Financial Engineering and Risk Management (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/ferm.2024.070317
ISSN 2523-2576 Vol. 7 Num. 3

Research on the Impact of Green Credit Development on Carbon Emissions under the Target of "Double Carbon"

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Keywords: Green credit, Carbon dioxide emissions, Upgrading of an industrial structure

Abstract: According to the phased strategic arrangement of building a socialist modern country in an all-round way, the main goal of economic and ecological development during the "14th Five-Year Plan" period is to build a beautiful China, achieve a fundamental improvement in the ecological environment, and stabilize the carbon emissions after reaching the peak. Green credit, as a key policy tool for China to deal with the carbon emission problem and achieve the goal of "double carbon", is also an important financial tool to help the development of low-carbon economy. It is of great practical significance to investigate the implementation effect of this policy strictly and scientifically, and to evaluate the impact of green credit on China's carbon emissions and its mechanism. Based on this, this paper uses the panel data of 29 provinces, autonomous regions and municipalities directly under the Central Government of China from 2005 to 2020 to construct a double fixed effect model to answer the above questions. The results show that: ① Green credit policy can effectively curb carbon dioxide emissions, and carbon emissions decrease with the increase of green credit scale, and the implementation effect of the policy is remarkable. ② The upgrading of industrial structure plays a positive regulatory role in the emission reduction effect of green credit, that is, the higher the industrial structure, the stronger the effect of green credit in restraining carbon emissions. ③ Heterogeneity analysis shows that the emission reduction effect of green credit is more significant in eastern and western regions and provinces with higher degree of marketization. By virtue of its natural geographical advantages, the eastern region has continuously innovated green technologies and accumulated green financial capital, which has better promoted the implementation of green credit policy. With the support of national policies, the western region has actively promoted the implementation of green credit policy and achieved remarkable carbon emission reduction results. The central region, where many industrial provinces gather, has a weak emission reduction effect, and the effect of green credit policy is not significant. In addition, the provinces with higher degree of marketization have larger market scale and richer types of financial instruments, and the implementation effect of green credit is better. The conclusion of this paper provides a new perspective for the emission reduction effect of green credit, and provides the latest and powerful empirical evidence for green credit to help achieve the goal of "double carbon".

1. Introduction

Under the multiple backgrounds of international tension and global ecological crisis, environmental problems are severe challenges faced by human beings, and the emission of carbon dioxide is the main reason for a series of natural environmental problems. As a big carbon emitter, China actively responds to this climate challenge and undertakes its own responsibilities, and promises to achieve peak carbon dioxide emissions in 2030 and carbon neutrality in 2060. The realization of the goal of "double carbon" is a systematic revolution involving economy, environment, society and other aspects. China must formulate a unique low-carbon transformation plan based on its own reality. Market-based environmental regulation has left more room for enterprises to play, and the emission reduction mechanism is more reasonable and the effect is more sustained and remarkable. Therefore, gradually replacing the position of administrative imperative environmental regulation in realizing carbon emission reduction has become the main way to achieve the goal of "double carbon". The concept of "green development" was first put forward in the "Thirteenth Five-Year Plan", including the development of green credit, green bonds and the establishment of green development funds. The Tenth Five-Year Plan once again emphasizes "vigorously developing green finance" and "promoting green transformation". Green finance has both financial services and environmental protection, emphasizing that more financial resources will flow to clean and environmental protection industries, which is conducive to achieving a win-win situation for economic growth and environmental quality improvement, and is the meaning of low-carbon economic transformation. As the core of green financial system, green credit is the largest green financial product issued at present. By the end of 2021, the issuance scale of green credit in China has ranked first in the world. The formulation and implementation of green credit policy aims to optimize the allocation of credit resources, guide the flow of funds to energy-saving and environmental protection projects, and force the "two high and one surplus" industries to accelerate the green transformation and upgrading. However, whether the green credit policy can be implemented in an ideal state and help realize the goal of "double carbon" still needs further investigation. Based on this, this paper measures the objective law between green credit and carbon emissions from a realistic perspective, conducts empirical research based on the actual data of China, and deeply digs into the emission reduction effect of green credit, so as to provide new ideas for realizing the goal of "double carbon" at an early date.

