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Analysis of the coupling and coordination relationship between regional green finance and rural revitalization

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Abstract: This paper analyzes the coupling and coordination relationship between green finance and rural revitalization, which is beneficial to empowering rural revitalization, and analyzes the entropy method, coupling coordination model, global and local Moran index and geographic spatiotemporal weighted regression model based on Guizhou data. The results show that: (1) The coupling coordination degree of green finance and rural revitalization in Guizhou Province increased from 0.7241 in 2012 to 0.8385 in 2022, and the coordination level changed from medium-level coordination to good coordination, and the spatial imbalance changed from stronger in the northwest than in the southwest to stronger in the northeast than in the southwest. (2) It was positively correlated in space, with local characteristics of low and low significance and low and high significance. (3) Carbon finance has the most significant impact on coupling coordination, followed by per capita residential construction area, and green investment has the weakest impact.

1. Introduction

The Fifth Plenary Session of the 18th Central Committee of the Communist Party of China (CPC) put forward the five development concepts of "innovation, coordination, green, openness, and sharing", and for the first time elevated "green" development to the national development strategy. In

recent years, Guizhou Province has actively practiced the concept of "lucid waters and lush mountains are invaluable assets", and solidly promoted the construction of a national ecological civilization pilot demonstration zone. Therefore, exploring the coupling and coordination mechanism of green finance and rural revitalization in Guizhou is conducive to promoting the deep integration of rural revitalization and green finance in Guizhou Province, further solving the "three rural" problems, and finding an innovative way for the green development of our country.

Regarding the research on the coupling and coordination mechanism of green finance and rural revitalization, scholars at home and abroad mainly start from two aspects: theoretical and empirical research. In terms of theoretical research, Zuo Zhenglong et al. believe that the establishment of contract chain and blockchain through contract economy will complement the development of green finance and rural revitalization[1][2][3]; Zhang Fangli et al. proposed a research on the path of green finance to promote rural revitalization in the context of "dual carbon".0[4]; In terms of empirical research, Fredrick Oteng Agyeman et al. analyzed green finance and rural revitalization by using spatial effects and spillover effects, and analyzed the number of human resources more closely, and believed that education level is the breakthrough point[5][6]][7]; Li Ruimin et al. analyzed the supply and demand status of green finance, and proposed the innovation of green financial products to develop rural revitalization[8]; Shu Taiyi and Zhang Ping used the coupling model and Moran index to study the coupling mechanism of green finance and rural revitalization from a national perspective, and obtained the relationship between the two[9][10][11][12]; Zhang Jie et al. developed the regional economy through the application of the "two mountains" theory and the transformation of ecological value[13][14] Judging from the available literature, the research objects of domestic and foreign scholars are mainly aimed at developed countries or the developed eastern regions of China, and there are few studies on the western region.

This study analyzes the coupling and coordination degree of green finance and rural revitalization in Guizhou Province, compares, analyzes and studies the coupling coordination degree of green finance and rural revitalization in Guizhou Province from the time and space dimensions in the past decade, and explores the relationship between the two with the help of economic and mathematical models, aiming to provide a reference for the high-quality economic development of Guizhou Province.

2. Analysis of the research mechanism of green finance and rural revitalization

Green finance promotes rural revitalization. It guides the flow of funds to help industrial transformation and upgrading, attracts talents and promotes sustainable development; It changes the thinking of villagers, develops green industries, spreads environmental awareness, and protects traditional culture; It also Improves rural infrastructure, promotes the generation and development of new technologies, and optimizes the allocation of resources.

Rural revitalization reacts to green finance. It improves the ecological environment, contributes to the dual carbon goals, and promotes the development of green finance; The affluent life of the villagers drives the upgrading of the consumer market and realizes the sustainable development of the factor market; Rural civilization, we need to cultivate environmental awareness, win support, and

create a new energy industry environment; Governance effectively reflects the development of green industries and promotes the high-quality development of green finance. Therefore, green finance and rural revitalization interact with each other and develop in synergy. (see Figure 1)

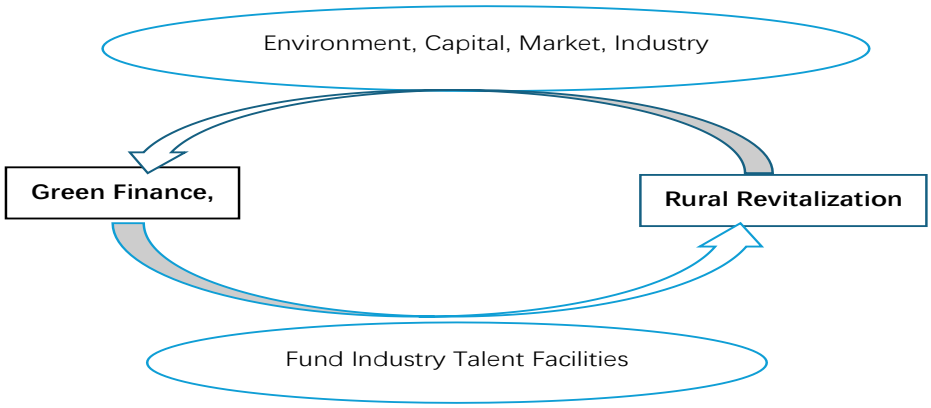


Figure 1: Study Mechanism

3. Data sources and research methods

3.1 Research data sources

The data are from the websites of authoritative institutions such as the Bureau of Statistics of Guizhou Province, the Ministry of Science and Technology, and the People's Bank of China from 2012 to 2022, as well as various authoritative statistical yearbooks, including Guizhou Provincial and Urban Statistical Yearbooks, Environmental Status Bulletins and Professional Statistical Yearbooks.

3.2 Research Methodology

3.2.1 Construct an indicator system

The coupling and coordination mechanism of green finance and rural revitalization is affected by factors such as explanatory variables and explanatory variables, and it is important to scientifically select relevant indicators. The entropy weight method was used to construct the index system, and the explanatory variables were green credit, green investment, green insurance, and carbon finance. The explanatory variables are thriving industry, livable ecology, civilized rural customs, effective governance, and affluent life. This is shown in Table 1.

