

REGIONAL DISPARITIES IN THE DEVELOPMENT LEVEL OF AGRICULTURAL INSURANCE IN YUNNAN PROVINCE

RiXuan Lu*, Xiang Wang

School of Finance, Yunnan University of Finance and Economics, Kunming 650221, Yunnan, China.

**Corresponding Author: RiXuan Lu*

Abstract: The balanced regional development of agricultural insurance is an important foundation for ensuring the effectiveness of agricultural risk dispersion and optimizing the allocation of policy resources. Studying the disparity pattern of agricultural insurance development levels within a province is of great significance for targeted policy formulation. Based on panel data from 16 prefectures and cities in Yunnan Province from 2014 to 2023, this paper measures the development level of agricultural insurance using the entropy method, and analyzes regional disparities through the coefficient of variation and the Gini coefficient. The results show that the scale of agricultural insurance in the province has continued to expand, yet the problem of unbalanced regional development remains prominent, with distinct hierarchical differentiation characteristics among different prefectures and cities. The absolute disparity in agricultural insurance development across the province has widened, while the relative disparity has gradually narrowed, indicating an improvement in overall regional balance. Further analysis reveals that the low level of industrial structure, the frequent occurrence of natural disasters, and the regional imbalance of fiscal subsidies are the three key drivers of the current unbalanced regional development. Based on the above conclusions, this paper proposes recommendations such as implementing differentiated regional policies, optimizing the allocation of fiscal subsidies, and improving the grassroots service system.

Keywords: Yunnan Province; Agricultural insurance; Regional disparities

1 INTRODUCTION

China is in a critical stage of comprehensively advancing rural revitalization. As a core policy instrument for diversifying agricultural risks and stabilizing farmers' income, the balanced regional development of agricultural insurance plays a vital supporting role in consolidating the agricultural foundation and safeguarding farmers' rights and interests [1]. Issued by the Ministry of Finance in 2021, the Measures for the Administration of Central-Government Premium Subsidies for Agricultural Insurance establishes basic principles including government guidance and market-oriented operation. By adopting policy instruments such as premium subsidies and rewards instead of direct subsidies, it provides institutional basis for the insurance development of bulk agricultural products and local characteristic agricultural products.

As a typical borderland multi-ethnic agricultural province, Yunnan Province takes industries such as tea, rubber and Chinese medicinal herbs as its economic pillars. Nevertheless, it is confronted with challenges including complex terrain, frequent natural disasters and the fragmented operation of small-scale farmers. In 2025, four departments including the Yunnan Provincial Department of Finance issued the Several Policies on Promoting the Innovative Development of Agricultural Insurance, proposing to foster a new development pattern of "one main body, two auxiliaries and one overlay". The Work Plan for Accelerating the Development of Insurance for Local Characteristic Agricultural Products in Yunnan Province focuses on key industries such as "one industry for one county" and optimizes the fiscal reward and subsidy mechanism. The Implementation Rules for the Administration of Premium Subsidy Funds for Agricultural Insurance in Yunnan Province standardizes fund management and fiscal cost-sharing. Despite continuously growing policy support, the regional development of agricultural insurance in Yunnan remains unbalanced. Prefectures and cities differ substantially in economic development level, agricultural industrial structure and fiscal capacity, which gives rise to uneven performance in insurance coverage, product supply and service efficiency. Regions with high agricultural industrialization possess relatively sound service systems, whereas remote mountainous and ethnic-minority areas still suffer from problems including limited product categories, insufficient insurance participation and delayed claim settlement. Systematically investigating regional disparities and their influencing factors of agricultural insurance in Yunnan constitutes an essential prerequisite for advancing the province's agricultural insurance from full coverage toward equalized development.

Against the increasingly prominent unbalanced regional development of agricultural insurance, academic circles have conducted extensive research on evolutionary characteristics, formation mechanisms and influencing factors of agricultural insurance regional disparities at diverse spatial scales. From the national macro-regional perspective, driving mechanisms for agricultural insurance development differ significantly among eastern, central and western China. Market factors act as the core driving force in eastern regions, while the development of central and western regions relies heavily on policy support [2]. From the perspective of provincial-level development gaps, the degree of divergence in agricultural insurance development among provinces has been narrowing year after year. Central fiscal transfer payments exert a critical regulatory effect on balancing provincial development disparities [3]. Focusing on the