2. Literature Review and Mechanism Elaboration

2.1 Literature Review

The research on the impact of green credit policy implementation is mainly divided into micro and macro levels. At the micro level, it focuses on the perspective of policy implementation on enterprise development. Su Dongwei and Lian Lili [1] took the official implementation of the Green Credit Guidelines in 2012 as an event to construct a quasi-natural experiment to investigate the impact of green financial policies on the investment and financing behavior of heavily polluting enterprises, and found that the implementation of green credit policies has a significant financing penalty effect and investment inhibition effect. Hetong W[2] also takes the Green Credit Guidelines as a quasi-natural experiment, focusing on its impact on the quality of green innovation of heavily polluting enterprises. The results show that the green credit guidelines have significantly improved the quality of green innovation of enterprises. Arel, Wang Ying [3] Based on this method, the different impacts of the Green Credit Guidelines on green innovation in non-green credit-restricted industries and green credit-restricted industries were investigated. The results show that compared with non-green credit-restricted industries, green innovation in green credit-restricted industries is

more active. Lu Jing and Zhang Yun [4] studied the green credit policy in 2007 as a quasi-natural experiment, and proposed that the green credit policy significantly aggravated the exit risk of highly polluting enterprises and promoted the market share growth of incumbent enterprises. Haiyan N[5] based on the panel data analysis of heavily polluting listed companies, it is believed that green credit promotes the transformation and upgrading of green enterprises through two intermediary paths: debt cost and government subsidies.

In addition to playing a role as a traditional commercial financial product, green credit is also a public product, so the macro impact of the implementation of this policy also has a unique effect. At present, the research mainly focuses on industrial structure and economic development. Li Yu, Hu Haiya [6] based on the provincial panel data of China, take the green credit policy as a dummy variable to analyze the impact of green credit on the upgrading of industrial structure in China. It is pointed out that the green credit policy has a significant positive role in promoting the upgrading of the overall industrial structure. Xu Sheng and Zhao Xinxin [7] further analyzed that the implementation of green credit policy has an impact on the optimization and adjustment of China's industrial structure through three mechanisms: capital formation, signal transmission, feedback and credit promotion. From the perspective of economic development, green credit can achieve the growth of green economy by upgrading technological progress [8]. Xiaodong L[9] By studying the influence of green credit on green economy and its transmission mechanism, it is found that green credit can not only promote the local green economy, but also promote the development of green economy in surrounding areas through spatial spillover effect.

Under the background of "double carbon", with the continuous development of green finance, the discussion between green credit and carbon emissions has gradually emerged. Most research conclusions focusing on the relationship between them show that the implementation of green credit can significantly promote carbon emission reduction and promote the realization of peak carbon dioxide emissions and carbon neutrality. As an important part of green finance, green credit can be used as an intermediary variable to alleviate the increasing effect of financial resource mismatch on carbon emissions [10]. In addition, due to the spatial dependence of variables related to economy and environment, Mao Yanjun and Qu Yingbo [11] built a spatial econometric model based on provincial panel data, and found that green credit can not only promote local carbon dioxide emission reduction, but also promote carbon dioxide emission reduction in surrounding areas through spatial spillover effect. Based on the conclusion that green credit can reduce carbon emissions, more scholars focus on the study of intermediary mechanism and regulatory effect. Li Zengfu and Feng Liuhua [12] found through empirical research that green credit mainly suppresses carbon emissions by promoting green technology innovation and optimizing industrial structure. Yin He and Wang Lu [13] believe that the transmission mechanism of green credit to promote carbon emission reduction is the R&D investment of high-tech enterprises. Liang Fusheng, Cao Li [14], etc. based on the provincial panel data from 2007 to 2020, tested the regulatory role of fiscal decentralization in the relationship between green credit and carbon emission reduction. The results show that fiscal decentralization has a positive regulatory effect on the carbon emission reduction effect of green credit, which weakens the effect of green credit.