Table 1: Index system of green finance and rural revitalization

First level indicators	Secondary indicators	Metric definitions	quality	weight
Green Finance	Green credit	Interest Expense of High Energy-Consuming Industries/Interest on Industrial Industries (%)	—	0.2013
	Green investment	Investment in pollution control/GDP (%)	+	0.2423
	Green insurance	Agricultural Insurance Income/Gross Agricultural Output Value (%)	+	0.3554
	Carbon Finance	CO2 emissions/GDP (ton/10,000 yuan)	—	0.201
Rural revitalization	The industry is thriving	Per capita output value of agriculture, forestry, fishery and animal husbandry (100 million yuan/10,000 people)	+	0.0574
		Total power of agricultural machinery (kW)	+	0.058
		Per capita availability of grain (kg/person)	+	0.0598
	Ecologically livable	Harmless treatment rate of domestic waste (%)	+	0.057
		Forest cover (%)	+	0.0566
		Health technicians per 1,000 rural population	+	0.0565
		Coverage rate of safe drinking water (%)	+	0.0566
		Public toilet (seat)	+	0.0567
	Rural civilization	Percapita consumption expenditure on culture, education and recreation of rural residents (RMB)	+	0.0584
		Proportion of illiterate population to population aged 15 years and over (%)	—	0.0567
		Television Program Population Coverage (%)	+	0.0819
	Governanceis effective	Per capita disposable income in rural areas/per capita disposable income in urban areas (%)	+	0.0582
		Number of Rural Residents with Minimum Livelihood Guarantee/Rural Population (%)	—	0.0565
		Per capita consumption expenditure in rural areas/per capita consumption expenditure in urban areas (%)	+	0.0593
	Life is rich	Per capita disposable income of rural residents (RMB/person)	+	0.0564
		Residential floor area per capita (sqm/person)	+	0.0564
		Rural Household Food Expenditure/Consumption Expenditure (%)	—	0.0577

Note: "+" indicates a positive indicator, and "—indicates a negative indicator

3.2.2 Research Methodology

(1) Coupling coordination

The coupling coordination model is introduced to measure the synergistic effect of green finance and rural revitalization, and the model is as follows:

$$C_{fg} = \sqrt{\frac{S_1 S_2}{S_1 + S_2}} \tag{1}$$

C_{fg} The coupling coordination degree of green finance and rural revitalization reflects the strength

of the interaction between the two, S_1 and represents S_2 the index of green finance and rural revitalization, respectively. From equation (1), it can be seen that C_{fg} the value range of the coupling degree is between [0,1], when $C_{fg} = 0$ it means that the coupling coordination degree between green finance and rural revitalization is extremely low, and the two are in a disordered state. When $C_{fg} = 1$ it means that the best coupling between the two systems of green finance and rural revitalization has been achieved, and a benign resonance coupling has been reached between the two.

In order to systematically study the degree of coordination between green finance and rural revitalization and avoid the phenomenon of "pseudo-coordination", this paper uses the coupling coordination model to further measure the coupling coordination between the two.

$$D_{fg} = \sqrt{C_{fg} * G_{fg}} \tag{2}$$

$$D_{fg} = \alpha * S_1 + \beta * S_2 \tag{3}$$

In equations (2) and (3), the D_{fg} coupling coordination degree between green finance and rural revitalization is dedicated, and the G_{fg} G_{fg} comprehensive coordinated development index between green finance and rural revitalization, αand βrepresent undetermined coefficients and satisfyα + β = 1. According to existing research, both αand β are 0.5., the value range of coupling coordination degree is (0,1], and the coupling coordination degree is divided into 10 levels on the basis of reference to previous studies, as shown in Table 2

Table 2: Classification criteria for coupling coordination levels

Coupling coordination	Coupling coordination level	Coupling coordination	Coupling coordination level
(0,0.1]	Extreme dysregulation	(0.1,0.2]	Severe dysregulation
(0.2,0.3]	Moderate disorder	(0.3,0.4]	Mild disorder
(0.5,0.6]	Barely coordinated	(0.5,0.6]	Primary coordination
(0.6,0.7]	Intermediate coordination	(0.7,0.8]	Good coordination
(0.8,0.9]	On the verge of coordination	(0.9,1]	High-quality coordination

(2) Moran index and local Moran index

(1) In order to measure whether there is a spatial agglomeration effect between green finance and rural revitalization, the Moran index was introduced to investigate it. Such as equation (4).

$$I = \frac{\sum_{f=1}^{n}\sum_{g=1}^{n} W_{fg}(X_f - \bar{X})(X_g - \bar{X})}{S^2 \sum_{f=1}^{n}\sum_{g=1}^{n} W_{fg}} \tag{4}$$

where: $\bar{X} = \frac{1}{N}\sum_{f=1}^{n} X_f, S^2 = \frac{1}{N}\sum_{f=1}^{n}(X_f - \bar{X})^2$

I represents the global Moran index, and N is the number of regions in the study area. X_f , X_g representing the specific attribute values of regions f and g, respectively; $\bar{X}$ is the average value of the attribute value of each region; S^2 Represents variable variance; W_{fg} Represents the weight matrix of spatial relations in regions f and g. When the Moran index is greater than 0, there is a spatial positive correlation between green finance and rural revitalization between cities and counties. When it is less than 0, there is a negative correlation in space; At 0, there is no spatial autocorrelation.

(2) At the same time, in order to understand the local spatial agglomeration effect between regional green finance and rural revitalization, the local Moran index is introduced, such as equation (5).

$$I_f = Z_f \sum_{f \neq g} W_{fg} Z_g \tag{5}$$

where: $Z_f = X_f - \bar{X}, Z_g = X_g - \bar{X}$

In Eq. (5), the I_f local Moran index is described, which measures the correlation between the neighborhoods of region f and g.