provincial micro-level, the core driving conditions for agricultural insurance development vary across provinces. Specifically, the development of agricultural insurance in Shandong Province is jointly driven and constrained by both supply-side and demand-side factors [4]. Henan Province, by contrast, boasts unique agricultural resource endowments and enjoys inherent advantages driven by insurance demand [5]. In addition, although the regional disparities of agricultural insurance in Gansu Province have narrowed slightly, its overall development level remains relatively low [6]. The Yangtze River Delta region suffers from intra-regional imbalance in agricultural insurance development, and the growth of the insurance industry has not formed a synchronous coupling relationship with regional economic growth [7]. Specialized studies focusing on Yunnan Province further indicate that due to complex geographical conditions, diversified agricultural industries, extensive operation modes and crude risk zoning, general agricultural insurance products can hardly adapt to the differentiated development demands across various regions of Yunnan [8]. Meanwhile, the dual problems of farmers' low willingness to participate in insurance and insufficient supply of characteristic insurance types further restrict the high-quality development of agricultural insurance within the province [9]. To sum up, existing studies have yielded fruitful achievements in the measurement of regional disparities in agricultural insurance and the application of research methods. Nevertheless, research gaps still remain. Few studies have systematically explored prefecture-level development differences within the province by combining the regional characteristics of Yunnan as a border multi-ethnic province. Accordingly, constructing an evaluation system for agricultural insurance development that conforms to Yunnan's provincial reality represents a key research direction for follow-up studies in this field.

Current research in the field of agricultural insurance has yielded abundant achievements, providing theoretical support for understanding the development level and regional disparities of agricultural insurance. Nevertheless, certain limitations still exist in existing studies. Meanwhile, with the further advancement of the regional coordinated development strategy, considerable research space remains in this field. Starting from three dimensions: systematic measurement, evolutionary characteristics and formation mechanism of regional differences, this paper explores the differential pattern of agricultural insurance development across 16 prefecture-level cities in Yunnan Province, and puts forward paths to optimize the allocation of agricultural insurance resources and implement differentiated policies.

2 DATA SOURCES AND RESEARCH METHODS

2.1 Data Sources

Mature research results are available for reference regarding the construction of the evaluation index system for agricultural insurance development level [10]. Following existing index selection principles and statistical caliber, this paper adopts five indicators to measure the agricultural insurance development level of each region, including agricultural insurance premium income, the proportion of agricultural insurance premium income in property insurance, agricultural insurance loss ratio, agricultural insurance depth, and agricultural insurance density. The specific indicators are shown in Table 1:

Table 1 Selected Indicators

Indicator Name	Calculation Formula	Unit
Agricultural insurance premium income	/	Ten thousand yuan
Proportion of agricultural insurance premium income in property insurance	Agricultural insurance premium income / Property insurance premium income	%
Agricultural insurance loss ratio	Agricultural insurance claim expenditure / Agricultural insurance premium income	%
Agricultural insurance depth	Agricultural insurance premium income / Added-value of the primary industry	%
Agricultural insurance density	Agricultural insurance premium income / Agricultural population	Yuan per capita

Among the above-mentioned data, agricultural insurance premium income, claim expenditure and property insurance premium income are sourced from China Insurance Yearbook. The added-value of the primary industry and agricultural population are obtained from Yunnan Statistical Yearbook. The proportion of agricultural insurance premium income in property insurance, agricultural insurance loss ratio, agricultural insurance depth and agricultural insurance density are calculated.

2.2 Research Methods

2.2.1 Entropy method

By reviewing existing literature, multiple approaches are available to measure the development level of agricultural insurance. As a widely-used measurement method, the entropy-weight method has well-established application procedures. It determines weights according to the information entropy of each indicator, which can effectively avoid subjective arbitrariness in indicator weighting and guarantee the objectivity and scientific nature of weight calculation

[11]. Accordingly, this paper adopts the entropy-weight method to evaluate the development level of agricultural insurance. The specific steps are as follows:

First, construct the original matrix. Taking each city in each year from 2014 to 2023 as an evaluation object, an original data matrix $X = (X_{ij})_{m \times n}$ is established, where m denotes the number of evaluation objects and n denotes the number of evaluation indicators.

Second, carry out homotropic treatment to unify the attribute of all indicators:

$$X_{ij}^* = \frac{1}{x_{ij}} \quad (1)$$

To eliminate the interference of dimensional units, redundancy reduction is conducted for indicators. The homotropic-processed matrix is further normalized to improve the comparability of indicator scores:

$$z_{ij} = \frac{x_{ij}^*}{\sqrt{\sum_{i=1}^m x_{ij}^{*2}}} \quad (2)$$

Then standardize the indicators.

