

Research on the Impact of Green Credit Policy on Corporate Environmental Social Responsibility

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Abstract: Since the 1970s, my country's industrialization process has continued to advance. However, with the improvement of economic level, the contradiction between my country's economic growth and environmental protection has become increasingly prominent. Green development has become an important principle guiding the high-quality development of my country's economy in the new era. In response to increasingly severe environmental problems, my country promulgated the "Green Credit Guidelines" in 2012, requiring financial institutions to include enterprises' environmental performance into credit review standards, implement differentiated credit interest rates for different enterprises, and raise the threshold for corporate loans. Penal high-interest credit is issued to highly polluting enterprises to limit the blind expansion of pollution-intensive industries. Since debt financing from banks and other financial institutions is the main source of funds for Chinese enterprises, changes in credit principles will inevitably affect the business and development strategies of enterprises. Then, can the green credit policy promote high-polluting enterprises to undertake environmental and social responsibilities? This issue deserves our in-depth study. This article designs a quasi-experimental based on the "Green Credit Guidelines" promulgated in 2012, constructs a difference-in-difference model to study the impact of green credit policies on corporate environmental responsibility levels, and analyzes the transmission mechanism of this impact. At the same time, it analyzes the differentiated impact of the "Green Credit Guidelines" on corporate environmental social responsibility under different enterprise sizes, proportions of institutional investors, regional legal environments, and factor market development levels.

Keywords: Green credit, Corporate social responsibility, Green finance.

1. Introduction

As one of the largest developing countries in the world, China faces severe environmental problems, including air pollution, water shortages, soil pollution, etc. The implementation of the green credit policy is to promote sustainable development and the construction of ecological civilization, to improve the quality of the environment, protect the ecosystem, and improve the quality of people's lives. At the same time, China's rapid economic development in the past few decades has significantly increased energy consumption, placing great pressure on the environment and resources. The implementation of green credit policy can promote the adjustment of energy structure, promote the clean and efficient use of energy in China, and reduce the dependence on traditional energy.

The development of green industries such as low-carbon economy, circular economy, and new energy is the key to achieving economic transformation, upgrading, and sustainable development. Green credit policies can provide financial support and incentives to promote the development and growth of green industries and have a positive impact on global industrial competitiveness. China actively participates in international climate change negotiations and has undertaken a series of emission reduction targets. To achieve these goals, China needs to vigorously promote green finance and green credit. Implementing green credit policies is not only a need to fulfill international commitments, but also the basis for strengthening cooperation with other countries and regions.

The Chinese government attaches great importance to the development of green finance and green credit and has

introduced a series of relevant policies and measures. The government guides banking institutions to increase credit support for green projects, encourages financial institutions to increase green credit, and provides incentives such as low-interest loans and tax incentives to promote the development of green finance. More and more companies are aware of the importance of environmental and social responsibilities and voluntarily assume corporate social responsibilities. The implementation of green credit policies can help encourage enterprises to perform better in terms of environmental protection and social responsibility, and encourage enterprises to carry out green projects and sustainable development through financial incentives and preferential interest rates. Implementing green credit policies can help financial institutions expand business areas, cultivate new market demands, and improve the competitiveness of sustainable development. At the same time, green credit policies can also help improve the reputation and image of financial institutions and enhance their social responsibility and sustainability.

2. Research Background

2.1. Policy Background

The background and development of my country's green credit policy have gone through multiple stages, and important progress has been made from policy orientation to system construction.

2.1.1. Background and initial policy orientation (2007-2012)

In 2007, eight ministries and commissions including the People's Bank of China and the Ministry of Environmental

Protection jointly issued the "Guiding Opinions on Strengthening Green Credit Work", which is regarded as China's green credit policy starting point. The guidance emphasizes that financial institutions should consider environmental and social responsibilities in credit approval and financing decisions, and encourages financial institutions to increase credit support for environmental protection projects. Since then, the state has increased policy support for environmental protection and promoted the further development of green credit policies.

2.1.2. Preliminary construction of green credit policy system (2013-2015)

In 2013, China Banking Regulatory Commission and other four ministries and commissions jointly issued the "Green Credit Guiding Opinions", which clarified the concept and scope of green credit and put forward specific policy requirements. The guidance requires financial institutions to effectively increase credit support for green industries and environmental protection projects, establish a special work system for green credit, and strengthen internal management and external disclosure of green credit.

2.1.3. Deepening and breakthrough of the green credit policy system (2016-2020)

In 2016, the China Banking Regulatory Commission issued the "Guiding Opinions on Improving the Green Financial Policy Framework", which is an important milestone in the construction of China's green credit policy system. The guidance proposes four principles for promoting the development of green credit by financial institutions, namely highlighting environmental and social benefits, innovating financial products and services, strengthening risk management, and improving information disclosure and public participation. Since then, the state has successively issued a series of policy documents to improve the green financial policy system and promote the development of green credit. At the same time, local governments and financial institutions also responded positively and launched corresponding green credit policies and measures.