(3) Spatiotemporal geographically weighted regression model

The spatiotemporal geographically weighted regression model is based on geographically weighted regression, and the spatial and temporal nonstationarity is considered. In this paper, a GTWR model is constructed based on ArcMap software to analyze the driving factors of green finance and rural revitalization, and the following model is established.

$$Y_f = \beta_0(\upsilon_f + \vartheta_f + t_f) + \sum_{k-1}^{n} \beta_k(\upsilon_f + \vartheta_f + t_f) X_{fk} + \varepsilon_k \tag{6}$$

where is the Y_f coupling coordination degree of green finance and rural revitalization at f spatio-temporal position, and X_{fk} is the index of green finance and rural revitalization at f spatio-temporal position, k=1,2,... n; $(\upsilon_f + \vartheta_f + t_f)$ is the coordinates of the space-time position of f; $\beta_0(\upsilon_f + \vartheta_f + t_f)$ is the spatiotemporal intercept; $\beta_k(\upsilon_f + \vartheta_f + t_f)$ is the regression coefficient; ε_f is the model residual.

4. Empirical analysis

4.1 Spatiotemporal coupling analysis of the coupling coordination degree of green finance and rural revitalization in Guizhou

(1) Time series analysis of the coupling coordination degree of green finance and rural revitalization in Guizhou

The time coupling model of green finance and rural revitalization in Guizhou Province was constructed, and the coupling coordination degree of green finance and rural revitalization from 2012

to 2022 was obtained, as shown in Table 3.

Table 3: Coupling coordination degree and coordination level of green finance and rural revitalization in Guizhou Province

province	In 2012		In 2013		In 2014	
Guizhou Province	Coordination	Coordination level	Coordination	Coordination level	Coordination	Coordination level
	0.7241	Intermediate coordination	0.7268	Intermediate coordination	0.7241	Intermediate coordination
province	In 2015		In 2016		In 2017	
Guizhou Province	Coordination	Coordination level	Coordination	Coordination level	Coordination	Coordination level
	0.6145	Primary coordination	0.7654	Intermediate coordination	0.7872	Intermediate coordination
province	In 2018		In 2019		In 2020	
Guizhou Province	Coordination	Coordination level	Coordination	Coordination level	Coordination	Coordination level
	0.8686	Good coordination	0.7975	Intermediate coordination	0.7769	Intermediate coordination
province	In 2021		In 2022			
Guizhou Province	Coordination	Coordination level	Coordination	Coordination level		
	0.7985	Intermediate coordination	0.8385	Good coordination		

Table 4: Coupling and coordination levels of green finance and rural revitalization in Guizhou Province

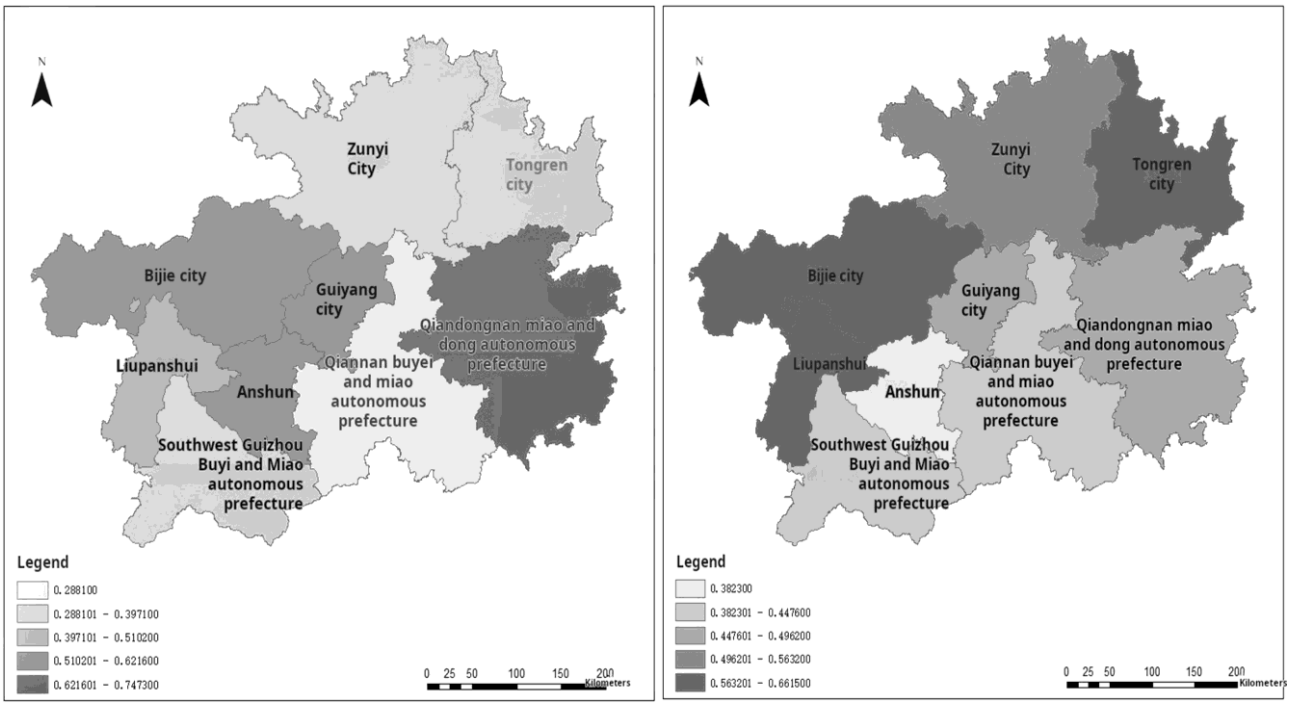
Urban	In 2012		In 2016		In 2019		In 2022	
	Coordination	Coordination level	Coordination	Coordination level	Coordination	Coordination level	Coordination	Coordination level
Guiyang	0.6216	Primary coordination	0.5892	Barely coordinated	0.2917	Moderate disorder	0.5962	Barely coordinated
Liupanshui	0.5102	Barely coordinated	0.6944	Primary coordination	0.3927	Mild disorder	0.6562	Primary coordination
Zunyi	0.3455	Mild disorder	0.4062	On the verge of disorder	0.6247	Primary coordination	0.5632	Barely coordinated
Anshun	0.5579	Barely coordinated	0.6662	Primary coordination	0.3884	Mild disorder	0.3823	Mild disorder
Bijie	0.5716	Barely coordinated	0.5543	Barely coordinated	0.5494	Barely coordinated	0.6615	Primary coordination
tongreen	0.3755	Mild disorder	0.5349	Barely coordinated	0.6478	Primary coordination	0.6171	Primary coordination
Southwest Guizhou	0.3971	Mild disorder	0.4429	On the verge of disorder	0.4549	On the verge of disorder	0.4353	On the verge of disorder
Southeast of Guizhou	0.7473	Intermediate coordination	0.6027	Primary coordination	0.7661	Intermediate coordination	0.4741	On the verge of disorder
Qiannan	0.2881	Moderate disorder	0.2851	Intermediate coordination	0.5922	Barely coordinated	0.4476	On the verge of disorder
Guizhou Province	0.7241	Intermediate coordination	0.7654	Intermediate coordination	0.7975	Intermediate coordination	0.8385	Good coordination

