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Has Green Insurance Ensured the Realization of China 's Dual Carbon Goals?

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Abstract: As an essential risk guarantee and economic compensation mechanism to construct green and low-carbon circular economic development system, the role of green insurance in the field of energy conservation and emission reduction remains a realm yet to be explored substantially. Based on the panel data of 30 provinces in China from 2005 to 2019, the influence and theoretical mechanism of green insurance on carbon emissions were analyzed by the construction of intermediary effect model and moderating effect model. Additionally, the spatial spillover effect was explored by the spatial Durbin model. The results show that: (1) Green insurance has a significant inhibitory effect on carbon emissions, which retains salience across the spectrum of endogenous tests and stability tests. (2) Both the “local effect” and “neighboring effect” of green insurance on carbon emissions are inhibitory, displaying “simultaneous resonance” characteristics based on the spatial perspective. In view of the above conclusions, this thesis provides policy suggestions for promoting the construction of a diversified and collaborative green insurance system and enriching carbon emission reduction paths.

Keywords: Green insurance, Carbon emissions, Spatial spillover effect.

1. Introduction

The chain reaction caused by the intensified greenhouse effect has induced a series of ecological problems, such as the glacier retreat and the northward migration of the climate zone, which has more seriously restricted the healthy and sustainable development of China's economy [1-3]. The report of the 20th National Congress of the Communist Party of China has repeatedly underscored the goal of 'carbon peak and carbon neutrality', withal, it said that it is necessary to actively and steadily promote carbon peak and carbon neutrality, especially in the dual control of dual control of carbon emissions, energy revolution, sound carbon market, and improvement of carbon sequestration capacity. Hence, it is imperative to establish and improve the economic system of green low-carbon cycle development and explore and improve the path of carbon emission reduction.

Green insurance is the basic means of environmental risk management under the condition of market economy, including environmental pollution liability insurance. Green insurance gives full play to the function of strict control and sharing of environmental risks in promoting the prevention and control of environmental pollution and improving the modern environmental governance system. Green insurance guarantees the development of green low-carbon industries and improves the market-oriented allocation system of resource and environmental factors. Concurrently, green insurance accelerates the development and application of advanced technologies for energy conservation and carbon reduction, promoting the formation of green and low-carbon production methods and lifestyles [4]. Therefore green insurance has a positive effect on the achievement of the dual carbon goal.

This study tries to solve the following questions: First, can green insurance promote carbon emission reduction? Second, does green insurance have a spatial spillover effect on carbon emission reduction?

The potential research value of this thesis is reflected in the following aspects. On the one hand, energy consumption structure, environmental regulation and energy intensity are taken as the intermediary variables to explore the channels of green insurance to reduce carbon emission, which provides paths for how to promote the carbon emission reduction effect. On the other hand, this dissertation adopts the spatial Durbin model to further explore the spatial spillover effect of green insurance on carbon emissions to make up for the lack of research on the spatial spillover effect of green insurance.

2. Literature Review

Research on carbon emissions by various green policies has emerged in an endless stream and the research on carbon emissions by green finance [5-7], green credit [8-10] and carbon emission pilot policies [11-13] has been continuously enriched and in-depth, however, the relative research on carbon emissions of green insurance is quite rare.

Such studies mainly focus on pollution emissions and agricultural carbon emissions. Shi et al. employed the DID method to empirically test that the EPLI policy is a market tool to reduce the risk of industrial pollution [14]. Focusing on the agricultural industry, Ma and Cui found that the development of agricultural insurance significantly reduced the total amount, density and intensity of agricultural carbon emissions from three perspectives: development scale, coverage density and coverage breadth [15]. The above articles have made vital contributions to the research on the connotation, function and mechanism of green insurance, which provides important ideas for this paper. However, such articles have certain limitations in the research object along with dimension. The research object is industrial SO2 and dust emissions so that the correlation between green insurance and carbon emissions has not been directly explored. Concurrently, the agricultural industry, as the main research dimension, has certain industry limitations. On top of that, such articles do not take geographical factors into account, which ignores the spatial spillover effect of green insurance.