2.1.4. Institutionalization and implementation of green credit policies (2021 to present)

In 2020, the People's Bank of China and other relevant departments jointly issued the "Notice on Promoting Green Credit Work", clarifying the requirements and goals for further strengthening green credit. The notice requires financial institutions to incorporate green finance into strategic planning, increase credit support for green projects, and do a good job in reporting and disclosing green financial information. In addition, the notice also proposed specific measures such as strengthening regulatory assessment and risk management, and promoting differentiated pricing of loan interest rates by financial institutions. The institutionalization and implementation of green credit policies have further enhanced the support and participation of financial institutions in green development.

2.2. Green credit and corporate environmental social responsibility

Green credit policies encourage financial institutions to provide preferential loan rates or other incentives to projects that meet environmental and social responsibility standards. After enterprises obtain green credit support, they can invest in environmental protection, resource conservation and social responsibility projects, which will help enterprises fulfill their

environmental and social responsibilities and promote sustainable development. The green credit policy provides financial incentives for companies that actively care about environmental and social responsibilities, and reduces financing costs through low-interest loans and interest discounts to increase the return on investment of projects. At the same time, by obtaining green credit support, enterprises can increase market competitiveness, gain better brand image and reputation, and gain recognition and favor from consumers and investors.

Information asymmetry is the main problem that inhibits financial institutions from participating in environmental governance. It is often difficult for financial institutions to obtain complete and accurate information when evaluating a company's environmental governance status (Askenazy P., Berman N, 2012). Companies may conceal and be opaque in information disclosure, preventing financial institutions from fully understanding the company's environmental risks and governance practices (Banga J, 2019). This may reduce financial institutions' confidence in and participation in environmental governance projects (Beck T., Levine R, 2010). Companies may have a tendency to emphasize the advantages of their environmental governance measures while ignoring or covering up potential environmental risks and problems when disclosing information (Berger G. J., Shaw F. C., 2009). This information asymmetry may cause financial institutions to misjudge the true status of corporate environmental governance, thereby inhibiting their enthusiasm to participate in environmental governance (Brammer S., Pavelin S, 2004).

Therefore, we put forward Hypothesis H1: Green credit policy can promote enterprises to undertake environmental and social responsibilities.

The introduction of green credit policies has made financial institutions pay more attention to the environmental risk assessment of enterprises in credit reviews (Cai X., Lu Y., Wu M., et al., 2016), thus affecting the internal resource allocation structure of enterprises. Traditionally (Christopher Wright. Global Banks, 2012), financial institutions have mainly focused on corporate profitability and solvency, ignoring environmental factors. However, the introduction of green credit policies has changed this situation, making financial institutions pay more attention to corporate environmental performance and social responsibility.

As environmental risks are included as one of the considerations in credit review, highly polluting companies may face higher loan interest rates and stricter loan approval conditions (Cowane, 1998). This has led to stronger credit constraints on these companies, which require more costs to finance and face greater funding pressure. This may force companies to adjust resource allocation, increase investment in environmental protection, and adopt more sustainable and environmentally friendly business strategies (Delmas M. A., Toffel M W, 2008).

After the implementation of the green credit policy, high-polluting enterprises lost the advantages brought by their political status in the past and faced stricter credit constraints (Diamond D W., 1991) The stricter scrutiny requirements of the government and financial institutions on environmental risks make these companies need to better manage and respond to environmental risks in order to obtain lower loan interest rates and more relaxed loan terms (Eshet A, 2017).

In short, the implementation of the green credit policy has made financial institutions pay more attention to the environmental performance and social responsibility of

enterprises, which has had a significant impact on the debt financing of high-polluting enterprises, which may force enterprises to adjust their resource allocation structure (Ge Y., Zhu Y., Zhang W., 2021), increase investment in environmental protection, and adopt more sustainable policies.

Therefore, we put forward Hypothesis H2: Green credit policy promotes enterprises to undertake environmental and social responsibilities by imposing credit constraints.

Under different enterprise sizes, green credit policies have different promotion effects on corporate environmental and social responsibility (Hu Y., Jiang H., Zhong Z, 2020). Large-scale pollution-intensive enterprises are usually able to obtain more financial support before the implementation of the green credit policy (Lee C C., Wang C W, 2021), but after the implementation of the policy, they are subject to stricter constraints. This is because large-scale enterprises have higher levels of energy consumption and pollution emissions, so they are more susceptible to policy restrictions.

In addition, investment in environmental protection projects often requires a long period and has low returns (Sun J., Wang F., Yin H., et al., 2019). Therefore, the size of an enterprise has an impact on its level of environmental and social responsibility. Larger enterprises usually have better operating conditions, more sufficient funds, and are more likely to accommodate environmental protection investment, while small-scale enterprises may be more cautious due to greater uncertainty, and may abandon environmental protection investment when credit policies change to maintain business operations (Wen H., Lee C C., Zhou F, 2021).

Institutional investors play an important role in the capital market. They make investment decisions based on the financial performance of the company and have an important impact on the operation of the company. Institutional investors are more inclined to make long-term investments and have good professional qualities (Wen H., Lee C C., 2020). Compared with individual investors, institutional investors are more likely to understand the significance of low-return, long-term green investment by enterprises, and they are more willing to provide long-term and stable financial support for enterprises. In addition, due to their capital scale and professional advantages, institutional investors have a stronger ability to collect and process information, and can more effectively supervise and restrain enterprises. Therefore, companies with a higher shareholding ratio of institutional investors are more susceptible to the impact of green credit policies (Zhang D, 2021).