From the perspective of time, the coupling coordination degree of green finance and rural

revitalization in Guizhou Province showed an overall upward trend, from 0.7241 in 2012 to 0.8385 in 2022, and the coupling coordination level improved from intermediate coordination to good coordination, and the situation tended to be ideal.

(2) Spatial evolution of coupling and coordination between green finance and rural revitalization in Guizhou

By constructing a coupling and coordination model of green finance and rural revitalization in Guizhou Province, the coupling coordination degree in 2012, 2016, 2019 and 2022 was extracted for analysis (see Table 4), and the spatial pattern of coupling degree was visualized (see Fig. 2).



A. Distribution of coupling coordination degree between green finance and rural revitalization in 2012 B. Distribution map of the coupling coordination degree of green finance and rural revitalization in 2022

Figure 2: Distribution of coupling coordination degree between green finance and rural revitalization in Guizhou Province

Spatially, in 2012, Zunyi City, Tongren City, and Qianxinan Prefecture were mildly out of balance, Liupanshui, Anshun, and Bijie were barely coordinated, Qiandongnan and Qiannan were intermediate coordinated, and Guiyang was primary. In 2022, southwest Guizhou, southeast Guizhou, and southern Guizhou were on the verge of imbalance, Guiyang and Zunyi were barely coordinated, and Anshun was mildly out of balance, so the coordination effect between the two in Guizhou Province from 2012 to 2022 was not good.

At the regional level, in 2012, the coupling and coordination degree of green finance and rural revitalization in Guizhou Province was strong in the northwest and weak in the southwest, and the cities (prefectures) of Guiyang, Liupanshui, Bijie, Anshun and Qiandongnan were in the primary stage of coordinated development, while other cities (prefectures) were out of balance. In 2022, it

will become strong in the northeast and weak in the southwest, Anshun, southwest Guizhou, southeast Guizhou and southern Guizhou are out of balance, and the rest of the cities (prefectures) are coordinated. The reason for the change is that Guizhou is located in the transportation artery of the western development, and the economic development brought about by the inward migration of coastal industries and produced pollution, resulting in a decline in the coupling and coordination degree in some areas.

4.2 Spatial correlation and agglomeration degree between green finance and rural revitalization

The global Moran index was used to analyze the spatial correlation of the coupling and coordination of green finance and rural revitalization in Guizhou Province, and the local Moran maps in 2012, 2016 and 2022 were used to analyze the spatial correlation and aggregation degree of different urban areas in Guizhou Province. From 2012 to 2022, the Moran index passed the 1% significance level test (see Table 5), first rising and then decreasing, and the spatial aggregation effect weakened after 2014, and the spatial distribution of coupling degree weakened in the later period (see Fig. 3).

Table 5: Global Moran index of the coupling coordination degree of green finance and rural revitalization in Guizhou Province from 2012 to 2022

year	Moran'I	Z-value	P-value
In 2012	0.320669	1.774805	0.07593
In 2013	0.548523	2.798931	0.051127
In 2014	0.513165	2.623967	0.008691
In 2015	0.334565	2.212357	0.026942
In 2016	0.370375	2.118303	0.034149
In 2017	0.350315	1.975248	0.04824
In 2018	0.36268	2.092994	0.03635
In 2019	0.347392	2.002024	0.045282
In 2020	0.320865	1.858313	0.063125
In 2021	0.296306	1.733932	0.08293
In 2022	0.320146	1.843627	0.065237

