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Study on the Impact Mechanism of Social Security Expenditure on the Economy of Low-Income Groups and Regional Macroeconomic Regulation Strategies

-- A Case Study of Anhui Province

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Abstract: The total social security expenditure of Anhui Province has increased constantly, reaching 142.67 billion yuan in 2022. Nevertheless, a significant internal development gradient exists within the province. There are enormous differences in economic structure, employment patterns, and the demand for social security among Wan bei (northern Anhui), Wan zhong (central Anhui), and Wan nan (southern Anhui). Based on this, it is challenging to establish the same social security policy in Anhui that suits each section. Hence, this paper aims to establish the mechanism by which social security expenditure impacts the economy of low-income groups, providing statistics for the Anhui government to inform macroeconomic regulation in Wan bei, Wan zhong, and Wan nan. Existing research usually used traditional disposable income and poverty rate indicators to analyze the current status of the social security system, lacking in-depth analysis of expenditure structure and the compatibility of regional development characteristics. This paper introduces the poverty factor model, constructs a new survival-oriented consumption burden index, and establishes a Theil index for regional disparities to depict the cumulative effect of various policies; adopts the logarithm of regional gross domestic product to control the impact of economic scale; utilizes the information entropy model to quantify the uniformity of expenditure structure, constructing a dynamic time series model. Research indicates that the lack of medical expenditure in Wan bei results in an overreliance on the minimum living security system. There is a significant mismatch between the security of elderly care and employment security in Wan nan. In the Wan zhong, however, high housing costs are squeezing the improvement effect of social security, and structural imbalance has become a key bottleneck restricting the enhancement of social security efficiency. In terms of research on the impact mechanism, current analyses focus on the effect of directly reducing poverty, lacking discussions of judgment on multidimensional causes. Therefore, this paper chooses per capita disposable income and poverty incidence as outcome variables and consumption expenditure as a mediating variable, controls for regional development indicators such as the urbanization rate and non-agricultural employment rate, constructs a two-way fixed effects model to control for the interference of regional characteristics and time trends, and establishes a mediating effect model to identify the mechanism of action. Results show that social security expenditure not only increases disposable income through direct income transfer, but also through the indirect improvement effect stimulated by consumption. Among these, medical care and minimum living security expenditures play an obvious role in alleviating short-term poverty. In contrast, expenditures on employment support and elderly care have greater potential for long-term income growth. Scholars' research related to regional macroeconomic regulation often overlooks the net effect of a policy and the differences between places. Based on the impact of the existing factor of the minimum living security standard increase policy in Wan bei, this paper controls for variables such as urbanization rate and fiscal self-sufficiency rate by identifying the net effect of policies through a multi-period DID model. This paper introduces the economic distance spatial weight matrix. It constructs a spatial Durbin model to capture inter-regional spillover effects, and while aiming to minimize the poverty rate, this paper constructs a non-linear programming model. Results reveal that the gap in inter-regional development conditions hinders the effectiveness of policies, and social security expenditure exhibits a spatial spillover effect. By allocating expenditures more efficiently toward areas such as medical care and elderly care, the poverty alleviation effect in vulnerable regions can be significantly improved. Based on the above research, this paper creatively proposes a three-dimensional regulation paradigm: structurally, establish a linkage mechanism between the expansion of the chronic disease reimbursement catalog and consumption-employment; in terms of regional adaptation, design agricultural income insurance for northern Anhui, occupational injury protection for southern Anhui, and gradient reduction of affordable housing rents for central Anhui; in terms of coordinated governance, promote the construction of the Yangtze River Delta medical insurance settlement sharing and dynamic monitoring platform. This model offers a viable plan for targeted regulation and high-quality development of social security within provinces.

Keywords: Bidirectional fixed effects model; Entropy model; Multi period double difference test; Spatial Durbin model.

1. Introduction

1.1. Research Background and Problem Proposal

(1) The core role of social security expenditure

Social security expenditure, as the core carrier of fiscal transfer payments, plays a dual role as an income guarantee and a risk buffer for low-income groups. Scholars' research indicates that a healthy social security system can reduce the poverty rate through direct income transfer and improve economic resilience by facilitating smooth consumption,

thereby enhancing human capital accumulation[1]. The World Bank's 2019 reports emphasized that for every 1 percentage point increase in the proportion of social security expenditure in GDP, the Gini coefficient decreases by an average of 0.38%. Empirical studies by Deng Dasong et al., based on national comprehensive survey data, have confirmed that social security expenditure not only directly decreases the possibility of rural residents being poor by 12.7% but also buffers the negative effect of the widening income gap on poverty, with an elasticity coefficient of 0.21. This suggests that social security expenditure is a crucial institutional arrangement for addressing the poverty trap mentioned above[2].

(2) Economic characteristics and regional differentiation of low-income groups in Anhui Province

The low-income group in Anhui Province exhibits significant regional differences, forming a ladder-like pattern. The economic characteristics of this group can be summarized into the following dimensions.

Income structure and stability: Wan bei is characterized by an agriculturally dominated economy, which contributes to the significant fluctuations in the revenue of lower-income groups. For instance, in traditional agricultural areas such as Fuyang and Bouzhou, rural residents' per capita disposable income has been less than 10000 yuan for a long time, which is only 41.7% of that in the southern Anhui tourist areas. Moreover, Wan bei's informal employment rate reached 61.3%, which is much higher than Wan zhong's 38.5%. In contrast, although Wan nan has formed a relatively high proportion of non-farm income by relying on its tourist industry, seasonal unemployment results in the annual income fluctuation coefficient reaching 0.42, ultimately weakening the sustainability of the economy. Benefiting from Hefei's economic agglomeration, the Wan zhong leads in manufacturing wage levels. Nonetheless, housing costs squeeze disposable income, restricting the actual consumption capacity of low-income groups.

Imbalance in social security coverage and structure: Social security expenditure in Anhui continues to increase. It reached 142.67 billion yuan in 2022, an increase of 67.3% compared with 2015, but its regional adaptability is insufficient. The Wan bei region shows excessive dependence on the Minimum Living Security Policy, with its expenditure accounting for 32.1% of the total social security investment. However, the growth rate of medical insurance participation lags, and the number of urban residents participating in medical insurance in Bengbu City showed negative growth in 2022. In Wan nan, gig workers account for 40% population, but the unemployment insurance coverage rate is less than 10%. This indicates that there is a lack of institutional guarantee for occupational injury risks. In the Wan zhong, subsidies for high-tech industry training account for 24.3% of the total (training subsidies). However, the social security connection mechanism for migrant workers is absent, and institutional gaps weaken the effectiveness of policies.[3]

Asset accumulation and risk resistance capacity: low-income families' asset structures reveal characteristics of low liquidity and low appreciation potential. Their average housing valuation per household is only 38,000 yuan, accounting for 75% of the provincial average level. Low-income families' accumulation of financial assets is almost exhausted - the average annual savings per person is 268 yuan, accounting for less than 5% of that of high-income households. This characteristic is most severe in Wan bei, where the disease-induced poverty rate reached 18%, and the out-of-pocket medical expense ratio is as high as 35.4% [4] - much higher than Wan nan's 22.1%.

Table 1. Comparison of Economic Characteristics of Low Income Groups in Three Major Regions of Anhui Province (2022)

Feature Dimension	Wan bei	Wan nan	Wan zhong
Per Capita Disposable Income	9281 yuan	22680 yuan	34500 yuan
Informal employment rate	61.30%	39.00%	38.50%
Social security expenditure structure	The proportion of subsistence allowances is 32.1%	Elderly care services account for 15.2%	Employment subsidies account for 15.6%
Core Vulnerability	Poverty rate due to illness>18%	Seasonal unemployment fluctuation coefficient 0.42	Housing cost to income ratio reaches 48%

(3) Core Research Question

Based on the above background, this study focuses on three core issues:

- **Question One: Multi-Dimensional Analysis of the Impact Paths of Social Security and Regional Heterogeneity**

Traditional disposable income and poverty rate indicators have limitations in identifying the depth of economic vulnerability and multi-dimensional resilience structure exhibited by low-income groups in Anhui Province, especially in typical regions such as resource-depleted areas in Wan bei and mountainous agricultural-tourism areas in Wan nan. It is necessary to systematically analyze the specific transmission mechanisms through which social security expenditures affect the disposable income resilience, multi-dimensional poverty alleviation rate, and livelihood system risk resistance capacity of low-income groups via three core paths—the income transfer effect, the consumption multiplier effect, and the human capital accumulation effect. Additionally, it is essential to identify the effectiveness of these paths, as well as the dynamic weight evolution laws and spatial differentiation thresholds of such effectiveness across four major regions: the resource-based sector in Wan bei, the industrial-based sector along the Yangtze River in Anhui, the ecological-based sector in Wan nan, and the Dabie Mountain sector in western Anhui.

- **Question Two: Interactive Adaptation Effectiveness between Differentiated Security Policies and Regional**

Vulnerability

Due to the regional resilience structure differences identified in question one, especially the vulnerability characterized by sluggish industrial transformation in Wan bei, and the vulnerability characterized by the fluctuation of informal employment in Wan nan, regional differentiated social security strategies are now implemented. For instance, the high-standard subsistence allowance system implemented in Wan bei and the pilot tourism insurance policy in Wan nan. Unfortunately, those policies have a structural deviation in the targeted intervention for the core regional vulnerability dimensions. This paper plans to design an optimized path for institutional adaptability to address the aforementioned crux, as well as its spatial policy boundaries, through quantitatively evaluating the formation conditions of two negative mechanisms: the subsistence allowance dependency lock-in effect in Wan bei and the flexible employment protection gap effect in Wan nan, and analyzing the non-linear interactive attenuation intervals between social security policy parameters (including but not limited to payment standards, coverage scope, and eligibility criteria) and regional dominant vulnerability variables (such as the industrial decline index and the proportion of informal employment).

- **Question Three: Social Security Efficiency Spillover and Fiscal Gate Constraint in Regional Coordination**

Targeted at the problem that the regional areas with partial policy ineffectiveness revealed in question two, high social security investment in the Hefei metropolitan circle generates cross-regional spillover effects through the flow of labor factors, the equalization of public services, and the collaboration in industrial chains, but this effect is constrained by regional coordination limitations caused by the gradient difference in fiscal self-sufficiency rates. This paper firstly elaborates on the cyclical blocking channel formed by this constraint in Wan bei through dependency on transfer payments and lag in industrial upgrading, as well as the blocking channel formed in Wan nan through low-level coordination of social security and distortion in labor allocation. It also analyzes the inhibitory intensity on the development capacity of social security resources, such as the enhanced synergy effect of the integrated medical insurance settlement in the Yangtze River Delta region across various areas. Then reveals the spatial attenuation gradient of the constraint effect and its transmissive obstacles to the construction of a comprehensive social security resilience network.

