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Performance Evaluation of Green Finance Development and Analysis of Regional Differences in China

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Abstract

Using the relationship between green finance development and carbon emissions as an entry point, this paper collects carbon emissions per unit of GDP, green credit and total credit to GDP in 30 provinces in China from 2011 to 2019. Also, use the spatial lag model to assess green finance development performance. The results show that there is a strong positive spatial correlation between the development of green finance and carbon emissions, and there is a feature that the development of the eastern region is better and the development of other regions is slightly worse. At the same time, the development of green finance has a strong inhibiting effect on energy saving and emission reduction.

Keywords

Green Finance; Space Measurement; Regional Differences; Emission Reduction.

1. Introduction

If 2021 is the first year of the Double Carbon target, then 2022 is the year that Double Carbon work has moved from preliminary planning to key actions.The 2022 government work report proposes “implementing the carbon peak action plan” and “developing green finance and accelerating the formation of green and low-carbon production and lifestyles”.

In recent years, China has continued to intensify its green finance reform and innovation efforts, and has achieved good results.The State Financial Inspectorate will focus on four aspects to provide a financial guarantee for realizing the value of ecological products.The first is to accelerate the construction of a green and low-carbon financial system that meets the country's real needs and development characteristics, and provides comprehensive and diversified green and low-carbon financial services.The second is to develop a green financial organization system to provide specialized and accurate financial services to green and low-carbon areas.The third is to continue to innovate green financial products and service models, take full advantage of the combined advantages of financial innovation operation demonstration zones, free trade pilot zones, independent innovation demonstration zones and international consumption center pilot cities [1], and promote the formation of more innovative green financial products and models.The fourth is to continuously expand the financing channels for green industries and work with financial regulators, relevant municipal departments and districts to further sort green industries and projects, and make full use of monetary policy tools such as carbon emission reduction tools.

Green is the background color of social development in the new era and a passport to future competition. Accelerating green development is the only way to high-quality development.As the blood of economic development, finance has become an impetus for implementing the concept of green development and achieving high-quality economic development.In recent

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years, the rise of green economy has led to vigorous development of low-carbon, circular and green economy, so more financial resources are urgently needed.Many people in the financial industry believe that sticking to green development is the main theme of economic development under the new normal. Only by seizing the opportunities of green development can we open up a broader growth space in the new round of the economic cycle.In order to promote the development of green finance, we should aim for high-quality growth of green industries, support big data and Internet technology, and build a rational green financial system with the reform of ecological civilization system as the driving force.

2. Literature Review

The construction of China's green financial market is still in the rapid construction phase, and many domestic scholars have conducted in-depth research on the need and direction of green financial development in combination with the latest national policies. Li Mei et al (2016) analyzed the disparities and ecological vulnerabilities in the areas along the “Belt and Road” and thought that the financial sector should pay more attention to environmental protection issues and follow the path of international cooperation [2]. Analyzing the current situation of green finance development in my country, Wang Fengrong et al (2018) pointed out that the demand for green finance funds cannot be met in the long term, and a balance between the market and the government is still needed in the future [3]. Zhou Mi (2021) used a set of empirical analysis methods to analyze the development performance of green finance in Jiangsu Province based on various data, and emphasized the positive role of green credit in the development of green financial business at this stage [4].

3. Performance Evaluation

Referring to relevant literature studies, it is assumed that the direct impact of green finance is to reduce the total amount of industrial pollutant emissions.Based on this, this paper establishes a regression equation between total industrial pollutant emissions and green finance development, and uses the sign and magnitude of the regression coefficient to evaluate the performance of green finance development in China [5-7].