To sum up, the influence of enterprise size and institutional investors makes the promotion effect of green credit policy on corporate environmental social responsibility different. Large-scale polluting companies face stricter constraints (Zhang K., Li Y., Qi Y., et al., 2021), while companies with a higher shareholding ratio of institutional investors are more susceptible to the impact of green credit policies (Zhang, Y., Hu, H., Zhu, G, 2022).

To sum up, we propose hypothesis H3: When the scale of the enterprise is larger, the proportion of institutional investors is higher, the legal regulations in the location of the enterprise are stronger, and the level of financial market development is higher, the role of green credit policy in promoting enterprises to assume environmental social responsibilities is greater.

3. Research Design

The study of this article uses all A-share listed companies listed on China's Shanghai and Shenzhen stock exchanges from 2010 to 2019 as the original sample, and divides the sample into a control group according to the "List of Listed Companies' Environmental Verification Industry Classification Management List" published in 2008 and experimental group (Xing, C., Zhang, Y., & Tripe, D, 2021). In order to avoid the impact of extreme values on the empirical results, a series of treatments were carried out on the samples: excluding financial listed companies, deleting samples with abnormal trading status (such as ST, ST* and PT) in the current year, and deleting asset-liability ratios exceeding (0, 1) range of company samples, and exclude listed companies with missing environmental and social responsibility data and important financial data.

The data in this paper consists of two parts: one is the data related to corporate environmental responsibility, in which the corporate environmental social responsibility report score comes from the sustainable development rating report issued by Runling Global (RKS). The second is data at the company level, including variables of the company's management structure and financial information. These data come from CSMAR and RESSET. After matching these data, a sample of 4839 year-firms is obtained. In order to alleviate the endogeneity problem, the empirical part performs a first-order lag treatment on the control variables.

In order to evaluate the level of environmental and social responsibility of enterprises, this paper refers to the research method of Luo et al. (2019), and selects the rating data in the sustainable development rating report published by Runling Global (RKS) as an indicator. Runling Global is the first independent third-party rating agency in the field of corporate social responsibility evaluation in China. Its evaluation system is independent and scientific, and it refers to the standards of the International Social Responsibility Voluntary Action Guidelines. Runling Global's evaluation system includes four aspects: integrity (M), content (C), technology (T) and industry (I). Among them, the content score covers the key content of the enterprise's overall environmental management information, pollution prevention information, sustainable resource utilization information, and climate change mitigation and adaptation information.

This study selected a sample period from 2010 to 2019, and used the content evaluation score in the sustainable development rating report issued by Runling Global as an indicator to measure the level of corporate environmental and social responsibility. This score can comprehensively reflect the company's environmental management and sustainable development performance.

This article studies the impact of green credit policies, in which the time point of policy implementation is set as 2012. In order to measure the net impact of the policy on the level of corporate environmental responsibility, this paper selects the content evaluation score in the sustainable development rating report published by Runling Global (RKS) as the measurement index. In order to distinguish enterprises affected by the policy from those not affected, this paper classifies enterprises in pollution-intensive industries as the treatment group, and enterprises in other industries as the control group.

In the empirical model, this paper controls a series of variables related to enterprise characteristics, including

enterprise size (Size), asset-liability ratio (Lev), net profit ratio of total assets (ROA), total asset turnover ratio (ATO), and cash flow ratio (Cashflow), annual operating income growth rate (Growth), board size (BOARD), TobinQ value (TobinQ), company establishment years (FirmAge), equity balance (Balance), monthly average excess turnover rate

(Dturn), management Expense ratio (Mfee), fund occupation level (Occupy), Big Four audits (Big4), etc.

In addition, the fixed effects of time (Year) and industry (Industry) were also controlled to exclude their possible influence on the research results.

The basic empirical model of this article is:

$$ECSR_{it} = \beta_0 + \beta_1 \text{Treat} * \text{Post}_{it} + \beta_2 \text{Treat}_i + \beta_3 \text{Post}_t + \sigma_j \beta_j \text{Control}_{jit} + \delta_i + \Phi_t + \varepsilon_{it}$$

In the model of this paper, β_0 represents the constant term, β_1 represents the coefficient of the double difference term, ε_{it} represents the random disturbance term, δ_i and Φ_t represent individual and time fixed effects, respectively. $ECSR_{it}$ represents the level of environmental social responsibility of a company. Post_{it} is an explanatory variable in this paper, which is used to represent the impact of listed companies on green credit policies. Treat_i is a dummy variable indicating whether the enterprise belongs to the heavily polluting industry, if the enterprise belongs to the heavily polluting industry, $\text{Treat}_i=1$, otherwise $\text{Treat}_i=0$. Post_t is a dummy variable representing the time of the sample enterprise, and it is used to indicate whether the green credit policy is implemented. If the sample enterprise is in the year after the implementation of the green credit policy (2012 and later), Post_t takes the value 1, otherwise it takes the value 0. Control_{jit} is a series of control variables. The estimated coefficient β_1 in the model reflects the impact of green credit policy on corporate environmental social responsibility. If β_1 is significantly positive, it means that the green credit policy has a positive impact on the environmental and social responsibility performance of enterprises.