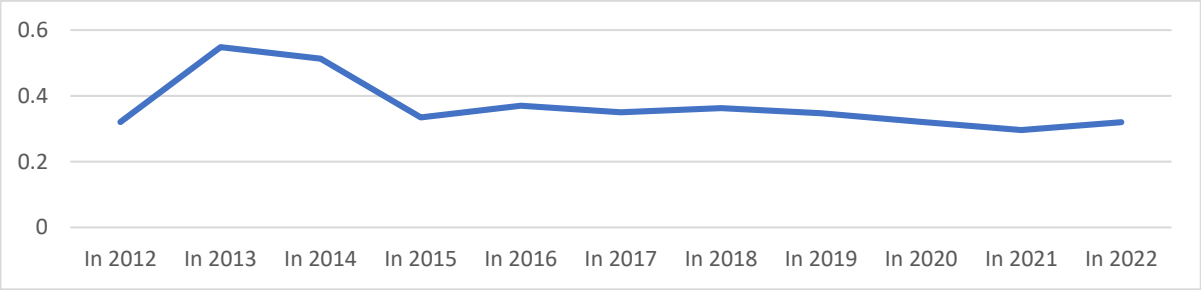
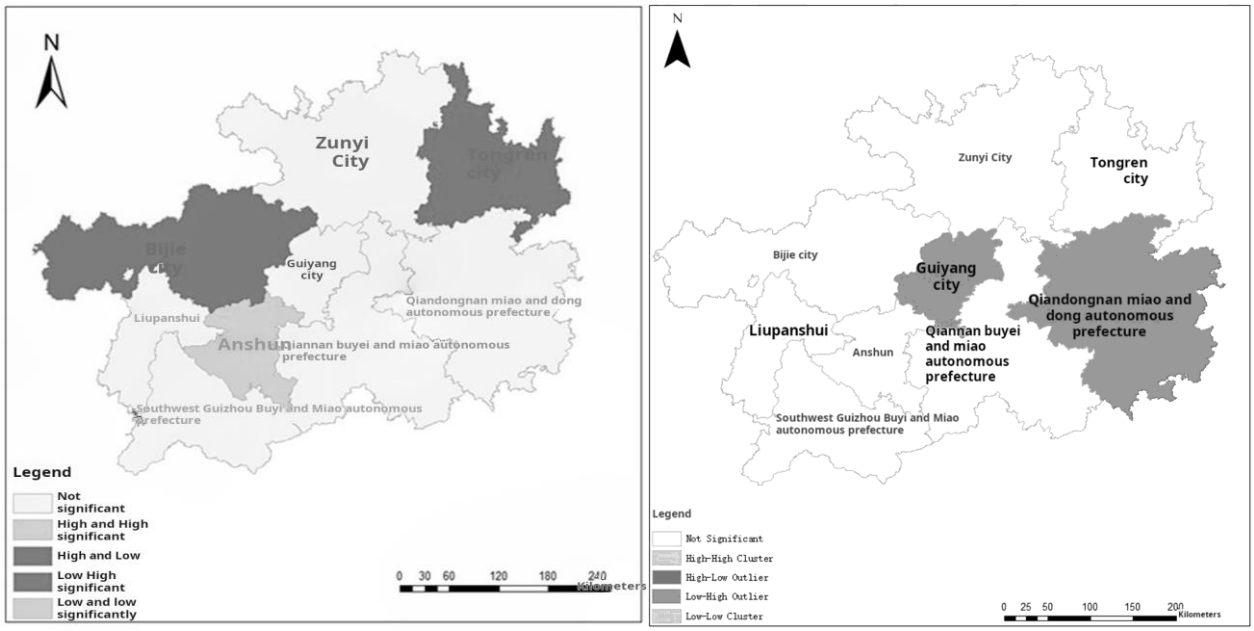


Figure 3: Global Moran index of the coupling coordination degree of green finance and rural revitalization in Guizhou Province

The global Moran index is used to observe the overall correlation of the coupling coordination degree of green finance and rural revitalization in the spatial system of Guizhou Province, but there

may be situations that cannot be reflected by the overall situation or even the opposite "insignificant", so it is necessary to analyze the distribution of the coupling coordination degree of green finance and rural revitalization in Guizhou Province (see Fig. 4).



A.2012 B.2016

C.2022

Figure 4: Local Moran diagram of the coupling coordination degree of green finance and rural revitalization in Guizhou Province

According to Figure 4, the spatial coupling and coordination degree of green finance and rural

revitalization in Guizhou Province has the distribution characteristics of "low and low significant" and "low and high significant", and the degree of aggregation has changed from dispersion to agglomeration, indicating that the government pays attention to overall development to achieve the goal of common prosperity. In 2012, Bijie was "high and low", Tongren was "low and high", and Anshun was "low and low"; In 2016, Guiyang and Qiannan were "low and high"; In 2022, Bijie, Liupanshui, and southwest Guizhou will be "low and low significant", and southern Guizhou will be "low and high significant". On the whole, Bijie has the most ideal degree of coupling, but the economic development lags behind and has a limited role in driving the surrounding areas.

4.3 Driver analysis

4.3.1 Data verification

In this paper, the spatio-temporal geographic weighted regression model was used to study the driving factors and spatial heterogeneity of the coupling coordination degree of green finance and rural revitalization in Guizhou Province. Using the coupling coordination degree as the explanatory variable, the collinearity test of the green finance index and the rural revitalization index was carried out by SPSS software (see Table 6). The results show that the variance inflation coefficient of green credit, per capita total power of agricultural machinery, per capita output value of agriculture, forestry and animal husbandry, the number of health technicians per 10 million in rural areas, the ratio of disposable income of rural residents to the disposable income of urban residents, and the ratio of food expenditure to consumption expenditure of rural residents is greater than 10, and the other coefficients are less than 10. Further multiple linear regression analysis showed that there was a significant correlation between green investment, green insurance, carbon finance, safe drinking water penetration rate, per capita residential floor area, the proportion of illiterate population in the population over 15 years old, the ratio of rural residents' minimum living security to rural population, and the per capita net income of farmers and the coupling coordination degree ($P<0.05$). Many factors such as green investment were significantly correlated with the coupling coordination degree ($P<0.05$), and green investment was negatively correlated with the coupling coordination degree, while other factors were positively correlated

Table 6: Multiple linear regression analysis results of green finance and rural revitalization index and coupling coordination degree in Guizhou Province

argument	Standard regression coefficients	Distinctiveness	VIF	Tolerance
Green investment	-1.097	0.017	2.456	0.407
Green insurance	1.356	0.003	4.053	0.247
Carbon Finance	1.091	0.001	2.597	0.385
Coverage rate of safe drinking water (%)	0.416	0.008	3.396	0.294
The proportion of the illiterate population is over 15 years old	0.626	0.042	2.245	0.445

Per capita net income of farmers (RMB)	0.549	0.041	4.896	0.204
Number of Rural Residents with Minimum Livelihood Guarantee/Rural Population (%)	0.619	0.041	4.761	0.21
Residential floor area per capita	0.237	0.276	2.908	0.344

4.3.2 Robustness test

In order to verify the reliability of the research conclusions, the least squares method is used to test the robustness, and the results show that the above conclusions are still valid. This is shown in Table 7.

Table 7: Robustness test of green finance and rural revitalization in Guizhou Province

argument	Regression coefficients	Distinctiveness	95% CI
Green investment	-0.611	0.021	-1.426 ~ 0.206
Green insurance	1.522	0.003	0.546 ~ 2.498
Carbon Finance	6.511	0.001	3.878 ~ 9.144
Coverage rate of safe drinking water (%)	1.094	0.013	0.025~1.973
The proportion of the illiterate population is over 15 years old	1.351	0.039	0.088 ~ 2.613
Per capita net income of farmers (RMB)	1.146	0.046	0.039~2.253
Number of Rural Residents with Minimum Livelihood Guarantee/Rural Population (%)	1.333	0.039	0.087~2,579
Residential floor area per capita	2.162	0.276	0.525 ~ 3.798

4.3.3 Temporal heterogeneity analysis of influencing factors and regression coefficients of coupling coordination

The regression coefficients of the influencing factors of coupling coordination degree in Guizhou Province were tabulated by year (see Table 8) to explore their temporal heterogeneity.