2. Significance of the Study

2.1. Theoretical Significance: Deepening the Correlation Mechanism and Expanding the Differentiated Regulation Framework

1. Revealing the Dynamic Correlation Mechanism between Social Security Expenditure and Economic Resilience

Existing research mainly focuses on the poverty-reduction effect of social security expenditure, but lacks systematic research on the transmission path for enhancing the economic resilience of low-income groups. This paper empirically tests the enhancing effect of social security expenditure on low-income groups' risk resistance capacity via the three-dimensional mechanism model: direct income transfer - consumption simulation - human capital accumulation. Panel data from Anhui province indicate that with every 10% increase in medical insurance subsidy, the ill-induced poverty rate among Wan bei's low-income group decreases by 2.3 percentage points, and labor participation time increases by an average of 15 days per year. Panel data also show that with every 10000 yuan increase in employment training subsidy, non-farm employment wages rise by 6.9%. This finding reveals the theoretical path through which social security expenditure enhances economic resilience by strengthening capabilities and provides micro-level empirical support for the developmental welfare theory.[5][6]

2. Innovating the Theoretical Framework for Regional Differentiated Regulation

Currently, regional regulation models are generally based on the division of eastern Anhui, central Anhui, and western Anhui, which can hardly help with refined policy design within provincial jurisdictions. This research promotes dividing Anhui into north and south and contrasts the differences between central Anhui (Wan zhong), northern Anhui (Wan bei), and southern Anhui (Wan nan). This paper also constructed an adaptability analysis framework of "regional vulnerability – social security expenditure structure – policy effectiveness":

Wan bei: the proportion of the primary industry accounts for 24.7%. Social security expenditure is dominated by subsistence allowances. Ill-induced poverty rate reached 18%. Overall, Wan bei is oriented toward traditional township economic development.

Wan nan: Wan nan's main development orientation is the tertiary industry, such as tourism. The proportion of informal employment in the tourism industry accounts for 39%; the seasonal unemployment fluctuation coefficient reaches 0.42; and the social security coverage rate of flexible workers is lower than 10%. This indicates the existing gap remains difficult to balance.

Wan zhong: The housing cost-to-income ratio in manufacturing upgrading areas reaches 48%, squeezing the consumption-driven effect of social security expenditure.

3. Promoting the Interdisciplinary Integration of Social Security Policy Research

Introduce the Spatial Durbin Model to quantify the spill-over effect of the social security system in the metropolitan cycle. Integrating econometrics and public policy studies interdisciplinarily by optimizing regional expenditure structure with policy simulation tools to enhance the practical predictive power of theoretical models.

2.2. Practical significance: Driving precise regulation and regional equity

1. Addressing the Structural Imbalance in Regional Social Security Expenditure

Although Anhui province's social security expenditure increases continually, it lacks regional adaptability.

Wan bei: Excessive reliance on minimum living security, coupled with a 4.2-month delay in medical assistance disbursement, has restricted the health improvement effect.

Wan nan: The proportion of elderly care service expenditure accounts for 15.2%, while employment subsidies only account for 6.4%, which is mismatched with the needs of flexible workers.[7]

Wan zhong: The proportion of high-tech training subsidies

accounts for 24.3%, but there is a gap in the insurance participation linkage for migrant workers.

This research identifies the main route of every section via the mediating effect model, providing empirical evidence for optimizing expenditure structure.

2. Anhui's Practice in Boosting the Integration of Social Security in the Yangtze River Delta

Based on the result of spatial calculation, this paper proposes a cross-regional collaboration plan:

Pilot projects for cross-provincial medical insurance settlement will be launched in northern Anhui and northern Jiangsu. It is expected to reduce the current out-of-pocket ratio for off-site medical treatment in rural areas of northern Anhui by approximately 35.4%. Meanwhile, efforts will be made to promote Shanghai's fiscal subsidies for seasonal elderly care in the ecological protection areas of southern Anhui, so as to activate idle rural housing resources. These measures aim to alleviate the practical problems of heavy medical expense burdens and insufficient elderly care supply, integrate the interconnection of medical insurance and the replacement of elderly care resources into the Yangtze River Delta coordinated governance framework, and drive Anhui's transformation from an "intra-provincial self-circulation" model to a "regional symbiotic system" characterized by interconnected medical security and complementary elderly care supply. Ultimately, this will enhance the cross-regional accessibility of public services and improve the current situation of imbalanced regional development.[8]

Table 2. Practical Path and Expected Effects of Regional Regulation of Social Security in Anhui

Region	Main Strategy	Policy Instrument	Quantitative Goals
Wan bei	Health capital enhancement	Expansion of chronic disease outpatient reimbursement catalog	The poverty rate caused by illness has dropped below 12%
Wan nan	Flexible employment guarantee	Travel off-season unemployment mutual aid fund+occupational injury insurance	Social security coverage rate reaches 80%
Wan zhong	Coordination of housing and social security	Linking the allocation of affordable housing with employment subsidies	The employment retention rate in the manufacturing industry has increased to 85%

This research deepens the understanding of the economic effects of social security expenditures through dual dimensions of theoretical innovation and policy practice: theoretically, this research explores the differential shaping mechanism of economic resilience through the dual path of "health-skills", constructing a regional regulatory framework under spatial heterogeneity conditions; practically, the results of the research provide a precise policy basis for solving "the health trap in Wan bei", "the blind spots of policy establishment of Wan nan" and "cost squeeze in Wan zhong", further contributing Anhui's wisdom on regional coordination to national social security reform.

3. Theoretical Basis and Research Hypotheses

3.1. Definition of Core Concepts

1. Social Security Expenditure: The government provides cash or physical support for low-income groups through fiscal transfer payments, such as endowment insurance, medical insurance, and direct transfer expenditures - minimum living allowance subsidies and employment subsidies.

2. Theoretical Connotations: Income security as a safety net, risk mitigation, and development empowerment.

- **Income Floor Guarantee**: Ensuring basic survival needs through security of a minimum living allowance and pension. In 2022, the expenditure on minimum living allowance in Anhui Province accounted for 28.7% of the fiscal expenditure on people's wellbeing. Among this, the proportion in northern Anhui was 32.1%, significantly higher than the 18.7% in southern Anhui.
- **Risk Buffer**: Mainly manifested as reducing the ill-induced poverty rate through medical security. The off-site medical self-payment ratio of the low-income group in Wan bei is about 35.4%. Medical insurance subsidies can reduce the poverty rate caused by illness by approximately 2.3 percentage points.
- **Development Empowerment**: This is reflected in the fact that employment subsidies increase labor force participation rate and human capital accumulation, with the input-output ratio of manufacturing job training subsidies in Hefei being approximately 1:5.3.

3. Measuring social security: Including two types of indicators – total scale and structural efficiency.

- **Structural Efficiency**: Focus on whether the allocation of expenditures across different purposes is approximately matched. Employment subsidies in Wan nan only accounts for 6.4% of social security expenditure. There is a mismatch with the actual needs of flexible employment.

4. Indicators for Evaluating the Economic Status of Low-Income Groups:

Disposable income, poverty incidence, and risk resistance capacity.

- **Disposable Income**: Reflect the difference of purchasing power. Wan bei rural residents' per capita disposable income is 9281 yuan, only 26.9% of the 34500 yuan for manufacturing practitioners in Wan zhong.
- **Poverty Incidence**: Used for dynamic monitoring of vulnerability. The ill-induced poverty rate in Wan bei exceeds 18%. This mean reason for this is the inefficient medical insurance coverage.
- **Risk Resistance Capacity**: Quantify the resilience of recovery after a shock. The resilience to recover from medical shocks can be characterized by the relationship between the medical insurance reimbursement ratio and the duration of labor force participation – with every increase in 10 percentage point in medical insurance reimbursement ratio,

labor participation time can be increased by about 23 days. The resilience to recover from unemployment shocks reflect the impact of insufficient unemployment insurance coverage on the extension of seasonal unemployment cycles – places with unemployment insurance coverage of less than 10% may suffer from seasonal unemployment cycle extending by about 40%.

Regional macro-regulation is a process in which provincial governments implement adaptive social security policies in response to intra-regional development disparities[9]. Its core characteristics include goal orientation, tool differentiation, and spatial coordination. This process requires designing differentiated intervention plans based on the existing deficiencies in different regions.

3.2. Theoretical Framework and Research Hypotheses

(1) Direct Effect: Poverty Reduction Mechanism through Income Transfer

Theoretical Basis: Principles of Compensation in Welfare Economics

Governments directly increase low-income individuals' disposable income through income transfer. Huang Xiuhai et al. confirmed based on inter provincial panel data that the incidence of poverty decreases 0.38 percentage points with every 1% increase in social security expenditure.[6]

Empirical Support: The panel fixed-effects model shows that low-income groups' per capita income rises 0.21% with every 1% increase in social security expenditure. Among these, the income-increasing elasticity of employment subsidies is significantly higher than that of the minimum living allowance.

Regional Verification: Due to a higher marginal propensity to consume in northern Anhui, the elasticity coefficient of the direct effect reaches 0.27, which is significantly higher than that in southern Anhui (0.16).

(2) Regional Heterogeneity: The Moderating Role of Spatial Differentiation

Theoretical Framework: Construction of the "Regional Endowment – Social Security Structure – Policy Effectiveness" Adaptation Model:

Differences in Economic Foundations: Primary industry accounts for 24.7% in Wan bei, which indicates that Wan bei depends on the minimum living allowance for basic support; and the average manufacturing wage in central Anhui is 112,019 yuan, yet housing costs are crowding out consumption.

Institutional Coverage Gap: Over 40% of workers in southern Anhui are in flexible employment, yet the unemployment insurance coverage rate for this group is less than 10%.

Spatial Spillover Effects: The Spatial Durbin Model shows that Hefei's social security investment yields positive spillover for counties within a radius of 100 kilometers, but the siphoning effect of medical resources has driven up the out-of-pocket payment ratio in neighboring provinces.

