

Research on the Impact of Green Finance on Rural Revitalization and Development: A Case Study of Anhui Province

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Abstract

The comprehensive promotion of rural revitalization was officially proposed in the 20th National Congress report, which means that the rural revitalization strategy has been pushed to a new height. At the same time, the report also emphasizes that improving the rural financial service system is an important part of achieving rural revitalization. Under the guidance of sustainable and green development concepts, new forms of financial services are also developing towards green finance. Green finance, as an important driving force for green and sustainable development, can provide financing services such as green financing and green credit for rural revitalization, and has a certain impact on achieving the rural revitalization strategy. Therefore, by studying the impact of green finance on rural revitalization, direction can be provided on how to improve green financial services, and effective implementation methods can be provided for the deepening of rural revitalization strategies. This article first reviews and summarizes the relevant literature on green finance and rural revitalization, analyzing the main content and related theories of green finance and rural revitalization; Secondly, analyze the mechanism of the role of green finance in rural revitalization and development; Re analyze the current development status of green finance and rural revitalization in Anhui Province, and empirically analyze the impact of green finance on the level of rural revitalization in Anhui Province from 2018 to 2022 using entropy method and coupling model; Finally, relevant suggestions are provided on how to develop and improve green finance to promote rural revitalization.

Keywords

Green finance; Rural revitalization; Evaluation indicators; Entropy weight method; Coupling model.

1. Introduction

The report of the 20th National Congress pointed out that the most arduous and heavy task in comprehensively building a socialist modernized country still lies in rural areas. Since the reform and opening up, there have been significant changes in the relationship between rural and urban areas. With the deepening of industrialization, there is a growing gap in the development speed of rural areas compared to cities. The contradiction between the growing needs of the people for a better life and unbalanced and inadequate development is most prominent in the field of agriculture, rural areas, and farmers, mainly manifested as low agricultural efficiency compared to other industries, and the increasing gap in urban-rural development. Therefore, it is necessary to implement the strategy of rural revitalization, adhere to the priority development of agriculture and rural areas, and gradually shift the focus of development from cities to rural areas.

The implementation of the rural revitalization strategy was officially proposed in the 19th National Congress report and pushed to a new height in the 20th National Congress report. The

report emphasized the need to comprehensively promote rural revitalization, while also providing several specific development directions and implementation approaches for achieving this goal. Among them, improving the rural financial service system is an important part of achieving rural revitalization. Under the guidance of sustainable and green development concepts, green finance can effectively play a financing service role in rural revitalization, support green "agriculture, rural areas, and farmers" projects, achieve green and sustainable development of rural agriculture, and promote rural green revitalization. Studying the impact of green finance on rural revitalization and development can provide direction for improving green financial services, and thus provide effective implementation methods for the deepening of rural revitalization strategies. This is reflected in both theoretical and practical significance.

2. Literature Review

2.1. The connotation of green finance

There are many definitions of green finance in foreign countries, and many scholars believe that green finance is to solve environmental pollution problems, protect the environment, and use financial instruments or financial product combinations for investment and financing activities. Scholtens (2006) believes that there is an inseparable relationship between green finance and sustainable development, and the use of green finance tools can effectively address the constraints of resources and the environment. Anderson's (2016) conclusion is that green finance raises funds through traditional financial instruments and then invests them in environmental protection projects. There is no unified definition of the connotation of green finance in China's academic community. Gao Jianliang (1998) understood green finance as the financial business of the financial sector in green projects, which can achieve the goal of promoting environmental protection and coordinated economic development through this new type of financial business; In addition to considering financial institutions and natural ecology, He Jiankui et al. (2006) added the role of green finance development in economic development itself; Li Xiaoyan (2007) understands green finance as a specific process, which involves measuring environmental or economic value and applying the calculated results to evaluate various financial activities; Deng Xiang (2012) believes that the purpose of green finance is to provide support for sustainable development, using green finance tools to help achieve the common development of the economy, society, and ecological environment; He Qian (2021) also understands green finance as a financial operation strategy that guides the rational and effective allocation of social resources through the operation of financial services, thereby promoting environmental protection and sustainable economic development.

2.2. Relevant theories of rural revitalization

There is little research on rural revitalization by foreign scholars, but research on rural construction abroad has enlightening and reference significance for the implementation of China's rural revitalization strategy. In terms of factors affecting rural development, Korsching P (2009) believes that rural development requires collaboration among multiple communities. In terms of the main body of rural revitalization, Greene (2014) believes that the government plays an irreplaceable role in rural development, and explores the specific path of rural revitalization from the perspective of rural finance. Domestic scholars mainly focus on the research of rural revitalization. In terms of the connotation of rural revitalization, Zhang Qiang (2018) believes that it is proposed to solve the problem of rural decline, covering various aspects such as rural environment, economy, culture, and governance. It is a key strategy for solving the "three rural issues" in the new era. In terms of constructing an evaluation index system, Li Liqing and Li Mingxian (2007) evaluated the level of rural development from five aspects: rural democracy, livelihood, rural customs, village appearance, and production management. After the proposal of the rural revitalization strategy, scholars have characterized

the indicators of rural revitalization based on the implementation principles and goals of rural revitalization from multiple dimensions. In terms of research method selection, Li Liqing (2007) used Analytic Hierarchy Process (AHP) and Zhang Ting (2018) used Expert Survey Method to screen indicators and assigned weights to indicators using Entropy Method; Xu Lamei (2018) used factor analysis to measure and evaluate the level of rural revitalization.

