Exploring the Role of Green Finance in Promoting Rural Revitalization in China

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Abstract. Green finance (GF), a vital catalyst for sustainable development, has a significant effect on China's rural rejuvenation. Using the issue of how green financing affects rural renewal, this paper adopts panel data from 31 Chinese provinces from 2010 to 2022 to systematically explore the actual effects and path mechanisms of GF policies. The regression analysis results demonstrate that GF significantly boosts rural revival, and the robustness test results further verify these conclusions. The regression results were significant in various robustness tests by propensity score matching method, clustering robustness standard error, and bootstrap self-service sampling method. Nonetheless, the study also points to challenges such as regional disparities in policy implementation, uneven allocation of resources, and inadequate applicability and risk management for environmentally friendly financial products. Thus, it is advised to encourage the creation of new green financial instruments, particularly those that are suited for rural regions, and to further maximize the regional adaptation of policy implementation.

Keywords: green finance; rural revitalization, regression analysis.

1. Introduction

Revitalizing rural region means an important strategic goal for the comprehensive realization of a community achieving moderate affluence and common prosperity in China's new era. General Secretary Xi Jinping pointed out that to promote Chinese-style modernization, it is necessary to unremittingly strengthen the foundation of agriculture and promote the comprehensive revitalization of the countryside [1]. This statement clearly illustrates the core strategic position of rural revitalization in facilitating the modernization of China and restoring its historical prominence, and also indicates that rural revitalization has a key role and far-reaching significance in fostering the development of a robust and influential country and the process of the rejuvenation of the nation’s strength and prosperity. A thorough push for rural revitalization efforts also requires a large amount of financial support. In this process, not only the injection of traditional capital is needed, but also the support of Environmentally sustainable finance in line with the goal of sustainable development.

Green finance, as a financial system centered on sustainable development, can effectively Steer the allocation of resources to projects with ecological benefits and provide a new development impetus for rural revitalization. In recent years, green finance, as a key area of national policy, has been gradually moving towards systematization and standardization. The 2018 perspectives on the Execution of the Rural Revitalization plan clearly states the strategic direction of the deep integration of green development and rural revitalization. Green finance can not only Steer resources toward environmentally friendly projects and help agro-ecological transformation, but also crack the difficulty of agricultural financing, mitigate environmental contamination and foster sustainable development. An insightful analysis of the contribution of green finance on rural revitalization can further optimize the institutional framework for green finance, strengthen product innovation and mechanism optimization, and provide stronger green power for rural revitalization. Only by realizing the in-depth merging of them can we truly inject new kinetic energy for pushing forward modernization and achieving the nation's great rejuvenation.

Through reviewing many kinds of literature, it is found that Cowan proposed early that the focus of green finance is the coordinated development of environmental protection and economic growth

[2]. This green development concept is also very consistent with the direction of China's rural revitalization strategy. Qin believes that green development in the new development stage is not only the continuation and innovation of sustainable development but also an inherent requirement and important support for the comprehensive revitalization of the countryside in the new era [3]. Fu finds that both the digital economy and green finance have a substantial role to play in the revitalization of the countryside, and puts forward the idea of shifting the center of gravity of the rural revitalization policy to the cultivation of digital green finance [4]. Jun believes that green finance is an important cornerstone for promoting rural revitalization, and that the obstacles on the way to the full promotion of green finance should be solved in order to better promote the development of rural revitalization [5].

Based on this, this paper absorbs the theoretical experience of previous scholars and adopts empirically supported methods of research to systematically parse the actual impact of green finance on rural revitalization. This article also extends the research timeline to the near future in order to improve the timeliness and academic frontiers of the research, which is of high reference significance.

