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ANALYSIS ON THE INHIBITION OF GREEN FINANCE ON CARBON EMISSIONS IN FUJIAN PROVINCE UNDER THE NEW DEVELOPMENT PATTERN

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ABSTRACT

This paper studies the relationship between green finance and carbon emissions, aiming at finding ways to curb carbon emissions in Fujian Province, and then adding theoretical basis for carbon reduction in China. By collecting and sorting out the relevant data of Fujian's carbon emission intensity, green investment and green insurance from 2005 to 2019, and using the multiple linear regression model, this paper analyzes and discusses whether green investment and green insurance have an inhibitory effect on Fujian's carbon emission when they work together. It is found that when green investment and green insurance work together on carbon emissions in Fujian Province, they can play a positive role in curbing carbon emissions. Therefore, we should vigorously develop green finance, realize the transformation of economic green development, improve the development system of green industries, encourage and guide social funds to flow into the field of ecological protection, and provide a strong guarantee for the development of green finance in China.

Keywords: fujian province; green finance; carbon emissions; multiple linear regression model

1. Introduction

During the "14th Five-Year Plan" period, China's ecological civilization construction takes "carbon reduction" as the central task and "pollution reduction and carbon reduction, synergy" as the main line, aiming at vigorously promoting the development of ecological green cycle. In this paper, green finance is divided into two parts: green investment and green insurance, and energy processing conversion efficiency, energy consumption elasticity coefficient and total energy production are added as control variables. By studying the relationship between the explanatory variable of green investment and green insurance and the interpreted variable of carbon emission intensity, the further role of green finance development and carbon emission suppression is

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studied, and finally effective suggestions are provided for Fujian's carbon reduction cause to help it achieve the goals of "peak carbon dioxide emissions" and "carbon neutrality" for China.

1.1. Relationship Between Carbon Emission and Economic Development

It is believed that the improvement of a country's financial and economic development level will inevitably lead to a stronger demand for resources, thus improving the level of carbon emissions (Dogan & Seker, 2016).There will still be a "positive correlation" nonlinear relationship between China's carbon emissions and economic scale in the short term, and the growth rate of China's carbon emissions will further increase with the increase of economic scale, and carbon emissions will slowly decline when it reaches the "critical value" of economic development in the long term (Chen, 2019).Based on the theory of environmental Kuznets curve, the relationship between national economic development, environmental pollution and energy waste is clearly divided into three parts, showing an inverted U-shaped correlation (Tong & Wang, 2021).

1.2. The Meaning of Green Finance and Its Restraining Effect on Carbon Emission

Green finance is a necessary financial support component for human beings to pursue ecological green development, and it is a bridge between environmental industry and financial industry (Cowan, 1999). Green financial instruments can increase investment in technology research and development, and use advanced technological achievements to improve resource utilization efficiency (Tamazian et al., 2009). Green finance is an important bridge to realize the green, low-carbon and high-quality development of the real economy (Xu & Jiang, 2021). Green finance requires the financial industry to carry out specific financial business based on the basic principles of environmental protection and sustainable development, so as to realize the coordinated development of resources, environment, economy and society and the sustainable development of the financial industry itself (Ma, 2015).

Some scholars believe that there is an uncertain relationship between financial development and carbon emissions, such as reducing carbon dioxide emissions through technological innovation, but financial development has promoted people's demand for energy, thus expanding per person carbon dioxide emissions. However, most scholars have affirmed the inhibitory effect of green finance on carbon emissions. There is a long-term equilibrium relationship between financial development and carbon emissions, which is conducive to the decline of per capita carbon dioxide emissions (Shahbaz et al., 2013).Based on the data of China from 1953 to 2006, it is found that financial development plays a positive role in restraining carbon emissions by using ARDL method (Jalil & Feridun, 2011).The inhibitory effect of green financial development on carbon emissions is certain, among which green investment plays a more significant role, and it is considered that other variables can be added for further study (Xu & Xiao, 2018).In the short

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term, the combination of green finance and the utilization of renewable energy can restrain the carbon emission per unit GDP, and it has certain sustainability (He et al., 2019).