3.1. Variable Selection

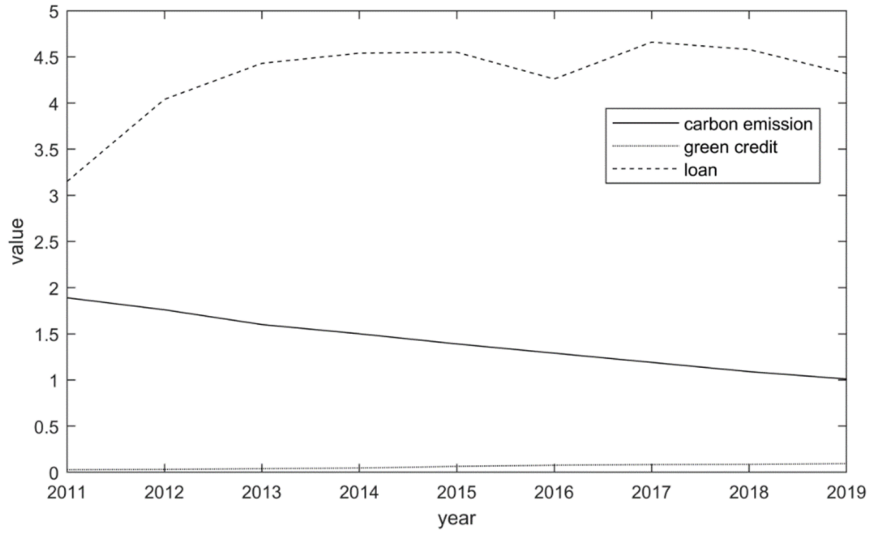

Figure 1. Variable Trend Graph

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The measuring caliber of the development effectiveness of green finance is not yet mature, in particular, capital market-related data such as green bonds and carbon finance are not easy to obtain. Therefore, in conducting a regression analysis between green finance and green economy to study the development performance of green finance in my country, this paper relies more on green credit data to construct a regression model. This paper collects statistics on green credit balance, gross domestic product (GDP), carbon emissions and total credit in China's provinces (excluding Hong Kong, Macau, Taiwan and Hainan) from 2011 to 2019.Taking carbon emissions per unit of GDP as the dependent variable and the ratio of country-reported green credit balance to total credit and total credit to domestic GDP ratio as independent core variables.

To visually analyze the relationship between the three variables, the average value of each province is used to substitute for the overall level and a trend chart is drawn.

3.2. Model Building

The variables were tested for stationarity and VIF, and the results showed that the variables were stationary and there was no serious multicollinearity. Before deciding to use a spatial econometric model, a spatial autocorrelation test should be performed to test whether the variables exhibit spatial dependence.Before deciding to use a spatial econometric model, a spatial autocorrelation test should be performed to test whether the variables exhibit spatial dependence.This paper chooses the inverse distance matrix for empirical analysis.

The Moran's I of the three key variables (see Table 1) was estimated using Stata software and a global spatial autocorrelation analysis was performed.The results in Table 1 show that the global Moran's I from 2011 to 2019 are all positive and the p-values passed the test of significance, indicating that the three variables have significant positive spatial correlations in the years observed.

Table 1. Global Moran's I of variables

		2011	2012	2013	2014	2015	2016	2017	2017	2019
Carbon emission	Moran's I	0.120	0.181	0.354	0.254	0.315	0.192	0.341	0.333	0.259
	P	0.025	0.027	0.015	0.042	0.012	0.028	0.039	0.028	0.021
Green credit	Moran's I	0.290	0.359	0.269	0.299	0.176	0.294	0.351	0.101	0.335
	P	0.040	0.017	0.017	0.031	0.028	0.011	0.034	0.039	0.039
Loan	Moran's I	0.316	0.191	0.390	0.139	0.366	0.115	0.335	0.266	0.167
	P	0.030	0.023	0.028	0.006	0.010	0.022	0.039	0.012	0.031

To test which model is more suitable for the needs of this paper, LM test and R-LM test are performed and the results are shown in Table 2.

Table 2. Results of LM Test and R-LM Test

	Spatial Error Model			Spatial Log Regression Model	
	Moran's I	LM	Robust LM	LM	Robust LM
Statistic	0.032	0.146	0.265	5.415	6.410
P	0.123	0.115	0.221	0.002	0.009

Table 2 shows that only the Lagrange multiplier and the robust Lagrange multiplier of the spatial lag model passed the significance test, so this work constructs a spatial lag model to test the relationship between the two. The specific spatial lag model is as follows:

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$$CE_{it} = \alpha_0 + \beta_1 GC_{it} + \beta_2 L_{it} + \rho \sum_j w_{ij} CE_{it} + \varepsilon_{it} \quad (1)$$

Among them, i is the province; t is the year; CE is the carbon emission per unit of GDP; GC is the proportion of green credit; L is the proportion of total loans in GDP; $\rho \sum_j w_{ij} CE_{it}$ is the spatial lag variable; w_{ij} is the element value of the inverse distance spatial weight matrix; β represents the regression coefficient; ε is the random disturbance term.