Table 8: Regression coefficients of the influencing factors of coupling coordination

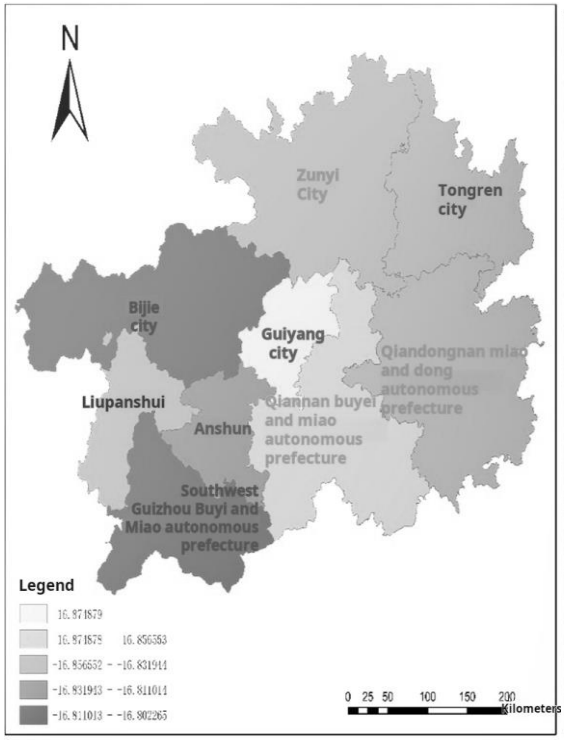
year	Green investment	Green insurance	Carbon finance	Access to safe drinking water	Residential floor area per capita	The proportion of the illiterate population is over 15 years old	Minimum subsistence allowance for rural residents/rural population	Per capita net income of peasants
In2012	-16.87	0.92	6.06	-1.66	1.87	1.46	-1.41	-0.75
In 2013	-16.84	0.88	6.92	-1.28	1.95	1.57	-1.39	-0.76
In 2014	-16.83	0.42	6.47	-0.89	1.84	1.78	-1.84	-0.71
In 2015	-16.81	1.22	6.43	-0.86	1.89	1.71	-1.83	-0.93
In 2016	-16.8	1.53	6.48	-0.73	1.91	1.58	-1.78	-0.91
In 2017	-16.83	1.53	6.71	-0.77	1.92	1.92	-1.65	-0.81
In 2018	-16.8	1.63	6.84	-0.93	1.96	1.54	-1.64	-0.72

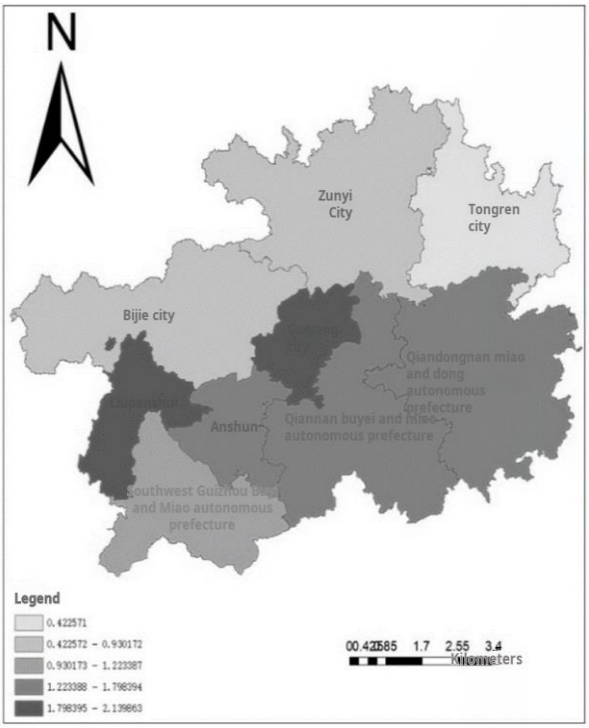
In 2019	-16.84	1.74	6.5	-0.79	1.99	1.69	-1.78	-0.89
In 2020	-16.86	1.84	6.32	-0.74	1.97	1.71	-1.62	-0.89
In 2021	-12.06	1.94	6.15	-0.92	1.66	1.82	-1.68	-0.84
In 2022	-13.06	2.14	7.11	-0.61	1.29	1.32	-1.86	-0.92

The impact of green investment on coupling coordination is negative and the degree of influence increases, due to the pollution caused by the relocation of a large number of labor-intensive enterprises to Guizhou, the advantages of green investment are relatively enhanced, and the impact becomes larger. The impact of green insurance on coupling coordination is positive and gradually increases, and its impact is enhanced due to the large fluctuation of farmers' agricultural product income caused by the karst landform in Guizhou. The impact of carbon finance on the coupling coordination degree is positive and rising, and Guizhou, as a key node of the western development, has developed rapidly and carbon dioxide emissions have risen, and the impact has become greater. The penetration rate of safe drinking water has a negative impact on the coupling coordination degree and the degree of influence increases, and its impact is increasing year by year due to the country's emphasis on safe drinking water. The per capita residential floor area has a positive effect on the coupling coordination degree, but the degree of influence decreases, and the impact becomes smaller because the housing demand is basically satisfied. The proportion of illiterate population in the population over 15 years old has a positive impact on the coupling coordination degree and the degree of influence increases first and then decreases, because Guizhou has increased investment in basic education, reflecting the development of basic education. The coupling coordination degree of rural residents' minimum livelihood security/rural population is negative and the impact is weakened, which is reduced due to the increase in scientific and technological investment in Guizhou to improve agricultural production efficiency and improve life. The per capita net income of farmers has a negative impact on the coupling coordination degree and the degree of influence is reduced, which decreases due to the improvement of farmers' living standards and the diversification of income sources.