2. Theoretical Analysis and Research Hypotheses

Green finance, as an important hand in promoting rural revitalization, effectively alleviates the problem of lack of funds in the countryside by guiding financial resources to accurately invest in the fields of green agriculture, clean energy and ecological governance, thus enhancing the efficiency of the use of resources in the countryside economy, and injecting new vitality into the development of the regional economy [6]. In ecological restoration, green finance with the help of green credit and other tools, centralized funds to support pollution prevention and control, ecological restoration and other projects, for the construction of the rural ecological environment to provide a strong guarantee, and a good ecological environment to feed the agricultural production, laying a natural foundation for balance rural growth with sustainability [7]. In terms with respect to industrial upgrading, green finance promotes the transformation of traditional agriculture to modernization and greening through green bonds and special funds, while accompanying the rise of new industries such as eco-tourism, which gradually builds up a diversified rural economic system. The optimization of this industrial structure contributes to building a resilient rural economy while promoting labor mobility and skills enhancement in rural areas, thus injecting lasting vitality into rural revitalization. At the same time, green finance effectively reduces development uncertainty through policy tools such as green insurance, which provides a long-term guarantee for agricultural green transformation [8]. In addition, by promoting the implementation of ecological projects, green finance effectively helps improve the grassroots governance system, which not only significantly improves the rural governance capacity, but also promotes the strategic alignment of the economy, ecology and society, and becomes an important institutional guarantee and central impetus for implementing the rural revitalization goals. Therefore, the following hypotheses are suggested in this paper:

Assumption 1: Green finance significantly contributes to rural revitalization.

3. Research Design

3.1. Sample Selection and Data Sources

Within the scope of this study, a panel dataset covering 31 Chinese provinces between 2010 and 2022 is assigned to empirical analysis. The data come from the EPS data platform, the Wind data platform, the National Research Network, the National Bureau of Statistics, China’s Rural Yearbook, and statistical records from each province. For some of the missing data, linear interpolation is used to supplement the data, and a total of 403 observations are finally obtained.

3.2. Definition of Variables

Explained variables: the explained variable in this paper is rural revitalization, referring to the practice of Xu Xue to construct rural revitalization evaluation indexes (see Fig.1 for details), and obtain the final rural revitalization index by entropy value method [9].

