# The impact of green credit policy on corporate carbon emissions

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**Abstract.** Green credit policy, as an important financial tool, has significant implications for promoting a low-carbon economy and achieving emission reduction targets. This study explored the impact of China's green credit policy on corporate carbon emissions, using the implementation of the Green Credit Guidelines(GCG) as a natural experiment, and designed a difference-in-difference model. Evidence suggests that GCG can reduce the carbon emissions of green credit restricted enterprises by increasing financing constraints. Further research has found that the carbon reduction effect of policies is more significant for smaller enterprises with stricter total factor productivity and regional environmental regulations. These findings contribute to understanding the implementation effectiveness of GCG and provide theoretical and practical support for achieving the carbon peaking and carbon neutrality goals.

**Keywords:** Green credit policy; carbon emissions; DID.

## 1. Introduction

Green finance is regarded as an investment and financing activity that uses financial instruments and policy guidance to direct financial funds towards green environmental protection industries, improve environmental quality, and achieve sustainable economic development (Sachs et al., 2019). Among them, green credit policy, as one of the important tools of green finance, is a financial innovation that effectively addresses environmental pollution issues (Labatt and White, 2002). In September 2020, China first explicitly proposed the "dual carbon" target, promising to strive to reach its peak before 2030 and achieve carbon neutrality before 2060. Therefore, studying the relationship between green credit policies and carbon emissions provides theoretical and practical support for promoting low-carbon economy and achieving emission reduction goals.

The essence of green credit is that banks consider the environmental impact of loan projects when approving loans, in order to make judgments on whether to issue project loans (Cowton, 2004). The release of the "Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks" in China in 2007 marked the formal introduction of the concept of green credit. In the following years, a series of related policies were introduced to actively promote the development and implementation of green credit. In 2012, the China Banking Regulatory Commission issued the "Green Credit Guidelines", providing operational guidance for the banking industry on green credit. In the same year, the statistical and monitoring system for green credit was gradually established, improving policy transparency and implementation.

Previous research on the implementation effectiveness of green credit policies has mainly focused on environmental performance and corporate business behavior. Most opinions believe that green credit policy can have the effect of energy conservation and emission reduction (Sun et al., 2019; Zhang et al., 2021; Tian C et al., 2022). Evidence shows that green credit policies do help reduce carbon dioxide emissions through various means (Sun and Zeng, 2023; Zhang et al., 2022). However, some viewpoints also point out that while promoting high polluting enterprises to reduce emissions, excessive constraints of green credit policy may also lead to enterprises adopting the approach of reducing production in extreme situations to achieve emission reduction targets, thereby affecting their survival and development (Fan et al., 2021).

The impact of green credit policy on corporate environmental performance is manifested in various aspects. On the one hand, green credit has a guiding role in the allocation of credit resources, increasing the debt financing costs of heavily polluting enterprises and reducing the debt financing costs of green enterprises (Liu et al., 2019; Xu and Li, 2020), thereby forcing enterprises to save energy and reduce emissions. On the other hand, green credit can significantly promote technological innovation in high polluting enterprises (Hu et al., 2021) and improve their green production efficiency (Lv C et al., 2023).

Based on existing research, this study empirically tests the impact of green credit policy on carbon emissions of restricted enterprises, including their channels of action and heterogeneity analysis, in order to provide targeted recommendations for governments and financial institutions. The rest of this article consists of the following parts. The second part describes the method and data, while the third and fourth parts introduce the research results and further discussion. The conclusion and policy impact can be found in Part Five.