3.3. Research Approach

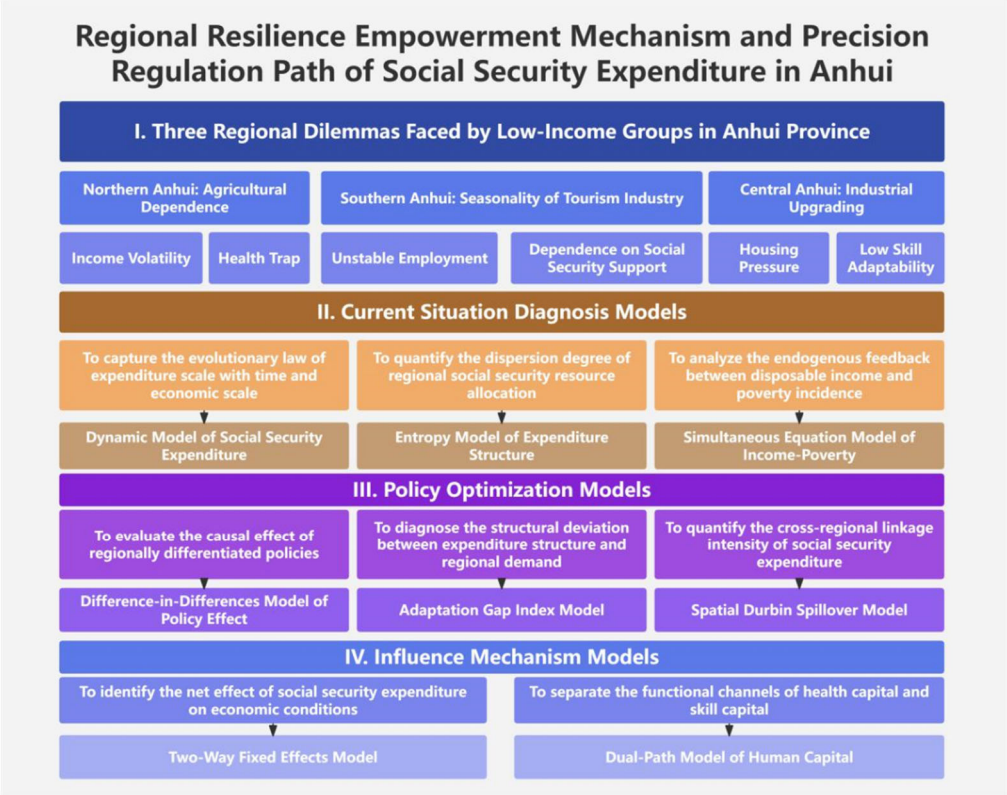


Figure 1. Solution flowchart

4. Analysis of the Current Situation of Social Security Expenditure and the Economic Status of Low-Income Groups in Anhui Province

The contradiction between Anhui province's expansion in the total social security expenditure and the regional structural imbalance is becoming increasingly acute. Existing studies mostly focus on the macro trend of the province's annual expenditure exceeding 150 billion yuan, yet overlook its adaptation efficiency to regional economic characteristics. The subsistence allowance expenditure in Wan bei traditional farming areas makes up 32.1%, severely crowding out medical security resources. This led to a negative growth in the participation rate of urban residents' medical insurance in Bengbu City in 2022. In Wan nan, informal employment groups driven by the tourism industry account for 39%, yet the unemployment insurance coverage rate for this group is less than 10%—a situation that exposes the lack of institutionalized responses to seasonal unemployment risks. Housing costs in the core manufacturing areas of Wan zhong account for 48% of total income, strikingly weakening the stimulating function of social security consumption. This structural imbalance has led to the failure of response mechanisms for three types of vulnerability structures in Anhui: the industrial stagnation type in northern Anhui, the employment fluctuation type in southern Anhui, and the cost squeeze type in central Anhui. Specialized data from the finance department of Anhui Province (2023) suggests that the entropy values of the three regions show a systematic deviation[3] from the theoretical equilibrium value of 1.79. Hence, this research adopts a dynamic structural entropy model to analyze the problem of regional mismatch of social security expenditure, aiming to reveal the inherent conflict between the rigid expansion of institutions and their adaptation to regional characteristics, providing empirical evidence for optimizing the provincial-level fiscal coordination mechanism.

4.1. Study on the Current Situation of Social Security Expenditure

Firstly, analyze the structure and scale of social security expenditure, meanwhile consider the coupling effect of two factors – institutional path dependence and systematic advancement of the macroeconomy. In addition, the policy cumulative effect in terms of institutions will determine the expenditure foundation in the long run; further considering changes in economic scale, the stable development of the province's economy also provides practical support for the social security system. Based on this, this paper establishes a dynamic regression framework for time trends to capture the drivers of policy accumulation and institutional rigidity, and introduces information entropy to measure and diagnose the balance of the expenditure structure.

This paper introduces time trend variables to depict the cumulative effect of multiple policies; simultaneously, it uses the logarithm of regional gross domestic product to control the fundamental driving role of economic scale in expenditure. The model assumes: policy cumulative effects' performance in the short and medium term is a monotonically non-decreasing driving force, while the impact of economic expansion passively enhances expenditure capacity through improvements in fiscal revenue.

Social security expenditure's evolutionary trajectory is driven by the dual forces of institutional rigidity constraints and economic development. Based on the path dependence theory, a dynamic model of time trends is constructed:

$$S_t=\alpha+\beta T_t+\gamma\ln(GDP_t)+\epsilon_t$$

S_t stands for the total social security expenditure in year t, which can represent the scale of fiscal input in people's livelihoods; T_t is a time trend variable, the assignment range from a baseline value of 1 in 2015 to an incremental value of 9 in 2023, which is used to capture the policy cumulative effect; $\ln(GDP_t)$ is the logarithmic form of regional gross domestic product, controlling the passive impact of economic scale expansion; ϵ_t represents the random disturbance term, which includes unobserved active policy interventions. Coefficient β characterizes the intensity of institutional rigidity expansion, and its significance directly verifies the strategic orientation of the sustained growth of people's livelihood expenditure; and γ expresses and measures the economic cushioning effect. The relative size of γ and β can be used to explain the factors of economic growth in this region.

We further evaluate whether the expenditure structure among different social security programs is balanced. Using the concept of information entropy, we quantify structural uniformity into a dimensionless indicator to compare the allocation status across different regions or years.

$$H_j=-\sum_{i=1}^{n} p_{ij}\ln p_{ij}(i=1,2,\ldots,n)$$

H_j represents the entropy value of the social security expenditure structure of the area j, with range $[0,\ln n]$; p_{ij} represents the proportion of the i type of expenditure in the j region, covering core programs such as subsidies for minimum living security, medical insurance, and employment subsidies; n represents the total number of expenditure categories.

4.2. Multidimensional Measurement of the Economic Status of Low-Income Groups

1) Poverty Factor Equation

According to 2.1,3.1, we research the economic well-being needs of low-income groups through income level, poverty incidence rate, and medical burden. The current situation indicates that the mutual influence of poverty traps inhibiting income growth is relatively significant in Anhui Province, which cannot be reasonably explained by a single equation regression. Therefore, we simultaneously incorporate the aforementioned variables and quantify per capita disposable income into the regression relationship between social security expenditure intensity and non-agricultural employment rate, and the resulting model is as follows.

$$Y_{jt}=\theta 0+\theta 1X_{jt}+\theta 2Z_{jt}+u_{jt}$$

Y_{jt} represents the per capita disposable income of low-income groups in the j-th region in year t; X_{jt} represents the social security expenditure intensity; Z_{jt} represents the non-agricultural employment rate.

We further conduct a fitting regression between the regional poverty incidence rate, the per capita disposable

income of low-income groups, and parameters such as medical service level, and the resulting income-poverty system is as follows:

$$\begin{cases} Y_{jt}=\theta_0+\theta_1 X_{jt}+\theta_2 Z_{jt}+u_{jt} \\ P_{jt}=\phi_0+\phi_1 Y_{jt}+\phi_2 W_{jt}+v_{jt} \end{cases}$$

Correspondingly, P_{jt} represents the poverty incidence rate of the corresponding region; W_{jt} denotes the medical out-of-pocket ratio, which measures the deficiency in risk resistance capacity.

2) The New Survival-Oriented Consumption Burden Index

Traditional Engel's coefficient mainly measures the proportion of food expenditure, but as the medical expenditure increases rapidly (in the context of unduly high medical expenses), only using the Engel's coefficient could easily underestimate the survival burden of the family. We proposes a comprehensive burden index that add food and medical expenditures and compare the result with disposable income, so that we can more directly depict the development ability of households that are squeezed out by survival concumption.

$$E_{jt}=\frac{C_{food,jt}+C_{hel,jt}}{Y_{jt}}\times 100\%$$

$C_{food,jt}$ represents per capita food consumption expenditure; $C_{hel,jt}$ represents per capita medical cash expenditure; Y_{jt} represents per capita disposable income.

E_{jt}>60% means the family is trapped in a state of crowding out survival resources;

$E_{jt}\in$[50%,60%) is the warning zone; and E_{jt}<50% means there is a space for development capability.

3) Theil Index of Regional Disparities

To understand the income gap among low-income groups across the province, we need to decompose the overall inequality into two parts: inter-regional disparities and intra-regional disparities. **Theil index** with additive decomposability can clarify the contribution of northern, central, and southern Anhui to the overall inequality, and the constructed model is as follows:

$$T=\sum_{j=1}^{3}\frac{Y_j}{Y}\ln\left(\frac{Y_j/Y}{N_j/N}\right)+\sum_{j=1}^{3}\frac{Y_j}{Y}T_j$$

T represents the total index of income gap of all the low-income groups in Anhui; Y_j represents the total income of area j; N_j represents the scale of the low-income population in the corresponding area; T_j represents the sub-index of intra-regional county-level disparities.

The first term measures the contribution rate of disparities among the three major regions (Northern, Central, and Southern Anhui); the second term reveals the intensity of intra-regional disparities within each region. When the inter-regional contribution rate exceeds 70%, it indicates that spatial structural contradictions have become the main cause of differentiation.

4.3. Basic Results and Explanation:

Samples reveal that Anhui province's social security expenditure shows a continuous upward trend, and the fitted model exhibits a high degree of goodness-of-fit across time cross-sections. The empirical curve and the fitted curve basically overlap, and the explanatory power of years is significant. This fact supports the institution-driven expansion hypothesis rather than the purely economically passive one. Further, the Theil decomposition based on time series confirms that inter-regional disparities play a dominant role in overall inequality, and the inter-annual component almost covers the total fluctuation. This indicates that policy path dependence and annual policy orientations exert a concentrated impact on expenditure scale.

