

Empirical Study on the Impact of Green Credit Policy on the Volatility of Corporate Stock Price

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Abstract: From the period of reform and opening-up onward, China's economy has experienced fast growth. However, as China's economic development enters a new stage, the previous extensive economic growth model contradicts the current principles of green development. To further promote the coordinated development of economic growth and environmental protection, China has gradually adopted financial instruments to foster the green and sound development of its economy. As an essential part of the green financial system, green credit holds a key position in China's economic green transition. Scholars have conducted extensive research on the impacts of green credit policy, mainly focusing on its mechanism and economic consequences. Stock price volatility, a key indicator of capital market stability, reflects investors' valuation of firms' future prospects. A meaningful research question arises: Can green credit policy help firms mitigate stock price volatility and achieve more stable performance in the capital market? Against this backdrop, the paper selects Chinese A-share listed companies from 2008 to 2023 as the samples, and uses stock price volatility as the dependent variable. The difference-in-differences method (DID) is adopted to test the impact of green credit on stock price fluctuations. Additionally, tests were conducted separately for enterprises of different ownership types to see if there are differences in the impact of the green credit policy on different types of enterprises.

1. Introduction

The report of the 20th National Congress of the Communist Party of China clearly states that promoting the transformation of economic and social development towards green and low-carbon is of vital importance for achieving high-quality development. It emphasizes accelerating the green transformation of enterprises and pursuing the goals of carbon peaking and carbon neutrality in a proactive and steady manner. Green credit serves as the mainstay of China's green financial system. In 2007, the "Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks" was officially released, marking the launch of China's green credit policy. Subsequently, the promulgation of the Green Credit Guidelines in 2012 provided strong support for financial institutions such as banks to implement green credit policies.

As a barometer reflecting China's economic development, the stock market plays a pivotal role in

corporate investment and financing and resource allocation. Stock price volatility has long been a prominent issue in China's stock market. Excessive and persistent stock price fluctuations not only impair investors' interests but also increase systemic risks in the capital market, undermining financial stability. Therefore, in the wave of green development, whether green credit can effectively suppress stock price volatility is critical to China's goal of high-quality economic growth.

Against the background, the paper selects China's A-share listed firms' data from 2008 to 2023 to investigate the impact of green credit policy on corporate stock price volatility, which carries both theoretical and practical significance. This study aims to reveal the effect and transmission mechanism of green credit on stock price volatility, measure the effectiveness of green credit policy, provide references for firms' operational decisions under the green credit framework, and contribute to the sound and steady development of China's green economy and the high-quality growth of the capital market.

2. Literature Review

Relevant literature falls into two streams: the economic consequences of green credit policy and the determinants of stock price volatility.

2.1. Economic Consequences of Green Credit Policy

At the micro level, financial institutions such as banks exert critical financing constraints through green credit policy. By incentivizing banks to expand green credit supply, the policy channels credit funds to enterprises with strong environmental governance capabilities (Hong et al., 2023)[1]. However, in the short run, green credit may raise banks' credit risk via cost effects and risk spillover effects (Zhou et al., 2022)[2]. When banks reduce lending to energy-intensive and highly polluting industries, their short-term profitability is negatively affected. Meanwhile, green credit-supported clients often face high information asymmetry and operational risks in green projects, exposing banks to higher risks (Zhao et al., 2023)[3]. Focusing on financing structure and environmental investment, Guo and Fang[4] find that green credit effectively boosts environmental investment and reshapes the financing structure of firms in energy-intensive and highly polluting industries, curbing their interest-bearing debt financing and long-term liabilities.

At the macro level, Wang et al.[5] use a DSGE model to verify that green credit policy of appropriate intensity optimizes the economic structure from a green perspective, achieving a win-win situation for economic development and environmental protection. Meanwhile, the effectiveness of green credit policy fluctuates with economic cycles. Using panel data from 30 Chinese provinces spanning 2005 to 2018, Xiong et al.[6] document that green credit directly promotes green economic growth and indirectly drives it by advancing green technological progress and industrial transformation.

2.2. Determinants of Stock Price Volatility

Stock price volatility is the most direct reflection of changes in market and investor valuations, mirroring market assessments and future expectations of firms. It affects corporate operations, investor returns, and capital market stability and development. As a heated research topic, stock price volatility has been examined from the perspectives of market participant behavior, information asymmetry, and market structure to uncover its complex mechanisms. Broadly speaking, drivers of stock price volatility include macroeconomic conditions, firm fundamentals, technical factors, and market sentiment.