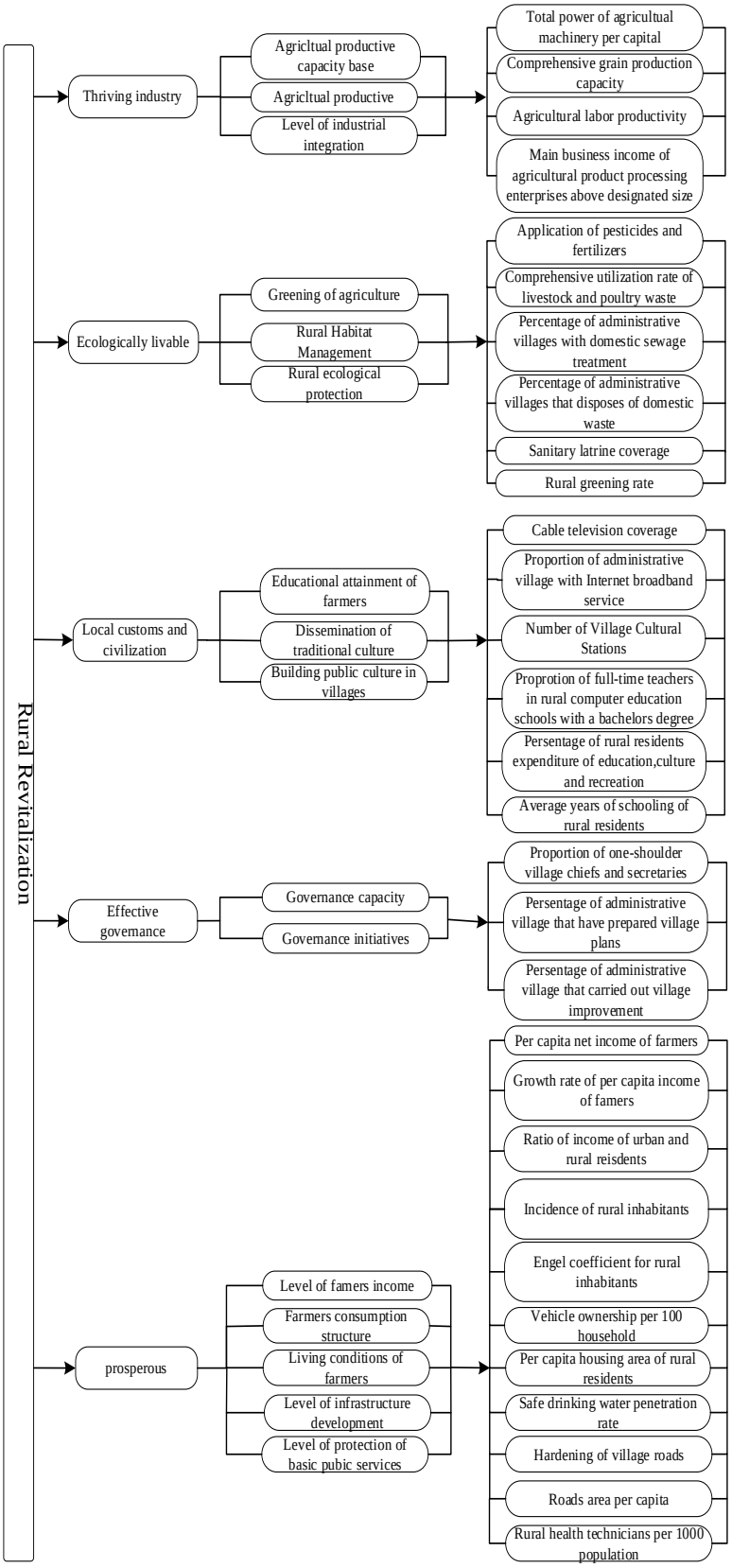

Fig. 1 Rural Revitalization Evaluation Indicator System (Photo/Picture credit: Original).

Explanatory variables: the explanatory variables in this paper are green finance, referring to the research of Xie and other scholars to construct green finance evaluation index (Gfinance) from green credit, green investment, green insurance, green bonds, green support in total seven dimensions (Fig. 2) [10].

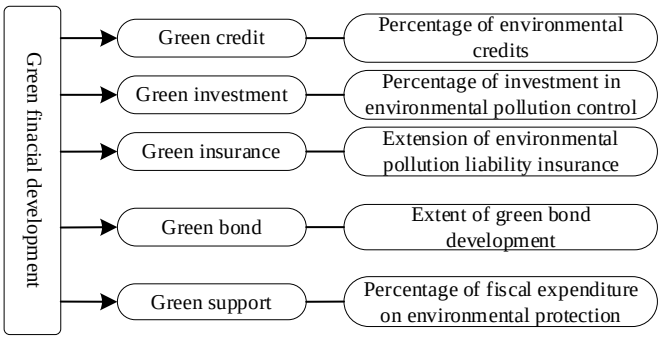

Fig. 2 Green Finance Evaluation Indicator System (Photo/Picture credit: Original).

Control variables: this paper refers to existing research and selects the following control variables. Degree of economic advancement, stage of industrialization, financial support, level of urbanization, please refer to Fig. 3 for specific measurements.

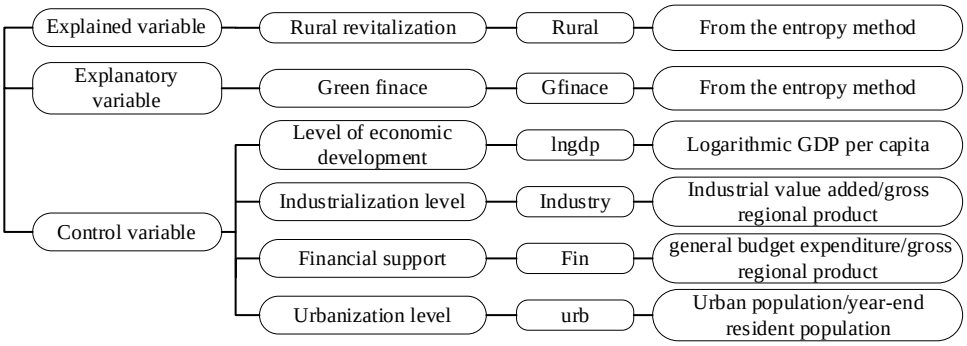

Fig. 3 Variable Definitions (Photo/Picture credit: Original).