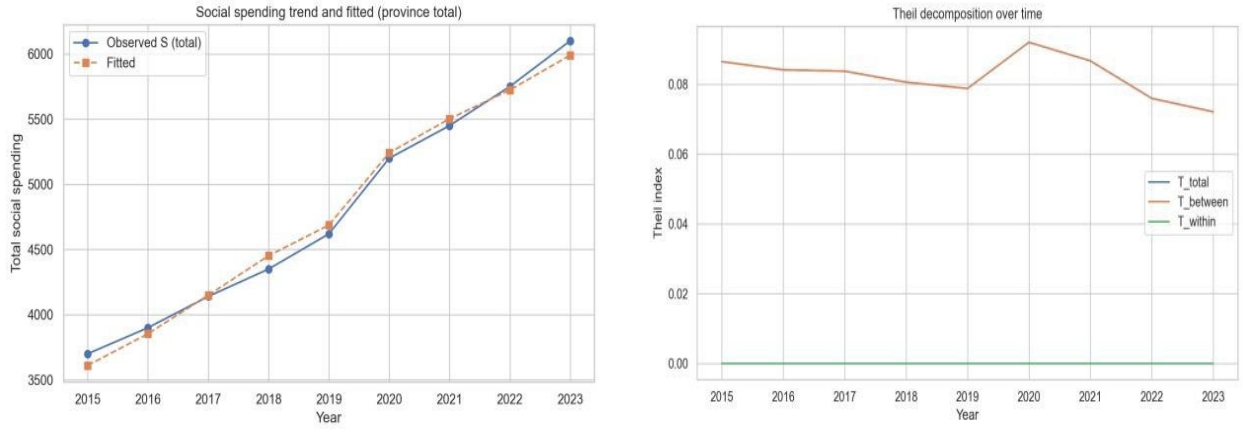


Figure 2. The Trend of The Social Expenditure in Anhui

The proportion of each sub-item has undergone significant changes over time: the share of medical expenditure in the total has declined slowly, while the proportion of other expenditures has increased significantly. This shift in expenditure structure brings potential risks from the perspective of institutional functions—specifically, the increasing proportion of short-term or one-time funding may weaken the structural security effectiveness for low-income groups.

Table 3. Annual Expenditure Structure Distribution

year	exp_low_protection	exp_medical	exp_employment	exp_pension	exp_other
2015	0.15	0.34	0.11	0.22	0.19
2018	0.14	0.32	0.10	0.21	0.23
2022	0.14	0.32	0.10	0.21	0.23
2023	0.12	0.28	0.09	0.18	0.34

The structural entropy index, sorted by region, reveals that Wan zhong has a relatively balanced distribution of programs. On the contrary, Wan nan and Wan bei exhibit different kinds of mismatches: Wambei is characterized by an excessively high proportion of low protection expenditures coupled with insufficient depth of the medical security catalog, while southern Anhui shows a mismatch between elderly care provisions and population aging, as well as inadequate coverage of security for flexible employment groups.

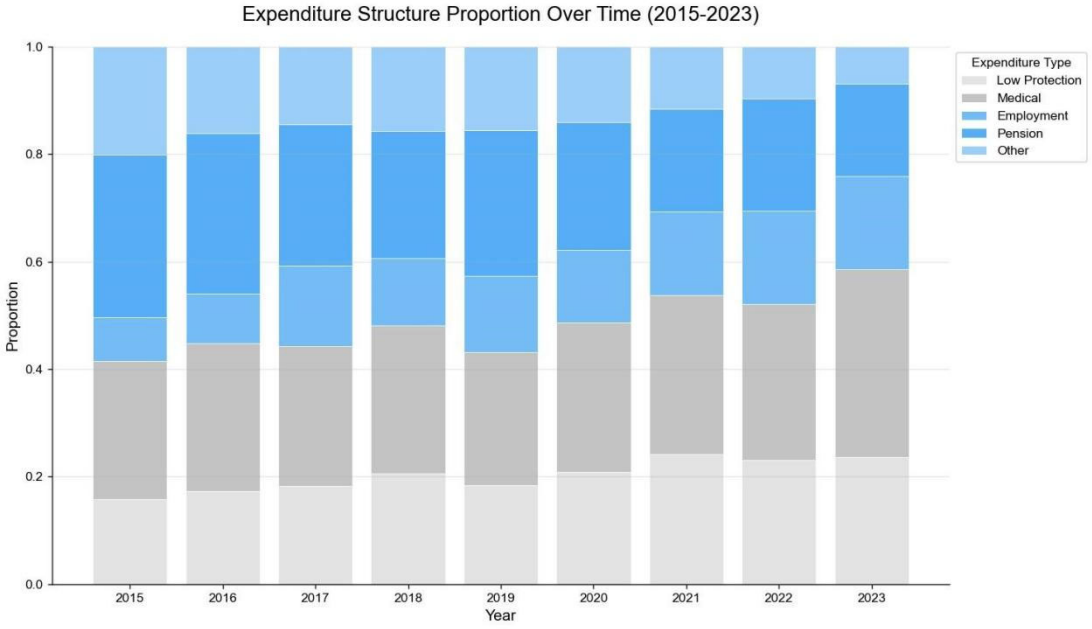


Figure 3. Stacked Distribution of Expenditure Structure

We further analyze the spatial differentiation of survival burdens and their crowding-out effect on the disposable resources of low-income groups. The survival burden index, which integrates both food and medical expenditures, shows that the survival burden of low-income households in northern Anhui is significantly higher than the provincial average, exceeding 60%. This fact, that the disposable space for developmental expenditures is severely compressed, explains the paradoxical phenomenon where income increases but poverty remains difficult to reduce.

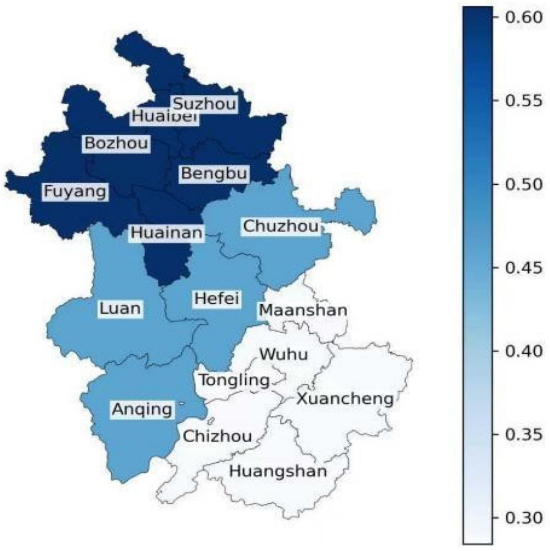


Figure 4. The Survival Burden of Each Region

The Cook's Distance plots show several highly influential observations in both stages of the model. These observations are mostly concentrated at the two ends of the sample, indicating that extreme values from individual counties or cities or years have an amplifying effect on coefficient estimation.

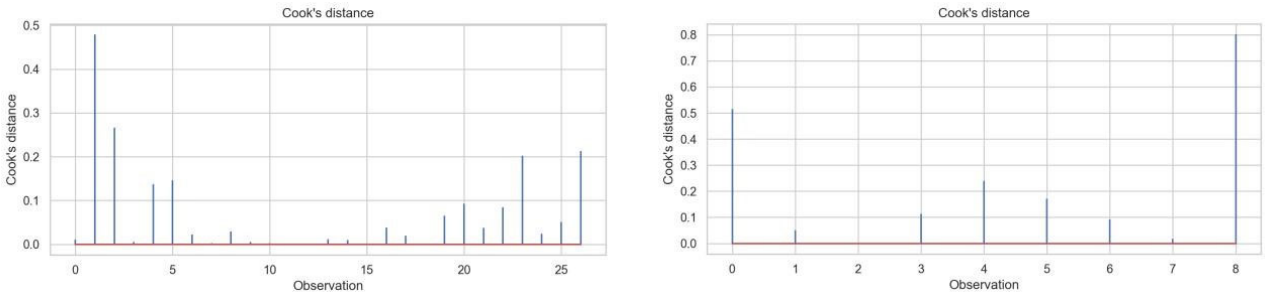


Figure 5. Magnification Effect Map of Coefficient Estimation in Individual Districts and Counties

The residual histogram and kernel density curve show that the residuals are generally approximately normally distributed, though there is a slight deviation in the tails. Similarly, the QQ plots exhibit deviations at the extreme quantiles in both stages. However, this does not undermine the rationality of inferences based on large-sample approximations overall. Meanwhile, the residual-fitted value plot reveals a certain degree of heteroscedasticity—particularly at the two ends of the fitted value range, where the residual magnitude is larger. Therefore, robust standard errors or heteroscedasticity-adjusted methods should be used in the estimation.

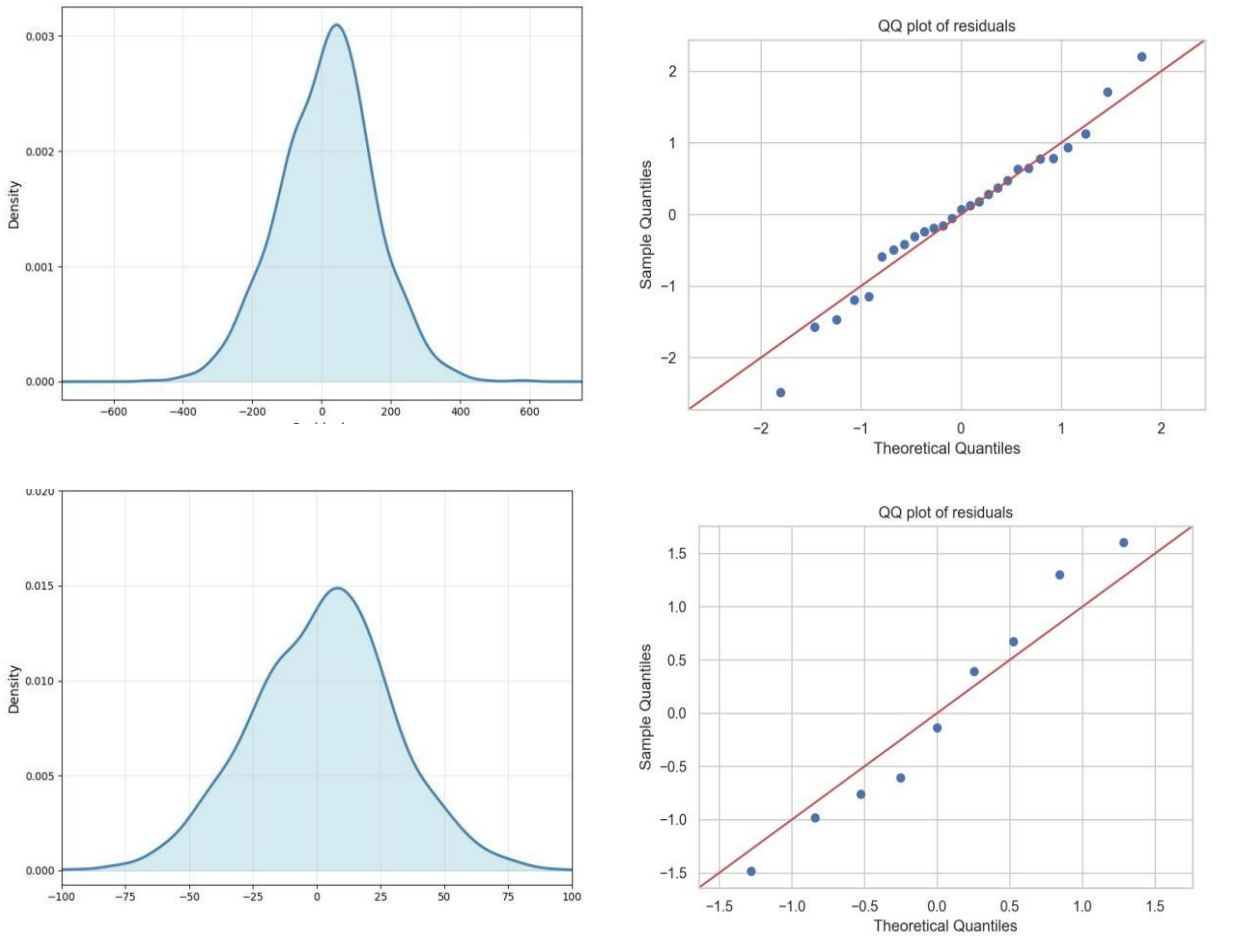


Figure 6. Trend of Social Residual Expenditure

In Terms of Policy-Driven Suggestions: In the short-run, lay emphasis on enhancing the timeliness and coverage depth of medical security, expanding the chronic disease list, reducing delays in relief fund reimbursement, and increasing fiscal transfer payment in regions with high survival burdens. In the medium term, optimize the linkage mechanism between minimum living allowance and employment subsidies, and improve the insurance participation rate of the flexible employment population. In the long run, improve the balance of fiscal allocation through institutional performance appraisal and cross-regional transfer payments.