2.3. Research on the Impact of Green Finance on Rural Revitalization

There is relatively little research abroad on the role of green finance in rural revitalization, mainly focusing on the role of finance in rural development. Jeannenry (2011) believes that the more developed the finance, the better the economic situation of farmers in the region; Farmers not only rely on traditional agriculture, but also participate in financial investment to increase income and drive economic development in underdeveloped areas. Jingzhong (2005) conducted a comprehensive analysis of the relationship between the level of regional economic development and financial development by comparing and processing data on farmers' financial needs and the actual issuance of credit by financial institutions. For the first time, the problem of imbalanced flow of funds between rural supply and demand was discovered. At present, domestic scholars' research on the impact of green finance on rural revitalization is still at the level of theoretical exploration. Wen Yan (2019) believes that green development and lifestyle can better achieve the rural revitalization strategy; An Guojun (2018) pointed out that green finance has brought a large amount of funds and innovation driving force to rural sustainable development. If the funds raised by green finance can be accurately invested in rural green development projects, it can greatly support the development of rural revitalization.

3. Construction of Evaluation Indicators

3.1. Indicator System for Measuring the Development Level of Green Finance

The current development status of green finance is mainly analyzed from the following five aspects: green credit, green bonds, green investment, green insurance, and financial carbon intensity. At the same time, referring to the measurement methods of Zeng Xuewen et al. (2014) and Gao Jinjie et al. (2021), these five aspects are used as five evaluation indicators to measure the level of green finance development, and a corresponding evaluation index system is constructed. Then, the entropy method is used to analyze the current development status of green finance.

3.2. Evaluation index system for measuring the level of rural revitalization and development

Nowadays, the strategy of rural revitalization has been widely implemented throughout the country, and rural areas in various regions have achieved a certain degree of development. Rural industries, cultural construction, ecological environment, and quality of life have all undergone new changes. The current development status of rural revitalization is mainly analyzed from the following four aspects: the types and quantities of rural industries, the level of rural economic development, the level of rural education and culture, and rural social welfare security. At the same time, based on these four aspects and referring to Zhang Ting's (2018) measurement method, this project combines the connotation of rural revitalization and the availability and scientificity of data. According to the overall requirements of rural revitalization, four primary indicators and seven secondary indicators are selected to construct an evaluation index system for the development level of rural revitalization. Then, the entropy method is used to conduct a specific analysis of the current development status of rural revitalization. The four primary indicators are: industrial construction, economic construction, medical construction, and cultural construction. The seven secondary indicators are: in terms of industrial construction, selecting per capita total power of agricultural machinery and per

capita agricultural, forestry, animal husbandry, and fishery production value; Economic development: per capita net income of rural households and per capita electricity consumption of agricultural machinery; Medical construction: number of beds in medical institutions; Cultural Construction: Per capita consumption of education, culture, and entertainment in rural areas, as well as the ownership of rural cultural stations.

3.3. The specific content and data sources of the evaluation index system

3.3.1. Specific content of evaluation index system

The construction of an evaluation index system lays the foundation for studying the coupling relationship between two systems and is also an important tool for analyzing their impact relationship. Table 1 presents the specific content of the evaluation index system for two systems.

Table 1. Indicators of Green Finance and Rural Revitalization Development Level

System	First level indicator	Specific measurement
Green finance	Green Credit	The proportion of the number of business outlets in the country multiplied by the balance of green credit loans in the country
	Green bonds	Market value of A-shares/A-shares in six high energy consuming industries
	Green investment	Industrial pollution control completed investment/regional GDP
	Green Insurance	Agricultural insurance expenditure/total insurance expenditure
	Financial carbon intensity	CO2 emissions/RMB loan balance
Rural revitalization	Industrial construction	Per capita total power of agricultural machinery
		Per capita agricultural, forestry, animal husbandry, and fishery production value
	Economic construction	Per capita net income of rural households
		Per capita electricity consumption of agricultural machinery
	Medical construction	Number of beds in medical institutions
	Cultural Construction	Per capita consumption of education, culture, and entertainment in rural areas
		Occupation of rural cultural stations

3.3.2. Data sources

Based on the selected evaluation indicators, this project uses panel data from Anhui Province from 2018 to 2022 as the research interval. The data sources include the "China Banking Social Responsibility Report," "China Insurance Yearbook," "China Environmental Statistics Yearbook," "China Rural Statistics Yearbook," and "China Statistical Yearbook."