4. Empirical Analysis

Table 1 shows the statistical results of the main variables involved in the baseline regression in this paper. The data in the table shows that according to the statistics, the mean value of the variable ECSR is about 17.512, and the standard deviation is about 5.961, indicating that the environmental and social conditions of different enterprises within the research interval. There are large differences in levels of responsibility. The treatment group (enterprises belonging to heavily polluting industries) in the double difference model accounts for about 36.89% of the total sample. The mean value of the variable Size is about 23.095, and the standard deviation is about 1.459, indicating that the size distribution of the sample enterprises is relatively discrete. Therefore, this paper chooses enterprise size as the variable for heterogeneity analysis to discuss whether there are differences in the impact of green credit on the level of environmental and social responsibility commitment of listed companies under different enterprise sizes. The descriptive statistics of other control variables were all within the normal value range.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ECSR	4,839	17.5122	5.9613	2.6368	41.6602
Treat	4,839	0.3689	0.4826	0	1
Size	4,839	23.0946	1.4590	19.5410	28.5087
Lev	4,839	0.4950	0.1976	0.0080	0.9819
ROA	4,839	0.0491	0.0580	-0.6448	0.6688
ATO	4,839	0.6941	0.5371	0.0012	7.8714
Cashflow	4,839	0.0531	0.0741	-0.4700	0.5525
Growth	4,839	0.3054	4.3668	-0.9532	251.2112
Board	4,839	2.2080	0.2100	1.6094	2.8903
TobinQ	4,839	1.9354	1.3607	0.6992	26.8177
FirmAge	4,839	2.7987	0.3490	0.6931	3.6635
Balance	4,839	0.6017	0.5851	0.0077	3.6397
Dturn	4,839	-0.0604	0.3690	-4.4081	3.3685
Mfee	4,839	0.1058	0.9902	0.0015	55.4582
Occupy	4,839	0.0152	0.0232	2.14E-06	0.3129
Big4	4,839	0.1560	0.3629	0	1

Table 2 shows the correlation coefficient matrix between the explained variables and the core explanatory variables. Based on the data in the table, the following conclusions can be initially drawn: Corporate Environmental Social Responsibility (ECSR) and Green Credit Policy (Treatx Post) are positively correlated, with a correlation coefficient of 0.076, which is statistically significant at the 1% significance level. The correlation coefficients between other control variables and corporate environmental social responsibility are also in line with expectations and are statistically

significant, indicating that there is a certain relationship between them and the explained variables. Therefore, it is very necessary to control these potential influencing factors in further empirical analysis.

In addition, after calculating the VIF value (variance inflation coefficient) of each variable, it was found that, except for Size, the VIF values of other variables were less than 2, which indicated that the multicollinearity of the model was weak. Therefore, it can be concluded that there is no serious correlation problem among the variables in the model.

Table 2. Correlation coefficient matrix

Panel A						
	ECSR	Treat x Post	Size	Lev	ROA	ATO
ECSR	1	0.079***	0.365***	0.126***	0.055***	0.142***
Treat x Post	0.076***	1	0.034**	-0.063***	-0.095***	0.046***
Size	0.452***	0.034**	1	0.536***	-0.138***	-0.043***
Lev	0.141***	-0.064***	0.518***	1	-0.460***	0.009
ROA	0.032**	-0.074***	-0.096***	-0.416***	1	0.210***
ATO	0.097***	0.019	0	0.041***	0.162***	1
Cashflow	0.078***	0.099***	-0.024*	-0.232***	0.420***	0.126***
Board	0.159***	0.049***	0.209***	0.102***	-0.025*	0.005
TobinQ	-0.183***	-0.029**	-0.432***	-0.396***	0.304***	0.018
FirmAge	-0.039***	0.122***	0.046***	0.115***	-0.100***	-0.060***
Balance	0.033**	-0.018	-0.066***	-0.106***	0.066***	-0.038***
Mfee	-0.053***	-0.02	-0.012	0.004	-0.001	-0.053***

Panel B						
	Cashflow	Board	TobinQ	FirmAge	Balance	Mfee
ECSR	0.079***	0.137***	-0.197***	-0.007	0.044***	-0.122***
Treat x Post	0.126***	0.053***	-0.047***	0.107***	-0.023	-0.034**
Size	-0.031**	0.191***	-0.625***	0.126***	-0.053***	-0.425***
Lev	-0.241***	0.089***	-0.517***	0.119***	-0.078***	-0.406***
ROA	0.411***	-0.012	0.380***	-0.111***	0.099***	0.085***
ATO	0.173***	0.018	0.113***	-0.117***	-0.043***	-0.346***
Cashflow	1	0.068***	0.160***	-0.040***	0.021	-0.031**
Board	0.051***	1	-0.124***	-0.006	0.038***	-0.091***
TobinQ	0.142***	-0.150***	1	-0.072***	0.063***	0.416***
FirmAge	-0.034**	0.012	-0.014	1	0.053***	-0.075***
Balance	0.018	0.033**	0.029**	0.024*	1	0.074***
Mfee	-0.021	-0.007	0.026*	0.009	-0.003	1