3.3. Result Analysis

Table 3 on the next page shows the benchmark regression results, and columns (1) through (4) show the estimated results of random effects, single fixed effects, timed effects, and double fixed effects, respectively. From the estimation results of column (4) in Table 3, the adjusted R^2 is 0.845 and the model adjustment effect is good. The estimated value of the spatial autocorrelation coefficient ρ is significantly positive, indicating that neighboring provinces' carbon emissions have a positive spatial impact on the province's carbon emissions, indicating that spatial factors need to be considered when evaluating green finance performance. The coefficient of GC is -0.0412, which passed the 1% significance level test, indicating that each 1% increase in green credit reduces CO2 emissions by 4.12%.It can be seen that the development of green finance plays a significant role in promoting the reduction of carbon emissions.

Table 3. Results of benchmark regression

Variable	(1)	(2)	(3)	(4)
GC	-0.092*	-0.2513**	-1.2432***	-0.0412***
	(1.05)	(2.45)	(4.68)	(2.68)
L	-0.195***	-0.352***	-0.2201***	-0.146***
	(3.55)	(5.21)	(7.88)	(4.16)
ρ	0.152*	0.125*	0.148*	0.201*
	(1.52)	(1.45)	(1.49)	(1.78)
N	270	270	270	270
Adj. R^2	0.456	0.748	0.895	0.845
Log-Likehood	-155.664	-154.891	-198.514	-176.455
Hausman test		21.00		
		[0.00]		
LR test		19.64	492.64	
		[0.00]	[0.00]	

Note: ( ) is the t statistic, [ ] is the P value, * means P<0.1, ** means P<0.05, *** means P<0.01; Same as the table below.

3.4. Regional Difference Analysis

According to the division of administrative regions of China, the 30 provinces studied are divided into three major regions: East, Central and West, and clustered regressions are performed.The regression results are presented in Table 4.It can be seen that the development of green finance in the eastern region has the best effect on industrial pollution reduction with a regression coefficient of -0.1019, which passed the 1% significance test;The central region is similar to the western region, the regression coefficient is around -0.0350, and the development performance is slightly worse than that of the eastern region.Overall, the development of green finance in the three regions is having a dampening effect on CO2 emissions.

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Table 4. Regional difference analysis

Variable	East	Mid	West
GC	-0.1019***	-0.0349**	-0.0351**
	(3.25)	(1.55)	(1.25)
L	-0.593***	-0.142*	-0.131***
	(5.55)	(5.12)	(4.45)
ρ	0.245**	0.105*	0.095*
	(2.54)	(1.12)	(1.02)
Adj. R^2	0.865	0.821	0.801

4. Conclusion and Suggestion

This paper collects the relevant data from 30 provinces in China from 2011 to 2019, and after spatial autocorrelation analysis, constructs a spatial lag model to analyze the impact of green finance development on carbon emissions, and draws the following conclusions:

First, the development of green finance in China is unbalanced. The eastern coastal areas are developing rapidly. The Yangtze River Delta, Pearl River Delta and Bohai Rim are the leading areas, the central area is the catching-up area, and the western area is the backward area .Second, the results of the global spatial autocorrelation analysis show that the development of green finance and carbon emissions show a significant positive spatial correlation in the observed years.The results of the local spatial autocorrelation analysis show that carbon emissions and green finance development have the characteristics of high clustering in the eastern coastal area and low clustering in the western area.Third, the results of the spatial econometric analysis show that green finance has a significant promoting effect on CO2 emissions.

Based on the above conclusions, this paper makes the following suggestions:Firstly, the development of green finance should be accelerated for provinces with poor green finance development, for provinces with better development performance it should assume its role model function and strengthen the dynamism and charisma of backward provinces.Second, for the development of green finance, we must pay attention to the existence of spatial correlations, actively introduce advanced technologies and talents from neighboring provinces, and accelerate the development of this province.Third, continue to play the positive role of green finance in reducing carbon emissions and promoting high-quality economic development.

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