4. Research Method

Firstly, standardize the evaluation indicator data; Secondly, using the processed data, the entropy method is used to determine the weights of each indicator in the green finance and rural revitalization systems. Then, the product of each indicator value and the corresponding weight is summed to obtain the scores of the two systems, which can be used to compare the development level of the two systems; Finally, analyze the development level and current situation of green finance and rural revitalization.

4.1. Measurement of Green Finance and Rural Revitalization Development Level Based on Entropy Weight Method

(1) Data preprocessing. The green finance system has five primary indicators, among which green bonds and green investments are negative indicators, and the remaining indicators are positive indicators; The rural revitalization system has 4 primary indicators and 7 secondary indicators. At the same time, in order to eliminate the influence of different indicator dimensions, it is necessary to set the value range of each value to [0,1] and first preprocess the data. If the indicator is a positive indicator, then it is:

$$y_{ij} = \frac{x_{ij} - x_{ijmin}}{x_{ijmax} - x_{ijmin}} + 0.01 \quad (1)$$

If the indicator is a negative indicator, then it is:

$$y_{ij} = \frac{x_{ijmax} - x_{ij}}{x_{ijmax} - x_{ijmin}} + 0.01 \quad (2)$$

Among them, is the x_{ij} average value of indicator data for a unit in 34 provinces and cities in a certain year, calculated using the formula $x_{ij} = \frac{x_1 + x_2 + \dots + x_{34}}{34}$, x_{ijmax} is the maximum value, and x_{ijmin} is the minimum value.

(2) Entropy weight method. This study uses the entropy weight method to determine the weights of each indicator in the green finance and rural revitalization systems. Based on the above data preprocessing, obtain a matrix Y. Calculate the weight of the i-th sample under the jth indicator:

$$q_{ij} = \frac{y_{ij}}{\sum_{i=1}^n y_{ij}} \quad (3)$$

Calculate the information entropy of the jth indicator:

$$w_j = -\frac{\sum_{i=1}^n q_{ij} \ln q_{ij}}{\ln n}, (j = 1, 2, \dots, n) \quad (4)$$

Among them: n represents the number of indicators

Normalize the information entropy value again to obtain the weight of each indicator:

$$Z_j = \frac{w_j}{\sum_{i=1}^n w_j}, (j = 1, 2, \dots, n) \quad (5)$$

Finally, using the linear weighted sum method, the product of each indicator value and its corresponding weight is summed to obtain the scores of the two systems:

$$M_{ij} = \sum_{i=1}^n Z_j \cdot q_{ij} \quad (6)$$

4.2. Correlation analysis between green finance and rural revitalization development based on coupling model

(1) Coupling correlation degree. The coupling degree can reflect the correlation between green finance and the level of rural revitalization development. The final scores of the two systems obtained through the linear weighted sum method in this study were used to construct a coupled correlation model and analyze the degree of coupling correlation between the two systems

$$\alpha = \frac{\sqrt{ab}}{a+b} \quad (7)$$

Among them, a and b respectively represent the scores of green finance and rural revitalization development level. The α greater the coupling correlation, the greater the correlation between two systems. Referring to the research results of Liu Shuru et al. (2019) [23], the coupling correlation level is divided into six stages, as shown in Table 2:

Table 2. Classification and Characteristics of Coupling Correlation Degree

Coupling correlation interval	Coupling level	Features
$\alpha = 0$	It's okay	The elements within the system are almost unrelated to each other
$0 < \alpha \leq 0.3$	Low level coupling	Low level coupling phenomenon begins to occur between systems
$0.3 < \alpha \leq 0.5$	Antagonistic stage	Systems begin to interact with each other, and elements communicate with each other
$0.5 < \alpha \leq 0.8$	Running in stage	A benign coupling state occurs between systems
$0.8 < \alpha \leq 1$	High level coupling	Complete coupling occurs between systems
$\alpha = 1$	Benign resonance coupling	The coupling degree reaches its highest value, and all elements exhibit benign resonance coupling

(2) Coupling coordination. The calculation of coupling coordination degree is to prevent the occurrence of extreme situations such as excessive development of one system in green finance and rural revitalization, which may lead to severe compression of the other system, in order to obtain the coordinated development status between the two systems. The comprehensive coordination index between green finance and rural revitalization development T is:

$$T = \gamma a + \delta b$$

Among them, they γ, δ respectively represent the importance of green finance and rural revitalization development.