For positive indicators:

$$y_{ij} = \frac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}}, i=1, 2, \dots, m, j=1, 2, \dots, n \quad (3)$$

For negative indicators:

$$y_{ij} = \frac{x_{\max} - x_{ij}}{x_{\max} - x_{\min}}, i=1, 2, \dots, m, j=1, 2, \dots, n \quad (4)$$

On this basis, calculate the proportion p_{ij} of the i -th sample under the j -th indicator. Next, compute the entropy value e_j of the j -th indicator.

If $P_{ij}=0$, define $\sum_{i=1}^m p_{ij} \ln p_{ij} = 0$. After obtaining entropy values, calculate the utility value of the j -th indicator: $g_j = 1 - e_j$. A larger utility value implies higher variation degree and greater information weight of the corresponding indicator. Further compute the weight of each indicator:

$$w_j = \frac{g_j}{\sum_{j=1}^n g_j} \quad (5)$$

Finally, multiply the normalized data by corresponding weights to obtain the weighted matrix:

$$z_{ij}^* = z_{ij} \times w_j \quad (6)$$

Through the above steps, the comprehensive score of agricultural insurance development level for each prefecture-level city in Yunnan Province can be acquired.

2.2.2 Coefficient of variation and Gini coefficient

Drawing on existing studies on regional disparity measurement, scholars have applied the coefficient of variation and Gini coefficient to provincial-level agricultural insurance research. They systematically analyzed the temporal-evolution characteristics, regional differentiation rules and spatial convergence trends of agricultural insurance development, and verified the rationality and applicability of combining the two methods in depicting dynamic changes of regional disparities [12]. Accordingly, this paper adopts the coefficient of variation and Gini coefficient to measure score differences of regional composite indexes, so as to objectively reflect the dynamic evolution of regional development gaps.

As an effective statistical tool, the coefficient of variation can accurately reveal disparities and changing trends of agricultural insurance development across regions. Its formula is shown below:

$$C_v = \frac{1}{Q_0} \sqrt{\frac{1}{(m-1)} \sum_{i=1}^m (Q_i - Q_0)^2} \quad (7)$$

Where C_v stands for the coefficient of variation in a given year; m is the number of cities; Q_0 is the mean value of the comprehensive index of agricultural insurance development in a given year; Q_i represents the comprehensive index of agricultural insurance development of city i . A larger C_v indicates greater gaps in agricultural insurance development among prefecture-level cities.

The Gini coefficient is used to measure spatial disparities. A higher Gini coefficient means larger spatial disparities, while a lower value means smaller spatial disparities. Its formula is as follows:

$$Gini = 1 + \frac{1}{M} - \frac{2}{M^2 \bar{x}_{mean}} (x_1 + 2x_2 + 3x_3 + \dots + mx_m) \quad (8)$$

Where $Gini$ denotes the Gini coefficient; M is the total number of research units; $\bar{x}_{mean}$ is the average development level, and $x_1 \geq x_2 \geq x_3 \geq \dots \geq x_m$.

3 CURRENT SITUATION OF AGRICULTURAL INSURANCE DEVELOPMENT IN PREFECTURE-LEVEL CITIES OF YUNNAN PROVINCE

3.1 Security Level of Agricultural Insurance in Prefecture-level Cities

Agricultural insurance premium income serves as a core indicator for measuring market scale and development status, which can directly reflect the actual security capacity of agricultural insurance. It can reflect the coverage and penetration of agricultural insurance, as well as farmers' trust and participation willingness. Meanwhile, changes in premium income help reveal the development trend of agricultural insurance security capacity and its supporting role in mitigating agricultural production risks. See Table 2 for details:

Table 2 Agricultural Insurance Premium Income of Prefecture-level Cities in Yunnan Province (2019-2023) (Unit: Ten Thousand Yuan)

Region	2019	2020	2021	2022	2023
Kunming	21452	15689	20800	17167	21624
Qujing	19876	22588	26221	27105	29131
Yuxi	9491	8499	10578	10493	11733
Baoshan	11646	15327	16939	15979	18325
Zhaotong	7339	8981	11470	16569	18930
Lijiang	6386	7017	6887	5946	6250
Pu'er	8255	13499	14146	16999	17364
Lincang	15367	15679	15069	15663	15501
Chuxiong	12403	12570	13110	11962	15197
Honghe	9957	9680	11749	12871	14267
Wenshan	6710	6998	7771	7897	8402
Xishuangbanna	5777	5854	6037	7238	9758
Dali	13814	16711	16607	16517	15851
Dehong	7241	7851	7102	7090	9361
Nujiang	2394	2590	2700	2972	2738
Diqing	6491	7191	6060	6489	5009