Regarding the macro environment, changes in fiscal expenditure significantly negatively affect stock market volatility, while changes in money supply exert a significant positive effect (Kang, 2014)[7]. Using an MS-VAR model, Wang and Qian[8] show that stock prices fluctuate more sharply under shocks from external events such as economic crises and financial turbulence.

At the firm level, taking listed firms in heavily polluting industries as samples, Zhao et al.[9] apply the control function method and sensitivity analysis to prove that corporate green investment greatly lowers stock price volatility, identifying the causal chain: corporate green investment—improved information environment—increased institutional ownership—lower stock price volatility. Liu and Zhang[10] argue that in industries with severe pollution, when enterprises disclose environmental information, it can provide the market with more information about the company's own operating conditions, reducing the information asymmetry between the company and external investors, thereby reducing the risk of a sudden sharp drop in stock prices.

3. Mechanism Analysis and Hypothesis Proposal

3.1. Green Credit Policy and Corporate Stock Price Volatility

Amid strong advocacy for green development, corporate green transformation is essential for long-term high-quality growth. This study argues that green credit policy significantly suppresses corporate stock price volatility.

From the perspective of resource allocation, green credit policy offers preferential credit terms for green projects, redirects financial resources to corporate green initiatives, accelerates green transformation, stimulates technological innovation, and upgrades business models. These efforts enhance firms' market competitiveness and brand image, attract investors—especially those prioritizing sustainable development and environmental protection—and send positive signals to the market. Such brand effects and market recognition stabilize the operating environment and reduce stock price volatility, exerting a positive impact on stock prices.

From the financing constraint perspective, government incentives such as tax breaks and fiscal subsidies improve firms' financing conditions and reduce costs. Support from social capital provides additional funding and strengthens market recognition of firms' green strategies, further optimizing the capital structure of firms in green credit-restricted industries, boosting investor confidence, underpinning long-term development, and mitigating stock price volatility.

Therefore, based on the above theoretical analysis, we put forward the following hypothesis:

Hypothesis 1: Green credit policy has a significantly negative effect on the stock price volatility of polluting firms.

3.2. Heterogeneity in the Effect of Green Credit Policy

By property rights, Chinese enterprises can be divided into two categories: one is state-owned enterprises (SOEs), and the other is non-state-owned enterprises (non-SOEs). Non-SOEs are controlled by legal persons, while SOEs are controlled by the government, which intervenes in their operational decisions.

SOEs hold a pivotal position due to their large scale and volume. They play a key role in the national economy and bear extra responsibilities in environmental protection and corporate social responsibility. Owing to inherent political connections, SOEs enjoy preferential access to government resources such as pollution treatment subsidies and tax incentives, but also undertake stricter environmental and social obligations. In contrast, non-SOEs focus more on financial performance and pay less attention to environmental issues.

Ning et al.[11] point out that green credit policy imposes a more pronounced disciplinary effect on SOEs, especially state-owned heavily polluting firms. The policy optimizes resource allocation and incentivizes greener business strategies. Before the policy, non-SOEs faced tighter bank credit constraints than SOEs. However, green credit sends a clear market signal: it favors non-SOEs committed to green development.

Supported by green credit, non-SOE green firms gain easier access to credit, ease financing constraints, and effectively reduce stock price volatility. This effect is more pronounced for non-SOEs, which can flexibly adjust strategies to meet market demand for green development.

Based on the above analysis, this paper proposes the following hypothesis:

Hypothesis 2: The mitigating effect of green credit policy on stock price volatility exhibits property-right heterogeneity, with a stronger effect for non-SOEs.

4. Research Methodology

4.1. Sample Determination and Data Processing

The study uses A-share listed firms from 2008 to 2023 as the initial sample. To improve empirical accuracy, we process the data as follows: exclude financial and insurance firms, ST and *ST firms, observations with missing data, and firms with leverage below 0 or above 1. Winsorize all continuous variables at the 1st and 99th percentiles to eliminate outliers. The final sample includes 24,150 firm-year observations.

Following the Key Evaluation Indicators for Green Credit Implementation, this study classifies industries rated Class A and B as green credit-restricted industries, covering industry codes: B06, B07, B08, B09, B11, C17, C19, C22, C25, C26, C27, C30, C31, C32, D44, D45, E48.

4.2. Definition and Explanation of Indicators

4.2.1. Dependent Variable

The dependent variable in this paper is stock price volatility (VOL). Following the research of Xin Qingquan et al. (2014), stock price volatility (VOL) is calculated as the average of the variance of monthly stock returns for each listed firm from May of year t to April of the following year, and then taking the logarithm.

