

Spatial Pattern and Evolutionary Trend of Enterprise Employee Pension Insurance Security Levels in China's Jiangxi Province

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Abstract: From the dual perspective of supply and demand, this study takes the 11 prefecture-level cities of China's Jiangxi Province as research subjects to measure and project the demand-side security level, supply-side security level, and their evolutionary trends for enterprise employee' pension insurance from 2025 to 2045. It systematically analyzes the spatial pattern of pension security across the three major regions of Jiangxi: northern Jiangxi, central Jiangxi, and southern Jiangxi. The findings are as follows. First, the demand-side pension security level in all prefecture-level cities has been rising continuously, with a "catch-up effect" observed among late-developing cities. However, the absolute disparity in demand-side security levels among cities has continued to widen, while the relative disparity exhibits a U-shaped evolution, with pronounced hierarchical rigidity. Second, the provincial pension supply can fully cover the demand without systemic shortfall. Nevertheless, the surplus margin—defined as the supply-side security level minus the demand-side security level—shows significant spatial differentiation. Cities such as Yingtian and Ganzhou face medium- and long-term tight balance risks between pension supply and demand, representing weak links in the regional pension system. On this basis, this study proposes countermeasures including the establishment of a differentiated dynamic adjustment mechanism for pensions and the improvement of a provincial-level fund coordination and reallocation system.

Keywords: Old-Age Insurance, Demand-Side Security Level, Supply-Side Security Level.

1. INTRODUCTION

Population aging has become a long-term fundamental national condition as China enters a new development stage. According to the Seventh National Population Census, the proportion of people aged 65 and above reached 13.50% in 2020, an increase of 4.63 percentage points from 2010. As the core pillar of the social security system, the primary objective of the enterprise employee pension insurance system is to "guarantee basic needs"—that is, to provide retired elderly people with a stable income source sufficient to cover their basic living expenses. However, determining whether the security level is appropriate is essentially a supply-demand matching problem. On the demand side, "guaranteeing basic needs" implies a reasonable minimum benefit standard that must cover the consumption expenditures necessary for the elderly's basic survival and development. On the supply side, the system's benefit provision capacity is constrained by multiple factors, including contribution base, contribution rate, dependency ratio, local economic foundations, and fiscal support capacity. When the supply-side security level consistently exceeds the appropriate demand-side security level, the system operates with sufficient security redundancy and a safety buffer; otherwise, it may lead to old-age poverty and sustainability risks. Thus, systematically examining the spatial differentiation characteristics and evolutionary trends of pension security levels from both supply and demand perspectives is of significant theoretical value and practical importance for precisely identifying regional security weaknesses and optimizing the allocation of pension resources. China has a vast territory, and its provinces differ markedly in economic development, population aging, and fiscal revenue and expenditure capacities. If analysis relies solely on national averages, it may easily mask deeper differentiations within provinces and among cities. Hence, it is necessary to shift the research perspective from the national level down to the provincial and municipal levels for empirical investigation.

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Jiangxi Province is located in central China, adjacent to economically developed regions such as the Yangtze River Delta and the Guangdong-Hong Kong-Macao Greater Bay Area, but its economic development has long been at the middle level nationally. According to data from the official website of the Jiangxi Provincial Bureau of Statistics, in 2024, the province's gross regional product was approximately 3.42 trillion CNY, and per capita GDP was about 75,000 CNY, both below the national average. In terms of demographic structure, as a major labor-exporting province, Jiangxi experiences a large outflow of young and middle-aged adults, which worsens the actual dependency ratio and creates simultaneous pressures on pension fund collection and benefit payment. Although enterprise employee pension insurance has achieved provincial-level pooling and full coverage, the prefecture-level cities within the province differ greatly in industrial structure, urbanization level, wage income, and fiscal self-sufficiency. Consequently, the demand- and supply-side security levels of pension insurance across these cities inevitably exhibit significant spatial heterogeneity. Moreover, existing literature largely focuses on macro-level descriptions and policy reviews of Jiangxi's pension insurance system, while empirical studies specifically examining the spatial differentiation of security levels and the dynamic supply-demand evolution within its cities remain scarce. Thus, this study selects the 11 prefecture-level cities of Jiangxi as research samples to systematically reveal the spatial pattern and evolutionary trends of enterprise employee pension insurance security levels in the province from the dual perspective of supply and demand.

2. LITERATURE REVIEW

Research on the security level of basic pension insurance and its appropriate demand-side security level has mainly focused on refining the replacement rate indicator system and measuring the demand-side security level. Regarding security level measurement, the pension replacement rate is a core international indicator, and its conceptual definition and measurement methods have long been a research focus. Xu and Li (2009) systematically reviewed the theoretical categories of target replacement rate, average replacement rate, and cross replacement rate. Xue *et al.*, (2020) classified and compared various replacement rates. Wang and Mi (2013) clarified statistical misunderstandings of the average replacement rate and pointed out that the median replacement rate is more representative. Lin (2013) discussed the relationship between the average replacement rate and the target replacement rate and its impact on pension pressure estimation. Chia and Tsui (2019), incorporating the linkage between housing and pension policies in Singapore, included net imputed rent into the replacement rate measurement framework, significantly improving the comprehensiveness of retirement adequacy assessment. Alonso-Fernandez *et al.*, (2018) and Chybalski and Marcinkiewicz (2016) noted that the traditional replacement rate only reflects the consumption-smoothing dimension and cannot cover multiple security objectives such as poverty protection. Thus, they constructed composite adequacy indicators and comprehensive pension adequacy indicators, respectively, establishing a multidimensional evaluation paradigm.