1.3. Literature Review

To sum up, although scholars generally agree that "there is a correlation between green finance and carbon emissions", there are still few empirical studies in this field today, and more scholars need to explore and study in this field. As the first national experimental base for ecological civilization construction and the province with the highest forest coverage rate in China, Fujian Province has established a green leading fund by the government to incite social funds to flow to green ecological projects, thus enabling the province's green economy to develop. And Fujian's green credit has made great progress with the encouragement and supervision of China Banking and Insurance Regulatory Commission. Therefore, this paper takes the whole province of Fujian Province as the breakthrough point, uses Stata's multiple regression model to explore the temporal and spatial evolution law of the inhibitory effect of green finance on carbon emissions in Fujian Province, and further refines it, analyzes the interaction between green investment and green insurance, and studies the relationship between it and carbon emissions, so as to study the further role of green finance development and carbon emissions suppression, and provide targeted suggestions for carbon emission reduction in Fujian Province.

2. Research Design

2.1. Green Finance and The Calculation of Carbon Emissions

This paper aims to study the inhibition of green finance on carbon emissions in Fujian Province, in which green finance will be divided into two parts, namely green investment and green insurance. For the sake of data integrity, the time span of the study is set as 2005-2019.China's green finance is classified into ten fields, which are specifically divided into green credit, green investment, green insurance and green securities (Ma, 2016). Because many scholars have affirmed the positive effects of green credit and green securities on curbing carbon emissions, this paper chooses green investment and green insurance as the basis to study. See Table 1 for the construction of specific indicators.

Table 1. Calculation of Green Investment, Green Insurance and Carbon Emission Intensity Index

Level 1 Indicators	Characterization Index	Indicator Instructions
Green Investment	Investment in Environmental Pollution Control	Investment Amount in Environmental Pollution Control

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Green Insurance	Agricultural Insurance Depth	Income From Agricultural Insurance
Carbon Emission Intensity	Carbon Emissions As AShare of GDP	Carbon Emission /GDP

In this paper, the selection and calculation of the three first-class indicators refer to the calculation methods of green investment, green insurance and carbon emission intensity in some articles (Zhang & Zhang, 2022; Li & Feng, 2022; You & Peng, 2022).Among them, except the data of carbon emission comes from *China Carbon Emission Database*, the rest of the data are from *Fujian Statistical Yearbook*, and the development index of green investment, green insurance and carbon emission intensity in Fujian Province from 2005 to 2019 is obtained through the calculation method of indicators. During this period, the change trend of carbon emission intensity in Fujian Province is shown in Figure 1, and the change trend of green investment and green insurance in Fujian Province is shown in Figure 2. As can be seen from Figure 1, the overall carbon emission intensity in Fujian Province shows a downward trend. As can be seen from Figure 2, the development level of green investment and green insurance in Fujian Province shows an overall upward trend.