## 2. Methodology and data

### 2.1. Model setting

To accurately identify the impact of green credit policy on corporate carbon emissions, this paper regards the "Green Credit Guidelines" issued in February 2012 as an exogenous shock event to the implementation of green credit policy, and constructs a DID model as follows:

$$C_{it} = \beta_0 + \beta_1 time_t + \beta_2 time_t * treat_i + \beta_3 treat_i + \beta_4 Control_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

In Equation (1), $C_{it}$ denotes the carbon emissions of listed companies; $time_t$ denotes policy implementation dummy variables, the value after 2012 is 1, otherwise it is 0; $treat_i$ denotes group virtual variables, according to previous related studies (Wang and Wang, 2019), this paper considers enterprises belonging to industries restricted by the green credit policy as the treatment groups while the rest are considered as control groups. The industries restricted by the green credit policy include nuclear power generation, hydropower generation, water conservancy and inland port engineering construction, coal mining and washing industry, oil and gas mining industry, black metal mining and selection industry, non-ferrous metal mining and selection industry, non-metallic mining and selection industry, and other mining industries. If the listed company belongs to the above 9 industries, the treat value is taken as 1, otherwise it is taken as 0. $time_t * treat_i$ denotes the core explanatory variable, its coefficient measures the impact of policy implementation on the carbon emissions of industries restricted by green credit policy. If it is less than 0 and significant, green credit policy can reduce the carbon emissions of enterprises in industries restricted by green credit; $Control_{it}$ denotes control variables; $\mu_i$ denotes industry-fixed effect; $\delta_t$ denotes time-fixed effect; $\varepsilon_{it}$ is the random interference term.

In order to further explore the channels through which green credit policy affect the carbon emissions of restricted enterprises, a mediation effect model was introduced. The specific model settings are as follows:

$$M_{it} = \eta_0 + \eta_1 time_t + \eta_2 time_t * treat_i + \eta_3 treat_i + \gamma Control_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

$$C_{it} = \alpha_0 + \alpha_1 time_t + \alpha_2 time_t * treat_i + \alpha_3 treat_i + \alpha_4 M_{it} + \gamma Control_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3)$$

$M_{it}$ is the mediator variable, $\eta_2$ in Equation (2) denotes the effect of the independent variable on the mediator variable $M_{it}$, and $\alpha_4$ in Equation (3) represents the effect of the mediator variable M on the dependent variable $C_{it}$, $\alpha_2$ denotes the direct effect of the independent variable on the dependent variable after controlling for the influence of mediator variable.

## 2.2. Description of variables

### 2.2.1 Explained variable

Due to the lack of mandatory regulations for companies to disclose carbon emission related information in China, there are relatively few companies that voluntarily disclose carbon emission data in their annual reports. Moreover, considering that companies willing to disclose carbon emission information are often those that perform well in carbon emission control, the availability of relevant data in this area is relatively low. In view of this, this paper refers to previous studies (Sun C et al., 2023), using the proportion of operating costs of listed companies to the main operating costs of their respective industries as weights, and estimating the company's carbon emissions based on the company's operating costs and industry carbon emissions. The industrial carbon emissions are calculated using the standard coal method proposed by the Intergovernmental Panel on Climate Change (IPCC) in 2006, which selects and estimates eight energy sources by multiplying their actual consumption with their corresponding carbon emission factors. The specific calculation formula is as follows:

$$CO_{2_{it}} = \sum_{n=1}^{8} E_{n,it} * \lambda_n \tag{4}$$

Among them, $CO_2$ denotes industry carbon emissions, E denotes the energy consumption, $\lambda$ represents the carbon emissions coefficient of various energy sources (Table 1).

**Table 1**. Carbon emission coefficient of various energy

| Energy | Raw coal | Coke | Crude oil | Gasoline | Kerosene | Diesel | Fuel oil | Natural gas |
|---|---|---|---|---|---|---|---|---|
| $\lambda$ | 1.9003 | 2.8604 | 3.0202 | 2.9251 | 3.0179 | 3.0959 | 3.1705 | 2.1622 |

Subsequently, the carbon emissions at the company level were estimated based on the industry carbon emissions, and the logarithm was taken. The calculation formula is as follows:

$$C_{it} = \ln CO_{2_{it}} * \frac{OC_{it}}{BC_{it}} \tag{5}$$

In Equation (5), $OC_{it}$ denotes company operating costs; $BC_{it}$ denotes the main business cost of the industry.