Regarding the appropriate demand-side security level, scholars have gradually shifted from a single static indicator to a dynamic assessment of both supply and demand sides. Xue (2012) and Xue and Xian (2014) used actuarial methods and the extended linear expenditure system model to estimate the supply replacement rate and the desirable replacement rate for the New Rural Pension Scheme and the Urban-Rural Resident Pension Scheme, respectively, laying a methodological foundation for assessing the appropriate demand-side security level under the "guaranteeing basic needs" objective. Bian and Mu (2011) measured the dynamic interval of the appropriate security level for rural pension insurance. Li *et al.*, (2024) focused on benefit adequacy and contribution burden for low-income participants. Collectively, the foregoing research lends theoretical and methodological support to the definition of the demand-side security level adopted in this study. However, most existing literature focuses on static estimations at the national level or for a single type of scheme in China, lacking dynamic examinations of provincial spatial heterogeneity and medium- to long-term evolutionary trends.

Research on the basic pension insurance system in Jiangxi Province has mainly addressed macro issues such as system construction, full coverage promotion, and economic support capacity. Xu and Le (2011) discussed the construction path of the New Rural Pension Scheme in Jiangxi. Tao *et al.*, (2012) evaluated the economic support capacity of Jiangxi's New Rural Pension Scheme and concluded that full coverage could be achieved under effective management. Cai (2016) analyzed issues in regulatory norms and budget management of enterprise employee pension insurance in Jiangxi from the perspective of local people's congresses. Zhang (2011) focused on the current status and countermeasures for constructing the basic old-age service system in Jiangxi. Chen *et al.*, (2023) actuarially assessed the impact of delayed retirement on the payment capacity of Jiangxi's basic pension insurance fund. Overall, existing studies are largely descriptive and policy-review oriented. Empirical research specifically examining the spatial differentiation characteristics of enterprise employee pension insurance security levels and the dynamic supply-demand evolution within Jiangxi Province remains scarce. This study systematically investigates the spatial pattern and medium- to long-term evolutionary trends of pension insurance security levels across the 11 prefecture-level cities of Jiangxi from the supply-demand perspective, offering distinct regional research features.

3. Analysis of Demand-Side Pension Security Levels and Their Spatial Pattern Evolution across Regions of Jiangxi Province

The internationally accepted indicator for measuring pension security levels is the pension replacement rate, which reflects the extent to which the pension system maintains pre-retirement living standards by comparing pension benefits to the average wage of employed workers or the social average wage. However, as a relative indicator, the replacement rate has inherent measurement limitations. Its denominator is significantly influenced by regional economic development levels, industrial structure, and wage statistics, so that the same absolute pension benefit can produce substantially different replacement rate values under different wage baselines, thereby obscuring the actual purchasing power of the security level. Moreover, the replacement rate cannot directly reflect the actual matching relationship between pension benefits and the basic consumption expenditures of the elderly, making it difficult to accurately align with the institutional objective of “guaranteeing basic needs”. For these reasons, this study abandons the relative measure of the replacement rate and instead adopts per capita pension benefits as an absolute indicator of the supply-side security level, while defining the demand-side security level of “guaranteeing basic needs” as the consumption expenditure necessary to sustain the basic living needs of the elderly.

To measure the appropriate demand-side security level for the elderly’s “guaranteeing basic needs”, this study follows the dichotomy of elderly consumption needs proposed by Li and Wang (2012) and Xue *et al.*, (2023). Daily living expenses can be divided into essential consumption for maintaining basic living and developmental consumption for improving quality of life. The former includes food, clothing, housing, transportation, and medical care, while the latter covers education, culture, leisure, and other areas. Since medical expenses are already covered by basic medical insurance, the demand-side security function of pension insurance should focus on five expenditure categories: food, clothing, daily necessities, housing, and transportation and communication. These correspond to the per capita consumption indicators for urban residents in the *China Statistical Yearbook*, namely “food”, “clothing”, “housing”, “household facilities, articles and services”, and “transportation and communication”. In the specific measurement, adjustments to the statistical definitions are necessary: housing expenditure should exclude home purchase, mortgage repayment, and rent, retaining only daily maintenance costs such as water, electricity, and gas; for household facilities, articles and services, expenditures on durable consumer goods such as refrigerators and washing machines should be excluded, and only non-durable consumption items such as household textiles, daily sundries, and household services should be included. After these adjustments, the sum of the five expenditure categories yields the basic living expenditure level for urban elderly residents.

Following the specific approach of Xue *et al.*, (2023) and using data from the statistical yearbooks of each region in Jiangxi or publicly available data from the regional statistics bureaus or people’s governments, this study calculates the basic living expenditure levels of the elderly for the 11 prefecture-level cities of Jiangxi Province from 2019 to 2024. For Ji’an City, due to the lack of publicly available data, the provincial average from the *Jiangxi Statistical Yearbook* is used as the basic living expenditure level for that region.

Based on the basic living expenditure levels of the 11 prefecture-level cities from 2019 to 2024, this study calculates the year-on-year growth rates for each city and then takes the average of these growth rates from 2020 to 2024 as the growth rate of basic living expenditure for each region during the projection period. The resulting average annual growth rates for the 11 prefecture-level cities of Jiangxi are as follows: Nanchang 4.10%, Jiujiang 4.83%, Shangrao 4.94%, Fuzhou 5.29%, Yichun 4.93%, Ji’an 5.00%, Ganzhou 5.23%, Jingdezhen 4.84%, Pingxiang 5.16%, Xinyu 5.41%, and Yingtan 5.42%.

