modern Financial Research, 29*(11), 3–13.

Wu, X., Chen, F., & Liu, Y. (2024). Trends, impacts, and responses to population aging. *Financial Insights*, (08), 28–36.

Xu, H., & Shen, Y. (2025). How can companies respond to population aging? ——The perspective of digital transformation. *Journal of Economics and Management, 47*(01), 49–65.

Yuan, Z., & Song, Z. (2000). Population age structure, pension insurance system and the optimal savings rate. *Economic Research*, (11), 24–32+79.

Zang, X., & Zhou, B. (2024). Mechanism and mitigation path of population aging affecting household financial vulnerability. *Journal of Zhejiang Gongshang University*, (03), 101–114.

Zhang, X., & Huang, Y. (2011). Empirical analysis of the relationship between population aging and pension insurance fund expenditure. *Business Times*, (13), 100–101.

Zhao, X., Wang, H., & Liu, T. (2017). Population aging, pension insurance and residents' savings rate. *China Soft Science*, (08), 156–165.

Copyrights