### 2.2.2 Mediating variable

Using the KZ index as a measure of corporate financing constraints, which is constructed with reference to relevant studies (Kaplan and Zingales, 1997), as shown in Equation (6). Among them, $CF_{it}$ represents the company's operating net cash flow, $DIV_{it}$ represents dividends, and $CASH_{it}$ represents cash holding level, all of which are standardized using the beginning total assets, $LEV_{it}$ represents the asset liability ratio, and $Q_{it}$ is the Tobin Q value. The KZ index is a positive indicator, and the larger the value, the higher the degree of financing constraints faced by the enterprise.

$$KZ_{it} = \alpha_1 * \frac{CF_{it}}{ASSET_{it-1}} + \alpha_2 * LEV_{it} + \alpha_3 * \frac{DIV_{it}}{ASSET_{it-1}} + \alpha_4 * \frac{CASH_{it}}{ASSET_{it-1}} + \alpha_5 * Q_{it} \tag{6}$$

### 2.2.3 Control variable

Considering that there are many factors that affect a company's carbon emissions, in order to control for the possible impact of other factors, the following variables that reflect the characteristics of the company are selected as control variables. The control variables are defined as follows: the scale of a company (Size) is measured by the logarithm of its total assets. The leverage level (Lev) is measured by the asset liability ratio. Profitability (ROA) is measured by the return on total assets. The growth of a company (Growth) is measured by its revenue growth rate. The size of the board of directors (Board) is measured by the number of board members. The proportion of independent directors (Indep) is measured by the ratio of the number of independent directors to the number of directors on the board. The shareholding ratio of the largest shareholder (Top1) is measured by the

proportion of shares held by the first shareholder to the total share capital of the company. Table 2 shows the description.

**Table 2**. Definition and measurement of main variables

| | Variables | Description |
|---|---|---|
| Dependent variable | C | Calculated according to IPCC |
| Core independent variable | Time | The year after 2012 is 1, otherwise it is 0 |
| | Treat | 1 for enterprises restricted by green credit policy, otherwise it is 0 |
| | Time*treat | The net effect of green credit policy |
| Mediating variable | KZ | Calculated by Equation(6) |
| Control variable | Size | The logarithm of company total assets |
| | Lev | Total liabilities/total assets |
| | ROA | Net profit/total assets |
| | Growth | Revenue growth rate |
| | Board | The number of board members |
| | Indep | The number of independent directors/the number of directors on the board |
| | Top1 | Shares held by the first shareholder/the total share capital of the company |

### 2.3. Sample and data

This paper selects all A-share listed companies in China from 2004 to 2022 as the research sample and conducts the following processing: excluding listed companies in the financial and insurance industry, excluding listed companies with asset liability ratios less than 0 and greater than 1, excluding listed companies with abnormal trading (including ST, ST * and PT), and excluding listed companies with missing relevant data samples. After matching and merging the above data, in order to control the influence of extreme outliers, the top and bottom 1% quantiles of the main continuous variables were truncated. Industry carbon emission data is sourced from the China Energy Statistical Yearbook and Industrial Statistical Yearbook, while other relevant financial data is sourced from the CSMAR database.

### 2.4. Descriptive statistics

Table 3 presents the descriptive statistical results. It can be seen from this that, except for the large standard deviation of enterprise carbon emissions and scale, there is not much difference in other variables among enterprises.

**Table 3**. Descriptive statistics

| VARIABLES | N | mean | sd | min | max |
|---|---|---|---|---|---|
| Time | 31,698 | 0.776 | 0.417 | 0 | 1 |
| Treat | 31,698 | 0.0576 | 0.233 | 0 | 1 |
| Time*treat | 31,698 | 0.0427 | 0.202 | 0 | 1 |
| Size | 31,698 | 21.95 | 1.199 | 19.76 | 25.84 |
| Lev | 31,698 | 0.404 | 0.196 | 0.0514 | 0.878 |
| ROA | 31,698 | 0.0455 | 0.0649 | -0.202 | 0.231 |
| Growth | 31,698 | 0.172 | 0.351 | -0.482 | 2.055 |
| Board | 31,698 | 2.131 | 0.201 | 1.609 | 2.708 |
| Indep | 31,698 | 0.372 | 0.0530 | 0.273 | 0.571 |
| Top1 | 31,698 | 0.349 | 0.147 | 0.0908 | 0.741 |
| C | 31,698 | 0.432 | 2.627 | -4.578 | 7.349 |