Collectively, in view of the lack of relevant research, it is of great theoretical and practical significance to empirically study the impact mechanism of green insurance on carbon emissions. With the object of further promoting the internal mechanism of green insurance and carbon emissions, this dissertation explores the channels of carbon emission reduction in green insurance through energy consumption structure, environmental regulation and energy consumption intensity. Additionally, the moderating effects of urban-rural income gap, high-quality economic development and industrial structure are studied. Finally, this paper employs the spatial Durbin model to study the spatial spillover effect of green insurance on carbon emissions, which makes up for the lack of spatial research on green insurance and provides specific policy recommendations on how to promote the development of green insurance and carbon emission reduction based on the empirical results.

3. Methodology and Data

3.1. Model Specification

3.1.1. Benchmark model

To explore the impact of green insurance on carbon emissions, this article establishes a regression model:

$$\mathrm{Carbon}_{i,t} = \beta_0 + \beta_1 \mathrm{GI}_{i,t} + \beta_s \mathrm{CVs}_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

Where i represents the province and t represents the year, $\mathrm{Carbon}_{i,t}$ represents the CO2 emissions in t in province i, $\mathrm{GI}_{i,t}$ represents the green insurance in t in province i, $\beta_1$is the coefficient of green insurance, which represents the degree of influence of green insurance on carbon emissions, $\mathrm{CVs}_{i,t}$ is a series of control variables, β_s is the corresponding coefficient of each control variable, μ_i represents the fixed effect of province, γ_t represents the fixed effect of time.$\varepsilon_{i,t}$ is the random error term.

3.1.2. Spatial Durbin model

When insurance companies launch relevant green insurance products, the surrounding insurance companies will also launch them to meet the market demand. At the same time, the surrounding areas will also follow the example of the region to make relevant policy adjustments and ultimately achieve the reduction of carbon emissions. In an attempt to study the spatial spillover effect of green insurance on carbon emissions, this essay constructs the following spatial Durbin model.

$$\mathrm{Carbon}_{i,t} = \rho \sum_{j=1}^{N} w_{i,j}\mathrm{Carbon}_{i,t} + \alpha \mathrm{GI}_{i,t} + \alpha_1 \sum_{j=1}^{N} w_{i,j}\mathrm{GI}_{i,t} + \beta_s \mathrm{CVs}_{i,t} + \vartheta_s \sum_{j=1}^{N} w_{i,j}\mathrm{CVs}_{i,t} + \mu_i + \gamma_i + \varepsilon_{i,t} \quad (2)$$

Equation (2) is the spatial Durbin model, and ρ is the spatial autoregression coefficient, which represents the degree of influence of the carbon emissions of neighboring provinces on the carbon emissions of the province.α_1 is the lag coefficient of green insurance, which represents the degree of the impact of green insurance in the pilot areas on carbon emissions in the surrounding areas.β_s is the degree of the influence of the control variable on the carbon emissions of the province.ϑ_s is the degree to which the control variable affects the carbon emissions of the neighboring province.$w_{i,j}$ is the basic element of the spatial weight matrix.

3.2. Sample Selection and Data Sources

From the statistical and data rationality point of view, Hong Kong, Macao and Taiwan and the Tibet Autonomous Region, respectively, due to the lack of data, this article does not include them in the scope of this measure. On account of missing values in some data in individual years, this article uses linear interpolation method for estimation. Referring to previous studies, carbon emissions are measured by sectoral methods and are derived from the China Carbon Accounting Database (CEADs). The data of explanatory variables and control variables are from the National Bureau of Statistics, China Statistical Yearbook and China Industrial Statistical Yearbook.

4. Analysis of Empirical Results

4.1. Descriptive Statistics of The Variables

Data from 30 provinces in China from 2005 to 2019 were selected for analysis and 450 total sets of data were obtained. The descriptions of the variables used in this article are shown in Table 1.