Table 3. Variance expansion coefficient

Variable	VIF	1/VIF
Treat x Post	1.08	0.922951
Size	2.02	0.495424
Lev	1.86	0.538399
ROA	1.57	0.635127
ATO	1.07	0.934602
Cashflow	1.28	0.780014
Growth	1	0.995461
Board	1.06	0.940635
TobinQ	1.4	0.711862
FirmAge	1.05	0.95145
Balance	1.03	0.97425
Dturn	1.03	0.972462
Mfee	1	0.995301
Occupy	1.08	0.928447
Big4	1.32	0.757513
Mean VIF	1.26	

5. Regression Results and Analysis

Table 4 reports the regression results of green credit policy on corporate environmental social responsibility. The first column shows the coefficient estimates of the regression of the independent variables and control variables on the dependent variable. The results show that the coefficient of the $Treat*Post_{i,t}$ variable is 0.434 and is significantly greater than 0 at the 5% statistical level. Columns (2) to (4) show the regression results after adding year fixed effects, individual

fixed effects and industry fixed effects to the model in sequence. The coefficient estimates of the $Treat*Post_{i,t}$ variable are 0.433, 0.450 and 0.439 respectively. And they are all significantly positive at the 1% statistical level. It can be seen that compared with other industries, the environmental social responsibility level of pollution-intensive industries has significantly improved after the promulgation of green credit policies, which is consistent with hypothesis H1.

Table 4. Baseline regression results

Variable name	ECSR			
	(1)	(2)	(3)	(4)
Treat×Post	0.434** (2.29)	0.433*** (2.85)	0.450*** (2.72)	0.439*** (2.64)
Post	-0.263** (-2.11)	1.403*** (6.07)	1.488*** (3.31)	1.522*** (3.34)
Treat	-0.367** (-2.24)	-0.386*** (-2.91)	-0.228 (-0.46)	0.133 (0.33)
Size	0.119*** (2.99)	0.096*** (3.14)	-0.303** (-2.18)	-0.288** (-2.06)
Lev	0.074 (0.26)	0.129 (0.58)	0.519 (0.92)	0.648 (1.13)
ROA	2.483*** (2.86)	1.840** (2.11)	0.848 (0.64)	0.915 (0.67)
ATO	0.048 (0.63)	0.007 (0.13)	0.033 (0.17)	0.035 (0.19)
Cashflow	-1.445** (-2.36)	-0.506 (-0.93)	-0.368 (-0.49)	-0.370 (-0.49)
Growth	-0.004 (-0.46)	-0.007 (-1.35)	-0.011* (-1.70)	-0.011* (-1.67)
Board	-0.197 (-0.99)	-0.156 (-1.01)	-0.480 (-1.21)	-0.487 (-1.21)
TobinQ	0.028 (0.80)	0.031 (1.21)	0.041 (0.75)	0.055 (0.96)
FirmAge	0.177 (1.45)	0.071 (0.78)	0.417 (0.58)	0.380 (0.52)
Balance	0.118* (1.71)	0.110* (1.94)	0.287* (1.83)	0.304* (1.92)
Dturn	-0.462*** (-4.20)	0.088 (0.70)	0.050 (0.35)	0.048 (0.33)
Mfee	0.009 (0.22)	0.004 (0.32)	-0.250** (-2.56)	-0.225*** (-2.99)
Occupy	-2.358 (-1.32)	-1.497 (-0.98)	0.257 (0.09)	0.013 (0.00)
Fxed time	No	Yes	Yes	Yes
Individual fixation	No	No	Yes	Yes
Industry fixed	No	No	No	Yes
N	4839	4839	4839	4839
R ²	0.009	0.074	0.077	0.081

Since there are some unobservable variables at the enterprise level and the year level, and these variables may have an impact on the level of environmental social responsibility of the enterprise, and then interfere with the research issues of this paper, we draw on the research strategy of Cai et al. (2016), through random A placebo test was conducted by drawing a fictitious experimental group from the industry. The industries of the experimental group obtained through manual extraction are random, and theoretically they will not have a consistent response to the green credit guidelines. Therefore, there should be no correlation between the interaction item constructed by the new experimental group and corporate environmental and social responsibility. This means that if the regression coefficients of the independent variables composed of randomly selected experimental groups are not significantly different from zero, the regression model constructed above is reasonable and there is no bias caused by omitted variables. On the contrary, if the newly constructed independent variable coefficient deviates significantly from 0 points, it means that there are problems such as omitted variables in the model. In addition, in order to ensure the randomness of the

sampling process, this article repeats the sampling process 1000 times and records the estimation results of the corresponding model. Figure1 shows the Kernal density distribution of the coefficient estimates of the variables obtained by random sampling. The figure shows that the estimated coefficients are mainly distributed around zero, and there is a significant difference from the previous baseline regression results. Therefore, it can be considered that the previous estimation results do not exist