Using the 2024 basic living expenditure level for each region as the baseline level, and incorporating the projected growth rates for each region during the forecast period, this study projects the basic living expenditure levels—that is, the demand-side security levels—for the 11 prefecture-level cities of Jiangxi from 2025 to 2045. The results are presented in Table 1.

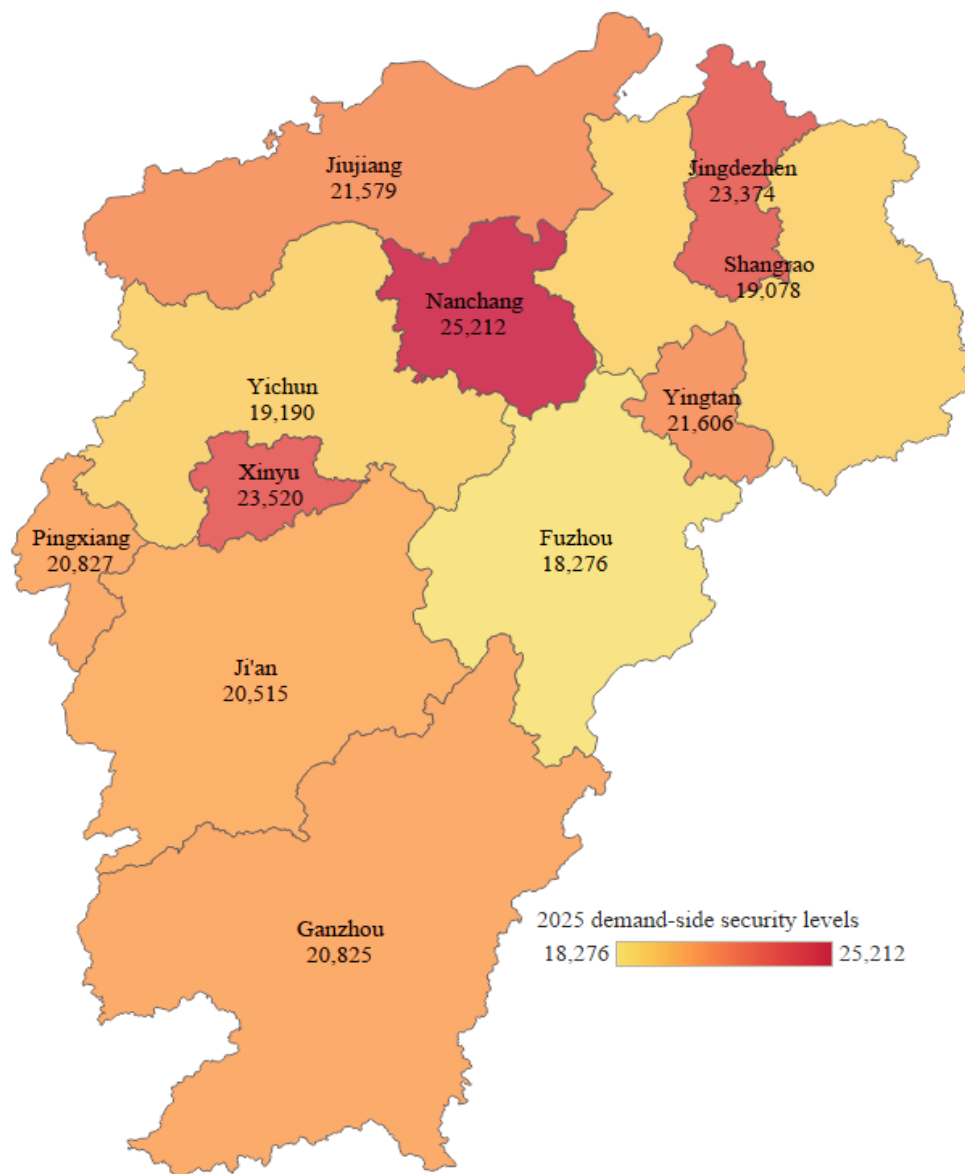
Table 1: Projected demand-side security levels for prefecture-level cities in Jiangxi Province during the forecast period (in CNY)

Year	Nanchang	Jiujiang	Shangrao	Fuzhou	Yichun	Ji’an	Ganzhou	Jingdezhen	Pingxiang	Xinyu	Yingtan
2025	25212	21579	19078	18276	19190	20515	20825	23374	20827	23520	21606
2026	26247	22621	20021	19243	20136	21541	21914	24506	21902	24793	22778
2027	27324	23715	21010	20261	21130	22618	23059	25692	23033	26135	24012
2028	28446	24861	22048	21332	22173	23749	24264	26936	24222	27550	25314
2029	29613	26062	23138	22461	23267	24937	25533	28240	25473	29042	26686
2030	30828	27322	24282	23649	24415	26184	26868	29608	26788	30614	28133
2031	32093	28642	25482	24899	25620	27494	28272	31041	28171	32271	29658
2032	33410	30026	26741	26216	26885	28869	29750	32544	29625	34018	31266
2033	34782	31477	28062	27603	28211	30313	31305	34120	31155	35860	32961
2034	36209	32998	29449	29063	29604	31829	32941	35772	32763	37801	34747