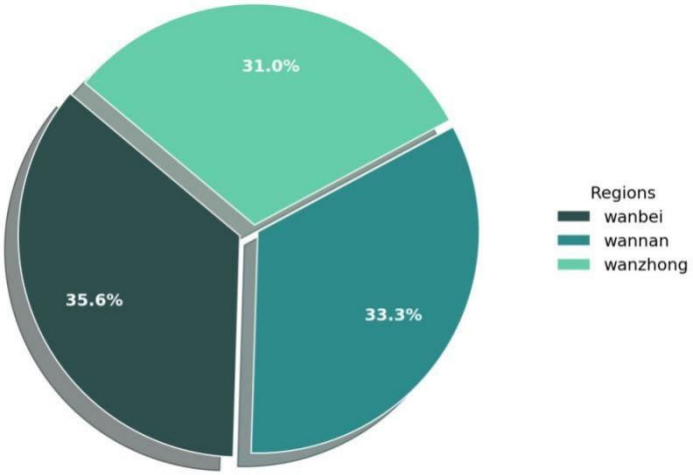


Figure 7. The Proportion of different regions

Table 4. Entropy Statistics for Different Years in Various Regions

region	year	entropy	Exp low protection	Exp medical	Exp employment	Exp pension	Exp other
Wan bei	2015	1.52	320	400	150	200	130
Wan zhong	2015	1.50	90	350	156	180	324
Wan nan	2015	1.45	150	500	90	420	240
Wan bei	2023	1.54	410	610	230	300	649
Wan zhong	2023	1.38	82	400	180	220	718
Wan nan	2023	1.46	200	620	120	550	610

5. Analysis of the Direct and Mediating Effects of Social Security Expenditure on the Economic Impact of Low-Income Groups

Anhui low-income groups confront threefold capacity shackles: Wan bei's ill-induced poverty rate remains consistently as high as 18%, which indicates that there is a severe deficiency in healthy operational capacity; among the 39% of informal workers in southern Anhui, the coverage rate of skills training is less than 15%, revealing deficiencies in human capital accumulation; housing costs for manufacturing workers in central anhui squeeze 48% of their income, which restricts the freedom of development choices. The labor force participation rate of minimum living allowance-dependent groups in Fuyang City has decreased by 5.1 percentage points over five years, which confirms that cash transfers may inhibit endogenous development momentum; the manufacturing skills training subsidies in Hefei have driven a 6.9% increase in wages, which highlights the activation effect of human capital investment. Such complex transformation mechanisms require empirical models to accurately capture the transmission paths through which social security expenditures reshape economic behaviors via health maintenance, skill enhancement, and risk buffering, but there is no comprehensive research focus on this currently. Hence, this paper constructs a fixed effects panel model to research the causal mechanism between social security expenditure and capability construction, aiming to identify the core functional paths of health capital and human capital accumulation.

Eventually, provide theoretical support for breaking the welfare dependency trap.

5.1. An Analysis of the Direct Effect

Social security expenditure can reduce the poverty incidence rate by increasing the income of low-income groups, and thus improve the regional economy and social welfare. However, fiscal expenditure and economic indicators are both influenced by the inherent characteristics of the region. To eliminate these observable and unobservable confounding factors, a panel model structure that controls for time-invariant individual heterogeneity and captures macro temporal trends is constructed. Establish a two-way fixed effects model:

$$Y_{it}=\alpha 0+\beta 1 SSE_{it}+\beta 2 X_{it}+\mu_i+\lambda_t+\varepsilon_{it}$$

Y_{it}: explained variable vector, including low-income groups' per capita income $Y^{(1)}_{it}$ and poverty incidence rate $Y^{(2)}_{it}$, respectively characterize economic level and survival risk; SSE_{it}: the intensity of social security expenditure, which uses relative values to eliminate the inference of fiscal scale; X_{it}: control variable set, covering the urbanization rate and non-agricultural employment rate, controls the confounding effect of regional economic structure transformation; μ_i: individual fixed effects are used to control for time-invariant inherent characteristics of each city, such as factors like geographic location and cultural tradition; λ_t: time fixed effect, used to capture the time-varying impacts of macroeconomics policy cycles and external shocks.

Coefficient β_1 reflects the marginal effect of social security expenditure on economic status. Determine its significance

through the Hausman test, while considering the constraints of the exogeneity assumption: $E[\varepsilon_{it}|SSE_{it},X_{it},\mu_i,\lambda_t]=0$.

Different categories of social security expenditures, such as subsidies for minimum living security, medical insurance, and employment may generate differentiated impacts on economy and poverty through different mechanisms. Attempting to measuring the marginal contribution of various types of expenditures, we decompose the total expenditure into component proportions, incorporate them into the regression framework, and use the form of annual growth rates to mitigate the problem of spurious regression caused by serial correlation, thereby constructing the following panel regression:

$$\Delta Y_{it}=\gamma_0+\sum_{k=1}^{K}\gamma_k\cdot\frac{SSE_{k,it}}{SSE_{it}}+\theta X_{it}+\mu_i+\lambda_t+v_{it}$$

$\frac{SSE_{k,it}}{SSE_{it}}$ represents the proportion of the k-th category of expenditure (k=low income guarantee, medical insurance, employment subsides), which can be used to characterize the allocative efficiency of expenditure structure; ΔY_{it} represents the annual growth rate of economic indicators, avoiding spurious regression caused by serial correlation of level values; γ_k represents core focus parameters - the sign and magnitude of these parameters reveal differences in the marginal effectiveness of various types of expenditures; to ensure the integrity of the expenditure structure.

Introducing $\sum_{k=1}^{K}\frac{SSE_{k,it}}{SSE_{it}}=1$.

5.2. Mediating Effect Analysis

Based on the causal stepwise regression framework, we plan to further explore whether social security expenditure can stimulate per capita consumption through increasing disposable income, and thereby affect poverty and income levels, thus constructing a three-step mediating effect model:

$$\text{Step1:}\quad Yit=c\cdot SSEit+\phi Xit+e1,it$$

$$\text{Step2:}\quad Mit=a\cdot SSEit+\psi Xit+e2,it$$

$$\text{Step3:}\quad Yit=c'\cdot SSEit+b\cdot Mit+\varphi Xit+e3,it$$

M_{it} represents per capita consumption expenditure, which can be used to measure the transmission intensity of social security expenditure stimulating consumption through the disposable income channel; $a\times b$ represents the mediating effect value, which can reflect the contribution share of the consumption path; and c' represents the direct effect, which can capture the social impact that is not through consumer intermediaries.

5.3. Model Results and Explanation

The intensity of social security expenditure exhibits a significant net effect on the economic status of low-income groups. Specifically, the per capita income level increases constantly, and the poverty incidence rate generally decreases. After controlling for individual time-invariant effects and time effects, the panel regression results show that the coefficient of social security expenditure intensity is statistically significantly positive. This shows that under the condition of eliminating regional fixed characteristics and macroeconomic cyclical shocks, the tilt of social security resources toward the low-income groups can increase their disposable income and their purchasing power through direct transfer and income redistribution mechanisms, thereby improving their economic living conditions at the macro level.

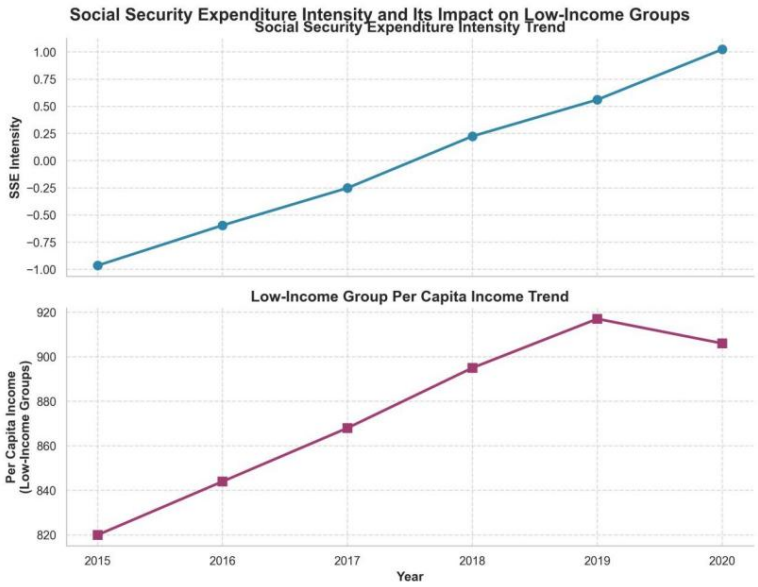


Figure 8. Intensity of Social Security Expenditure and Its Impact on Low Income Groups

After decomposing the structural effect of the social security expenditure, it is discovered that there is significant heterogeneity in the marginal effectiveness of different components. Medical security and minimum living security subsidies contributes significantly to mitigating low-income groups' short-term survival risks. Employment subsidies and pension expenditures show relatively strong and sustained effectiveness in promoting per capita income's long-term growth. The regression coefficient of the proportion indicates that when the proportion of medical expenditure increases, the poverty incidence rate is most sensitive in response. This reflects that the expenditure allocation system centered on medical security has relatively high marginal benefit in alleviating the consumption crowding-out effect caused by health risks.