3.3. Modeling

This paper carries out empirical inquiry into delving into the effects of Gfinance on Rural by constructing a panel data model, which sets up a model utilizing bidirectional fixed effect to test the hypotheses of this study, as shown in model (3-1):

$$\text{Rural\_revitalization}_{i,t} = \alpha_0 + \alpha_1 Gfinance_{i,t} + \alpha_2 Controls_{i,t} + \sum Id + \sum Year + \varepsilon_{i,t} \quad (1)$$

Where $\text{Rural\_revitalization}_{i,t}$ is the rural revitalization data of province i, year t, the larger value indicates the advanced level of development of rural revitalization; $Gfinance_{i,t}$ is the green finance index of province i, year t. $Controls_{i,t}$ is the control variable, whose variable definitions are as shown in the previous section, and $\varepsilon_{i,t}$ is the random perturbation term, meanwhile, this paper controls for the province and year.

4. Empirical Analysis

4.1. Descriptive Statistics

Tables 1 displays the findings of descriptive statistics., in which the maximum value of Rural_revitalization is 0.951, the minimum quantity is 0.013, the mean quantity is 0.290, and the standard deviation is 0.180, Implying that the Rural Revitalization Index is significantly different between different regions, and the level of rural revitalization in most of the regions is low. The maximum value of Gfinance of each province is 0.632, the minimum value is 0.080, the mean value is 0.314, and the standard deviation is 0.127, indicating that the overall level of the green finance

index of each province is moderate, and that Certain distinctions exist in the degree of green finance development among provinces, but they are small compared with the rural revitalization index.

Table 1. Descriptive Metrics

variable	N	min	max	mean	sd
Rural_revitalization	403	0.013	0.951	0.290	0.180
Gfinance	403	0.080	0.632	0.314	0.127
lngdp	403	9.464	12.15	10.81	0.489
Industry	403	0.070	0.574	0.329	0.0920
urb	403	0.227	0.896	0.585	0.133
Fin	403	0.040	0.204	0.115	0.034

4.2. Baseline Regression Analysis

The results of the model (1) are shown in Table 3-5, column (1) and column (2) demonstrate the regression results of Gfinance on Rural after controlling the year and province, respectively(Without special instructions, the military year and province are controlled).As illustrated in Table 2, the regression coefficients of green finance index on rural revitalization are always positive and all of them are significant at 1% significance level, which confirms the research hypothesis of this paper, that is, The advancement of green finance plays a crucial role in fostering rural revitalization.

Table 2. Benchmark Regression Analysis

VARIABLES	(1) Rural_revitalization	(2) Rural_revitalization
Gfinance	0.857***	0.619***
	(12.76)	(10.72)
lngdp		0.043***
		(3.35)
Industry		-0.240***
		(-6.93)
urb		-0.458***
		(-8.56)
Fin		0.072
		(1.42)
Constant	0.021	-0.035
	(1.00)	(-0.27)
Observations	403	403
R^2	0.994	0.996

Note: t-values in parentheses, *** p<0.01, ** p<0.05, * p<0.1 Same as below

4.3. Robustness Tests

1. propensity score matching (PSM). To mitigate the potential bias of the empirical results caused by the issue of endogeneity triggered by selection bias, this paper adopts the PSM method with kernel matching with 1:4 nearest-neighbor matching to Lessen the disruptions of sample diversity on the regression results. The regression is re-conducted using matched data, and the corresponding results are displayed in column(1) of Table 3, whose regression results are still significantly positive, proving the robustness of the study in this paper.