Year	Nanchang	Jiujiang	Shangrao	Fuzhou	Yichun	Ji'an	Ganzhou	Jingdezhen	Pingxiang	Xinyu	Yingtan
2035	37695	34593	30905	30600	31065	33421	34663	37504	34454	39847	36631
2036	39242	36265	32432	32219	32598	35092	36475	39320	36233	42004	38617
2037	40852	38017	34035	33923	34206	36848	38382	41223	38104	44278	40710
2038	42529	39854	35717	35717	35894	38690	40388	43219	40071	46675	42917
2039	44274	41780	37482	37606	37666	40625	42500	45312	42140	49202	45244
2040	46091	43799	39334	39595	39524	42657	44721	47506	44315	51865	47696
2041	47983	45916	41278	41690	41475	44791	47059	49806	46603	54673	50282
2042	49952	48135	43318	43895	43522	47031	49519	52217	49009	57633	53008
2043	52002	50461	45459	46217	45669	49383	52108	54746	51540	60753	55881
2044	54136	52900	47706	48661	47923	51853	54831	57396	54200	64041	58910
2045	56358	55456	50064	51235	50288	54446	57698	60175	56999	67508	62104

As shown in Table 1, during the forecast period, the demand-side pension security levels of all 11 prefecture-level cities in Jiangxi Province continued to rise, but with significant divergence in growth rates, leading to a profound restructuring of the regional pattern. In terms of temporal evolution, the security levels of each city increased from 18,300–25,200 CNY in 2025 to 50,100–67,500 CNY in 2045, representing a 2.24- to 2.87-fold increase, with average annual growth rates ranging from 4.10% to 5.42%. The growth rates of late-developing cities were notably higher than those of early-developing cities, exhibiting a clear “catch-up effect”.

The hierarchical ranking of demand-side security levels across regions underwent structural adjustments, as illustrated in Figure 1.



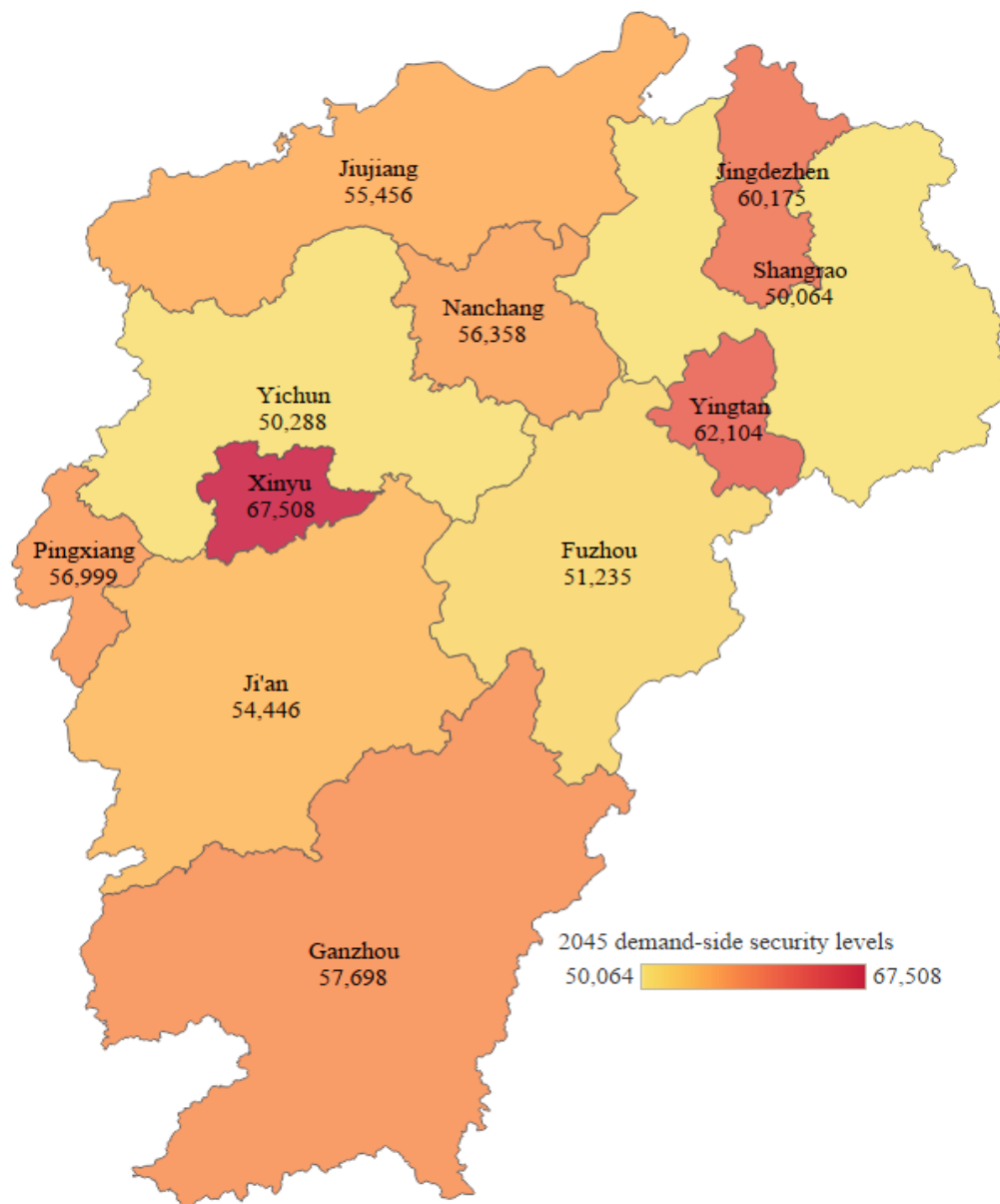


Figure 1: Spatial distribution pattern of demand-side security levels across regions of Jiangxi at the initial (2025) and terminal (2045) years of the projection period (in CNY)

As can be seen from Figure 1 and Table 1, Nanchang, which had the highest initial level in 2025, grew most slowly, and by the terminal year 2045, its ranking had continuously dropped from 1st to 6th place. In addition, Xinyu and Yingtian, owing to their higher growth rates, rose to 1st and 2nd place, respectively, by 2045. Ganzhou also climbed from 7th place in 2025 to 4th place in 2045. Meanwhile, Fuzhou and Shangrao consistently remained in the bottom tier, and the regional hierarchical pattern became increasingly entrenched.