The baseline regression results of this article are robust to serious bias caused by omitted variables. In addition, this paper also draws on the research methods of Hung and Wang (2014) and Ge et al. (2021), and uses the method of counterfactual testing to conduct a placebo test on the main regression results of this paper. Assuming that the policy implementation time is advanced by 1 year and 2 years respectively, the interaction item is constructed according to the virtual policy implementation year, and it is used to replace the original double difference variable and added to the benchmark model for regression. If the regression result of the counterfactual model is consistent with the main regression, it indicates that the causal relationship between

the dependent variable and the independent variable may be caused by other unobservable variables or random disturbances, which means that the previous regression results may be biased. The empirical results are shown in Table 5. Columns (1) and (2) show the regression results of the counterfactual model with the policy implementation year advanced by 2 years. At this time, the coefficient of the new interaction phase is not significant. Columns (3) and (4) show the regression results when the year of policy implementation

is advanced by 1 year. The data show that the regression coefficient of this counterfactual model is still not significant. To sum up, changing the year of policy implementation does not lead to a consistent conclusion with the main regression of this paper, indicating that the role of green credit in promoting enterprises to undertake environmental and social responsibility is not caused by unobservable factors, which further proves the robustness of the baseline regression of this paper.

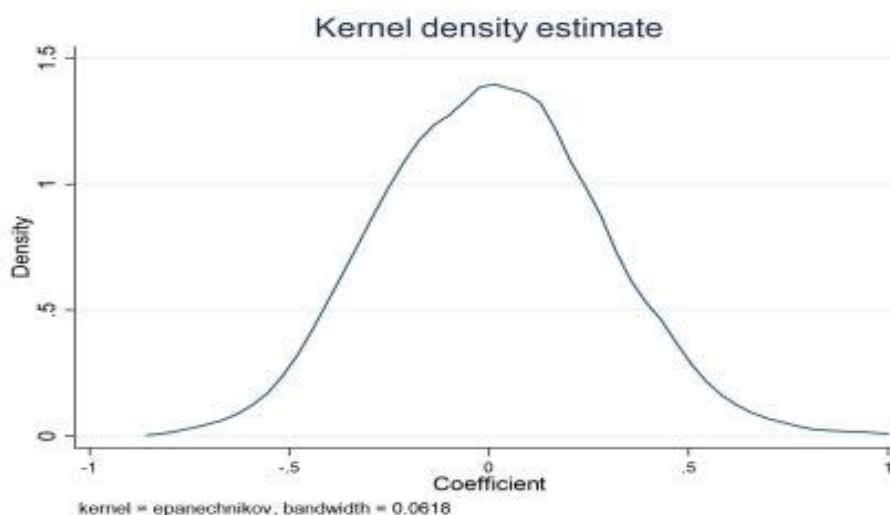


Figure1. the Kernel density distribution of the coefficient estimates

Table 5. the empirical results are shown

	Advance policy time 1 year		Advance policy time 2 years		Change sample (5)	(6)
	(1)	(2)	(3)	(4)		
Treat_x_Pre 1	-0.096 (-0.40)	-0.128 (-0.50)				
Treat_x_Pre 2			0.036 (0.07)	0.961 (1.26)		
Treat_x_Post					0.342* (1.80)	0.331* (1.74)
Control variable	control	control	control	control	control	control
Fixed time	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixation	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed	No	Yes	No	Yes	No	Yes
N	4838	4838	4839	4839	2914	2914
R ²	0.076	0.085	0.076	0.085	0.114	0.120

6. Conclusions and Policies

With the increasing public awareness of environmental protection and the need to improve the ecological environment, my country is paying more and more attention to the role of enterprises in environmental protection. The state has introduced various environmental regulatory measures, including command-and-control policies and market-oriented measures, to encourage enterprises to innovate green production technologies, save energy and reduce emissions, and improve environmental performance (Wen and Lee, 2020). In recent years, green financial instruments, especially green credit, have played an increasingly important role in regulating corporate environmental behavior and limiting the blind expansion of highly polluting industries (Hao and Wu, 2020; Lee et al., 2020). In 2012, my country officially promulgated the "Green Credit Guidelines" to curb industrial pollution by imposing

financial constraints on heavily polluting enterprises. The policy requires commercial banks to limit lending to companies in highly polluting industries and provide financial support to environmental companies. As of this year, the green credit policy has been implemented for nearly ten years. It is of great significance to objectively and neutrally evaluate this market-oriented environmental protection policy.

The Fourth Plenary Session of the 19th Central Committee of the Communist Party of China proposed to promote the construction of ecological civilization through the modernization of the national governance system and governance capabilities. Green credit policy is an important part of the national environmental governance system and a supplement to traditional administrative mandatory environmental governance. On the one hand, this policy allocates funds to environmentally friendly enterprises through differentiated credit and encourages enterprises to invest in environmental protection to achieve green

development; on the other hand, it imposes financing on enterprises through measures such as signaling effects and the implementation of flexible interest rates based on environmental performance, forcing them to improve their environmental performance. The previous analysis has analyzed the impact of the "Green Credit Guidelines" since its promulgation. On this basis, this article puts forward the following policy recommendations.

