

Research on the Impact of Green Credit Policy on the Performance of Listed New Energy Enterprises

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Abstract: As an essential constituent of environmental monitoring policies, green credit policies have received extensive attention. Prior study about the influence of green credit on corporate performance has predominantly concentrated on all enterprises, with limited investigation into its effects on the performance of firms within the new energy sector. This study utilizes panel data from A-share listed companies from 2008 to 2023 and applies the difference-in-differences model to analyze the 2012 implementation of the "Green Credit Guidelines" as an external event, investigating its potential adverse effects on new energy firms. Secondly, through heterogeneity analysis, the author explores the variances in the impact of green credit policies on enterprises of varying scales (using the average asset size of listed companies as the standard to distinguish big and small enterprises). After research, it has been found that the green credit policy's enforcement indeed exerts a detrimental influence on the operational performance of new energy enterprises (the coefficient of the explanatory variable in the benchmark regression stands at -0.00425). Moreover, the negative effect on the performance of large enterprises is even more obvious.

Keywords: Green credit, New energy enterprises, Difference-in-differences method

1. Introduction

The rapid economic growth of China over the past few decades has led to a series of environmental problems. According to relevant statistics, among the 339 prefecture-level cities across the country in 2022, 37.2% of them failed to meet the air quality standards; however, this figure increased to 40.1% in 2023. Therefore, the government gradually adjusted its environmental protection policies and began to focus on credit means. In 2003, the "Equator Principle" was advocated internationally, aiming to alleviate the environmental pollution problems caused by enterprises through the credit channels of banks [1]. Consequently, China's green finance program developed organically. In 2012, the CBRC issued the "Green Credit Guidelines," signifying the introduction of an official green credit policy in China [2]. This document requires that financial institutions such as banks, when deciding whether to grant credit to enterprises, take into account whether the enterprises fulfill their social responsibilities and environmental protection as important reference indicators. For enterprises with high pollution, their credit limits should be restricted and they should be required to pay high compensation interest rates. For green enterprises, preferential interest rates should be offered to increase credit support [3]. At present, the research on this policy mainly focuses on the performance and innovation capabilities of all enterprises. No researchers have probed into how green credit influences new energy enterprises' performance [1, 3]. This study sets the issuance of the "Green

Credit Guidelines" in 2012 as the time-boundary point. Through the CSMAR database, it acquires the relevant financial information of A-share listed enterprises from 2008 to 2023, processes it and generates panel data [4]. This study utilizes the Difference-in-Differences (DID) model to statistically assess the effect of the "Green Credit Guidelines" on the performance of publicly listed companies in the renewable energy industry, while also investigating the potential asymmetry of this influence. In terms of academic research, this study is a supplement to the previous research that was lacking. In practical terms, this paper not only examines whether the green credit policy has a negative effect on new energy enterprises, but also conducts a heterogeneity analysis to study whether the performance of enterprises with different scales shows asymmetry when they are impacted by external policies. This provides a reference for the environmental protection departments to formulate targeted policies for enterprises of different scales in the future.

2. Literature Review

The existing studies have largely centered around how green credit policies affect aspects such as enterprise performance and innovation capacity. Chen Zhigang and Gong Yifei employed the DID to investigate the mediating role of green innovation and investment efficiency. Since the establishment of the "Green Credit Guidelines," the performance of significantly polluting firms has exhibited a marked decline [5]. Fan et al. utilized theoretical models to demonstrate that after strengthening the supervision of green credit, enterprises without emission reduction would face higher financing costs and their economic performance would be negatively affected [6]. Wang Xin et al. found through the DID model that green credit policies, once implemented, are capable of enhancing the innovation capabilities of high-pollution and energy-intensive firms by reducing agency costs and improving investment efficiency [7]. Ding Ning et al. employed PSM-DID to explore how green credit policies influence bank cost efficiency in terms of cost - effectiveness and reputation-effect. They found that the net impact effect presented a U-shaped pattern [8]. Ma Yanyan and Yu Maomao pointed out that the green credit policy, when implemented, has exerted a notable influence in curbing enterprises' pollution discharge behaviors. By imposing financial restrictions on highly polluting enterprises, it has the ability to compel them to scale back production, thereby achieving the goal of emission reduction [9]. Prior research on the efficacy of green finance has predominantly concentrated on all firms and financial institutions. This paper examines the impact of green financing policies on the performance of new energy enterprises, drawing on existing research. The author presents the subsequent two hypotheses: Assumption 1: The efficacy of firms in the new energy industry is negatively impacted by the green credit program. Assumption 2: The green credit program has a more significant detrimental effect on the performance of large firms within the new energy sector.