In terms of regional disparities, the absolute disparity continued to widen, with the range of demand-side security levels across Jiangxi's regions increasing from 6,936 CNY in 2025 to 17,444 CNY in 2045. However, the relative disparity exhibited a U-shaped pattern, first narrowing and then widening. Specifically, the coefficient of variation, as a measure of relative disparity, declined from 0.099 to 0.088 and then rebounded to 0.094, indicating that regional coordination improved in the medium term, while the pressure of long-term differentiation persisted.

4. Analysis of Supply-Side Security Levels and Their Evolutionary Relationship with Demand-Side Security Levels Across Regions

Based on the statistical yearbooks of each prefecture-level city and the *Jiangxi Statistical Yearbook*, this study obtains the per capita pension benefit levels (i.e., the supply-side security levels provided by the pension insurance system) for the 11 cities in Jiangxi at the initial year of the projection period (2025). The supply-side security levels for Nanchang,

Jiujiang, Shangrao, Fuzhou, Yichun, Ji'an, Ganzhou, Jingdezhen, Pingxiang, Xinyu, and Yingtian are 3,640 CNY, 2,902 CNY, 3,581 CNY, 2,724 CNY, 2,496 CNY, 3,087 CNY, 2,718 CNY, 3,372 CNY, 2,958 CNY, 3,820 CNY, and 2,558 CNY, respectively. Since the growth rate of the supply-side security level—that is, the growth rate of basic pension benefits—is uniformly adjusted according to national standards, this study uses the average growth rate of basic pension benefits for urban employees in China from 2021 to 2025, as published by the Ministry of Human Resources and Social Security, the Ministry of Finance, and other relevant government departments. The average of these five annual growth rates is 3.46%, which is adopted as the basic pension growth rate for all 11 prefecture-level cities of Jiangxi during the projection period.

Using the above initial supply-side security levels and the uniform growth rate during the projection period, this study calculates the supply-side security levels for the 11 cities from 2025 to 2045. This study then compares the supply-side security level with the demand-side security level for each region and presents the comparison results by grouping the 11 cities into three major areas: northern Jiangxi, central Jiangxi, and southern Jiangxi.

During the projection period, the comparison and evolutionary trends between the supply-side and demand-side security levels in northern Jiangxi are shown in Figures 2 and 3. Northern Jiangxi comprises eight prefecture-level cities: Nanchang, Jiujiang, Shangrao, Yichun, Jingdezhen, Pingxiang, Xinyu, and Yingtian.