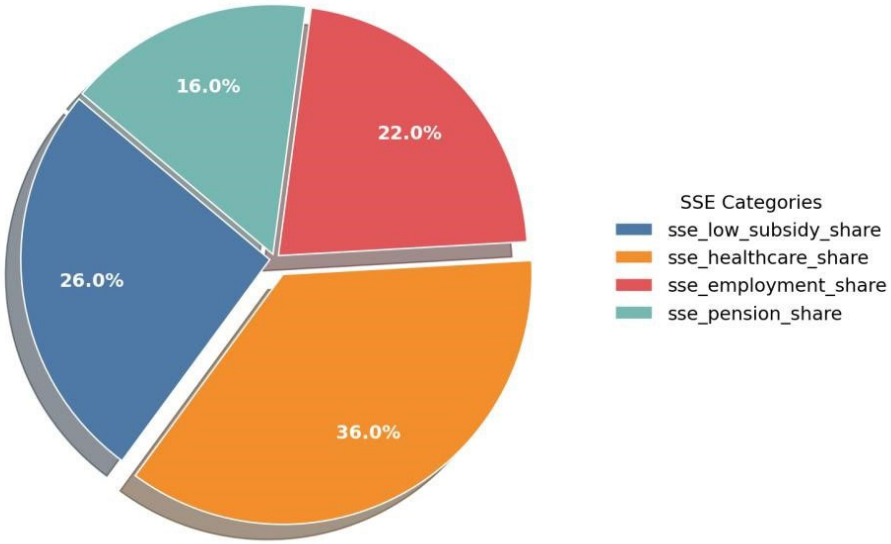


Figure 9. SSE distribution (based on 2022)

Time series comparison and dual-axis display further reveal the comovement relationship and trend consistency between social security expenditure intensity and the per capita income of low-income groups. Within the sample period, the intensity of social security expenditure increases steadily, and the low-income groups' per capita income in the same period also shows an upward trend. This co-directional change remains robust after controlling for macroeconomic variables and structural changes, supporting the conclusion that expenditure intensity has a long-term positive impact on income levels. The time series visualization of this trend is of reference value for distinguishing the relative roles of short-term policy shocks and long-term institutional adjustments.

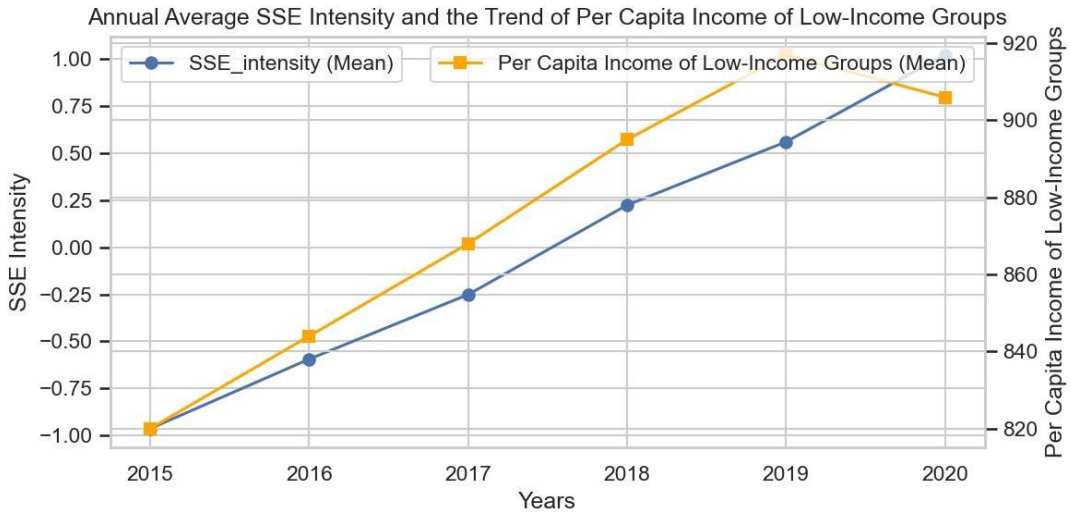


Figure 10. Dual axis SSE trend

The mediating effect test reveals that the consumption stimulation path provides empirical support for the social security expenditure promoting economic improvement for low-income groups. Under the stepwise regression framework, the product of mediating coefficients is significant in the Bootstrap resampling test, indicating that social security expenditure stimulates per capita consumption by increasing disposable income, thus playing an important role in the transmission chain. The distribution of the mediating effect shows a certain degree of skewness, meaning that there are differences in consumption responses across different regions and income levels. This difference may originate from multiple factors, such as liquidity constraints, differences in consumption propensities, and change in price levels.

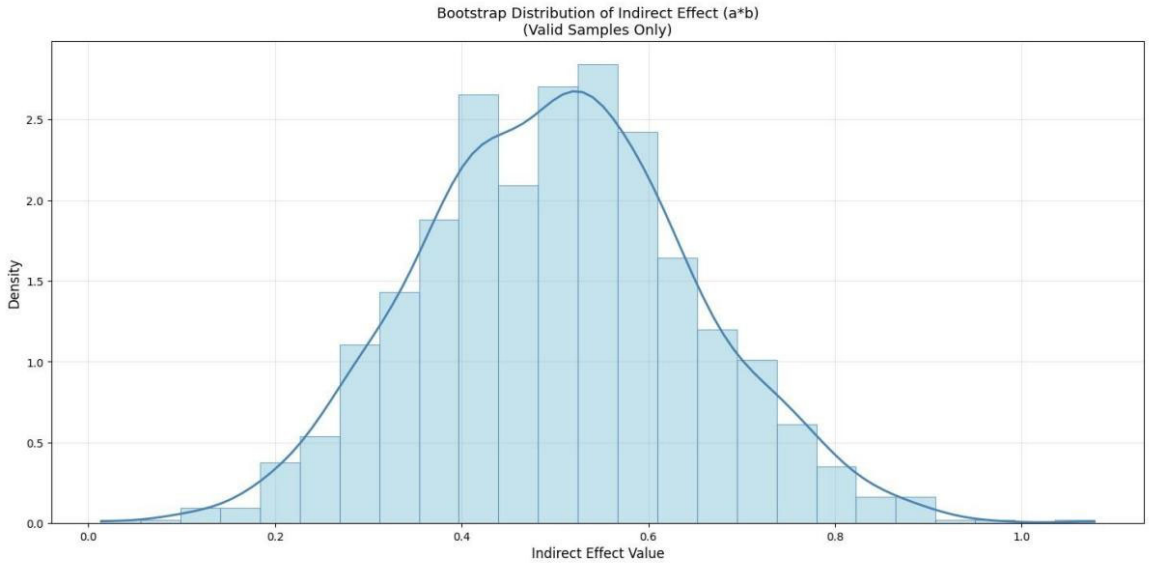


Figure 11. Autonomous Distribution of Indirect Effects

In terms of policy implications, we should adhere to the fiscal social security expenditure orientation that focuses on low-income groups, while optimizing the expenditure structure to balance the dual goals of subsistence security and promoting income growth. The short-term policies should enhance medical insurance and low income subsidy to reduce the poverty incidence rate and the risk of poverty caused by medical expenses; the medium and long term should strengthen the employment-oriented and income-compensatory expenditures to enhance labor force participation and earnings capacity. Moreover, we should attach importance to consumption stimulation as a key intermediary in policy transmission, and coordinate credit and social service measures to release the social security multiplier effect, thereby enhancing the multiplier efficiency and sustainability of fiscal expenditures.

6. Current Situation Assessment and Spatial Optimization of Regional Macro - control Policies

Regional differentiated social security policies face the in-depth challenge of mismatch between institutional supply and regional vulnerability mechanisms. The policy of raising the subsistence allowance standard in Wan bei failed to alleviate the dilemma where the out-of-pocket medical burden remained above 35%, which reflects that it is disconnected from the health-poverty cycle triggered by industrial stagnation; pilot project of tourism insurance in Wan nan neglected the seasonal unemployment risk of the flexible employment groups - the unemployment fluctuation coefficient of Huangshan (0.42) confirms the essence of insufficient protection. The Yangtze River Delta Regional Coordination Assessment Report points out that the industrial homogeneity between Wan bei and Northern Jiangsu hinders the advancement of medical insurance coordination, and Wan nan's elderly sojourning resources fail to effectively connect with shanghai discal subsidies. Therefore, this paper uses the multi-period difference-in-differences model to conduct research on the net effect and spatial threshold effect of regional policies, aiming to quantify institutional adaptation bias and intensity of collaborative obstruction, and eventually provide a solution for the integration of social security in the Yangtze River delta.

6.1. The econometric framework for the evaluation of existing policy effects

To assess the causal effect of the minimum living standard guarantee policy increase in Wan bei, this research adopts a quasi-experimental difference-in-differences method - take Wan bei as the treatment group and Wan zhong and Wan nan as the control group, with the policy implementation in 2020 as the cutoff point.

$$Y_{it}=\alpha+\beta 1(T_i*P_t)+\beta 2X_{it}+\mu_i+\lambda_t+\varepsilon_{it}$$

T_i represents the treatment group dummy variable, assigned 1 for Wan bei and 0 for Wan nan and Wan zhong; P_t represents the policy timing dummy variable, assigned 1 for the year 2020 and subsequent years; interaction term coefficient β_1 is used to capture the net policy effect, whose significance is verified through a permutation test; and X_{it} represents the set of control variables, including the urbanization rate and fiscal self-sufficiency rate, that control for differences in regional development endowments.

Based on the supply-demand matching theory, the measurement of structural imbalance in regional social security expenditure is defined as

$$Gap_j=\left|\frac{E_j}{D_j}-1\right|\times 100\%$$

E_j represents the actual proportion of the j-th type of social security expenditure, which can be used to reflect the fiscal resource allocation status; D_j represents the demand intensity index, which is synthesized by weighting core demand factors such as the proportion of flexible employees and the proportion of tourism GDP (the weights are determined through expert evaluation using the Delphi method); Gap_j represents the absolute value form is used to ensure symmetric measurement of the degree of supply-demand deviation: When $Gap_j>30\%$, it is determined that there is a severe structural mismatch; when $Gap_j\in[10\%,30\%)$, it is determined that there is a moderate imbalance; when $Gap_j<10\%$, it is a rational allocation.