3. Research Design

3.1. Data Sources and Sample Processing

This study examines Chinese A-share listed companies from 2008 until 2023. The data comes from the CSMAR database [4]. To guarantee data authenticity and integrity, the following processing is carried out on all sample data in this paper: During the sample processing, enterprises with ST or ST* status, financial listed enterprises, and enterprises with missing research variables were excluded. Furthermore, all continuous variables in the sample data were truncated by 1% at the upper and lower ends.

3.2. Variables and Model Design

(1) Description of Statistical Variables

Table 1 illustrates that the average net profit margin of total assets attained 5.17%, signifying a robust overall profitability among listed firms in China. Furthermore, the disparity between the greatest and minimum values is substantial, indicating that the profit levels of individual firms fluctuate markedly.

Table 1: Descriptive Statistics of Variables

Variable	Obs	Mean	Std.dev.	Min	Max
TobinQ	8,448	1.925863	1.301845	.63383	31.40024
ROA	8,448	0.0517026	.0466847	.000054	0.785865
Size	8,448	22.44944	1.298616	17.75689	28.51996
Msize	8,448	6.509115	2.515568	0	21
FA	8,448	0.2190601	0.1628885	0.000223	0.954179
Lev	8,448	0.4289979	0.1950351	0.00708	0.966625
Age	8,448	19.95463	7.544053	1.419178	69.04384
EPS	8,448	0.571228	0.9672305	0.000485	34.02081

(2) Variable Selection

This study used the Tobin Q value (TobinQ) and the return on assets (ROA) as metrics for the dependent variable. The interaction term created by the multiplication of the policy dummy variable and the group dummy variable functions as the primary independent variable. Total asset size (Size), scale of the executive team (Msize), proportion of fixed assets (FA), asset-liability ratio (Lev), duration of enterprise existence (Age), and earnings per share (EPS) are regarded as the control variables in this study. ROA is used to measure the efficiency of the utilization of a company's own capital. The higher the indicator, the higher the return on investment. The Tobin Q ratio estimates the proportion between a company's asset value in the stock market and the cost of creating those assets. The higher the value is, the higher the industrial investment return rate will be, which reflects the profitability of the enterprise.

This paper sets 2012, when the "Green Credit Guidelines" were promulgated, as the time demarcation. It introduces a time dummy variable and assigns the value of the time dummy variable to 0 for the period before 2012 and to 1 for the period after 2012. Individual dummy variables are introduced to categorize new energy enterprises and non-new energy enterprises, with the dummy variable for new energy enterprises assigned a value of 1 and that for non-new energy enterprises assigned a value of 0. The comprehensive definitions of the variables are provided in Table 2.

Table 2: Variable Names and Definitions Table

Type	Variable	Definition
Dependent Variable	TobinQ	The market value of the company/The replacement cost of the company's assets
	ROA	Net profit / Total assets
Independent Variable	Treat*Post	The interaction term between the policy dummy variable and the time dummy variable
Control Variable	Size	Take the natural logarithm of total assets
	Msize	The number of senior management teams in the statistical year
	FA	Fixed assets / Total assets
	Lev	Total liabilities / Total assets
	Age	Statistical year — Establishment date
	EPS	Net profit / Total number of ordinary shares at the end of the year

(3) Model Construction

In this study, the 2012 policy implementation is treated as an external event shock, and a single-point-in-time DID model for 2012 is constructed. In the regression analysis, the new energy enterprises within listed companies are designated as the treatment group that has been impacted by policies, while the other enterprises are regarded as the control group. This study utilizes the fixed-effect difference-in-differences model to examine the impact of green financing rules on the performance of new energy firms. The main regression model constructed is as follows:

$$Y_{it} = \beta_0 + \beta_1 \text{treated}_i \cdot \text{posted}_t + \gamma X_{it} + \sum \text{year} + \sum \text{industry} + \varepsilon_{it}$$

Among them, t symbolizes the year, i represents the enterprise, and ε_{it} denotes the random disturbance term. Y_{it} is an indicator used to measure the performance of listed firms. In this study, ROA is adopted to represent it, and TobinQ is used for robustness test. $\sum \text{year}$ and $\sum \text{industry}$ represent the fixed effects of years and individuals respectively.