Although most research results show that the implementation of green credit policy can have a significant impact on the economy and environment at the micro and macro levels, and ultimately reduce carbon dioxide emissions. However, in practice, the implementation of the policy will be affected by various factors, resulting in uncertain final results, and there is no consensus on the emission reduction effect of green credit. Based on this, this paper mainly examines the implementation effect of green credit policy from the perspective of per capita carbon dioxide emissions by constructing a two-way fixed effect model, and tests the impact of green credit policy on carbon emission reduction and the regulatory effect of industrial structure. It also focuses on the

differences in the effect of green credit policy in helping to achieve carbon emission reduction in different regions and different degrees of marketization, and finally reveals the corresponding policy implications.

2.2 Mechanism elaboration

As a top-level policy design, green credit can curb the disorderly development of enterprises with high energy consumption and high pollution from the source. Under the goal of "double carbon" policy, its impact on carbon emissions mainly exists in the following two aspects: First, optimize the allocation of financial resources. The implementation of green credit provides low-carbon enterprises with more favorable interest rate credit support, relieves financing constraints, promotes the development of green enterprises, and ultimately reduces carbon emissions. At the same time, for high energy-consuming enterprises, green credit will significantly increase financing costs, control the development of "two high and one surplus" industries, and thus reduce the level of carbon emissions [15]. The second is to send the signal of green development to the market, guide enterprises to carry out green transformation through differentiated credit policies, and at the same time encourage social capital to flow more to green industries [16] to promote the green and clean development of industrial structure. High-energy-consuming industries are gradually replaced by green and clean industries, eventually reducing carbon dioxide emissions. Accordingly, this paper puts forward the first hypothesis.

Hypothesis 1: Green credit can significantly reduce carbon emissions.

The emission reduction effect of green credit will be affected by industrial structure.The upgrading of industrial structure is often accompanied by the innovation and breakthrough of science and technology. The regions with advanced industrial structure have advanced technical level, sufficient investment in R&D, more reasonable economic growth mode and resource allocation, and the capital demand of the market and the capital supply of banks are relatively strong. Therefore, the implementation of green credit policy will make banks invest more money in green projects to meet the green loan demand of enterprises in the clean sector, thus promoting green technology innovation and strengthening the emission reduction effect of green credit [17]. Based on the above analysis, this paper puts forward the second hypothesis.

Hypothesis 2: Industrial structure has a positive regulatory effect on the emission reduction effect of green credit.

China's regional economic development is unbalanced, and there are differences in economic development, scientific and technological level, energy structure and industrial structure among different provinces, which leads to different effects in carbon emissions, green financial system and policy implementation among provinces [18]. In addition, influenced by the degree of marketization and financial resources allocation, the emission reduction effect of green credit will also be different. Accordingly, this paper puts forward a third hypothesis.

Hypothesis 3: The effect of green credit on carbon emissions is heterogeneous.

3. Data description and model setting

3.1 Variable description

3.1.1 Explained variables

Carbon emissions (LnRCO2). In this paper, per capita carbon emission is used as a proxy variable of carbon dioxide emission, which is obtained by dividing the carbon dioxide emission of each province by the total population [19]. Among them, there is no unified calculation method for

carbon emissions at the provincial level. The accounting process of China Carbon Emissions Accounting Database (CEADs) includes not only the burning of fossil fuels, but also the carbon emissions of cement production, which solves the widespread overestimation of China's carbon emissions in international institutions' databases. Therefore, this paper adopts the carbon emissions data of CEADs database.