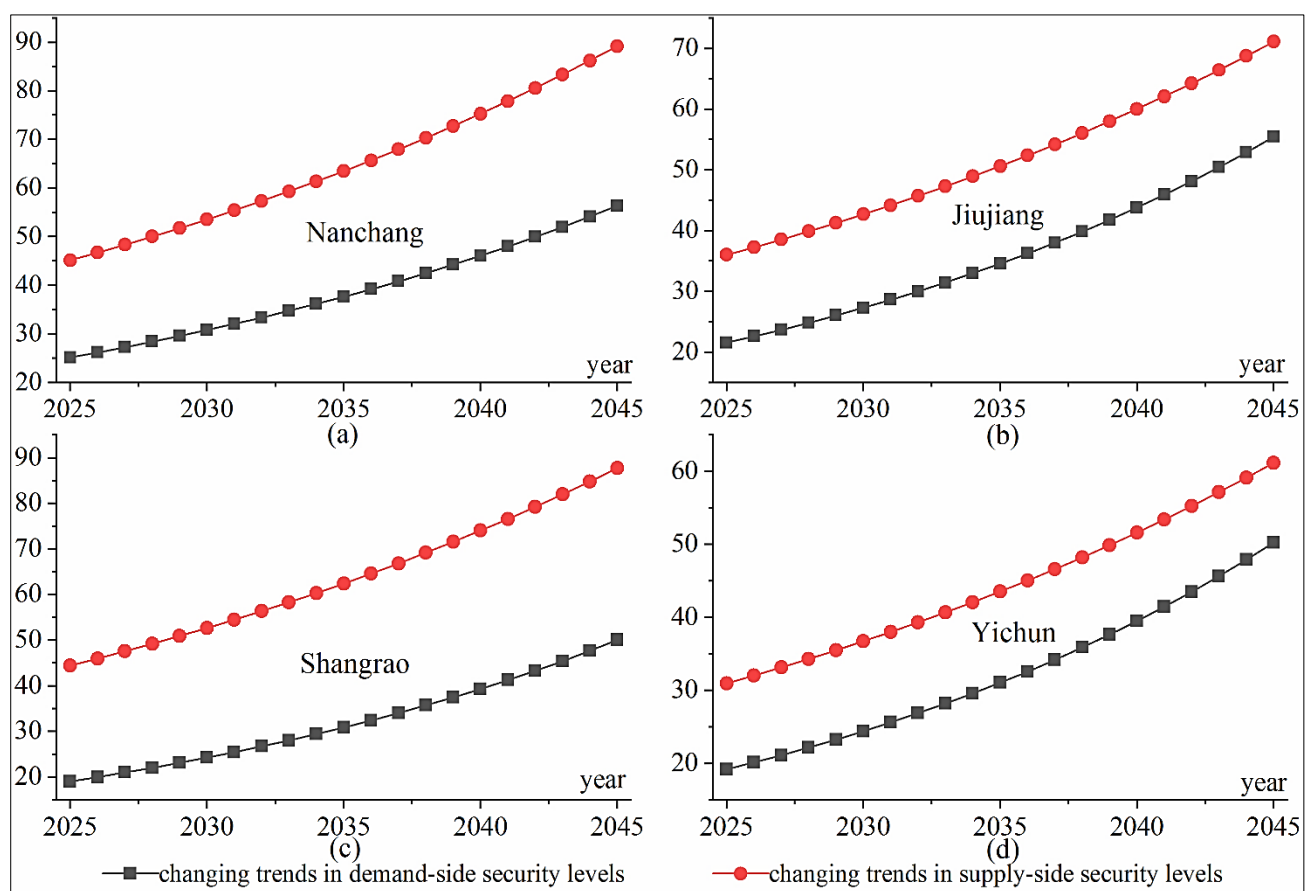


Figure 2: Trends of supply-side and demand-side security levels for the first four cities in northern Jiangxi (in thousand CNY)

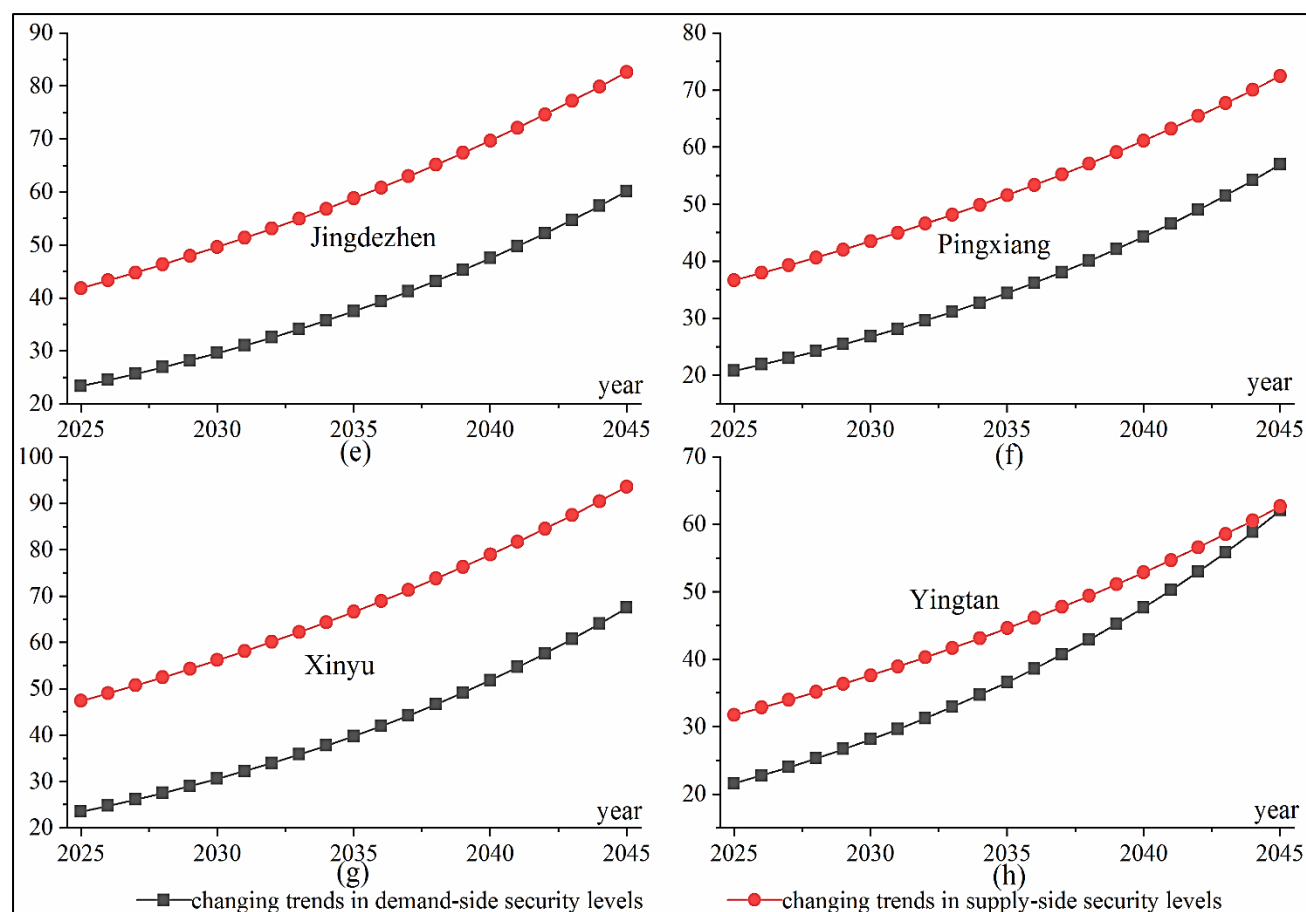


Figure 3: Trends of supply-side and demand-side security levels for the last four cities in northern Jiangxi (in thousand CNY)