# 3. Empirical Results

## 3.1. Baseline results

The benchmark regression analysis results are shown in Table 4. The first column shows the direct impact of green credit policy on corporate carbon emissions without controlling variables. The second column outputs the results after adding control variables. The third column controls for annual and industry fixed effects on the basis of introducing control variables. The estimated coefficient of $Time * treat$ remains significantly negative, indicating that after the implementation of green credit policy, the carbon emissions of enterprises subject to green credit constraints have decreased compared to those not subject to green credit restrictions. At the same time, the goodness of fit continues to increase, indicating a significant improvement in the explanatory power of the model.

**Table 4**. The impact of green credit policy on corporate carbon emissions

| VARIABLES | (1) | (2) | (3) |
|---|---|---|---|
| Time*treat | -0.573*** | -0.414*** | -0.313*** |
| | (0.089) | (0.063) | (0.062) |
| Treat | 4.062*** | 2.420*** | 2.401*** |
| | (0.055) | (0.045) | (0.108) |
| Time | -1.250*** | -1.596*** | -2.074*** |
| | (0.033) | (0.028) | (0.076) |
| Size | | 1.075*** | 1.144*** |
| | | (0.011) | (0.011) |
| Lev | | 2.002*** | 1.974*** |
| | | (0.073) | (0.066) |
| ROA | | 2.008*** | 1.446*** |
| | | (0.200) | (0.182) |
| Growth | | -0.103*** | 0.019 |
| | | (0.034) | (0.031) |
| Board | | 0.869*** | 0.422*** |
| | | (0.063) | (0.057) |
| Indep | | -1.255*** | -1.281*** |
| | | (0.231) | (0.202) |
| Top1 | | 1.347*** | 1.115*** |
| | | (0.074) | (0.066) |
| Constant | 1.193*** | -24.794*** | -25.690*** |
| | (0.029) | (0.265) | (0.287) |
| Year | NO | NO | YES |
| Industry | NO | NO | YES |
| Observations | 31,698 | 31,698 | 31,698 |
| R-squared | 0.149 | 0.489 | 0.616 |

Note: Standard error in parentheses. *, **, *** refers to significance at the 10, 5, and 1% level respectively.

## 3.2. Robustness test

### 3.2.1 Parallel trend testing

To test whether the selected treatment group and control group conform to the parallel trend hypothesis, regression analysis was conducted using the event study method (Jacobson et al., 1993). The regression results are shown in the figure 1. From the graph, it can be seen that before the implementation of the policy, there was no significant change in the difference in carbon emissions between green credit restricted industries and non green credit restricted industries. The regression

coefficient values are generally around zero, and the confidence interval for each point is zero. This indicates that before the implementation of green credit policy, the carbon emission trends of the two sample groups were similar, consistent with the parallel trend hypothesis.

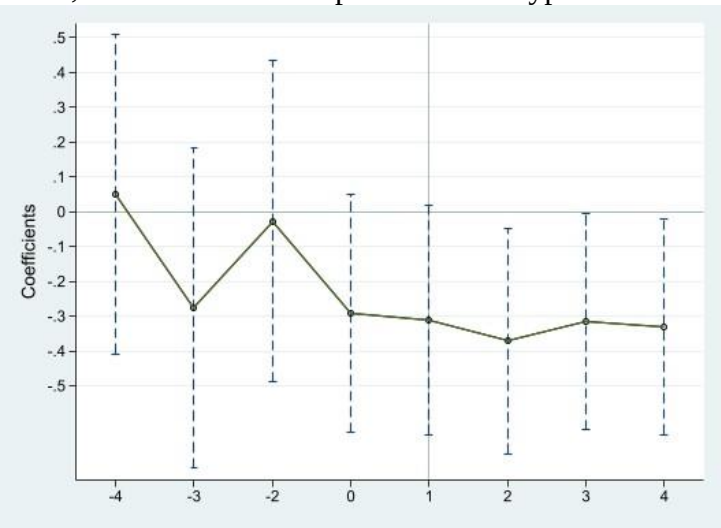


**Fig. 1** Parallel trend test

### 3.2.2 placebo testing

Based on the placebo test theory, the same number of samples as the original treatment group were randomly selected for regression analysis. The distribution of estimated coefficients after 500 samples is shown in Figure 2. It can be seen that the distribution of estimated coefficients follows a normal distribution, with the average value concentrated around 0, indicating that the policy effect is not affected by other unobserved factors.