3.1.2 Core explanatory variables

Green credit (Gc). It is difficult for the statistical data of green credit to be specific to the provincial level in a long time span. Based on the availability of existing data, this paper selects the ratio of interest expenditure to total industrial interest expenditure in all provinces except chemical, petroleum, electric power, heat, ferrous metal, nonferrous metal and nonmetal industries to measure green credit [20]. The reason for choosing this indicator is to build a green credit system based on provincial data, which can objectively and truly reflect the status of each provincial level.

3.1.3 Regulating variables

Advanced industrial structure (Isu). The advanced degree of industrial structure is closely related to the structural level. The higher the industrial structure level, the higher the level of economic development. Therefore, based on the availability of data, this paper uses the proportion of the added value of the secondary industry and the added value of the tertiary industry as a reverse indicator to measure [21]. The smaller the proportion, the more advanced the industrial structure is.

3.1.4 Control variables

Table 1: Variable Definition and Descriptive Statistics

variable name	definition	Mean	p50	SD	Min	Max	N
LnRCO2	Natural logarithm of per capita carbon dioxide emissions	1.864	1.848	0.598	-0.0917	3.774	464
Gc	Proportion of interest expenses of 1- 6 high energy-consuming industries	0.476	0.484	0.148	0.0330	0.808	464
Isu	The added value of secondary industry/tertiary industry.	0.960	0.948	0.310	0.191	1.874	464
Urban	Urban population/total population	0.553	0.535	0.142	0.269	0.896	464
Gover	General government expenditure/GDP of the year	0.238	0.219	0.110	0.0919	0.758	464
Edu	Natural Logarithm of Undergraduate Students in Colleges and Universities	2.245	2.457	0.820	-0.562	3.392	464
Rd	Natural Logarithm of R&D Expenditure	5.232	5.239	1.386	1.208	8.155	464
lner	Natural logarithm of total investment in environmental pollution control	11.74	11.83	1.066	6.165	14.16	464

In order to prevent the endogenous problems that may be caused by the omission of important variables and make the research results more reliable, this paper selects the following five indicators as control variables: urbanization level [21](Urban). The development and expansion of cities often

lead to the increase of production capacity and consumption, which in turn affects carbon emissions. Human capital [21](Edu), human capital affects carbon dioxide emissions by influencing regional innovation capacity and consumption capacity. Technological progress [20](Rd), which is the key to promote economic and social development and an important factor affecting carbon emissions. In addition, considering that local fiscal expenditure (Gover)[22] and environmental regulation (Er)[23] will change the development level of local economy and the innovation level of green technology, and then affect the level of carbon emissions, this paper adds them as control variables.

The main variables used in this paper and their definitions are shown in Table 1.

3.2 Model setting

In order to test hypothesis 1, the introduction of green credit will significantly reduce carbon dioxide emissions, this paper establishes the following model:

$$\mathrm{LnRCO_{2i,t}} = \beta_0 + \beta_1 \mathrm{Gc_{i,t}} + \beta_2 \mathrm{Controls_{i,t}} + \mu_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

In model (1), I and t refer to provinces and years respectively. Among them, $LnRCO_{2i.t}$,the explained variable refers to the per capita carbon dioxide emissions of a province in the t year, and other variables are analogized. In addition, $\mu_i$is a provincial fixed effect, ξ_t is a time fixed effect and $\varepsilon_{i.t}$ is an error term.

In order to test the role of industrial structure optimization in the effect of green credit emission reduction, this paper draws lessons from Li Zengfu's [12](2022) approach, and constructs a model (2) for empirical analysis:

$$LnRCO_{2i.t} = \alpha_0 + \alpha_1 Gc_{i.t} + \alpha_2 Gc_{i.t} \times Isu_{i.t} + \alpha_3 Isu_{i.t} + \alpha_4 Controls_{i.t} + \mu_i + \xi_t + \varepsilon_{i.t} \quad (2)$$

The dependent variables, independent variables and control variables in model (2) are the same as those in model (1). On this basis, industrial structure (Isu) is added, and the interaction term of green credit and new explanatory variables (Gc ×Isu) is added.