In terms of premium income across prefecture-level cities, most regions show an upward trend. Significant growth is observed in Qujing, Baoshan and Zhaotong. In 2023, Qujing ranks first across the province with 29131 ten thousand yuan, followed by Kunming with 21624 ten thousand yuan. Lincang, Dali and Chuxiong stay at the middle level. Regions with solid agricultural foundations and relatively high economic levels generally have larger premium scales, while regions with limited agricultural scale such as Nujiang and Diqing register lower values. Such disparities are related to local economic development, agricultural industrial structure and policy support intensity. Zhaotong achieves the most prominent premium growth, with an increment of 11591 ten thousand yuan from 2019 to 2023. Pu'er and Baoshan also witness considerable growth. Premium income fluctuates slightly in Lijiang, Lincang and Dali, and declines in Diqing, which generally reflects the unbalanced regional development of agricultural insurance in Yunnan Province.

Agricultural insurance claim expenditure directly reflects the economic compensation provided by insurance institutions for farmers' losses, and largely demonstrates the practical effect of agricultural insurance in risk response. Generally speaking, larger claim expenditure indicates heavier risk liabilities undertaken by insurers and stronger risk security capacity. Meanwhile, this indicator indirectly reveals regional differences in agricultural risks and provides valuable references for evaluating the real security level of agricultural insurance. See Table 3 for details:

Table 3 Agricultural Insurance Claim Expenditure of Prefecture-level Cities in Yunnan Province (2019-2023) (Unit: Ten Thousand Yuan)

Region	2019	2020	2021	2022	2023
Kunming	18169	16802	19536	24260	20002
Qujing	15679	16242	18416	25134	23100
Yuxi	5406	4280	7919	11049	7965
Baoshan	8055	11343	12567	14453	13066
Zhaotong	2151	4820	8108	11645	14751
Lijiang	3683	5869	6790	5774	4266
Pu'er	4095	6958	9343	12995	10432
Lincang	5739	9217	12729	10953	9024
Chuxiong	9337	10291	9688	14314	11583
Honghe	11326	13889	14570	25926	10786
Wenshan	7293	9510	10709	6963	6133
Xishuangbanna	2479	6179	4983	4635	6853
Dali	6292	16506	14401	20692	13205
Dehong	2590	6573	4933	6196	6101
Nujiang	1293	1496	1252	1088	2153
Diqing	3371	3222	4410	5151	4412

From the perspective of agricultural insurance claim expenditure, most regions including Kunming, Qujing, Baoshan, Zhaotong, Pu'er, Chuxiong and Dali show an overall fluctuating upward trend. Many prefecture-level cities reached periodic peaks in 2022. Honghe, Qujing and Kunming recorded claim expenditure of 25926 ten thousand yuan, 25134 ten thousand yuan and 24260 ten thousand yuan respectively, forming the core claim-paying areas of the province.

Central and eastern Yunnan with large-scale agricultural production and high disaster risks have relatively high claim expenditure, while regions with small agricultural volume such as Nujiang and Diqing remain at low levels. Nujiang's claim expenditure stayed below 2200 ten thousand yuan throughout 2019-2023. Such regional differences are closely related to local agricultural disaster frequency, industrial risk exposure and claim settlement efficiency. Zhaotong presents the most remarkable growth in claim expenditure, with an increment of 12600 ten thousand yuan from 2019 to 2023. Pu'er and Baoshan also achieve prominent growth. Claim expenditure declines periodically in Lijiang, Wenshan and Lincang. Honghe witnesses a sharp drop in 2023 compared with 2022. The above facts reflect the regional imbalance and annual fluctuation characteristics of agricultural insurance claim expenditure in Yunnan Province.

3.2 Fiscal Support for Agricultural Insurance in Prefecture-level Cities

In the 2024 agricultural insurance premium subsidy arrangement of Yunnan Province, central and provincial finance adopt hierarchical support measures according to local agricultural production characteristics, showing obvious regional differences in capital allocation. At the central level, the total advanced-allocated subsidies amount to 95592 ten thousand yuan, including 86032 ten thousand yuan for bulk agricultural product premium subsidies and 9559 ten thousand yuan of incentive funds for local competitive characteristic agriculture. Among all prefecture-level cities, Kunming obtains the largest central subsidy of 9603 ten thousand yuan; Zhaotong, Pu'er, Dali and Qujing also rank high across the province, while Nujiang ranks the lowest. In terms of capital structure, central special incentive funds are inclined to regions with solid characteristic agricultural foundations. Kunming, Zhaotong and Chuxiong benefit substantially, whereas Dali, Dehong, Nujiang and Diqing are not covered by this fund.