Table 1. Descriptive statistics of variables

Variable	N	Mean	p50	SD	Min	Max	Range
GI	450	0.733	0.449	0.991	0	7.972	7.972
Carbon	450	29.39	23.36	20.01	1.646	93.71	92.06
P	450	4.489	2.831	6.622	0.0750	39.13	39.05
lnpatent	450	9.371	9.425	1.639	4.369	13.18	8.806
C	450	0.0430	0.0210	0.0460	0.00200	0.230	0.228
Pgdp	450	4.496	3.830	2.747	0.543	12.49	11.95
Ec	450	11.31	7.146	10.22	0.0490	43.30	43.26
P1	450	4.496	3.830	2.747	0.543	12.49	11.95
GC	450	0.542	0.536	0.144	0.192	0.906	0.714
GS	450	0.224	0.185	0.179	0.00100	0.893	0.892
GIV	450	0.00100	0.00100	0.00100	0	0.0100	0.0100
ES	450	0.950	0.881	0.411	0.0250	2.461	2.436

4.2. Benchmark Regression

Table 2 reports the test results of the benchmark regression. Based on the two-way fixed effect model, columns (1) and (2) respectively reported the regression results of whether to add the control variable or not, and the coefficient was significantly negative at the level of 1%, which indicated that GI has a significant inhibitory effect on carbon emissions, and the hypothesis H1 was verified.

Table 2. Benchmark regression results

	(1)	(2)
	Carbon	Carbon
GI	-28.296***	-42.520***
	(6.794)	(8.763)
P		-1.796***
		(0.373)
lnpatent		0.061
		(0.867)
C		-75.670***
		(20.605)
Pgdp		4.705***
		(1.060)
Ec		0.014
		(0.027)
_cons	21.208***	12.428
	(1.028)	(8.583)
province	Yes	Yes
year	Yes	Yes
F	46.641	43.275
R2	0.633	0.684
N	450	450
Note: Standard errors in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01, and the same below.		

4.3. Analysis of the Spatial Durbin Model Regression

The data in this article are tested by LM, LR and Wald. The results of Hausman test show that the fixed effect model is more accurate. In this paper, the spatial Durbin model with double fixed effects is used. Based on the three matrices of adjacency matrix, economic distance matrix and linear geographic matrix, this paper adopts the spatial Durbin model for regression and the regression results are still significant. According to Table 3, the spatial lag term and each explanatory variable passed the significance level test.

Table 3. Results of the spatial Durbin model regression

	(1)	(2)	(3)
	W1	W2	W3
GI	-65.363***	-71.033***	-45.761***
	(0.00)	(0.00)	(0.00)
W*GI	-30.969*	-85.368*	71.912
	(0.09)	(0.06)	(0.12)
CVS	Yes	Yes	Yes
Year	Yes	Yes	Yes
Province	Yes	Yes	Yes
N	450	450	450
R2	0.380	0.327	0.223
Number of id	30	30	30

Green insurance can significantly reduce carbon emissions in adjacent areas and close economic distances. Additionally, green insurance has a stronger inhibitory effect on carbon emissions in areas with closer economic distances. The spatial effect of green insurance in the linear distance matrix is not obvious, which is closely related to the immature development of green insurance.

5. Conclusion and Revelation

5.1. Conclusion

Based on the panel data of 30 provinces in China from 2005 to 2019, this article empirically illuminates carbon emission reduction effect of role of green insurance's evolution in the context of engendering ecological stewardship within an actualised economy at a granular level. In addition, it utilizes the spatial Durbin model to further explore the spatial spillover effect of green insurance on carbon emissions. The conclusions are as follows:

First, green insurance has a significant inhibitory effect on carbon emissions and the research conclusion retains salience across an array of endogenous tests and robustness tests. Second, green insurance has a significantly negative spatial spillover effect on carbon emissions in adjacent regions. Further research finds that compared with the spatial spillover effect of adjacent regions, regions with similar economic distances have a stronger spatial spillover effect on the region.

5.2. Revelation

In order to promote the achievement of the two-carbon target, based on the perspective of green insurance, this dissertation makes the following suggestions:

Insurance companies should innovatively develop green insurance products and expand the coverage of green insurance to build a multi-coordinated green insurance system and enrich the green development mode. Green insurance has a significant inhibitory effect on carbon emissions. Consequently, insurance companies necessitate active cooperation with the pilot work of environmental pollution liability insurance and strengthen their own responsibilities and obligations. Simultaneously, it is not limited to state-owned enterprises, expanding the scope of underwriting and expanding the coverage of green insurance. It is suggested that insurance companies should focus on the new era and keep pace with the times. While updating and improving the relevant traditional green insurance, insurance companies should continue to design and promote diversified new green insurance products. Product design should effectively improve the ability of enterprise risk prevention, control and resolution, thereby providing risk guarantee for the achievement of dual carbon goals.

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