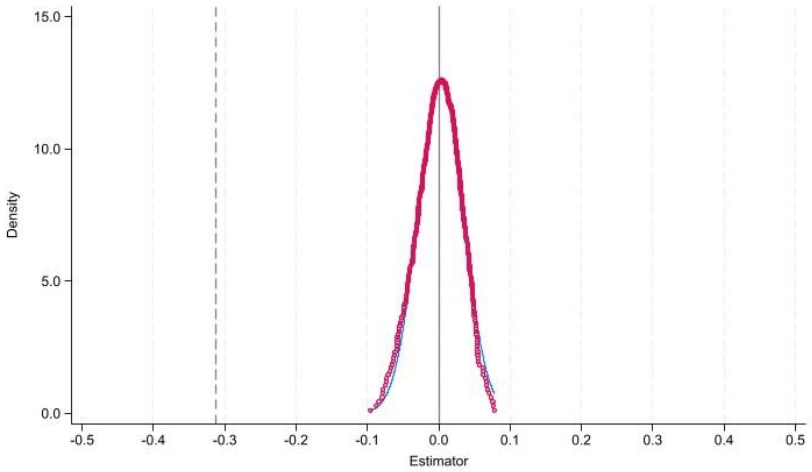


**Fig. 2** placebo test

## 4. Further discussion

### 4.1. Mechanism analysis

The first and second columns of Table 5 report the regression results with financing constraint (KZ) as the mediating variable. According to the results shown in column (1), the coefficient of $Time * treat$ is significantly positive, indicating that policy implementation does indeed increase the financing constraints of green credit restricted enterprises. The coefficient of $Time * treat$ in column (2) is significantly negative, which means that the addition of financing constraint variables can explain some of the policy's inhibitory effects on carbon emissions and is a partial mediating

effect. The regression coefficient of the mediator variable KZ is also significantly negative, indicating that the increase in financing constraints has reduced corporate carbon emissions.

**Table 5**. Test for financial constraint mechanism.

| VARIABLES | (1)<br>KZ | (2)<br>C |
|---|---|---|
| Time*treat | 0.332*** | -0.296*** |
| | (0.067) | (0.061) |
| Treat | -0.088 | 2.379*** |
| | (0.078) | (0.108) |
| Time | -2.749*** | -2.088*** |
| | (0.062) | (0.076) |
| KZ | | -0.020*** |
| | | (0.006) |
| Constant | 6.376*** | -25.712*** |
| | (0.241) | (0.288) |
| Controls | YES | YES |
| Year | YES | YES |
| Industry | YES | YES |
| Observations | 31,698 | 31,698 |
| R-squared | 0.658 | 0.622 |

Note: Standard error in parentheses. *, **, *** refers to significance at the 10, 5, and 1% level respectively.

### 4.2. Heterogeneity analysis

Considering that the impact of green credit policy on corporate carbon emissions reduction may vary due to differences in companies and regions, this paper conducts heterogeneity analysis.

Firstly, perform group regression on large and small enterprises. According to the results in Table 6, the regression coefficient of $Time * treat$ for large enterprises is positive and not significant, while the regression index for small enterprises is significantly negative. This indicates that the green credit policy has a more significant inhibitory effect on carbon emissions for small and medium-sized enterprises, which may be due to their relatively limited financing channels and the enormous survival pressure they face under policy constraints. Therefore, they are forced to undergo green transformation and adjust their production methods to reduce carbon emissions.