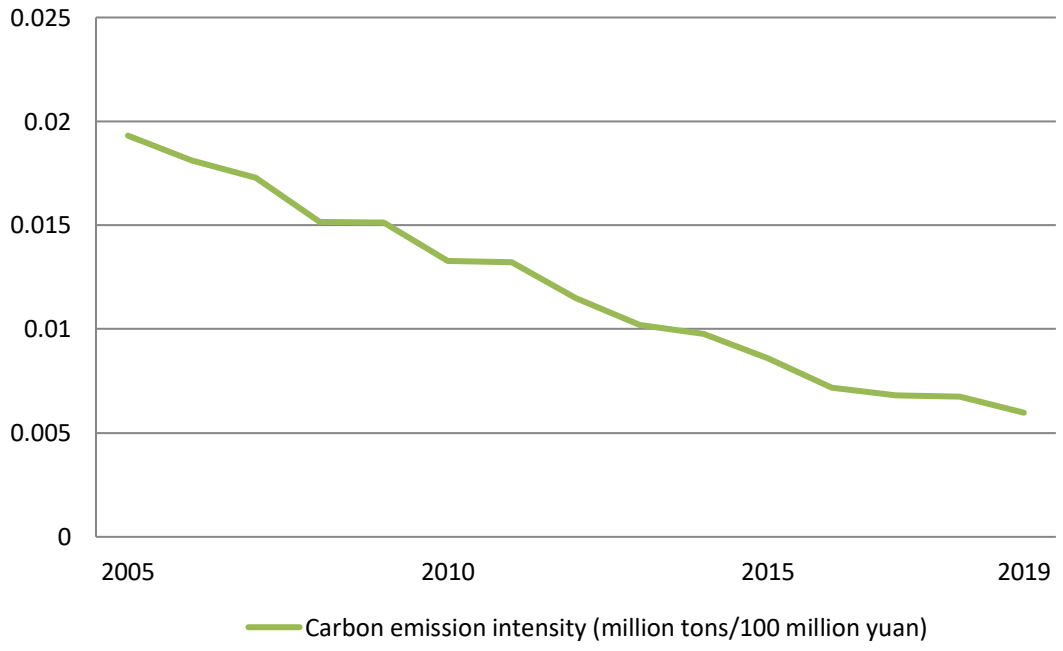

Figure 1. Changing Trend of Carbon Emission Intensity Year by Year

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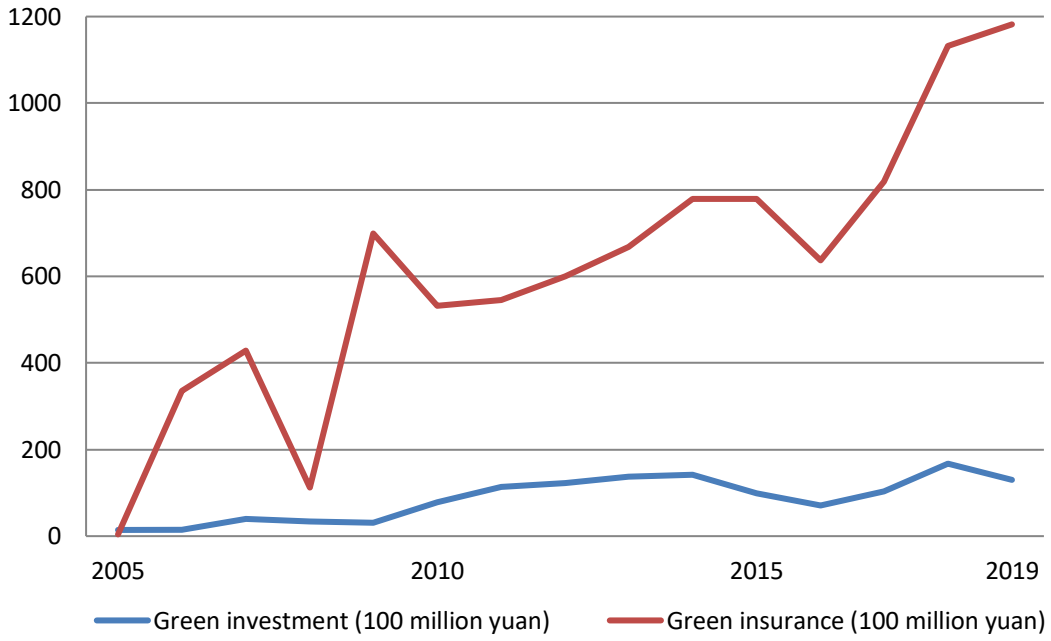