3.3 Data sources

According to the availability of data and the rationality of the emergence time of green credit policy, this paper selects the data from the panel data of 29 provinces, autonomous regions and municipalities directly under the Central Government in China from 2005 to 2020. Carbon emission data comes from CEADs database, green credit data comes from China Yearbook of Industrial Statistics and the fourth economic census, and the missing data in 2018 is supplemented by interpolation method. The data of advanced industrial structure, urbanization level, fiscal expenditure and education level all come from national data. Environmental regulation comes from China Environmental Statistics Yearbook, and the data of scientific and technological development level comes from China Scientific and Technological Statistics Yearbook.

4. Empirical results analysis

4.1 Benchmark Regression Results

Table 2 shows the regression results of model (1). Among them, column (1) of Table 2 shows the regression results without controlling any variables, columns (2)-(5) show the results of gradually adding control variables, and column (6) shows the regression results after adding all control variables. As can be seen from Table 2, the regression coefficient of Gc is significantly negative

regardless of whether the control variable is added or not, and it is significant at the level of 1%. The regression results show that green credit has a significant inhibitory effect on carbon dioxide emissions. This result supports the hypothesis H1 of this paper, that is, the introduction of green credit will significantly reduce carbon dioxide emissions.

Table 2: Carbon emission reduction effect of green credit: benchmark regression

variable	Dependent variable: LnRCO2					
	(1)	(2)	(3)	(4)	(5)	(6)
Gc	-0.903***	-0.689***	-0.579***	-0.520***	-0.438***	-0.416**
	(-3.33)	(-3.34)	(-3.44)	(-3.17)	(-2.79)	(-2.53)
Urban		2.440***	2.558***	1.585	1.969*	1.952*
		(2.86)	(3.26)	(1.50)	(1.84)	(1.87)
Gover			1.562***	1.475***	1.211***	1.112***
			(2.84)	(3.25)	(3.00)	(2.77)
Edu				0.464	0.507*	0.497*
					(1.87)	(1.82)
Rd					-0.149**	-0.164**
					(-2.17)	(-2.46)
lnEr						0.034*
						(2.01)
Constant	2.294***	0.843*	0.353	-0.158	0.335	0.056
	(17.76)	(1.71)	(0.78)	(-0.32)	(0.60)	(0.10)
N	464	464	464	464	464	464
Adjusted R2	0.926	0.933	0.940	0.943	0.944	0.945
time effect	YES	YES	YES	YES	YES	YES
Provincial effect	YES	YES	YES	YES	YES	YES

4.2 Robustness test

4.2.1 Increase control variables

In this paper, five control variables, namely urbanization level, human capital, technological progress, fiscal expenditure and environmental regulation, are added to the benchmark model, and at the same time, the fixed year effect and the fixed province effect are controlled to reduce the endogenous problems caused by the missing variables. In practice, there are many factors that affect carbon emissions, and the situation in different regions is quite different, so it is impossible to completely eliminate the influence of other factors on the benchmark regression results. Therefore, this paper adds the level of opening to the outside world, the total population and the degree of marketization as control variables to alleviate the endogenous problems caused by missing variables. The regression results show that the emission reduction effect of green credit is still significant at the level of 5%, as shown in column (1) of Table 3.

4.2.2 Lag regression

Considering that the mechanism of green credit affecting carbon emissions is complex, and the two are mutually causal, this paper draws lessons from the method of Li Zengfu and Feng Liuhua [12] to regress the current green credit with the per capita carbon emissions that are one to six periods behind. In order to save space, this paper only shows the lag regression results of one to

three periods, as shown in columns (2)-(4) in Table 3. The empirical results show that the emission reduction effect of green credit has a lasting impact, which is significant at 10% level with carbon emissions in at least the next one to six periods.