4. Results and Analysis

4.1. Empirical Analysis on the Impact of Green Credit Policies on the Performance of Listed Enterprises

(1) Parallel trend test

On the horizontal axis, the 0 represents the year when the policy was introduced in 2012; negative values represent the years before the policy was introduced; positive values represent the years after the policy was introduced. As illustrated in Fig. 1, prior to the policy shock, the coefficient of the interaction term lacked significance. This indicates that before the policy was implemented, the treatment group and the control group did not differ significantly. The data met the assumption requirements for parallel trends.

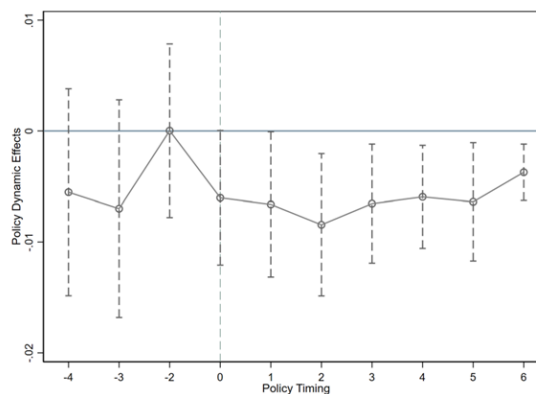


Figure 1: Parallel Trend Test Chart

(2) Main regression results and analysis

To test whether green credit exerts a negative influence on the performance of new-energy-sector enterprises, a regression analysis of the model is carried out in this paper. The regression outcomes are demonstrated in Table 3. The results in the (1) column are under the circumstances of introducing firm - level fixed effects and time - specific fixed effects. The coefficient for Treat*Post is -0.00425, with a t-value of -2.42. This shows a negative correlation that is significant at the 5% significance level. The (2) column presents the regression results after excluding the firm-specific fixed effects and the time-specific fixed effects. The coefficient of Treat*Post is -0.00746, accompanied by a t-value of -6.86, signifying a substantial negative association at the 1% significance level. This

substantiates the assertion that the green financing program negatively impacts the performance of new energy companies.

Table 3: Baseline Regression Results

	(1)	(2)		(1)	(2)
Treat*Post	-0.00425**	-0.00746***	Lev	0.00244	0.00605***
	(-2.42)	(-6.86)		(1.61)	(2.87)
Size	0.000117	0.0000199	Age	-0.00000741	0.000325***
	(0.46)	(0.06)		(-0.16)	(6.01)
Msize	-0.0000603	0.0000304	EPS	0.0487***	0.0403***
	(-0.56)	(0.19)		(44.74)	(72.38)
FA	-0.000511	0.000212	Constant	0.0222***	0.0204***
	(-0.32)	(0.09)		(4.31)	(2.89)
$\Sigma industry$	YES	NO	$\Sigma industry$	YES	NO
$\Sigma year$	YES	NO	$\Sigma year$	YES	NO
Observations	8448	8448	Observations	8448	8448
R-squared	0.757	0.387	R-squared	0.757	0.387

t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01

4.2. Robustness Test and Placebo Test

(1) Robustness Test

This paper conducts robustness tests by replacing the dependent variable. The Tobin Q value (TobinQ) is used to substitute for the dependent variable, which originally was the return on assets (ROA). The DID model was adopted to conduct regression tests by incorporating time and individual fixed effects. The regression findings in column (2) indicate that the green credit policy significantly affects the Tobin Q value (TobinQ) at the 1% significance level, with a regression coefficient of -0.186. This suggests that the green financing program continues to exert a substantial negative impact on the Tobin Q value (TobinQ) of new energy firms. The regression results displayed in Table 3 are robust.

Table 4: Results of Robustness Test

	(1)	(2)		(1)	(2)
	ROA	TobinQ		ROA	TobinQ
Treat*Post	-0.00425**	-0.186***	Lev	0.00244	0.0607
	(-2.42)	(-3.07)		(1.61)	(1.26)
Size	0.000117	-0.00509	Age	-0.00000741	0.00105
	(0.46)	(-0.61)		(-0.16)	(0.74)
Msize	-0.0000603	-0.00440	EPS	0.0487***	0.208***
	(-0.56)	(-1.27)		(44.74)	(7.59)
FA	-0.000511	-0.0328	Constant	0.0222***	1.914***
	(-0.32)	(-0.62)		(4.31)	(11.27)
$\Sigma industry$	YES	YES	$\Sigma industry$	YES	YES
$\Sigma year$	YES	YES	$\Sigma year$	YES	YES
Observations	8448	8448	Observations	8448	8448
R-squared	0.757	0.642	R-squared	0.757	0.642

t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01

(2) Placebo Test

This paper conducts placebo tests by adjusting the policy implementation time. Three placebo tests were conducted by advancing the policy implementation time (2012) to 2011, 2010, and 2009 respectively. Regression was carried out on the basis model by changing the policy time point. From Table 5, it can be seen that in 2011, 2010 and 2009, the regression coefficients in the regression results were all negative but not significant. Thus, we can infer that the regression results in Table 3 are robust. The green credit policy exerts a negative impact on the performance of new energy enterprises and is not affected by other factors.