Firstly, the government should continue to promote different market-oriented environmental protection policies, including green credit, and focus on improving environmental protection policies at the micro-enterprise level. The green credit policy has become an important strategic tool for China to develop a green economy in the new era and a useful supplement to traditional administrative environmental laws and regulations, through the allocation of funds in the financial market to achieve environmental protection goals. With the continuous advancement of my country's economic green and low-carbon transformation, green credit policies will play a greater role in promoting environmental protection and improving environmental quality. Micro-enterprises are the main source of industrial pollution. Only by allocating resources in a market-oriented manner can the endogenous motivation of enterprises to engage in environmental protection activities be stimulated, and enterprises can ensure long-term investment in environmental protection. Therefore, future environmental policies should focus on using market-based means, using market power to constrain micro-enterprises and promote them to assume environmental social responsibilities.

Secondly, different regions can adopt different strategies to implement green credit policies according to their own characteristics. For example, regions with relatively developed financial markets can make full use of the power of the market to restrain corporate behavior, try new green credit projects, and serve as pilot regions to accumulate experience and provide replicable development models for other regions. In regions with a low level of financial market development, the implementation and supervision of green credit policies should be maintained, with the focus on expanding the coverage of green credit, so that more companies can understand and enjoy the dividends of green credit policies.

References

- [1] Aghion P., Askenazy P., Berman N., et al. Credit Constraints and the Cyclicity of R&D Investment: Evidence from France[J]. *Scholarly Articles*, 2012.
- [2] Banga J. The green bond market: a potential source of climate finance for developing countries [J]. *Journal of Sustainable Finance & Investment*, 2019, 9(1): 17-32.
- [3] Beck T., Levine R., Levkov A. Big bad banks? The winners and losers from bank deregulation in the United States[J]. *Journal of finance*, 2010, 65(5): 1637- 1667.
- [4] Berger G. J., Shaw F. C., Cooke J A. The New Green Finance [J]. *Public Utilities Fortnightly*, 2009, 147 (10): 12- 18.
- [5] Brammer S., Pavelin S. Voluntary social disclosures by large UK companies. *Journal of Business Finance & Accounting*, 2004, 13(2-3): 1168- 1188.
- [6] Cai X., Lu Y., Wu M., et al. Does environmental regulation drive away inbound foreign direct investment? Evidence from a quasi-natural experiment in China [J]. *Journal of Development Economics*, 2016, 123: 73-85.
- [7] Christopher Wright. *Global Banks, The Environment, and Human Rights: The Impact of the Equator Principles on Lending Policies and Practices* [J]. *Global Environmental Politics*, MIT Press, 2012, vol. 12(1): 56-77.
- [8] Cowane. *Topical Issues In Environmental Finance* [Z]. Research Paper was Commissioned by the Asia Branch of the Canadian International Development Agency,1998.
- [9] Delmas M. A., Toffel M W. Organizational Response to Environmental Demands: Opening the Black Box[J]. *Strategic Management Journal*, 2008, 29(10): 1027- 1055.
- [10] Diamond D W. Debt maturity structure and liquidity risk [J]. *The Quarterly Journal of economics*, 1991, 106(3): 709-737.
- [11] Eshet A. Sustainable Finance? The Environmental Impact of the Equator Principles and the Credit Industry[J]. *International Journal of Innovation and Sustainable Development*, 2017, 11: 106- 129.
- [12] Ge Y., Zhu Y., Zhang W. Can Infrastructure Development Alleviate Multidimensional Poverty?-Evidence From China [J]. *The Singapore Economic Review*, 2021: 1-34.
- [13] Green A. You can't pay them enough: Subsidies, environmental law, and social norms[J]. *Harvard Environmental Law Review*, 2006, 30: 407.
- [14] Hu Y., Jiang H., Zhong Z. Impact of green credit on industrial structure in China: theoretical mechanism and empirical analysis [J]. *Environmental Science and Pollution Research*, 2020: 1- 14
- [15] Hung M., Y Wang. Mandatory CSR Disclosure and Shareholder Value: Evidence from China [R]. Working paper. University of Southern California and The Hong Kong University of Science and Technology, 2014.
- [16] Hurley R., Gong X., Waqar A. Understanding the loss of trust in large banks[J].*International Journal of Bank Marketing*, 2014, 32(5): 348-366.
- [17] Jeucken M. *Sustainable Finance and Banking*[M]. USA: The Earthscan Publication,2006.
- [18] Jose Salazar. *Environmental Finance: Linking Two World* [R]. Bratislava, Slovakia ,1998.
- [19] Kent M L., Taylor M. From Homo Economics to Homo Dialogical: Rethinking Social Media Use in CSR Communication [J]. *Public Relations Review*, 2016, (3): 60-67.
- [20] Lee C C., Wang C W., Ho S J., et al. The impact of natural disaster on energy consumption: international evidence [J]. *Energy Economics*, 2021, 97: 105021.
- [21] Li Wanjin, Kuang Xiaolan, Gong Guangming. Research on influencing factors of environmental information disclosure -- based on empirical test of 201 listed companies in Shanghai [J]. *Financial theory and practice*, 2008, 29(3).
- [22] Nandy M., Lodh S. Do banks value the eco-friendliness of firms in their corporate lending decision? Some empirical evidence[J]. *International Review of Financial Analysis*,2012, 25: 83-93.
- [23] Patten D M. Exposure, legitimacy, and social disclosure[J]. *Journal of Accounting and public policy*, 1991, 10(4): 297-308.
- [24] Popeanga V, Alina Georgiana Holt. The Strategy Of Financing the Environmental Projects Through The National Action Plan For Environment In Romania [J]. *Annals Economy Series*, Constantin Brancusi University, 2014.
- [25] Richardson R. Environmental Finance: Environmental Compliance Can Be Profitable [J]. *Natural Gas & Electricity*, 2014, 31(3): 9.

