The Impact of Green Credit on Corporate Environmental Investment

——Based on The Data of A-share Listed Companies in China

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Abstract. Green credit is essential for promoting green and low-carbon development in our country. Its purpose lies in encouraging and restricting heavy polluters to lend money, urging them to increase green investment, transform into green companies, and achieve the purpose of green and low carbon. This paper empirically analyzes how the Green Credit policy affects companies' green investment behavior. The results show that the green loan system in our country can effectively promote the company's green investment, and this effect is more evident for a company that highly depends on external financing. In addition, the incentive effect of green loans is more obvious in state-owned enterprises and central and western regions. The research results of this project will further clarify the promoting effect of green credit policy on the company's green investment, reveal the mechanism of Green Credit policy on the company's green investment, and provide a theoretical basis for promoting the green transformation and upgrading of enterprises.

Keywords: Green credit; Environmental investment; Financing constraints.

1 Introduction

China's economy is transforming to high-quality development, focusing on quality growth and efficiency. The 20th National Congress emphasized the importance of green and low-carbon development. As the key driving force of the real economy, the Green-Credit policy has become an important measure to promote the development of a green economy.

Green credit combines financial and environmental policies to support low-polluting enterprises through preferential interest rates while restricting high-energy-consuming and high-polluting industries to promote environmental transformation. The release of the Green Credit Guidelines boosted the growth of green credit, with the balance of green credit reaching 33.77 trillion yuan, growing faster than general credit. Green

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credit has developed and expanded rapidly due to its flexibility in terms of provision and availability. (Miroshnichenko S O & Mostovaya A N,2019)[1]

The green transformation of heavy-polluting enterprises is significant to achieving green development, and green credit can effectively promote this transformation. The mechanism of green credit on enterprise environmental protection investment needs to be further studied, and the degree of dependence of enterprises on external financing also significantly affects the effect of green credit.

This study uses China's A-share data from 2008 to 2021 to analyze the role of green credit on corporate green investment through the difference-in-differences (*DID*) and triple-difference (*DDD*) methods. The innovation points are as follows: first, this paper comprehensively considers the dependence of green credit, investment, and financing to provide a basis for policy; second, it analyses the differences in the impact of region and property rights on green investment.

2 Theoretical Analysis and Research Hypotheses

2.1 Green Credit and Corporate Environmental Investment

Green credit promotes enterprise environmental protection investment through resource allocation and signal transmission. The effect of resource allocation is reflected in preferential loan rates for enterprises with good environmental performance to encourage environmental protection investment. According to the empirical results of Sharfinan and Fernando (2008), companies with higher levels of environmental governance receive lower loan interest rates from banks [2]. The signal transmission effect conveys that the state attaches importance to environmental protection through policies, prompting enterprises to increase investment in environmental protection. Kong X et al.(2024) found that according to the signal transmission theory, green credit policies release effective green information and related policy support preferences to the market, increase the green investment preferences of relevant investors, and increase the cost of polluting enterprises to continue environmental pollution[3].

Hypothesis 1: Green credit can promote environmental investment.

2.2 External Financing Dependence, Green Credit, and Corporate Environmental Investment

Due to information asymmetry, the Green-Credit policy increases the financing cost of heavily polluting enterprises. After the issuance of the Green Credit Guidelines, heavily polluting enterprises faced stricter loan reviews, and the cost of loan financing became higher, which has a restraining effect on the pollution behaviour of enterprises with high dependence on external funding. Chen Qi (2019) found that heavily polluting enterprises with high external financing needs received less credit. Still, it had no significant effect on increasing their borrowing costs by observing whether the implementation of green credit policies achieved the goal [4]. Ma Chen (2023), from the perspective of "strategic deviation" of enterprises, found through research that green credit pol-

icy has a significant restraint effect on the strategic deviation of heavily polluting enterprises, and has a promoting effect on the environmental protection investment of enterprises with strong dependence on external financing [5]. However, the research on this topic is still limited and needs to be further deepened and expanded.

Hypothesis 2: Green credit can promote environmental investment highly dependent on external financing.

3 Model Design

The product of time and industry dummy variables was used as the proxy variable of Green-Credit policy, and the difference-in-differences (DID) model was constructed with environmental protection investment as the dependent variable.

$$Ei_{i,t} = \alpha_0 + \alpha_1 treat_i * post_t + \alpha_2 treat_i + \alpha_3 post_t + \sum controls_{i,t} + year + ind + \varepsilon_{i,t}$$

According to the research of Lu Jing et al. (2021) [6], the more heavily polluting enterprises rely on foreign financing, the more they are affected by green loan policies, while other environmental protection policies have no direct effect on them, so there is no heterogeneous effect of this variable. On this basis, this paper establishes a measure of the dependence of enterprises on external financing and uses it as a regulatory variable to study the changes in environmental protection investment under different external financing dependence of enterprises, and establishes the following triple difference (DDD) model:

$$Ei_{i,t} = \alpha_0 + \alpha_1 treat_i * post_t * credit_{i,t} + \alpha_2 treat_i + \alpha_3 post_t + \alpha_4 credit_{i,t} + \sum controls_{i,t} + year + ind + \varepsilon_{i,t}$$

4 Empirical Research and Analysis of Results

4.1 Regression Analysis

A parallel trend test is conducted before the double difference test to rule out the possibility of significant differences between the treatment and control groups before the policy is implemented. The results show that before the policy implementation, the confidence interval of the coefficient value of each year intersects with 0, indicating no significant difference between the variables before the policy implementation. However, the data of the four years after the implementation of the policy are significantly different from 0, indicating that the green credit policy has a significant impact on the environmental protection investment behaviour of enterprises through the parallel trend test.