Figure 2. Changing Trend of Green Investment and Green Insurance Year by Year

2.2. Model Construction

The data of Fujian's carbon emission intensity used in this paper are obtained and calculated from *China Carbon Emission Database*(https://www.ceads.net.cn/) and *Fujian Statistical Yearbook*. Considering the influence of non-financial factors on the research results, it is decided to take energy processing conversion efficiency, energy consumption elasticity coefficient and total energy production as control variables. The data comes from the Statistical Yearbook of Fujian Province from 2005 to 2019.Because green investment and green insurance have a common effect on carbon emissions, the interaction between them (represented by investment in environmental pollution control * agricultural insurance income) is selected as the explanatory variable, carbon emission intensity as the explained variable, and energy processing conversion efficiency, energy consumption elasticity coefficient and total energy production as the control variables.And learn from the multiple linear regression model that uses multiple factors as explanatory variables and green bond issuance pricing as explained variables in a certain year to explore the influence of each explanatory variable on the explained variable, and build a multiple linear regression model in Stata to get the effect of green finance on carbon emissions (Chen & Shi, 2021). The model formula is expressed as:

$$LNY_t = \alpha_0 + \alpha_1 LNX1 * \mathrm{X2}_t + \alpha_2 LNX3_t + \alpha_3 LNX4_t + \alpha_4 LNX5_t + \varepsilon_{it} (1)$$

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among,$\alpha_0$as a constant term,$\alpha_i$for the coefficient term, $\varepsilon_t$for the random error term,t on behalf of the year,LN for the logarithmic data,X1 for investment in environmental pollution control is expressed as green investment,X2 is expressed by agricultural insurance income as green insurance,X3, X4 and X5 are the control variables, which are energy processing and conversion efficiency, energy consumption elasticity coefficient and total energy production respectively.

3. Empirical Analysis on the Suppression of Carbon Emissions by Green Finance in Fujian Province under the New Development Pattern

3.1. Analysis of the multiple linear regression models

Table 2.Coefficients, P-values, and Standardized Coefficients of Each Variable

Variable	Ratio	T	P Value
Constant	8.1874	3.17	0.010
Green Investment and Green Insurance Interaction Item	-0.0517*	-2.13	0.059
Energy Processing and Conversion Efficiency	-0.9707	-1.07	0.309
Energy Consumption Elasticity Coefficient	0.0049	0.07	0.943
Total Energy Production	-1.0120**	-2.31	0.044

***, **, * Is indicated as statistically significant in 1%, 5%, and 10%, respectively.

From Table 4-3, the results of the multiple linear regression model on the inhibitory effect of green finance on carbon emission are:

$$Y = 8.1874 - 0.0517gf * -0.9707eec + 0.0049ere - 1.0120tep **（2）$$

3.2. Variable Stationarity Test

A multiple regression model was established by using Stata. In order to eliminate the pseudo-regression phenomenon, the carbon emission intensity (CDE), the interaction term between green investment and green insurance (GF), energy processing conversion efficiency (EEC), energy consumption elasticity coefficient (ERE) and total energy production (TEP) were logarithmically processed, and then the unit root test was carried out. From the results in Table 3, it can be seen that because the T values of carbon emission intensity (CDE), energy processing conversion efficiency (EEC), energy consumption elasticity coefficient (ERE) and total energy production (TEP) are all greater than 1%, the original sequences of the four are not stable.

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Table 3.Results of The Unit Root Test

Variable	Z(t)	Critical Value(1%)	Whether Smooth
LN (CDE)	0.228	-3.750	NO
LN（GF）	-5.398	-3.750	YES
LN (EEC)	-1.095	-3.750	NO
LN (ERE)	-2.165	-3.750	NO
LN (TEP)	-0.807	-3.750	NO

The second order difference command gen dy=d2.y is applied to the original unstable carbon emission intensity (CDE), energy processing and conversion efficiency (EEC), energy consumption elasticity coefficient (ERE) and total energy production (TEP), so that the four t values are less than 0.05, reaching the stable condition. Results are presented in Table 4.

Table 4.Results of The Second-order Difference Calculation

Variable	Z(t)	Whether Less Than 0.05	Whether Smooth
dLN (CDE)	0.0000	YES	YES
dLN (EEC)	0.0000	YES	YES
dLN (ERE)	0.0000	YES	YES
dLN (TEP)	0.0000	YES	YES

3.3. Multiple collinearity test

Table 5.Results of The Multicollinearity Test

Variable Name	VIF
GF	1.62
EEC	5.86
ERE	2.03
TEP	4.83

For the validity of the model, before the linear regression analysis, it is necessary to analyze the correlation between variables and detect the correlation of any two or more variables. The VIF values of all variables in the model are less than 10, so it is considered that there is no serious multicollinearity problem in the model.

