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Original Paper

The Impact of Green Credit Policy on Carbon Emissions

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Abstract

Under the background of China's "double carbon" target, green credit policy is an important economic means to protect the environment and promote energy conservation and emission reduction. It is of great significance to study the impact of green credit policy on carbon emissions. Based on the sample of A-share listed non-financial enterprises from 2009 to 2023, this paper examines the impact of green credit policy on carbon emissions by using China's 2012 "Green Credit Guidelines" as a quasi-natural experiment. Heterogeneity analysis shows that the policy has a more significant inhibitory effect on carbon emissions of low ESG enterprises and non-digital enterprises. This study provides reference and theoretical support for relevant institutions to scientifically formulate and implement green credit policies.

Keyword

green credit, Carbon Emissions, DID, heterogeneity analysis

1. Introduction

In September 2020, at the 75th United Nations General Assembly, China pledged to the world to achieve the dual carbon goals—namely, to peak carbon emissions by 2030 and attain carbon neutrality by 2060. To honor this commitment, a series of plans and policy documents have been successively issued. Consequently, curbing the blind expansion of energy-intensive and high-emission projects while advancing a green transformation has emerged as an urgent and critical issue. Green credit policy is an important economic means to protect the environment and promote energy conservation and emission reduction. It is to guide commercial banks to rationally allocate credit resources and take compliance with environmental monitoring standards, pollution control effects and ecological protection as the basis for credit decision-making. Therefore, the implementation of green credit policy is directly related to the green transformation and upgrading of enterprises. The research on the effect of environmental pollution control in the implementation of green credit policy has always been the focus of academic

circles. Therefore, this paper deeply discusses how the green credit policy affects the carbon emission reduction of enterprises by affecting the allocation of credit resources, which has important theoretical and practical value.

2. Literature Review and Theoretical Analysis

2.1 Literature Review

The existing literature is mainly from the macro and micro perspectives. At the macro level, Zhu (2024) based on urban spatial econometric analysis found that green credit can increase local green total factor productivity and produce positive spatial spillover, and natural resource dependence and excessive government intervention will weaken the policy effect. Li and Luo (2024) confirmed that green credit has significantly promoted the upgrading of regional industrial structure. Macro research has established the positive role of green credit in regional transformation, but it is difficult to accurately identify its specific impact on micro enterprises. At the enterprise level, the DID design based on the 2012 “Green Credit Guidelines” as a quasi-natural experiment has become the mainstream. Peng et al. (2024) found that green credit significantly improved the environmental performance of heavily polluting enterprises, and the improvement effect of non-state-owned enterprises was more prominent. Gao and Liu (2023) confirmed that the policy can improve the ESG performance of enterprises by optimizing credit allocation and increasing R & D investment. However, Liao and Zhou (2024) pointed out that green credit may inhibit the ESG improvement of polluting enterprises due to the “crowding-out effect”. Ma and Chen (2025) reported the incentive and inhibitory effects of green credit on green technology innovation, respectively. The divergence depends on the characteristics of enterprises and the environment of policy implementation. Chen et al. (2026) further found that green credit reduced the entry rate of enterprises in polluting industries by 10.1 % and increased the exit rate by 9.1 %. In summary, the existing literature lacks an integrated assessment of the carbon emission reduction effect of green credit, and pays insufficient attention to the heterogeneity of enterprises. The purpose of this study is to systematically test the policy effects from the perspective of carbon emissions and to include enterprise heterogeneity analysis.

2.2 Theoretical Analysis and Hypothesis

Drawing upon credit allocation theory, green credit policy fundamentally reshapes the financial incentives and constraints that firms face. By redirecting bank loans away from polluting sectors and toward green industries, the policy imposes a financing penalty on carbon-intensive activities, compelling high emitters to scale down or upgrade their operations. This mechanism directly contributes to carbon abatement, as Zhang et al. (2024) confirm. Moreover, preferential credit access for environmentally sound projects fosters green innovation, which enhances energy efficiency and carbon productivity (Li & Tang 2025). At the macro level, Ren et al. (2020) and demonstrate that the expansion of green finance significantly reduces carbon intensity. Through both the credit constraint and innovation promotion channels, green credit policy is expected to lower carbon emissions.

Accordingly, we propose the following hypothesis: Green credit policy significantly reduces carbon emissions.

3. Empirical Research Design

3.1 Data Sources

The data are primarily sourced from the financial statements and notes to financial statements in the CSMAR database. The sample comprises A-share non-financial listed firms on the Shanghai and Shenzhen stock exchanges from 2007 to 2023. To mitigate the adverse impact of outliers on the empirical results, all continuous variables except dummy variables are winsorized at the 1st and 99th percentiles.