As shown in Figures 2 and 3, both the supply-side and demand-side security levels in the eight cities of northern Jiangxi exhibit a rapid upward trend from 2025 to 2045. The supply-side security level consistently remains above the appropriate demand-side security level in all cities. For most cities, the surplus margin—defined as the supply-side security level minus the demand-side security level—expands year by year. In terms of spatial distribution, Nanchang, Shangrao, Xinyu, and Jingdezhen have relatively high supply-side security levels, and their surplus margins are among the largest. However, Yingtan's surplus margin continues to shrink. This indicates a clear hierarchical stratification among northern Jiangxi cities in terms of both the scale of supply and demand (i.e., the absolute levels) and the surplus margin. Nanchang, Shangrao, Xinyu, and Jingdezhen are characterized by high supply, high demand, and high surplus margins; Jiujiang, Pingxiang, and Yichun are at a medium level in terms of both the supply-demand scale and the surplus margin; and Yingtan has the lowest baseline levels across the entire region, with a continuously narrowing surplus margin, making it the weakest link in the supply-demand balance of northern Jiangxi's pension system and facing prominent long-term security pressure.

During the projection period, the comparison and evolutionary trends between supply-side and demand-side security levels in central and southern Jiangxi are displayed in Figure 4. Central Jiangxi includes Ji'an and Fuzhou, corresponding to panels (a) and (b) of Figure 4, while southern Jiangxi includes only Ganzhou, corresponding to panel (c).

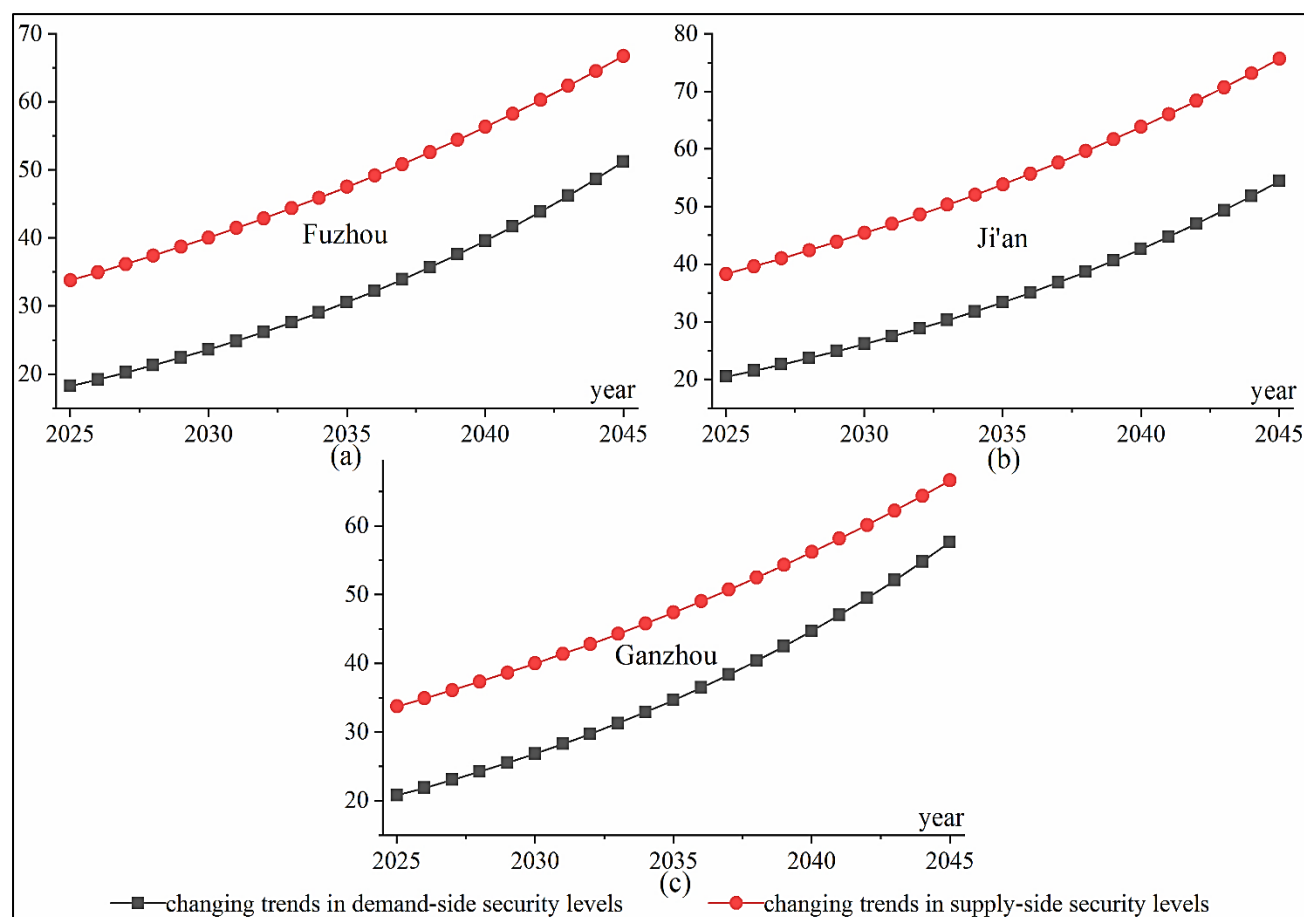


Figure 4: Trends of supply-side and demand-side security levels in central and southern Jiangxi (in thousand CNY)