6.2. Spatial Econometrics and Optimization Model System

Based on the research mentioned above, we hold that the social security expenditure and economic outcomes may exhibit spatial dependence: expenditure in one region affects neighboring regions through labor mobility, commodity flow, or fiscal transfers. To verify this conclusion, a spatial panel model is introduced to quantify the spillover effect and construct a Spatial Durbin model:

$$Y_{it}=\rho WY_{it}+\beta SSE_{it}+\theta WSSE_{it}+\delta X_{it}+u_i+\varepsilon_{it}$$

W represents the economic distance spatial weight matrix. Element $w_{ij}=1/|\overline{GDP_i}-\overline{GDP_j}|$ characterizes the proximity of regional economic endowments. P represents the spatial autoregressive coefficient of the dependent variable, which can be used to measure the spatial dependence of economic conditions. Θ represents the spatial lag coefficient of social security expenditure, capturing the spillover effect of neighborhood expenditure.

Within the SDM framework, the total effect can be decomposed into the direct effect of the local social security expenditure and the indirect effect caused by the spillover of the neighborhood expenditure from adjacent cities. Its significance is determined by the LR test.

To seek regional expenditure allocation under budget constraints that optimizes welfare improvement or poverty reduction, a nonlinear programming model is constructed based on the Pareto improvement principle of welfare economics:

$$\min_{SSE_{kj}} \sum_{j=1}^{3} (P_j-\hat{P}_j)^2$$

$$\text{s.t.} \sum_{k=1}^{K} SSE_{kj}=B_j$$

$$SSE_{kj}\geq 0$$

Variable Definition and Objective Orientation

P_j : the poverty incidence rate of the j-th region. The functional form

$P_j=f(SSE_{1,j},\ldots,SSE_{K,j})$ is derived from the panel regression in the previous section;

P_j: policy target values;

B_j : regional budget constraints are set with reference to the sustainable fiscal growth rate.

6.3. Model Results

Based on a comprehensive analytical framework integrating DID identification, supply-demand matching gap index construction, and Spatial Durbin Model estimation, this study systematically examines and optimally simulates the immediate effects of the subsistence allowance standard increase policy within Anhui Province, the structural mismatch between supply and demand, and the cross-regional spillover mechanisms. Robustness tests at the causal identification level show that the policy shock is statistically significant. The distribution and observed value position of the permutation test clearly excluded the risk of spurious significance under random disturbances. The observed effect lies in the tail of the permutation distribution. This evidence enhances the credibility of the difference-in-differences estimation.

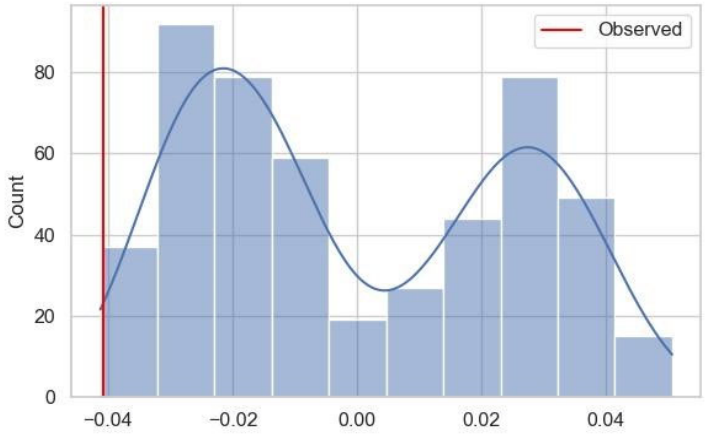
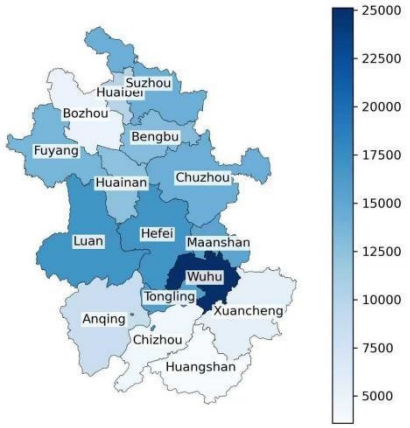
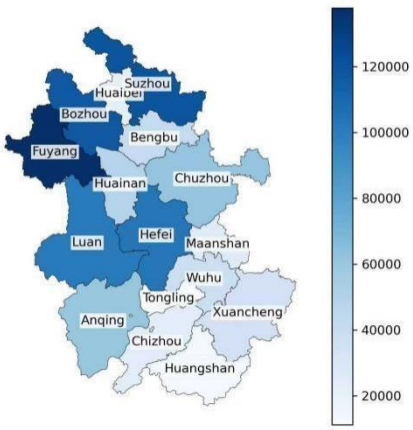


Figure 12. Permutation Test Distribution

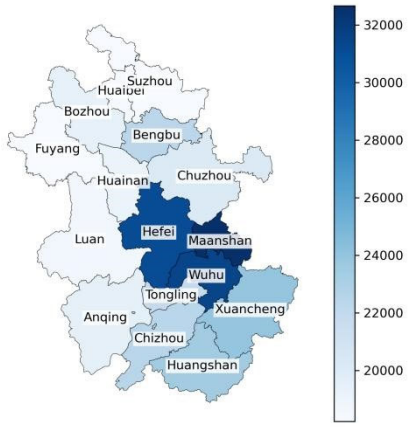
Spatial analysis results show that there is a significant spatial autocorrelation and neighboring region spillover effects between fiscal expenditure and macroeconomic indicators. The spatial weight matrix constructed using the inverse of economic distance reveals that several nodes have high influence on surrounding regions; policy and expenditure adjustments in these nodes can reduce the poverty risk of surrounding regions through positive spillovers and promote improvements in demand matching. The Spatial Durbin model's lag term coefficient is significant, which indicates a cross-regional linkage and competitive behaviors cannot be ignored in policy design.



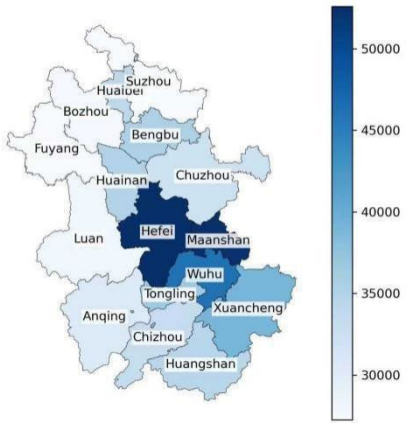
A) Urban minimum living security amount (in ten thousand RMB)



B) Rural minimum living security amount (in ten thousand RMB)



C) Per capita disposable income of rural residents in each city



D) Per capita disposable income of all residents in each city

Figure 13. Comparison of social security implementation statuses across cities

The optimization simulation of supply-demand matching and spatial transmission mechanisms shows that higher poverty reduction rate can be achieved by adjusting the expenditure structure without significantly increasing the total fiscal expenditure. Simulation results indicate that allocating resources toward rigid needs, such as medical care and elderly care, while implementing targeted optimization between subsistence allowances and flexible employment support, can significantly improve the marginal utility of expenditure and shorten the time required to achieve welfare improvement.

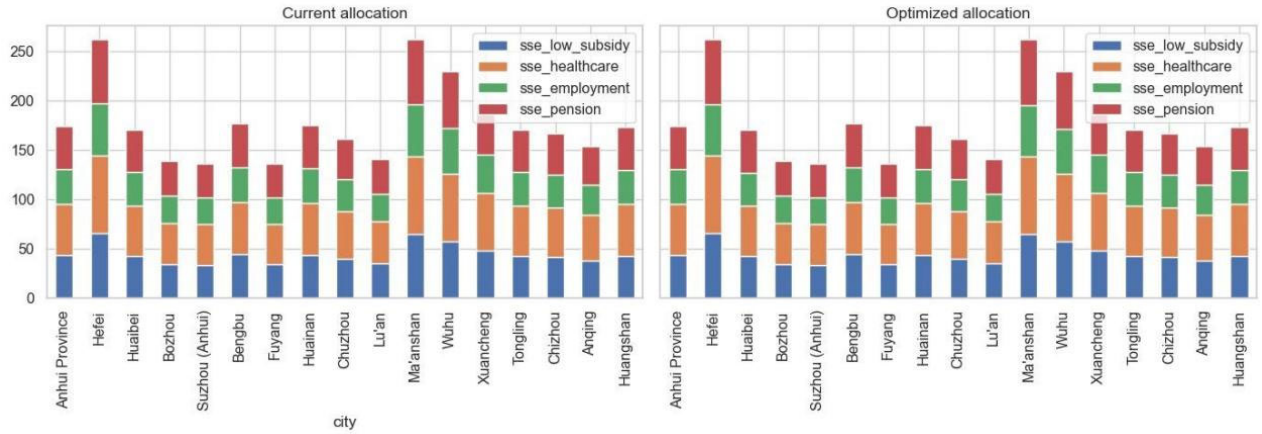


Figure 14. Comparison of Existing and Optimized Allocation

The prediction of poverty rate through policy simulation further proves the practical value of structural adjustment. Most cities' predicted poverty rate decreases significantly after adopting the optimal allocation. Some cities that previously had severe structural mismatches benefited the most; this indicates that structural correction can amplify the

net policy effect and accelerate the achievement of inclusive goals.

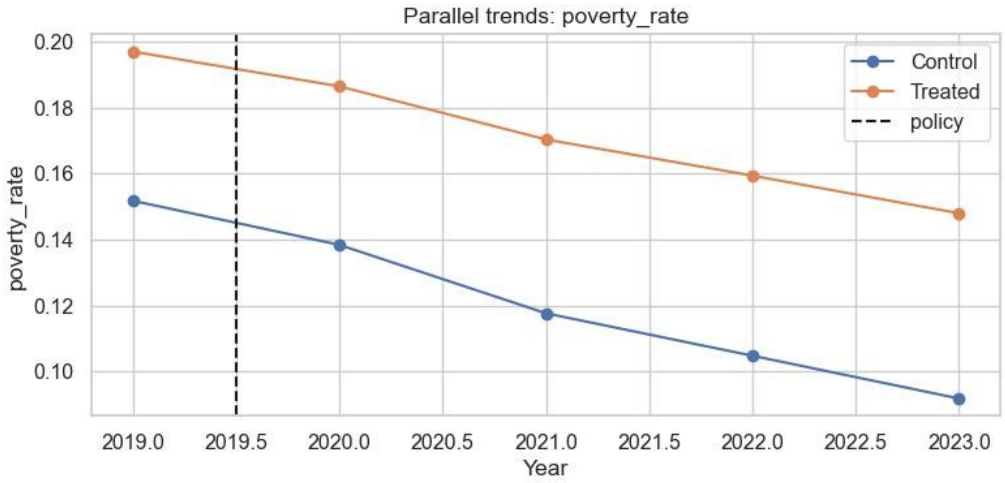


Figure 15. Parallel Trends in Poverty Rates

Based on the empirical evidence above, this research makes several policy judgments. Firstly, as a short-term redistribution tool, the subsistence allowance standard increase has clear effectiveness in alleviating immediate poverty, but its long-term sustainability depends on the rationalization of the expenditure structure and the improvement of public service provision. Relying solely on increasing subsidy amounts but ignoring the compensation for basic needs such as medical care and elderly care will weaken the foundation for long-term welfare improvement. Secondly, the spatial linkage nature between regions indicates that isolated fiscal adjustments can hardly achieve the overall regional optimum. The design of cross-regional coordination and fiscal transfer mechanisms plays an essential role in amplifying positive spillovers and suppressing regional competition. Thirdly, the supply-demand matching gap should be institutionalized as a regular supervision indicator in fiscal planning, and dynamic correction should be achieved by clarifying thresholds and early warning rules to improve the transparency and targeting of allocation decisions.