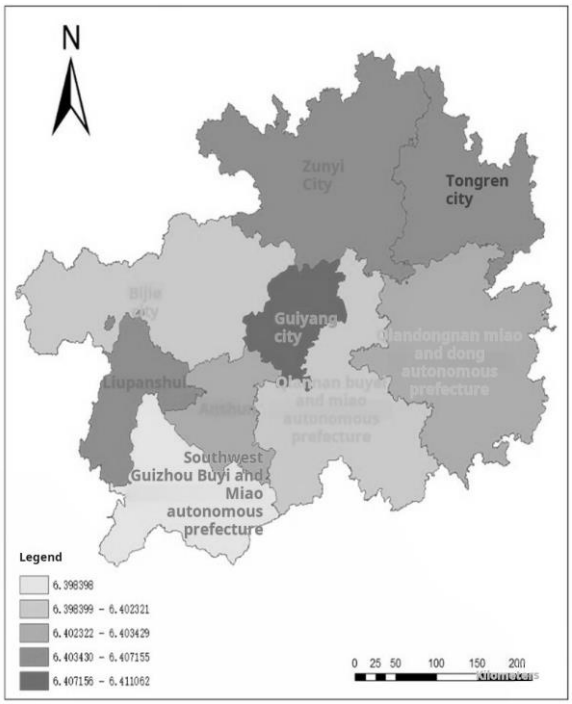
4.3.4 Spatial heterogeneity analysis of the regression coefficients of the influencing factors of coupling coordination

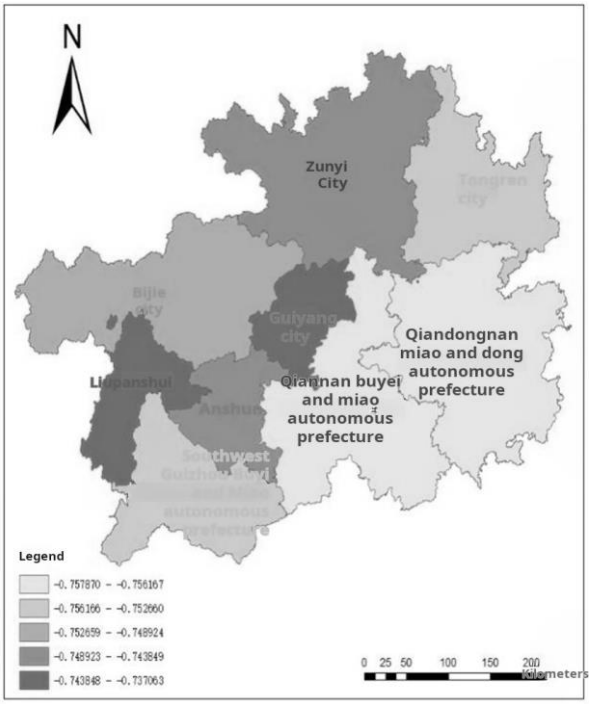
In this paper, the regression coefficients of the GTWR model of the influencing factors of coupling coordination degree in different regions of Guizhou Province are averaged, and ArcGIS 10.7 is used to classify them according to the natural breakpoint rule at five levels, and display them in the form of geographical maps (see Fig. 5), so as to more intuitively express the spatial distribution law of the regression coefficients of the influencing factors of coupling coordination.