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3.4. Co-integration Test

Table 6.Results of The Co-integration Test

Z（t）	Critical Value(1%)	Critical Value(5%)	Critical Value(10%)	P Value
-2.671	-2.681	-1.782	-1.356	0.0102

The co-integration test of the variables in this model gave the P-value of 0.0102 <0.05, so the model was considered to pass the co-integration test.

3.5 . Results Analysis and Discussion

In this model, R^2 = 0.8581, F = 22.17, and P =0.0001. Therefore, it is considered that the variable coefficients in this model are not all 0, and the F test is passed. According to Table 2, the coefficients of the interaction term between green investment and green insurance (GF), energy processing conversion efficiency (EEC), energy consumption elasticity coefficient (ERE) and total energy production (TEP) are -0.0517, -0.9707,-0.0049 and -1.0120 respectively. The interaction between green investment and green insurance (GF), energy processing conversion efficiency (EEC) and total energy production (TEP) have certain positive effects on the suppression of carbon emission intensity (CDE), and the carbon emission intensity will decrease by 0.0517% for every 1% increase in the interaction between green investment and green insurance.

4. Research Conclusions and Countermeasures

4.1 research conclusion

During the period from 2005 to 2019, the development level of green investment and green insurance showed an overall upward trend. From the empirical analysis results, the carbon emission intensity will decrease by 0.0517% for every 1% increase in the interaction between green investment and green insurance, so it can be concluded that the combination of green investment and green insurance has a good positive effect on carbon emission.

4.2 Countermeasures and Suggestions

4.2.1 Promote the development of green finance business of Fujian commercial banks and promote the flow of green funds.

Cultivate independent risk assessment institutions with strong capabilities in all aspects and establish long-term and stable cooperative relations with commercial banks to help commercial banks assess risk levels and make corresponding risk avoidance strategies. Expand and innovate

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the existing green financial instruments, such as adding soil desertification insurance, clean energy bonds, renewable energy funds and carbon futures on the original basis. Through the internal training of banks, we can cultivate talents who are familiar with the green financial business of commercial banks and the current development environment. At the same time, we can also hire professionals or consultants to absorb the latest information and technology from outside and organize the establishment of a professional green financial business service team.

4.2.2 Establish a long-term incentive mechanism to increase the participation of relevant industrial sectors.

Fujian provincial government optimizes the allocation of financial funds and formulates a green financial compensation mechanism. Local financial regulators can provide more favorable green financial policies, such as targeted cuts to required reserve ratios for banks' green credit, so as to reduce the operating costs of such financial institutions and mobilize their participation enthusiasm. On the one hand, the local government can require insurance companies to preach about environmental protection insurance to relevant financial institutions and industries, and on the other hand, it can subsidize the premiums within the capacity of sewage companies that choose to participate in insurance, so as to reduce the insurance cost of enterprises. In the end, the number of green insurance participants increases, which can achieve the purpose of restraining certain carbon emissions.

4.2.3 We will establish and improve information disclosure and supervision mechanisms to promote the healthy development of green finance.

The government departments of Fujian Province should establish an extensive information exchange platform, improve relevant laws and policies in a timely manner, punish enterprises that violate laws and regulations and destroy the ecology, and timely disclose relevant information such as violations, punishment measures and implementation progress of such enterprises. Enterprises disclose information such as the green business they have accepted, the objectives and progress of the green projects currently being carried out, the flow of funds after receiving green financial support, and the effectiveness of environmental governance; Evaluation institutions should improve their own evaluation technology and credibility, establish unified evaluation standards, and disclose the credit rating and risk coefficient of each enterprise in a timely and comprehensive manner to provide powerful reference for other departments.

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