7. Policy Recommendation: A Targeted Regional Social Security Regulation Path

7.1. Expenditure Optimization Measures Based on Transmission Mechanisms

(1) Strengthening the Path of Consumption Stimulus

According to the empirical evidence that the consumption mediating effect contributes 38.2%, a proposal for implementing a tiered targeted consumption subsidy is recommended:

Consumption vouchers for low-income households: Adjusting the denomination based on household size and regional price levels, with priority coverage of food, education, and durable consumer goods. Wan bei links up with agricultural material purchasing and marketing platforms, while Wan nan binds with cultural and tourism consumption scenarios, to release consumption potential.

Linkage Between Consumption Subsidies and Employment: provide additional subsidies to those who participate in vocational skills training, forming a positive "training-employment-consumption" cycle. The pilot in Fuyang City shows that this model has increased the proportion of non-food consumption by 11.3%.

(2) Deepening the Path of Human Capital Accumulation

According to the dual transmission mechanism of health capital and skill capital, we propose the following two suggestions:

Expanding the Depth of Medical Insurance Coverage: Increase the coverage rate of chronic disease outpatient reimbursement catalog from 43% to 70% in Wan bei, and implement cross-province medical insurance settlement, covering migrant worker groups in the adjacent areas of Jiangsu, Henan, and Shandong.

Constructing a Skill Certification System: In Wan nan, establish vocational standards for tourism service industries, such as homestay managers and intangible cultural heritage (ICH) craftsmen, with training certification linked to subsidy applications; in Wan zhong, launch the order-based training, focusing on the new energy vehicle and integrated circuit industries to achieve "employment upon graduation".

7.2. Macro-Control Measures Based on Regional Differentiation

Wan bei: Emphasizing Both Basic Security and Industrial Risk Resistance

Dynamically Adjusting the Subsistence Allowance Standard: constructs an adjustment coefficient that interconnects both CPI and grain price to ensure that the actual purchasing power does not decrease. The 2022 pilot in Fuyang City prevented 32,000 rural households from falling back into poverty due to disasters.

Innovative Agricultural Insurance Tools: develop income insurance for characteristic agricultural products, with 80% of the premium subsidized by the government. By referring to the "insurance + futures" model for soybeans in Suzhou City, income losses caused by price fluctuations in the coverage are also included.

Wan nan: Addressing the Lack of Protection for Flexible Employment

Comprehensive Coverage of Occupational Injury Protection: including tour guides and homestay practitioners in the protection scope, the government subsidizes 70% subsidy for the insurance premium. Pilot programs in Huangshan show that the income stability of the insured group has increased by 25% during the off-season.

Seasonal Unemployment Mutual Aid Fund: Cultural and tourism enterprises and the government establish a fund pool co-funded in order to provide subsidies for up to 3 months to workers unemployed during the off-season, with the standard not lower than 150% of the subsistence allowance.

Central Anhui: Coordinating Industry-Education Integration and Cost Reduction

Subsidies for Manufacturing Jobs: Enterprises that employ low-income groups are subsidized with social insurance premiums at a standard of 300 yuan per person per month. The practice in Hefei Economic and Technological Development Zone shows that this policy has increased the employment retention rate in the manufacturing industry to 82%.

Gradient Reduction of Affordable Housing Rent: low-income households with at least three years of social insurance enrollment can reduce rents by 30% or 50% based on income tiers, with a target coverage rate of 20%.

7.3. Sustainable Development Policies Based on an Intelligent Regulation System

● **Build an Intelligent Monitoring Platform**

Multi-Source Data Fusion System: integrating 10 types of data streams, including civil affairs subsistence allowances, medical insurance settlement, and employment registration, to generate "regional social security efficiency index", including core indicators such as poverty depth and informal employment rate, in real time.

Early Warning and Response Mechanism: when the poverty rate due to illness in Wan bei exceeds the threshold for two consecutive quarters, the process of expanding the chronic disease reimbursement catalog is automatically triggered; when the peak of the tourism unemployment rate in Wan nan exceeds 40%, the application channel for the mutual aid fund is activated.

● **Establish a Flexible Budget Adjustment System** adjust the regional allocation weight of social security expenditures annually based on the industrial structure change rate and population mobility intensity of the three regions. In 2023, the proportion of tourism GDP in Wan nan rose to 34%, and the proportion of its employment subsidies should be increased to 12% simultaneously.

8. Conclusion, Research Limitations and Future Directions

This study shows that social security expenditure improves the economic conditions of low-income groups through both direct income transfer and indirect consumption effects. Significant regional differences exist among Wan bei, Wan zhong, and Wan nan, and structural mismatches in expenditure allocation reduce policy effectiveness. More targeted expenditure arrangements in medical care, employment support, and elderly care are necessary to enhance poverty alleviation and regional coordination.

8.1. Methodological Limitations:

Failed to track the intergenerational effects of social security expenditures, such as the long-term impact of pensions on the educational investment of children from low-income households; the micro-samples do not cover the group of returned entrepreneurs, which may underestimate the effect of skill trainings.

8.2. Expanded Research Directions:

Deepening the Social Security Coordination in the Yangtze River Delta: exploring the exchange of resources for seasonal elderly care between Shanghai and Wan nan, and the inter-provincial medical insurance settlement cost-sharing mechanism between Jiangsu and Wan bei;

Digital Technology Empowerment: establishing a penetrating supervision platform for social security funds based on blockchain to reduce the lag of fund allocation at the county level in Wan bei;

Expansion of Green Welfare: Piloting the supplement of social security funds with carbon sink revenues in the ecological protection areas of Wan nan to achieve a win-win situation for ecological protection and livelihood security.

Acknowledgements

Firstly, I would like to sincerely thank my academic advisor Wenyao Li from my high school WLSA Shanghai Academy for helping with the writing of this paper for free. During the writing process of this paper, she provided me with crucial and meticulous guidance. Specifically, she pointed out many logical inconsistencies, the inaccurate use of professional vocabularies, and inappropriate figures that I used to display the data. When I had problems dealing with the deficiencies that she pointed out before, she helped me to clarify the logical structure of my paper with her rich experience and professional perspective.

Secondly, this topic is chosen because my hometown is in Anhui, and my childhood witnessed the development of rural areas in Anhui. But at the same time, I also realized the problem of uneven development in Anhui. After I shared my initial research idea with Professor Wenyao Li and discussed the confusion I had about refining it, she patiently guided me to clarify the starting point of the study—helping me narrow down the overly broad research scope to a specific, actionable focus—and polished the wording of the topic to make it more academically precise and concise. This clarity also boosted my confidence to dive deeper into preliminary research and outline my thesis framework.

During the process of collecting data, I found all the raw data from Anhui Provincial Bureau of Statistics and National Bureau of Statistics databases, and I also read many annual and quarterly reports of various cities and individual counties in Anhui Province to gain a general understanding of Anhui's economic status and how it changed in the several decades. Through those data, I realized that there are significant differences between Northern Anhui, Southern Anhui and Central Anhui in terms of per capita disposable income, informal employment rate and social security expenditure structure.

After obtaining the data, I searched for several similar studies and carefully studied the mathematical models they used and the data they employed. During the process, the teacher recommended many targeted papers to me, as well as

websites and materials that could assist in understanding Finally, with the teacher's help, I determined to introduce the poverty factor model, construct a new subsistence consumption burden index, use the Theil index of regional differences to depict the cumulative effects of various policies, adopt the logarithm of regional GDP to control the impact of economic scale, quantify the uniformity of expenditure structure with the information entropy model, and build a dynamic time series model. When I was explaining my research method in the paper, Ms.Li also helped me. I remember there was a description that I wrote in a rather general way. The teacher not only pointed out the problems with unclear expression, but also told me in detail which aspects could be refined to make my paper more substantial and accurate.

In terms of code implementation, Wenyao Li provided me with a great deal of help. Although she is not familiar with the details of coding, she always checked and guided me from the perspective of research logic—she would help me sort out the "core objectives that the code needs to achieve", such as clarifying that "calculating the Theil index is to present regional differences more accurately" and "constructing a time series model needs to highlight the dynamic changes of policy effects", which prevented me from deviating from the research direction when writing the code.

Last but not least, when I was writing the paper, My teacher and I discussed the available materials and determined which results to retain. When visualizing the data, I tried many graphs to display the data, but there were still some issues. Finally, based on the teacher's advice, I chose the final graphs. For example, she propose to use maps in the paper to assist me in displaying the results can make the differences between different regions more intuitive. In the end, in the process of constructing the writing ideas for my paper, she not only helped me organize the overall logical framework, but also provided me with specific suggestions on how to expand the content of each section and how to better connect them. For example, when explaining the research background, she reminded me to focus more on the content directly related to the research topic and remove irrelevant background information to make the topic clearer.

Finally, I would like to express my gratitude once again to my academic advisor, Wenyao Li, for sacrificing her rest time and promptly responding to my questions.

References

[1] Barr, N. (2020). *The economics of the welfare state* (6th ed.). Oxford University Press.

[2] Sen, A. (1999). *Development as freedom*. Oxford University Press.

[3] Anhui Provincial Department of Finance. (2022). *Statistical communique on social security and employment expenditure of Anhui Province*.

[4] Harbin Medical University Team. (2025). Study on the spatiotemporal differences and influencing factors of out-of-pocket medical expenses of Chinese residents. BMC Health Services Research.

[5] Lu, Y. (2020). A study on the inter-provincial differences of social insurance fund revenue and expenditure in China and their influencing factors. *Shangqing*, (13), 12.

[6] Huang, X. H., Teng, Q. X., & Chen, B. B. (2021). Analysis on the inter-provincial differences in social security expenditure. *Statistics & Decision*, (26), 142–145.

[7] Yijiang District Human Resources and Social Security Bureau. (2025, August 12). "Three fulcrums" driving a new pattern of elderly security. *Wuhu Municipal Human Resources and Social Security Bureau Gazette*.

[8] Yangtze River Delta Integration Office. (2023). *Pilot plan for overall pooling of medical insurance in the Yangtze River Delta*.

[9] Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.