Table 5: Results of Placebo Test

	(1)	(2)	(3)		(1)	(2)	(3)
	2011	2010	2009		2011	2010	2009
Treat*Post	-0.0036	-0.0002	-0.0007	Lev	0.0025*	0.0024*	0.0024*
	(0.0032)	(0.0035)	(0.0036)		(0.0015)	(0.0015)	(0.0015)
Size	0.0001	0.0001	0.0001	Age	-0.0000	-0.0000	-0.0000
	(0.0003)	(0.0003)	(0.0003)		(0.0000)	(0.0000)	(0.0000)
Msize	-0.0001	-0.0001	-0.0001	EPS	0.0487** *	0.0487** *	0.0487** *
	(0.0001)	(0.0001)	(0.0001)		(0.0021)	(0.0021)	(0.0021)
FA	-0.0005	-0.0005	-0.0005	Constant	0.0222** *	0.0219** *	0.0220** *
	(0.0016)	(0.0016)	(0.0016)		(0.0053)	(0.0053)	(0.0053)
$\Sigma industry$	YES	YES	YES	$\Sigma industry$	YES	YES	YES
$\Sigma year$	YES	YES	YES	$\Sigma year$	YES	YES	YES
Observations	8448	8448	8448	Observations	8448	8448	8448
R-squared	0.7566	0.7565	0.7565	R-squared	0.7566	0.7565	0.7565

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.3. Heterogeneity Analysis

The mean value of the asset size (Size) of listed companies is selected as the standard. If the total asset size of an enterprise exceeds the standard, it is defined as a big enterprise and assigned a value of 1 in the virtual grouping variable; the remaining enterprises are set to 0 in the grouping virtual variable. Table 6 presents the regression outcomes derived from the fundamental model. The results reveal that the green finance strategy does not significantly adversely affect the performance of small and medium-sized firms. Nonetheless, its effect on major firms is substantial at the 1% significance level. The statement indicates that big enterprises, due to their huge scale, require a large amount of funds for their own operations and project investments. As a result, they are more dependent on credit support from banking channels. Green credit policies, when implemented, have caused insufficient funding supply for pollution-related projects. Consequently, the financing channels have narrowed and the performance has deteriorated. Small and medium-sized enterprises, given their relatively small scale, are prone to being constrained by credit from financial institutions, resulting in narrow

financing channels. Consequently, the influence of green credit policies on the financial limitations faced by these firms is negligible.

Table 6: Results of Heterogeneity Analysis

	(1)	(2)		(1)	(2)
	Small enterprise	Big enterprise		Small enterprise	Big enterprise
Treat*Post	-0.00322	-0.00516**	Lev	0.00172	0.00325
	(-1.29)	(-2.19)		(0.83)	(1.38)
Size	0.000768	-0.000426	Age	-0.0000623	-0.00000930
	(1.28)	(-0.87)		(-1.02)	(-0.14)
Msize	-0.000234	0.0000565	EPS	0.0499***	0.0481***
	(-1.31)	(0.37)		(58.11)	(48.23)
FA	0.0000650	-0.00183	Constant	0.00873	0.0354***
	(0.03)	(-0.82)		(0.70)	(3.24)
$\Sigma industry$	YES	YES	$\Sigma industry$	YES	YES
$\Sigma year$	YES	YES	$\Sigma year$	YES	YES
Observations	4570	3796	Observations	4570	3796
R-squared	0.777	0.790	R-squared	0.777	0.790

t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01

5. Conclusion

The green credit policy has negatively impacted the performance of publicly listed new energy companies. The impact of green credit regulations on performance differs among firms of varying sizes. Specifically, green credit policies exert a remarkably negative influence on large - scale enterprises, yet have hardly any impact on small and medium - sized ones. Nevertheless, the amount of data related to new energy enterprises is not sufficiently rich. Future research can break through the traditional financial analysis framework, expand data collection channels through technological innovation, optimize data integration methods, fill the data gap, and construct a more comprehensive analysis system, thereby providing a reliable basis for policy formulation and corporate strategy.

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