The total provincial subsidy allocated simultaneously reaches 29000 ten thousand yuan. Although detailed component data of some prefecture-level cities are not fully disclosed, existing information indicates that provincial subsidies cooperate closely with central funds. For instance, Kunming enjoys advantages both in central support and provincial characteristic insurance. Regions prioritized by central funds such as Lincang receive corresponding provincial matching support. Meanwhile, regions with demand for characteristic agriculture such as Xishuangbanna and Lijiang obtain supplementary provincial special subsidies. It is worth noting that prefecture-level cities excluded from central special incentive funds receive no corresponding provincial characteristic insurance subsidies. Generally, Nujiang in northwest Yunnan also maintains a low level of provincial subsidies. Provincial funds focus on two main lines: guarantee for bulk crops and cultivation of characteristic industries, which is highly consistent with central fiscal policy orientation.

3.3 Continuous Improvement of Agricultural Insurance Policies

Over the past decade, based on local agricultural production realities, Yunnan has continuously optimized its agricultural insurance policies and gradually established a policy system covering both bulk and characteristic agricultural products. Policy priorities have shifted from basic insurance coverage toward expanding coverage scope, increasing insurance categories and raising insured amounts. Support mechanisms have evolved from simple premium subsidies toward coordinated development of fund management, product innovation and risk diversification, laying an institutional foundation for the development of agricultural insurance across the province. In 2020, four government departments jointly issued Implementation Plan for Accelerating the High-quality Development of Agricultural Insurance in Yunnan Province, which serves as the programmatic document for the new era.

In terms of subsidy administration, two versions of Implementation Rules for the Administration of Agricultural Insurance Premium Subsidy Funds in Yunnan Province were released in 2022 and 2025. They standardize subsidy scope, fund appropriation procedures and performance evaluation, and form a differentiated pattern in which the central government guarantees bulk agricultural products while local governments support characteristic industries. The 2024 work plan specifies the insured amount, premium rate and fiscal sharing ratio for key insurance types such as full-cost insurance for three major staple grains and natural rubber, so as to improve the adaptability between policies and practical risks.

Focusing on plateau-characteristic agriculture, the Work Plan for Accelerating the Development of Local Characteristic Agricultural Product Insurance issued in 2025 includes tobacco leaves, beef cattle, plateau fruits and vegetables into provincial-level characteristic insurance categories. It establishes a development model combining provincial overall planning with prefecture-county hierarchical administration, and builds an incentive mechanism integrating benchmark subsidies and performance motivation. In the same year, Several Policies on Promoting the Innovative Development of Agricultural Insurance put forward a new framework of "one main body, two auxiliaries and one superposition". It promotes comprehensive natural rubber insurance and financial innovation pilots, and improves the catastrophe risk-sharing mechanism.

In general, Yunnan's agricultural insurance policies have undergone an evolution from basic security to high-quality development, and from unified provincial-wide policy implementation to measures adapted to local conditions over the past decade. It provides institutional support for prefecture-level regions to develop agricultural insurance according to industrial realities and narrow regional gaps.

4 RESULTS ANALYSIS

By substituting the above-mentioned indicator data into the formula of the entropy-weight method, the weight scores of each indicator can be determined, and the comprehensive scores and corresponding rankings of agricultural insurance development level for prefecture-level cities in Yunnan Province can be obtained for analysis. The results are shown in Table 4 and Table 5:

Table 4 Comprehensive Scores of Agricultural Insurance Development Level of Prefecture-level Cities in Yunnan Province