2. Incorporate clustering robust standard errors. When there is clustering in the sample data, there is often a correlation between observations within groups. The existence of this problem may lead to a biased estimation of the coefficients. Therefore, this paper adds the robust standard error of clustering by province to ensure the robustness of the regression results. The results of the robustness test are shown in column (2) of Table 3, where regression results are still significantly positive at the 1% significance degree, demonstrating regression results remain robust.

3. Bootstrap autonomous sampling method. Considering that the distribution of the initial sample data may have some bias, to check the stability of the regression outcomes, this study utilizes the Bootstrap sampling technique for re-estimating the model, with the number of self-sampling samples of 1000 times. The findings are shown in column (3) of Table 3, and all thresholds of significance remain basically unchanged, signaling that the research is highly reliable.

Table 3. Robustness Checks

	(1)	(2)	(3)
VARIABLES	Rural_revitalization	Rural_revitalization	Rural_revitalization
Gfinance	0.505***	0.619***	0.619***
	(7.45)	(5.16)	(10.53)
lngdp	0.049***	0.043	0.043***
	(2.95)	(1.65)	(3.18)
Industry	-0.234***	-0.240***	-0.240***
	(-6.94)	(-3.36)	(-6.74)
urb	-0.244**	-0.458***	-0.458***
	(-2.58)	(-3.77)	(-7.58)
Fin	0.050	0.072	0.072
	(0.79)	(0.86)	(1.36)
Constant	-0.215	-0.035	-0.035
	(-1.44)	(-0.13)	(-0.26)
Observations	273	403	403
R^2	0.996	0.996	0.996

5. Challenges and Recommendations

5.1. Challenges

1. Although the policy text specifies the goal of supporting green development in villages, local implementation often results in the decay of policy effectiveness due to improper interpretation or insufficient resources. In addition, the imbalance of green financial development in different regions further exacerbates regional differences in resource allocation [11].

2. Although the current green credit, green bonds and other financial instruments have begun to take shape, their applicability is often limited to specific areas, and it is difficult to cover the complex rural industrial distribution [12]. Concurrently, the risk control mechanism of green financial products also needs to be improved, especially in the face of rural ecological projects with high risk and long cycle characteristics, where financial institutions lack effective risk mitigation means.

5.2. Recommendations

The regional adaptability of policy implementation should be further promoted, and the allocation of resources should be optimized through a dynamic assessment mechanism to narrow the development gap between areas; Simultaneously, actions should also focus on strengthening the development of green financial tools, and research and the advancement of environmentally friendly finance tools that meet needs of the countryside, such as green insurance for small farmers, low-interest green credits for rural cooperatives, and special green bonds in support of eco-tourism, so as to further enrich the forms of green financial services and further enhance the efficiency of financial support through financial innovation. Through financial innovation, the forms of green financial services should be enriched to further enhance the efficiency of financial support; in addition, policy synergy and multi-party cooperation should be strengthened to build a capital supply system led by the government with the joint participation of enterprises and social capital, so as to form a synergy to support the revitalization of the countryside.

6. Conclusion

Based on the data of China's 31 provinces over the period 2010 to 2022, this study provides an in-depth focusing on the influence of green finance on China's rural revitalization at the theoretical and practical dimensions. The analysis reveals that green finance is a key driver of rural revitalization. Meanwhile, the popularization of green finance effectively promotes the enhancement of rural ecological environment governance capacity and lays an ecological key to achieving sustainability in agricultural production This research improves the theoretical system of green finance for rural revitalization, meanwhile provides data support and theoretical basis for policy makers to optimize green finance policies. However, this study is mainly based on provincial data and fails to comprehensively cover individual differences at the micro level, making it challenging to Reveal the real-world implications of green finance for daily life of rural residents. In addition, although the time span of the study is long, the exploration of the sustained effects of green finance policies remain inadequate. Subsequent research should combine micro-survey data and focus on analyzing the ramifications of green finance on the behavior of rural SMEs and farmers. With the deepening of policies and the leaps in technological development, green finance will show broad prospects in emerging areas in the future, thus injecting stronger kinetic energy for rural revitalization.

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