4.2.3 Substitution variables

The selection of core variables will affect the regression results to a certain extent. In the empirical analysis, this paper selects the per capita carbon emission level and the proportion of interest expenses of non-six high-energy-consuming industries as the measurement indicators of carbon emissions and green credit. Considering that the per capita carbon emission index is not only related to carbon dioxide emissions, but also influenced by population factors, this paper selects the natural logarithm of carbon emissions as a replacement variable. At the same time, the proportion of interest expenses of six high energy-consuming industries is selected as a reverse indicator to measure the robustness of green credit, and the results are shown in columns (5) and (6) of Table 3. After replacing the core variables, the emission reduction effect of green credit is still significant, which can inhibit carbon dioxide emissions at the level of 5%.

Table 3: Carbon Emission Reduction Effect of Green Credit: Robustness Test

variable	Increase variable	Lagging regression			Substitution variable	
	LnRCO2	Lag one period	Lag phase 2	Lag phase 3	LnCO2	LnRCO2
	(1)	(2)	(3)	(4)	(5)	(6)
Gc	-0.507***	-0.469**	-0.461**	-0.451**	-0.534***	
	(-2.94)	(-2.54)	(-2.45)	(-2.32)	(-3.20)	
Gc1						0.416**
						(2.53)
Constant	5.032	0.025	-0.483	-0.885	3.619***	-0.361
	(1.15)	(0.04)	(-0.77)	(-1.19)	(6.67)	(-0.59)
N	464	435	406	377	464	464
Adjusted R2	0.947	0.946	0.945	0.942	0.969	0.945
Control variable	YES	YES	YES	YES	YES	YES
time effect	YES	YES	YES	YES	YES	YES
Provincial effect	YES	YES	YES	YES	YES	YES

4.3 Analysis of Regulatory Effect

In order to test the regulatory role of industrial structure in the emission reduction effect of green credit, this paper uses model (2) for empirical analysis. From the two columns of Table 4, it can be seen that the coefficient of interaction between industrial structure and green credit is significantly positive at the level of 1%, regardless of whether control variables are added. This shows that the more advanced the industrial structure, the stronger the effect of green credit on carbon emissions, that is, among the factors to reduce carbon emissions, there is a substitute relationship between industrial structure and green credit.

Table 4: Carbon emission reduction effect of green credit: regulatory effect

variable	Dependent variable: LnRCO2	
	(1)	(2)
Gc	-1.902***	-1.064***
	(-5.90)	(-4.68)
Isu	-0.691***	-0.390*
	(-3.29)	(-1.99)
Interactive item	1.528***	0.909***
	(4.60)	(3.08)
Constant	2.728***	0.530
	(13.82)	(0.93)
N	464	464
Adjusted R2	0.933	0.947
Control variable	NO	YES
time effect	YES	YES
Provincial effect	YES	YES

4.4 Heterogeneity analysis

4.4.1 Based on the analysis of regional heterogeneity

China has a vast territory, and the economic development level, resource endowment and policy system in different regions are significantly different. In addition, the allocation of financial resources is different in the eastern, central and western regions. Therefore, it is necessary to explore the effect of green credit on emission reduction in different regions. In this paper, the sample is divided into three sub-samples: East, Middle and West, and the results are shown in Table 5. Column (1) shows that the emission reduction effect of green credit in the eastern region is significant at the level of 5%. The reason is that the natural location advantage of the eastern region is conducive to innovation of green technology, development of high-tech industries and accumulation of financial capital, so the green credit policy has a better emission reduction effect. Column (2) shows that there is no significant relationship between green credit and carbon emissions in the central region. The reason for this result may be that Shanxi, Hubei, Jilin and other heavy industry provinces have gathered in the central region, and high-carbon emission industries occupy a dominant position. The implementation of green credit policy is weak, and the task of achieving emission reduction is still arduous. Column (3) shows that the green credit policy in the western region has significant emission reduction effect, and it is better than that in the eastern region. It is speculated that the reason for this result may be related to the inclusion of green financial reform and innovation pilot zones in Guizhou and Gansu provinces. The pilot zones are established under a strict supervision system and have a complete green financial service system, which can drive their provinces to better play the emission reduction effect of green credit.