Secondly, the differential effect of green credit policy on corporate carbon emissions may also be influenced by total factor productivity. Total factor productivity is calculated based on relevant research (Olley and Pakes, 1996). The third and fourth columns of Table 6 respectively report the impact of green credit policy on carbon emissions of enterprises with high and low total factor productivity. Compared with enterprises with high total factor productivity, enterprises with low total factor productivity usually rely more on high pollution and high energy consumption production methods, and are therefore more susceptible to policy financing constraints. On the other hand, enterprises with high total factor productivity have higher technological levels and more effective resource utilization methods, which can better adapt to or absorb the impact of green credit policy when facing policy shocks.

Thirdly, in regions or industries with stricter environmental regulations, companies face higher environmental requirements, which means that under the dual pressure of policy and regulations, these companies must take more proactive environmental measures. In order to analyze the heterogeneous impact of environmental regulations, the proportion of industrial pollution control investment completed in the province where the company belongs to the secondary industry is used to measure the environmental law enforcement efforts in different regions. According to the results

in columns (5) and (6) of Table 6, in regions with stricter environmental regulations, the inhibitory effect of green credit policy on corporate carbon emissions will be more pronounced, as companies bear higher environmental costs.

**Table 6**. Heterogeneity Analysis of Carbon Emission Reduction Effects of Green Credit

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Time*treat | 0.056 | -0.828*** | -0.104 | -0.654*** | -0.455*** | -0.294* |
| | (0.131) | (0.130) | (0.128) | (0.128) | (0.116) | (0.164) |
| Treat | 2.280*** | 2.756*** | 1.832*** | 3.000*** | 1.925*** | 3.133*** |
| | (0.160) | (0.144) | (0.155) | (0.142) | (0.134) | (0.185) |
| Time | -2.365*** | -1.841*** | -2.119*** | -1.798*** | -2.104*** | -1.552*** |
| | (0.113) | (0.104) | (0.109) | (0.102) | (0.082) | (0.100) |
| Constant | -28.272*** | -23.437*** | -23.665*** | -19.228*** | -26.263*** | -25.459*** |
| | (0.435) | (0.600) | (0.363) | (0.456) | (0.338) | (0.401) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year | YES | YES | YES | YES | YES | YES |
| Industry | YES | YES | YES | YES | YES | YES |
| Observations | 15,875 | 15,823 | 17,350 | 14,348 | 18,695 | 13,003 |
| R-squared | 0.546 | 0.516 | 0.587 | 0.552 | 0.623 | 0.611 |

Note: Standard error in parentheses. *, **, *** refers to significance at the 10, 5, and 1% level respectively.

## 5. Conclusions and policy implications

Since the clear goal of environmental protection economy was established, China's green credit policy has been continuously improved and optimized in the process of rapid development, and has now become an important tool for promoting economic structural strategic adjustment and achieving energy conservation and emission reduction. By exploring the impact of green credit policy on corporate carbon emissions at the micro level, the main findings of this article are as follows:Firstly, the implementation of green credit policy has significantly suppressed the carbon emissions of listed companies in industries restricted by green credit. Secondly, mechanism analysis indicates that increasing financing constraints is an important way for green credit policy to reduce corporate carbon emissions. Thirdly, the effect of green credit policy in suppressing carbon emissions is more pronounced for enterprises with smaller size, lower total factor productivity and stricter regional environmental regulations.

Based on the above research results and practical considerations, the following suggestions are proposed.

Firstly, establish a comprehensive standard evaluation system. The green credit policy requires commercial banks to consider the environmental compliance of enterprises as one of the necessary conditions for approving loans, but there is currently no clear evaluation standard publicly available, resulting in inconsistent and opaque policy implementation. Developing a set of universal loan standards and regulations can not only provide direct guidance for bank loan business, but also help financial institutions evaluate the environmental impact of projects more clearly in loan and investment decisions, and improve the fairness and transparency of policy implementation.

Secondly, strengthen the balance between policy incentives and constraint mechanisms. At present, green credit policy mainly restrict the production and operation behavior of high polluting enterprises by increasing credit restrictions to reduce carbon emissions. However, excessive constraints may exacerbate operational difficulties for businesses, leading some to reduce production inputs and delay green transformation under the pressure of funding shortages, thereby weakening the positive role of policy. Therefore, while implementing financing constraints on high polluting enterprises, the government should provide more targeted financial subsidies, tax incentives, and technical support

to encourage enterprises to increase investment in green technologies and energy-saving equipment, and help them carry out energy-saving and emission reduction technology transformation.