As can be seen from Figure 4, from 2025 to 2045, the supply-side and demand-side security levels in central Jiangxi (Fuzhou and Ji'an) and southern Jiangxi (Ganzhou) both increase steadily and linearly. The total supply can consistently cover the basic living needs of retired elderly residents in these regions. For the vast majority of cities, the surplus margin (the difference between the supply-side and demand-side security levels) expands, indicating that there is no systemic supply shortage in the regional pension system. The evolutionary trends of the supply-demand balance in Ji'an and Fuzhou are relatively similar. However, Ganzhou, as a city with a large population, exhibits a significantly higher growth rate in the demand-side security level compared to the two central Jiangxi cities, and its surplus margin is substantially smaller and continues to shrink over time. This highlights that Ganzhou faces a pronounced medium- and long-term tight balance pressure between pension supply and demand, making it a vulnerable unit in the supply-demand equilibrium of the central and southern Jiangxi regions.

5. CONCLUSIONS AND POLICY IMPLICATIONS

Based on the functional orientation of pension insurance to “guarantee basic needs”, this study defines the demand-side security level from the perspective of elderly living needs as the consumption expenditure necessary to sustain basic living, covering five categories: food, clothing, housing (limited to daily maintenance costs such as water, electricity, and gas), household facilities, articles and services (limited to non-durable goods), and transportation and communication. Using the estimated basic living expenditure levels of the 11 prefecture-level cities in Jiangxi from 2019 to 2024, this study projects the demand-side security levels from 2025 to 2045 by applying the average annual growth rates of each city. Meanwhile, taking the per capita pension benefit level of urban employees in each city in 2025 as the initial value, and incorporating the nationally adjusted average annual growth rate of basic pensions (3.46%), this study calculates the supply-side security levels over the same period. It then systematically examines the matching pattern and evolutionary characteristics of supply-side and demand-side security levels from the perspective of the three major regions of Jiangxi: northern, central, and southern.

The main findings are threefold. First, during the forecast period, the demand-side security levels of all prefecture-level cities continue to rise, increasing from 18,300–25,200 CNY in 2025 to 50,100–67,500 CNY in 2045. However, growth rates diverge significantly, with late-developing cities growing faster than early-developing ones, exhibiting a “catch-up effect”. Although regional rankings undergo structural adjustments, the bottom tier tends to become entrenched.

The absolute disparity continues to widen (the range increases from 6,936 CNY to 17,444 CNY), while the relative disparity displays a U-shaped pattern of first narrowing and then widening, indicating persistent long-term differentiation pressure. Second, the supply-side security levels also grow steadily during the forecast period, and the total supply in all three regions can consistently cover demand, with no systemic supply shortage. However, the spatial differentiation of the surplus margin (supply minus demand) is evident. Nanchang, Shangrao, Xinyu, and Jingdezhen are characterized by high supply, high demand, and high surplus margins, whereas Yingtan has the lowest baseline levels across the region and a continuously shrinking surplus margin, making it a prominent weak link in the supply-demand balance of northern Jiangxi. Third, although Ganzhou also falls into the category where supply consistently covers demand, as a city with a large population, its demand-side security level grows significantly faster than that of Ji'an and Fuzhou in central Jiangxi. Moreover, its surplus margin shrinks year by year, highlighting a pronounced medium- and long-term tight balance pressure and constituting a vulnerable unit in the central and southern Jiangxi regions.

The foregoing conclusions give rise to two policy implications. First, establish a differentiated dynamic adjustment mechanism for pensions and regional coordination mechanisms to alleviate the long-term differentiation pressure of demand-side security levels. The results show that although the demand-side security levels in all regions of Jiangxi have improved overall and late-developing cities exhibit a “catch-up effect”, the absolute disparity among regions continues to widen, and the rankings of bottom-tier cities such as Fuzhou and Shangrao tend to solidify, with the relative disparity exhibiting a U-shaped evolution. Thus, on the basis of implementing the national unified adjustment policy for basic pensions, the provincial government should explore the establishment of differentiated subsidies or dynamic adjustment mechanisms linked to the basic living consumption expenditures of the elderly in each region. Policy implementation should prioritize increasing fiscal transfers and safety-net support for bottom-tier cities, thereby enhancing the real purchasing power of their basic pensions, curbing excessive expansion of regional absolute disparities, and promoting long-term equilibrium and coordinated development of demand-side security levels across the province.

Second, implement targeted fund coordination, reallocation, and revenue-expenditure interventions at the provincial level to proactively address the risks of a tight balance between supply and demand in specific localities. The findings reveal that although the total provincial pension supply can generally cover basic demand, there are significant structural vulnerabilities in supply-demand matching. In particular, Yingtan has the lowest baseline levels and a continuously shrinking surplus margin, while Ganzhou faces a compressed surplus margin due to rapid demand growth. Both cities face prominent medium- and long-term tight balance pressures. In this context, under the framework of national unified pension pooling, the provincial-level fund coordination and reallocation system should be further deepened, with targeted financial support and revenue-expenditure interventions for weak units such as Yingtan and Ganzhou. At the same time, these cities should be guided to diversify pension fund financing channels, optimize local fiscal expenditure structures, and strengthen strategic reserves of pension funds in advance, so as to prevent the risk of local pension payment gaps and ensure the stability and sustainability of the regional pension system.

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