Region	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Kunming	0.33	0.38	0.36	0.33	0.24	0.25	0.19	0.25	0.23	0.16
Qujing	0.16	0.16	0.13	0.12	0.16	0.23	0.26	0.31	0.33	0.34
Yuxi	0.10	0.08	0.08	0.08	0.07	0.14	0.13	0.18	0.19	0.20
Baoshan	0.12	0.11	0.11	0.10	0.18	0.20	0.27	0.29	0.28	0.30
Zhaotong	0.04	0.06	0.06	0.04	0.04	0.09	0.12	0.17	0.24	0.27
Lijiang	0.12	0.11	0.09	0.08	0.08	0.18	0.21	0.22	0.18	0.18
Pu'er	0.06	0.05	0.06	0.06	0.11	0.13	0.23	0.25	0.31	0.30
Lincang	0.26	0.22	0.14	0.16	0.17	0.27	0.29	0.30	0.29	0.28
Chuxiong	0.20	0.17	0.15	0.18	0.18	0.20	0.22	0.23	0.23	0.26
Honghe	0.13	0.10	0.09	0.10	0.13	0.15	0.16	0.18	0.23	0.19
Wenshan	0.13	0.12	0.08	0.12	0.12	0.11	0.13	0.15	0.12	0.12
Xishuangbanna	0.12	0.11	0.06	0.10	0.08	0.14	0.17	0.17	0.19	0.26
Dali	0.11	0.13	0.10	0.10	0.10	0.18	0.25	0.24	0.25	0.22
Dehong	0.15	0.19	0.11	0.14	0.12	0.17	0.22	0.20	0.20	0.25
Nujiang	0.20	0.17	0.13	0.17	0.15	0.15	0.16	0.16	0.16	0.18
Diqing	0.39	0.36	0.19	0.72	0.64	0.58	0.63	0.50	0.52	0.43

Table 5 Comprehensive Ranking of High-quality Agricultural Insurance Development of Prefecture-level Cities in Yunnan Province

Region	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Kunming	2	1	1	2	2	3	10	6	9	15
Qujing	6	7	6	7	6	4	4	2	2	2
Yuxi	14	14	12	14	15	12	14	12	12	11
Baoshan	10	11	8	10	3	6	3	4	5	3
Zhaotong	16	15	15	16	16	16	16	13	7	6
Lijiang	12	10	10	13	14	8	9	9	14	14
Pu'er	15	16	16	15	11	14	6	5	3	4
Lincang	3	3	4	5	5	2	2	3	4	5
Chuxiong	5	5	3	3	4	5	7	8	10	7
Honghe	8	13	11	9	8	10	13	11	8	12
Wenshan	9	9	13	8	9	15	15	16	16	16
Xishuangbanna	11	12	14	11	13	13	11	14	13	8
Dali	13	8	9	12	12	7	5	7	6	10
Dehong	7	4	7	6	10	9	8	10	11	9
Nujiang	4	6	5	4	7	11	12	15	15	13
Diqing	1	2	2	1	1	1	1	1	1	1

Judging from comprehensive scores and rankings, obvious echelon differentiation exists among prefecture-level cities. Diqing Prefecture has long ranked at the provincial forefront and formed a mature model in security coverage and risk dispersion, which provides benchmarking significance. With steadily rising comprehensive scores, Qujing and Lincang together with Diqing constitute the core leading echelon, featuring sound performance in premium scale, claim security, insurance depth and insurance density, and relatively mature market conditions. Baoshan, Chuxiong and Dehong witness steady score growth with high rankings and stable development rhythm. Kunming shows a fluctuating downward trend with gradually falling rankings and insufficient development stability; its insurance depth and density still need improvement. Zhaotong, Pu'er and Xishuangbanna demonstrate late-comer catching-up momentum. Relying on characteristic agriculture, they achieve continuous breakthroughs in premium scale and security coverage, and their development potential is gradually released. Yuxi, Lijiang, Wenshan and Nujiang maintain persistently low comprehensive scores and backward rankings. There is large room for improvement in insurance depth and density, so more policy and resource inclination should be implemented. Overall, prominent regional disparities can be observed in agricultural insurance development across Yunnan Province. Regions represented by Diqing, Qujing and Lincang own mature markets and stable development, which can serve as references for other regions. Underdeveloped regions need to optimize policy support in light of local industrial characteristics to promote balanced development.

The comprehensive indexes of agricultural insurance development level for 16 prefecture-level cities in Yunnan Province from 2014 to 2023 are substituted into the calculation formulas of coefficient of variation and Gini coefficient, and the results are shown in Figure 1:

In terms of the coefficient of variation, unbalanced agricultural insurance development exists among the 16 prefecture-level cities, with the coefficient fluctuating between 0.11 and 0.26. The coefficient reached the minimum value of 0.11 in 2016, when the development levels of various regions were the closest. From 2014 to 2018, the

coefficient remained around 0.14 with relatively stable regional disparities. Since 2019, the coefficient of variation has climbed year by year and reached 0.26 in 2022 and 2023, indicating continuously widening development gaps among regions.