Thirdly, implement differentiated policy. Considering that the emission reduction effect of green credit policy varies depending on the characteristics of enterprises, the government and financial institutions should evaluate and manage them according to their actual situation and needs, and implement personalized strategic adjustments. Similarly, there are significant differences in geographical conditions, economic development levels, and environmental regulatory intensity among different regions of China, all of which can have an impact on the actual implementation effectiveness. Therefore, green credit needs to be tailored to local conditions, and differentiated scientific plans should be formulated to truly promote the effective implementation of green credit in different regions and industries, thereby helping the Chinese economy achieve green transformation and sustainable development.

Finally, strengthen the environmental information disclosure system and reduce information asymmetry. Establishing a sound mechanism for environmental information disclosure and sharing is crucial for improving policy transparency and promoting green transformation of enterprises. The government can formulate and implement strict regulations and policy, mandate high polluting enterprises to regularly release environmental impact reports, or establish open and transparent environmental databases to help financial institutions more accurately assess the environmental status of enterprises, thereby better supporting credit decisions for enterprises with excellent environmental performance, and implementing more targeted constraints and incentives for high polluting enterprises.

## References

[1] Sachs J, Woo W T, Yoshino N, et al. Importance of green finance for achieving sustainable development goals and energy security. Handbook of Green Finance: Energy Security and Sustainable Development, 2019(1): 3-12.

[2] Labatt S, White R R. Environmental Finance: A Guide to Environmental Risk Assessment and Financial Products. New Jersey: John Wiley & Sons, Inc., 2002.

[3] Cowton T C J. Bringing the Environment into Bank Lending: Implications for Environmental Reporting. The British Accounting Review, 2004, 36(2): 197- 218.

[4] Sun J, Wang F, Yin H, et al. Money talks: the environmental impact of China's green credit policy. Journal of Policy Analysis and Management, 2019, 38 (3): 653–680.

[5] Zhang K, Li Y, Qi Y, et al. Can green credit policy improve environmental quality? Evidence from China. Journal of Environmental Management, 2021, 298(4):113445.

[6] Tian C, Li X, Xiao L, et al. Exploring the impact of green credit policy on green transformation of heavy polluting industries. Journal of cleaner production, 2022(Feb.10):335.

[7] Sun C, Zeng Y, France N. Does the green credit policy affect the carbon emissions of heavily polluting enterprises?. Energy Policy, 2023, 180: 113679.

[8] Zhang A, Deng R, Wu Y. Does the green credit policy reduce the carbon emission intensity of heavily polluting industries?-Evidence from China's industrial sectors. Journal of Environmental Management, 2022, 311: 114815.

[9] Fan H, Peng Y, Wang H, et al. Greening through Finance?, Journal of Development Economics, 2021, 152: 102683.

[10] Liu X, Wang E, Cai D. Green credit policy, property rights and debt financing: Quasi-natural experimental evidence from China. Finance Research Letters, 2019, 29: 129-135.

[11] Xu X, Li J. Asymmetric impacts of the policy and development of green credit on the debt financing cost and maturity of different types of enterprises in China. Journal of Cleaner Production, 2020, 264:121574.

[12] Hu G, Wang X, Wang Y. Can the green credit policy stimulate green innovation in heavily polluting enterprises? Evidence from a quasi-natural experiment in China.Energy Economics, 2021, 98(3):105134.

[13] Lv C, Fan J, Lee C C. Can green credit policies improve corporate green production efficiency?. Journal of cleaner production, 2023, 397(Apr.15):136573.1-136573.15.

[14] Wang Xin, Wang Ying. Research on Promoting Green Innovation through Green Credit Policies. Management World, 2021, 37 (6): 173-188.

[15] Kaplan S N, Zingales L. Do investment-cash flow sensitivities provide useful measures offinancing constraints?. The quarterly journal of economics, 1997, 112(1): 169-215.

[16] Jacobson L S, LaLonde R J, Sullivan D G. Earnings losses of displaced workers. The American economic review, 1993: 685-709.