4.4.2 Heterogeneity analysis based on marketization characteristics

The emission reduction effect of green credit has different effects in different areas with different marketization degrees. Areas with a higher degree of marketization are more conducive to free competition, encouraging enterprises to carry out scientific and technological innovation, and then affecting carbon emissions. In this paper, referring to Wang Xiaolu's marketization index, the sample is divided into two groups of sub-samples for regression according to the median, and the results are shown in columns (4) and (5) of Table 5. Compared with the regions with low degree of marketization, the emission reduction effect of green credit is more significant in the provinces with

high degree of marketization. This is because the regions with high degree of marketization usually have more developed economies, larger green financial markets and richer types of financial instruments, so the green credit policy has better implementation effect and stronger emission reduction effect.

Table 5: Carbon Emission Reduction Effect of Green Credit: Heterogeneity Test

variable	Dependent variable: LnRCO2				
	Analysis of regional characteristics			Analysis of marketization characteristics	
	eastern region	middle	the west	Low marketization	High marketization
	(1)	(2)	(3)	(4)	(5)
Gc	-0.571**	0.266	-1.162**	-0.336	-0.467*
	(-2.66)	(0.54)	(-2.48)	(-1.56)	(-2.07)
Constant	-0.647	-0.900	0.774	1.374	-0.775
	(-0.50)	(-1.21)	(0.61)	(1.66)	(-0.73)
N	176	144	144	239	223
Adjusted R2	0.910	0.968	0.960	0.951	0.938
time effect	YES	YES	YES	YES	YES
Provincial effect	YES	YES	YES	YES	YES

5. Conclusions and policy implications

As a big emitter of carbon dioxide, China has actively fulfilled its responsibilities as a big country and made every effort to promote carbon emission reduction. Based on the basic national conditions of China, this paper selects the provincial panel data from 2005 to 2020 to investigate the carbon emission reduction effect of green credit and the regulatory role of industrial structure upgrading in it, so as to provide ideas for the early realization of China's "double carbon" goal. The results show that green credit has a significant emission reduction effect and a lasting effect. After controlling endogenous problems by adding variables, lagging regression and other robustness tests, the results are still significant. Secondly, the regulatory effect shows that the upgrading of industrial structure plays a positive regulatory role in the emission reduction effect of green credit. In addition, the carbon emission reduction effect of green credit is more significant in the eastern and western regions and the provinces with high degree of marketization.

Based on the above analysis, this paper puts forward the following policy suggestions: First, accelerate the all-round development of green credit and increase the scale of investment. The research results of this paper show that the increase of green credit scale can significantly curb carbon emissions, indicating that the implementation of green credit policy can help achieve the goal of "double carbon" at an early date. Therefore, the state should actively promote the implementation of green credit policy, improve the relevant legal system, increase the requirements for green credit data of provinces, and build a testing system covering pre-lending prediction, loan management and post-lending evaluation to ensure the full implementation of green credit policy. Second, accelerate the upgrading of industrial structure and strengthen the emission reduction effect of green credit. The regulatory effect shows that the upgrading of industrial structure plays a positive regulatory role in the emission reduction effect of green credit. Therefore, China should accelerate the upgrading of industrial structure and realize the rational flow and optimal allocation of production factors. All provinces and cities should increase their assistance to the tertiary industry, encourage and advocate the development of the service industry, and at the same time encourage the transformation and upgrading of traditional industries to enhance industrial efficiency.

Third, identify the key points of work and promote the implementation of green credit according to local conditions. Heterogeneity analysis shows that the emission reduction effect of green credit is more significant in the eastern and western regions and the regions with higher degree of marketization. Therefore, local governments should implement green credit policies according to the characteristics of local economic development, ecological environment and scientific and technological level, and make full use of regional advantages to promote the realization of green credit emission reduction effect.

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