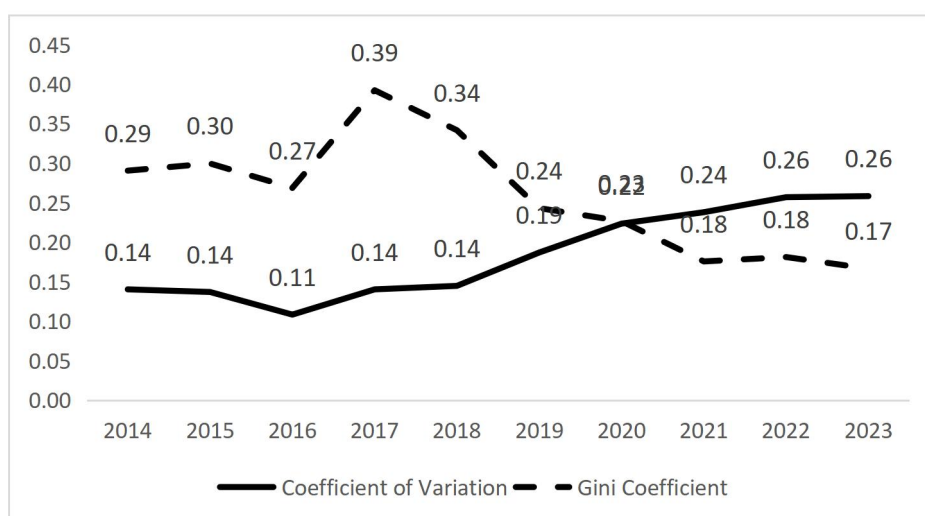


Figure 1 Disparities in Agricultural Insurance Development Level of Prefecture-level Cities in Yunnan Province (2014-2023)

As for the Gini coefficient, spatial equilibrium presents a rise-then-fall trend, fluctuating from 0.17 to 0.39. It peaked at 0.39 in 2017 when the disparity of development level was the most prominent. After 2018, the Gini coefficient kept declining, falling year by year from 0.34 to 0.17 in 2023, which reflects enhanced inter-regional coordination and gradually improved fairness of spatial distribution.

Combining the two indicators, agricultural insurance development in Yunnan Province from 2014 to 2023 shows distinct phased characteristics: relatively stable disparities in the early stage, severe fluctuations in the medium term, and a divergent pattern of expanding coefficient of variation alongside narrowing Gini coefficient in the later period. The coefficient of variation measures the absolute dispersion of regional development levels. Sustained and rapid premium growth in leading regions such as Diqing and Qujing widens absolute gaps with backward regions, pushing up the coefficient of variation. By contrast, the Gini coefficient is less sensitive to extreme values and mainly reflects the equilibrium of overall distribution structure. With the advancement of provincial differentiated fiscal subsidy policies, some late-developing regions including Zhaotong and Pu'er achieve rapid growth driven by characteristic agriculture, improving the equilibrium of overall distribution structure and bringing down the Gini coefficient. In short, the expansion of absolute gaps mainly stems from the rapid growth of leading regions, while the narrowing of relative gaps benefits from the catching-up effect of late-developing regions. While promoting priority development in key regions, relevant policies also contribute to narrowing inter-regional relative gaps.

5 CONCLUSIONS AND SUGGESTIONS

Based on the panel data of 16 prefecture-level cities in Yunnan Province from 2014 to 2023, this paper adopts the entropy-weight method, coefficient of variation and Gini coefficient to systematically analyze regional disparities in agricultural insurance development level. The core conclusions are drawn as follows.

First, the overall scale of agricultural insurance keeps expanding across the province, yet prominent unbalanced regional development remains. Premium and claim levels in regions with large agricultural scale such as central and southwestern Yunnan are significantly higher than those in northwest and northeast Yunnan with limited agricultural volume. Second, prefecture-level cities present an obvious echelon-differentiated pattern. Diqing stays at the forefront; Qujing and Lincang achieve steady improvement; Baoshan, Chuxiong and Dehong grow stably; Kunming fluctuates and declines; Zhaotong, Pu'er and Xishuangbanna catch up as late developers; Yuxi, Lijiang, Wenshan and Nujiang are at a low overall level. Third, the evolution of disparities is characterized by co-existence of expanding absolute gaps and shrinking relative gaps. The coefficient of variation keeps rising from 2014 to 2023 with enlarging absolute development gaps; the Gini coefficient declines generally with gradually improved equilibrium of regional distribution. Accordingly, this paper puts forward the following suggestions.