The results of the difference-in-differences (*DID*) test are shown in columns (1), (2) and (3) in Table 1, and the results of the triple difference (*DDD*) test are shown in Figs. (4), (5) and (6), whose coefficients are all significant at the 1% level, consistent with Hypothesis 1 and 2.

Table 1. Regression analysis

variables	(1)	(2)	(3)	(4)	(5)	(6)
	DID			*DDD*		
DDD				3.107***	4.419***	2.304***
				(10.31)	(12.92)	(5.91)
DID	2.476***	20.148***	22.797***			
	(8.28)	(26.20)	(5.99)			
Controls	*NO*	*YES*	*YES*	*NO*	*YES*	*YES*
year/ind Fe	*NO*	*NO*	*YES*	*NO*	*NO*	*YES*
N	12867	12867	12867	12867	12867	12867
R^2	0.005	0.056	0.103	0.008	0.018	0.105

Note: * * *, * *, * are significant at 1%, 5% and 10% levels respectively; The value in parentheses is *t*. The same is below.

4.2 Robustness Tests

Propensity Score Matching (PSM) Test. Before conducting PSM, a balance test was performed on the data. The difference between the two groups decreased sharply after random matching for most variables, and the standard bias was less than 5%. The sample distribution of the two groups had good consistency, and they passed the balance test. Secondly, comparing the kernel density function maps of the experimental group and the control group before and after matching, it was found that the coincidence degree of the curves after matching was good, indicating that the possible sample selection bias was corrected and the matching effect was good.

Then, the regression was conducted again. The PSM regression results are shown in Table 2. The results show that after matching, the Green-Credit policy (DID) and the regression coefficient of environmental protection investment of enterprises are still significantly positively correlated. This result is consistent with basic regression and enhances the robustness of this conclusion.

Table 2. Regression analysis after matching

	(1)	(2)	(3)
	Ei	*Ei*	*Ei*
DID	2.231***	21.539***	24.046***
	(7.25)	(25.54)	(6.07)
Controls	*NO*	*YES*	*YES*
year/ind Fe	*NO*	*NO*	*YES*
r2	0.004	0.055	0.102
N	12641.000	12641.000	12641.000

Placebo Test. Specifically, the time point for implementing the Green-Credit policy was first randomised. 500 regressions were conducted on this basis, and the results are shown in Figure 1. In the random process, the kernel density of the parameter and the value of t are close to zero, and they all obey the normal distribution. Therefore, the comfort test passes. Moreover, the estimated coefficients all deviate from the accurate regression coefficients, indicating that the placebo test results are significantly different from the actual values of the conclusions, which can exclude the interference of results caused by other random factors, indicating that the results of this study are robust.

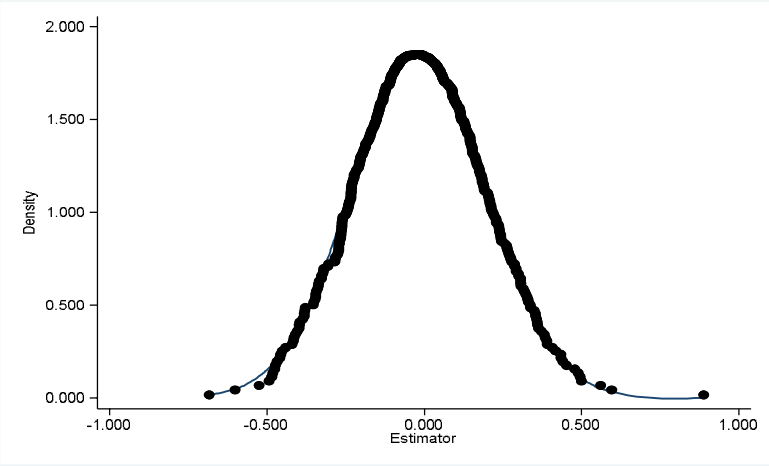

Fig. 1. Placebo test

4.3 Heterogeneity Analysis

The heterogeneity test of property rights and regions is performed, and the results are shown in Table 3 below, which shows that the environmental investment of state-owned companies has improved significantly, which may be due to their close relationship with the government. Non-state companies have been less affected. In this paper, according to the practice of Ding Z et al. (2020) [7], based on heterogeneity analysis, the data from the eastern region and the data from the central and western regions were tested for no correlation between groups. The p-value of the test was 0.0044, less than 10%, indicating a significant difference between the data groups. After the issuance of green credit, heavily polluting enterprises in the central and western regions began to be willing to make large-scale environmental investments to comply with the current policy. At the same time, the impact of the policy on enterprises in the eastern region was relatively small. The regression coefficient of the central and western regions is the largest, possibly because the economic development and marketisation levels of the western and central regions are lower than those of the eastern areas, and the policy implementation and implementation have a long time lag.

Table 3. Heterogeneity analysis

variables	property right		region	
	(1)	(2)	(3)	(4)
DID	23.505***	18.379**	21.286***	25.559***
	(6.19)	(2.25)	(3.97)	(4.57)
Controls	*YES*	*YES*	*YES*	*YES*
year/ind Fe	*YES*	*YES*	*YES*	*YES*
N	8136	4517	9355	3298
Adj R2	0.189	0.090	0.079	0.261

5 Conclusions and Implications

This study examines the effect of the Green-Credit policy on environmental investment by A-share listed companies using the DID and DDD methods. It was found that the policy has significantly promoted enterprise environmental protection investment, especially for enterprises with heavy pollution and dependence on external financing. The policy has a more significant impact on state-owned enterprises and enterprises in the central and western regions.

The article's implications include that the government can promote the development of green industries and optimize economic structure through Green-Credit policy to improve the environment. Besides, financial institutions are encouraged to consider environmental and social factors, strengthen their image and reputation, and establish long-term cooperative relationships with green enterprises to promote joint development.

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