- [26] Salarzar J. Green Finance: Linking Two World [R]. Bratislava Slovakia: In A Workshop on Finance Innovations for Biodiversity Bratislava, 1998: 2- 18.
- [27] Schneider T. E. Is There a Relation between the Cost of Debt and Environmental Performance? An Empirical Investigation of the U.S. Pulp and Paper Industry. Ph.D.Thesis, University of Waterloo, Waterloo, ON, Canada, 2008.
- [28] Principles Different from Non-Adopters[J]. World Development, 2007, 35(8): 1307- 1328Sheldon O. The Social Responsibility of Management [J]. The Philosophy of Management London, 1924.
- [29] Starks L T. EFA keynote speech:“ Corporate governance and corporate social responsibility: What do investors care about? What should investors care about? ” [J].Financial Review, 2009, 44(4): 461-468.
- [30] Stiglitz J E., Weiss A. Credit rationing in markets with imperfect information [J]. The American economic review, 1981, 71(3): 393-410.
- [31] Sun J., Wang F., Yin H., et al. Money Talks: The Environmental Impact of China's Green Credit Policy[J]. Journal of Policy Analysis and Management, 2019, 38(3): 653-680.
- [32] Tseng T Y. Will both direct financial development and indirect financial development mitigate investment sensitivity to cash flow? The experience of Taiwan[J]. Emerging Markets Finance and Trade, 2012, 48(sup2): 139- 152.
- [33] Wen H., Lee C C., Zhou F. Green credit policy, credit allocation efficiency and upgrade of energy-intensive enterprises[J]. Energy Economics, 2021, 94: 105099.
- [34] Wen H., Lee C C. Impact of environmental labeling certification on firm performance :Empirical evidence from China[J]. Journal of Cleaner Production, 2020, 255: 120201.
- [35] White M. Environmental Finance: Value and Risk in an Age of Ecology [J]. Business Strategy and the Environment, 1996, 5(3): 198-206.
- [36] Yuan R., Sun J., Cao F. Directors' and officers' liability insurance and stock price crash risk [J]. Journal of Corporate Finance. 2016, 37: 173- 192.
- [37] Zhang D. Green credit regulation, induced R&D and green productivity: Revisiting the Porter Hypothesis [J]. International Review of Financial Analysis, 2021, 75: 101723.
- [38] Zhang K., Li Y., Qi Y., et al. Can green credit policy improve environmental quality? Evidence from China [J]. Journal of Environmental Management, 2021, 298: 113445.
- [39] Fernandez., V.(2022).Environmental management: Implications for business performance, innovation, and financing [J].Technological Forecasting & Social Change, 182, 121797.
- [40] Xing, C., Zhang, Y., & Tripe, D.(2021).Green credit policy and corporate access to bank loans in China: The role of environmental disclosure and green innovation [J].International Review of Financial Analysis, 77, 101838.
- [41] Wen, H., Lee, C., & Zhou, F.(2021).Green credit policy, credit allocation efficiency and upgrade of energy-intensive enterprises [J]. Energy Economics, 94, 105099.
- [42] Zhu, Z., & Tan, Y.(2022).Can green industrial policy promote green innovation in heavily polluting enterprises? Evidence from China [J]. Economic Analysis and Policy, 74, 59-75.
- [43] Qi, X., Guo, Y., Guo, P., Yao, X., & Liu, X.(2022).Do subsidies and R&D investment boost energy transition performance? Evidence from Chinese renewable energy firms. Energy Policy, 164, 112909.
- [44] Chen, S., Ma, H., & Wu, Q.(2019).Bank credit and trade credit: Evidence from natural experiments [J]. Journal of Banking and Finance, 108, 105616.
- [45] Lu, J., Yan, Y., & Wang, T.(2021).Research on micro-effect of green credit policy [J]. China Industrial Economics, 1, 174-192.
- [46] Wang, K., Sun, X., & Wang, F.(2019).Green finance development, debt maturity structure and green enterprise investment [J]. Finance Forum, 7, 9-19.
- [47] Cao, S., & Leung, D.(2020).Credit constraints and productivity of SMEs: Evidence from Canada [J].Economic Modelling, 88, 163-180.
- [48] Cao, Y., Zhang, C., & Yang, X.(2021).The green effect and influence mechanism of green credit policy [J]. Finance Forum, 5, 7-17.
- [49] Zhang, Y., Yang, Y., & Bi, J.(2011) Tracking the implementation of green credit policy in China: Top-down perspective and bottom-up reform [J]. Journal of Environmental Management, 92, 1321-1327.
- [50] Ding, N., Ren, Y., & Zuo, Y.(2020).Green credit policy is not worth the loss or get what you want? [J].Journal of Financial Research, 4, 112-130.
- [51] Fan , Y., & Li, J.(2022).The impact of green credit policy on labor income share [J]. Economic Review, 3, 22-38.