Finally, the coupling coordination between the two systems is obtained β :

$$\beta = \sqrt{\alpha \cdot T}$$

Among them, α is the coupling correlation degree, β is the coupling coordination degree $\beta \in [0,1]$, and the β larger the value, the higher the coordination degree between the two systems.

Referring to the coupling coordination degree model constructed by Wang Cheng et al. (2018) [24], it is divided into five parts, as shown in Table 3:

Table 3. Classification and Characteristics of Coupling Coordination Degree

Coupling coordination interval	Coupling level	Features
$0 < \beta \leq 0.2$	Serious imbalance	The development speed of rural revitalization is too fast, and the development speed of green finance cannot adapt. The two are not coordinated
$0.2 < \beta \leq 0.4$	Moderate imbalance	Rural revitalization still has advantages, but the level of development of green finance is gradually improving

$0.4 < \beta \leq 0.5$	Basic coordination	The speed of rural revitalization and development is slowing down, while the development speed of green finance is gradually increasing, and the gap between the two is gradually narrowing
$0.5 < \beta \leq 0.8$	Moderate coordination	The development of green finance has begun to promote the development of rural revitalization, and the level of development of green finance is still steadily improving
$0.8 < \beta \leq 1$	Highly coordinated	Green finance and rural revitalization development mutually promote each other and can meet the requirements of different stakeholders

5. Empirical Research Results

5.1. There is a certain connection between the development of green finance and rural revitalization

By using the entropy weight method to determine the weights of each indicator, the average comprehensive score of green finance and rural revitalization development in Anhui Province is calculated, and this represents the national comprehensive score. The temporal changes in the average scores of green finance development level and rural revitalization development in Anhui Province from 2018 to 2022. The overall development level of green finance in the country is on the rise. Although there was a significant decline in 2019, it gradually recovered afterwards. The development level of green finance in 2021 has rapidly improved and surpassed previous years. Therefore, overall, the development trend of green finance in Anhui Province in recent years is still upward.

From the average curve of rural revitalization development in Anhui Province, it can be seen that the development of rural revitalization has been increasing year by year, especially with rapid growth in 2018-2019. The growth rate from 2019 to 2020 is relatively slow down due to the impact of the COVID-19 epidemic, but it is still in the growth stage. Overall, the development trend of rural revitalization in Anhui Province has been upward in recent years.

Specifically, from 2018 to 2022, the development level of green finance and rural revitalization in Anhui Province have both developed rapidly, and the development speed of both has slowed down consistently from 2019 to 2020. Therefore, it can be inferred that there is a certain impact relationship between the development of green finance and rural revitalization in Anhui Province.

5.2. The coupling relationship between green finance and rural revitalization development is on the rise overall

The coupling degree (i.e. coupling correlation degree) of the two systems has been steadily increasing in all years except for a slight decline in 2019-2020, and has shown a more significant increase compared to other years in 2020-2021. During the five-year period from $\alpha \in [0.392, 0.651]$ 2018 to 2022, the coupling degree between the two systems was in a phase of antagonism and adjustment. Starting from 2018, the coupling degree exceeded 0.5, and the two systems entered the adjustment phase, resulting in a benign coupling state. In recent years, the coupling degree between green finance and rural revitalization development in Anhui Province has shown a steady upward trend overall, and the rate of increase is also on the rise. At the same time, with the increase of coupling degree, the connection between green finance and rural revitalization development is becoming increasingly close.

5.3. The coordination between green finance and rural revitalization development is generally high

From Figure 2, it can be seen that in terms of development trend, the coordination degree of the two systems remained stable overall from 2018 to 2022, and the development trend of the coordination degree and coupling degree of the two systems were almost identical. From 2018 to 2022, the coordination degree and coupling degree steadily increased. In 2019-2020, the coordination degree and coupling degree decreased synchronously, and in 2020-2021, they rebounded synchronously. From the level of development, coordination is $\beta \in [0.813, 0.923]$ in a highly coordinated stage, where green finance and rural revitalization can mutually promote each other and meet the requirements of different stakeholders. Therefore, in recent years, the coordination between green finance and rural revitalization development in Anhui Province has generally been high.

6. Conclusion and Suggestions

This article constructs two systems, green finance and rural revitalization development level, and uses evaluation indicators to measure the development level of green finance and rural revitalization. The entropy weight method and coupling model are used to analyze the relationship between green finance and rural revitalization development in Anhui Province from 2018 to 2022, and the following conclusions are drawn. (1) The development level of green finance and rural revitalization is both on the rise, but the development level of green finance is lower than that of high-quality agricultural development; (2) The coupling degree between green finance and rural revitalization development is showing an overall upward trend, confirming that the connection between the two is becoming increasingly close, and there is also a lot of coupling space. (3) The coordination degree between green finance and rural revitalization development is generally high, indicating that the two are internally coordinated, further demonstrating the inherent relationship of mutual influence between green finance and rural revitalization development.

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