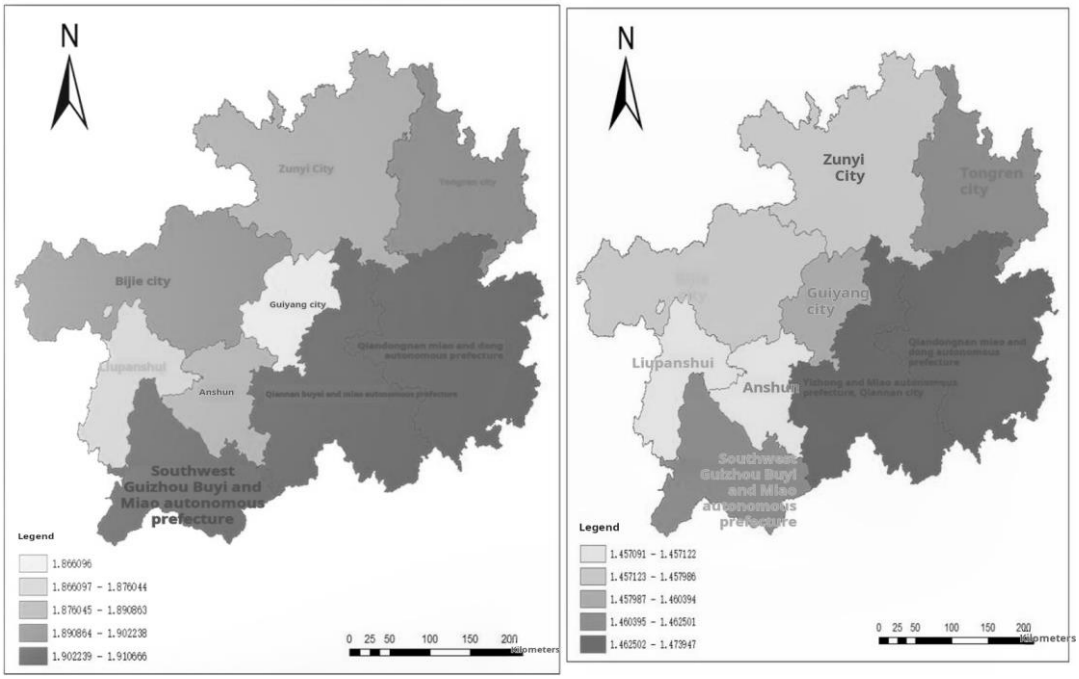


A. Green investment B. Green insurance

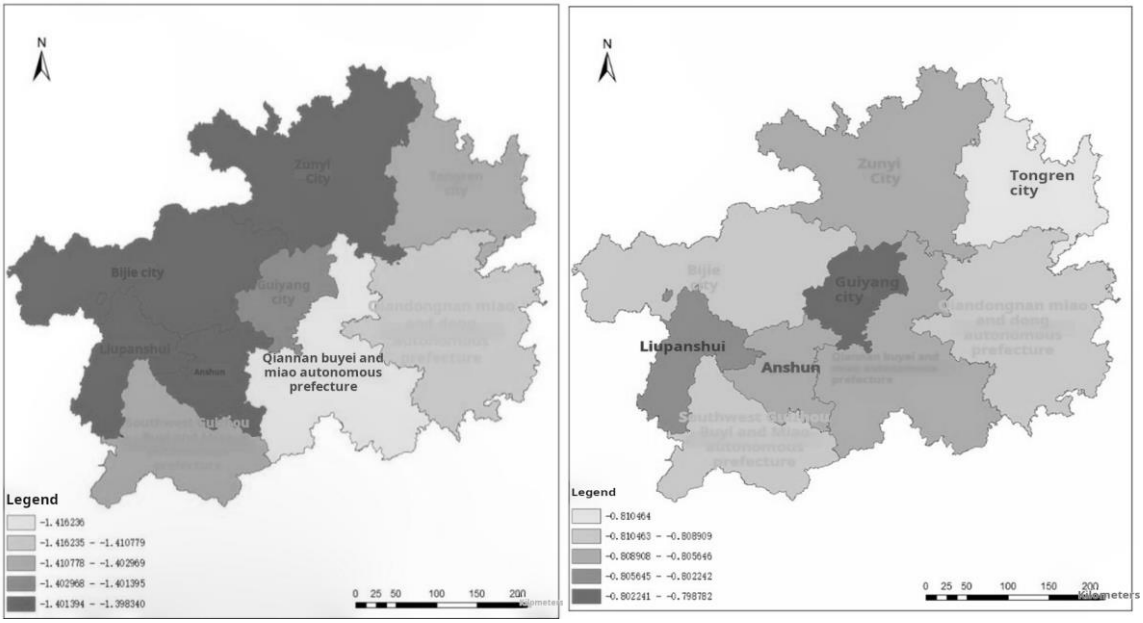




C. Carbon finance D. Penetration rate of safe drinking wate



E. Residential area per capita F. The *proportion of illiterate population over 15 years old*



G. Minimum livelihood guarantee for rural residents/rural population (Left)
H. Per capita net income of farmer (Right)

Figure 5: Spatial heterogeneity of coupling coordination degree in Guizhou Province based on the geographically and temporally weighted regression model.

From the perspective of time and space, the distribution characteristics of various factors in Guizhou Province are different. Green investment is strong in the northwest and weak in the northeast, while carbon finance is strong in the northeast and weak in the northwest. Green insurance is weak in the north and strong in the south; The minimum subsistence guarantee for rural residents/rural population and safe drinking water penetration rate are high in the northwest and low in the northeast;

The per capita net income of farmers is strong in the middle and weak on both sides, and the per capita residential construction area is opposite. The proportion of illiterate people over the age of 15 is higher in the southeast and lower in the northwest. The reasons for the influence of each factor on the coupling coordination degree are different: green investment is due to the rapid development of Guizhou relying on fossil energy to cause pollution; Carbon finance is due to the developed regional economy and high carbon dioxide emissions; Green insurance is due to the fact that Guizhou is dominated by the primary industry and the regional economic development is unbalanced, resulting in different government investment in agricultural insurance; The per capita net income of farmers is due to the unbalanced economic development of Guizhou Province; The proportion of illiterate population is due to the fact that Guizhou is dominated by ethnic minorities, and cultural differences and economic development are uncoordinated, resulting in backward education and culture. The per capita residential floor area is due to Guiyang's developed economy and high population density; The penetration rate of safe drinking water is due to the high urbanization rate of the region's developed economy; The minimum subsistence allowance for rural residents and the rural population is due to the fact that the region is economically developed and the government has the funds to guarantee the minimum subsistence standard.

5. Conclusions and policy recommendations

5.1 Conclusion

In this paper, the entropy method is used to construct the green finance and rural revitalization index of Guizhou Province, the coupling coordination degree model is used to analyze the relationship between the two, the spatial correlation is analyzed by the Moran index and the local Moran index, and the spatiotemporal geographic weighted regression is used to analyze the factors affecting the coupling coordination. The conclusions of the study are as follows.

(1) From the perspective of time and space, the coupling and coordination degree of green finance and rural revitalization in Guizhou Province has increased as a whole and deteriorated locally. From the regional level, there is an imbalance in the degree of coordination, and the overall pattern has changed from strong in the northwest and weak in the southwest to strong in the northeast and weak in the southwest.

(2) The results show that the coupling coordination degree of green finance and rural revitalization in Guizhou Province is positively correlated in the past ten years, and decreases slightly in the following years. Locally, there is a low and low significant and low and high significant, and the degree of aggregation changes from scattered to aggregate. On the whole, Bijie City has the best degree of coordination.

(3) The research on influencing factors shows that carbon finance has the greatest impact on the coupling coordination degree and is positive, showing weak in the northwest and strong in the northeast. The per capita residential area has the second highest impact and is positive, showing strong on both sides and weak in the middle. The impact of green investment is minimal and negative, showing strong in the northwest and weak in the northeast.

5.2 Policy Recommendations

(1) In view of the overall and partial incoordination of the coupling and coordination degree in Guizhou Province, the government should pay attention to the integration of the two, give full play to the leading role of the provincial capital, develop high-tech and low-energy-consuming industries, and formulate plans for the current situation on the verge of imbalance, so as to realize rural revitalization and meet the expectations of the people.

(2) In view of spatial heterogeneity, the government should play a leading role in strengthening the spatial agglomeration effect, expanding the radiation range, and enhancing the linkage within the province to promote the economic development of neighboring provinces.

(3) In order to promote the coupling and coordination of green finance and rural revitalization in Guizhou Province, the provincial government should strengthen the introduction of talents, develop low-carbon and high-income industries, and develop star industries with the help of "Internet +", while avoiding environmental pollution and market homogenization. In addition, it is necessary to intensify the training of talents in the region, train agricultural experts, and realize the flow of talents, capital, and markets, so as to achieve sustainable development.

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