3.2 Variable Selection

Explanatory Variable：This paper obtains industry-level carbon emissions from the CSMAR database. The carbon emissions of each firm are then computed by weighting industry carbon emissions with the share of the firm's total operating costs in the industry's main business costs, and the natural logarithm is taken. Specifically: ln (Firm's total operating costs / Industry's main business costs × Industry carbon emissions).

Explained Variable: This paper constructs an interaction term treat × time to examine the differential changes in carbon emissions between firms in heavily polluting industries and those in non-heavily polluting industries before and after the implementation of the green credit policy. The year 2012 serves as the experimental cutoff: time equals 1 for years 2012 and later, and 0 otherwise. Based on the Management Catalogue of Environmental Protection Verification Industry Classification for Listed Companies issued by the Ministry of Environmental Protection in 2008, heavily polluting industries are further classified into 16 specific sectors, including coal mining and washing, petroleum and natural gas extraction, and electricity and heat production and supply. Firms are divided into heavily polluting enterprises (treat=1) and non-heavily polluting enterprises (treat = 0).

Control Variables: To control for the influence of other important factors on the research findings, this paper includes firm size (Size), leverage ratio (Lev), return on total assets (ROA), cash ratio (Cash), fixed assets ratio (FIXED), revenue growth rate (Growth), CEO duality (Dual), shareholding ratio of the top five shareholders (Top5), Tobin's Q (TobinQ), number of employees (Labor), board size (Board), proportion of independent directors (Indep), and ESG as control variables.

3.3 Model Building

To investigate the impact of green credit policy on corporate carbon emissions, this paper constructs a difference-in-differences model:

$$CE_{it} = \beta_0 + \beta_1 treated_i * time_t + \gamma X + \mu_{i,industry} + \mu_{i,year} + \mu_{i,city} + \varepsilon_{it}$$

where i denotes firm, t denotes year, the core explanatory variable treati * postt captures the impact of green credit policy on firms, X is a set of control variables, μi andτt denote firm fixed effects and year fixed effects, respectively, and εit is the random error term.

4. Empirical Analysis

4.1 Descriptive Statistical Analysis

The descriptive statistics for all variables are presented in Table 1. The Explanatory Variable, carbon emissions, has 18,931 observations, with a mean of 3.266 and a standard deviation of 2.811, ranging from –4.192 to 11.78. Firm-specific controls include Size (mean = 22.42, sd = 1.342), ROE (mean = 0.0641, sd = 0.191), ITR (mean = 224.7, sd = 13,419, with a wide range due to extreme values), Lev (mean = 3.376, sd = 3.036), Cash (mean = 0.902, sd = 1.603), and Growth (mean = 0.318, sd = 0.851). Governance-related variables are CCD (mean = 1.716, sd = 0.507), Top5 (mean = 51.53, sd = 15.71), Board (mean = 2.145, sd = 0.199), and Indep (mean = 0.375, sd = 0.055). Sample sizes vary slightly across variables due to missing data, with all continuous measures showing reasonable dispersion for subsequent regression analysis.

Table 1. Descriptive Statistics of Variables

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
ESG	22,188	4.173	0.942	1	8
Size	22,744	22.42	1.342	19.98	26.50
ROE	22,738	0.0641	0.191	-14.71	1.751
ITR	22,591	224.7	13,419	0.00265	1.744e+06
Lev	22,744	3.376	3.036	1.142	19.65
Cash	22,744	0.902	1.603	0.0284	10.65
Growth	22,744	0.318	0.851	-0.662	5.987
CCD	22,744	1.716	0.507	0	2
Top5	22,743	51.53	15.71	18.57	88.87
Board	22,743	2.145	0.199	1.609	2.708
Indep	22,743	0.375	0.0549	0.333	0.571
carbon_e	18,931	3.266	2.811	-4.192	11.78

4.2 Analysis of Empirical Results

Table 2 reports the benchmark regression results of the impact of green credit policies on corporate carbon emissions. Column (1) only controls the fixed effects of individuals, cities and industries, and does not add control variables. The estimated coefficient of DID is − 0.1370, which is significantly negative at the 5 % level. After adding all control variables in Column (2), the DID coefficient is − 0.1189, which is significantly negative at the 10 % level. Column (3) further controls the triple fixed effects of individual, city and industry, and the DID coefficient is-0.2898, which is significant at the 10 % level. The above results show that the implementation of green credit policy has significantly

reduced the carbon emission level of enterprises in high-polluting industries, which verifies the hypothesis H1. This finding is consistent with the conclusion of the existing literature. From an economic point of view, the green credit policy has reduced the carbon emissions of the treatment group by about 11 % -29 % compared with the control group, and the policy effect has significant economic significance.