First, implement differentiated policies targeting three types of regions: leading regions, catching-up regions and vulnerable regions. For leading regions such as Diqing, Qujing and Lincang, carry out innovative pilot programs of agricultural insurance plus and promote business modes integrating contract farming with insurance, guarantee and credit. For catching-up regions including Zhaotong, Pu'er and Xishuangbanna, prioritize insurance for characteristic industries such as Chinese medicinal herbs and coffee, and expand coverage relying on the unified implementation mechanism of provincial characteristic insurance types. For vulnerable regions such as Yuxi, Lijiang, Wenshan and

Nujiang, priority should be given to constructing grassroots service systems, and a loss assessment committee shall be set up to mediate disputes arising from surveying and loss determination.

Second, optimize the allocation of fiscal subsidy funds from three dimensions: differentiated cost-sharing, incentive subsidies for characteristic insurance, and dynamic premium rates. Implement differentiated fiscal sharing ratios at all government levels. For key rural revitalization counties in northwest and northeast Yunnan, try to reduce the proportion borne by county-level finance to ease local matching pressure. Meanwhile, clarify benchmark subsidy ratios and performance-oriented incentive mechanisms for characteristic insurance, and directly link performance evaluation results with fund allocation. In addition, enforce the dynamic premium rate adjustment mechanism. Explore releasing differentiated premium rates at the prefecture-city level to break the province-wide unified rate pattern. Offer premium discounts for national key rural revitalization counties and three categories of key supported groups, so as to realize efficient allocation of fiscal subsidy funds.

Finally, improve the grassroots service system. Centering on the “1+10+3” key industries of plateau-characteristic agriculture, promote coordinated development of central bulk insurance types and provincial characteristic insurance types, and implement unified implementation plans for provincial insurance types covering tobacco leaves, beef cattle and apples. Push forward the construction of the provincial comprehensive management platform for agricultural insurance. Adopt satellite remote sensing, unmanned aerial vehicles and other technologies to realize accurate underwriting and claim settlement, facilitate the connection of policy-level data and whole-process supervision of subsidy funds.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

- [1] Zhu J S. High-quality Development of Agricultural Insurance Boosts Rural Revitalization. *China Finance*, 2022(18): 35-37.
- [2] Chen J C, Tang Y M, Liu Q. Research on the Agricultural-supporting Efficiency of Agricultural Insurance in China: From the Perspective of Regional Differences. *Price: Theory & Practice*, 2017(12): 114-117.
- [3] He X W, Xie Y T, Zhang W C. Regional Development Disparities of Policy-oriented Agricultural Insurance in China: Measurement and Interpretation. *Journal of Shanxi Agricultural University (Social Science Edition)*, 2021, 20(02): 76-82.
- [4] Mu L. Research on Regional Differentiation of Agricultural Insurance Development in Shandong Province. Shandong Agricultural University, 2020.
- [5] Yang H L, Zhang Z R. Research on Regional Development Imbalance of Agricultural Insurance in Henan Province Based on Factor Analysis and Cluster Analysis. *Financial Theory and Practice*, 2018(10): 93-97.
- [6] Li Y Q, Yang L J. Research on Regional Differentiation of Agricultural Insurance Development Level in Gansu Province. *Science & Technology and Economy*, 2021, 34(05): 51-55.
- [7] Zhou C. Spatiotemporal Pattern and Difference Analysis of Agricultural Insurance Development Level in the Yangtze River Delta. Anhui Agricultural University, 2022.
- [8] Huang Y H. Research on Current Situation and Development Mode of Policy-oriented Agricultural Insurance in Yunnan. Central South University of Forestry and Technology, 2015.
- [9] Wang J J, Xu M X, Wang T J. Construction Path of Multi-level Agricultural Insurance System in Yunnan Province. *Business Economy*, 2021(05): 109-110+163.
- [10] Li Q Y, Chen R G. Construction and Measurement of Evaluation Index System for High-quality Development Level of Agricultural Insurance: Evidence from 13 Core Grain-producing Areas. *Financial Theory and Practice*, 2021(05): 12-19.
- [11] Gao X J. Construction and Application of Evaluation Index System for High-quality Development of Agricultural Insurance. Guangdong University of Finance & Economics, 2021.
- [12] Zhang L, He B L. Regional Differences and Spatial Convergence of High-quality Agricultural Insurance Development: Theoretical Interpretation from the High-quality Development Perspective of the Report to the 20th CPC National Congress. *Journal of Financial Economics Research*, 2023, 38(01): 113-128.