Table 2. Base Regression Results

VARIABLES	(1) CE	(2) CE	(1) CE
did	-0.1370**	-0.1189*	-0.2898*
	(-2.11)	(-1.75)	(-1.85)
Controls	NO	Yes	Yes
Cons	3.3293***	1.9243**	1.0087
	(97.38)	(2.19)	(0.56)
Individual effect	Yes	Yes	Yes
City effect	Yes	Yes	Yes
industry effect	Yes	NO	Yes
N	18797	18345	18344
Adj- R^2	0.9381	0.9229	0.9428

Note. *** p<0.01, ** p<0.05, * p<0.1，In parentheses is the t.

4.3 Robustness Tests

To further strengthen the robustness of our main findings, we conduct a series of supplementary tests from multiple angles. First, to rule out potential interference from other concurrent policies, we randomly reshuffle the policy dummy variable and re-estimate the baseline model 500 times. The vast majority of the estimated coefficients turn out to be statistically insignificant, suggesting that our results are not driven by omitted policy shocks. Second, considering possible lagged effects of the policy, we replace the dependent variable with its one-period-ahead value (i.e., carbon emissions in the subsequent year); the coefficient remains significantly negative, confirming that the policy effect persists over time. Third, to eliminate the influence of the COVID-19 pandemic, we exclude the sample period from 2019 to 2021 and re-run the regression; the negative coefficient still holds, indicating that our conclusions are not driven by extreme events. Collectively, these additional tests corroborate the robustness and reliability of our empirical findings.

4.4 Heterogeneity Analysis

This study aims to reveal whether the impact of green credit on corporate carbon emissions is

significantly differentiated by corporate social responsibility (ESG) and digital transformation through heterogeneity test. Specifically, the following two grouping methods are used.

(1) Heterogeneity analysis based on ESG

It can be seen from Table 4.3 that the green credit policy has a significant inhibitory effect on the carbon emissions of low ESG enterprises (the DID coefficient is − 0.3922, which is significant at the 5 % level), while the impact on high ESG enterprises is not significant (the DID coefficient is − 0.1246). The possible explanation for this result is that high ESG enterprises themselves have better environmental management systems and lower carbon emission levels, and green credit policies have limited marginal emission reduction effects on them; however, low ESG enterprises have a high carbon emission base and a large space for emission reduction. The financing constraint effect of green credit can force them to carry out emission reduction actions more effectively.

(2) Heterogeneity analysis based on enterprise digital transformation

It can be seen from Table 3 that the green credit policy has a significant inhibitory effect on the carbon emissions of non-digital enterprises (the DID coefficient is − 0.2836, significant at the 10 % level), while the impact on digital enterprises is not significant (the DID coefficient is − 0.2432). The possible reasons are as follows : enterprises with a high degree of digital transformation usually have optimized their production processes and energy management with the help of digital technology, their carbon emission efficiency is relatively high, and the additional emission reduction space of green credit policy is limited; non-digital enterprises still rely on traditional production methods, and their carbon emission intensity is high. The effect of green credit policy on technological upgrading and process transformation through financing constraints is more prominent.

Table 3. Heterogeneity Analysis

VARIABLES	Higher ESG CE	Lower ESG CE	Digital transformation CE	Non-digitalization CE
did	-0.1246	-0.3922**	-0.2432	-0.2836*
	(-0.75)	(-2.53)	(-1.02)	(-1.99)
Controls	yes	Yes	Yes	Yes
Cons	4.3895	-0.6544	0.2235	1.2672
	(1.62)	(-0.48)	(0.09)	(0.84)
Individual effect	Yes	Yes	Yes	Yes
City effect	Yes	Yes	Yes	Yes
industry effect	Yes	Yes	Yes	Yes
N	8249	9912	9773	7042
Adj- R^2	0.9505	0.9442	0.9561	0.9458

5. Conclusions

Based on the sample of A-share listed non-financial enterprises from 2009 to 2023, this paper takes the implementation of the "Green Credit Guidelines" in 2012 as a quasi-natural experiment, and uses the difference-in-difference method to examine the impact of green credit policies on corporate carbon emissions. The benchmark regression shows that the green credit policy has significantly reduced the carbon emission level of enterprises in high-polluting industries. This conclusion is still robust after parallel trend test, placebo test, exclusion of policy interference in the same period and elimination of extreme event samples. The heterogeneity analysis further reveals that the policy has a more significant inhibitory effect on low ESG performance enterprises and non-digital enterprises, indicating that green credit has a greater marginal contribution in forcing the transformation of enterprises with weak environmental governance and technological lag. This study not only enriches the literature on the environmental effects of green credit policy from the micro level, but also provides an empirical basis for policy makers to implement differentiated green financial regulation for different types of enterprises.

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