4.2.2. Independent Variable

The independent variables are the grouping dummy variable (treat), the dummy variable for the implementation of the policy(time), and the interaction term (treat*time). Firms in green credit-restricted industries have treat = 1, while firms in unrestricted industries have treat = 0. time is a dummy variable for the period before and after the implementation of the “Guidelines.” Based on the official release of the “Guidelines” on February 4, 2012, and their immediate implementation, if the sample firm is in 2012 or later, time = 1; otherwise, time = 0.

4.2.3. Control Variable

Considering other factors that may potentially affect corporate stock price volatility, this paper draws on existing literature and selects firm size (Size), book-to-market ratio (BM), return on assets (ROA), leverage ratio (Lev), and institutional investor shareholding ratio (Inst) as control variables.

Table 1. Variable Definitions

Type	Name	Symbol	Definition
Dependent Variable	Stock Price Volatility	VOL	Log of the average monthly stock return variance from May of year to April of the next year
Independent Variable	DID variable	Treat*time	Interaction term of grouping dummy and policy dummy
Control Variables	Firm Size	Size	Ln (total annual assets of the firm)
	Book-to-Market Ratio	BM	Book value / total market value
	Leverage Ratio	Lev	Total liabilities / total assets
	Return on Assets	ROA	Net profit / average total assets
	Institutional Investor Holding Ratio	Inst	Number of institutional shares / total shares

4.3. Model Specification

To measure the impact of green credit policy on corporate stock price volatility, this paper adopts a DID model and constructs the following baseline regression equation:

$$VOL_{it} = \alpha_0 + \alpha_1 \text{treat} \times \text{time} + \gamma X_{it} + \theta_i + \delta_t + \varepsilon_{it} \quad (1)$$

where i denotes firm and t denotes year. VOL_{it} is the dependent variable, representing firm stock price volatility. $\text{treat} \times \text{time}$ is the core independent variable, and α_1 is the DID coefficient, representing the effect of green credit policy on firm stock price volatility. X_{it} represents control variables, θ_i represents firm fixed effects, δ_t represents year fixed effects, and ε_{it} represents the model's error term.

5. Empirical Results and Analysis

5.1. Descriptive Statistics

The descriptive statistics of each variable are shown in Table 2. From the table, we can see that a total of 24,150 observations are obtained. The average stock price volatility of firms is -0.039, with a minimum of -1.7824 and a maximum of 4.3874, and a standard deviation of 0.641, indicating large differences in stock price volatility among firms. Among the control variables, the minimum ROA is -0.270 and the maximum is 0.227; meanwhile, the standard deviation of the Size variable is 1.485, indicating differences in firm size, which may lead to differences in competitiveness. The minimum institutional investor holding ratio is 1.806%, the maximum is 91.47%, and the standard deviation is 20.42, significantly greater than 1, indicating considerable differences in ownership structure across firms. The statistical values of the other control variables are within a reasonable range, with standard deviations less than 1, indicating that the overall fluctuations of the control variables are small and consistent with the reality of listed companies.

Table 2. Descriptive Statistics

Variable	Observations	Mean	Std	Min	Max
VOL	24,150	-0.039	0.641	-1.7824	4.3874
ROA	24,150	0.0302	0.0691	-0.270	0.227
Lev	24,150	0.504	0.212	0.0704	1.033
BM	24,150	0.656	0.273	0.0932	1.231
Inst	24,150	50.62	20.42	1.806	91.47
Size	24,150	22.50	1.485	19.25	26.60

5.2. Descriptive Statistics

Correlation analysis is shown in Table 3. The table shows a negative correlation between the interaction term and corporate stock price volatility, preliminarily suggesting that the green credit policy restrains fluctuations in corporate stock prices. Meanwhile, the correlation coefficients among all variables are within normal ranges, suggesting that the variables do not suffer from severe multicollinearity.

Table 3. Correlation Analysis

	Treat*time	VOL	ROA	Lev	Inst	Size	BM
Treat*time	1						
VOL	-0.083***	1					
ROA	0.017***	-0.111***	1				
Lev	-0.027***	0.024***	-0.385***	1			
Inst	0.087***	-0.338***	-0.108***	0.292***	1		
Size	0.061***	-0.113***	0.202***	0.094***	0.199***	1	
BM	0.142***	-0.318***	0.092***	0.312***	0.634***	0.432***	1

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

5.3. Empirical Analysis

5.3.1. Parallel Trends Test

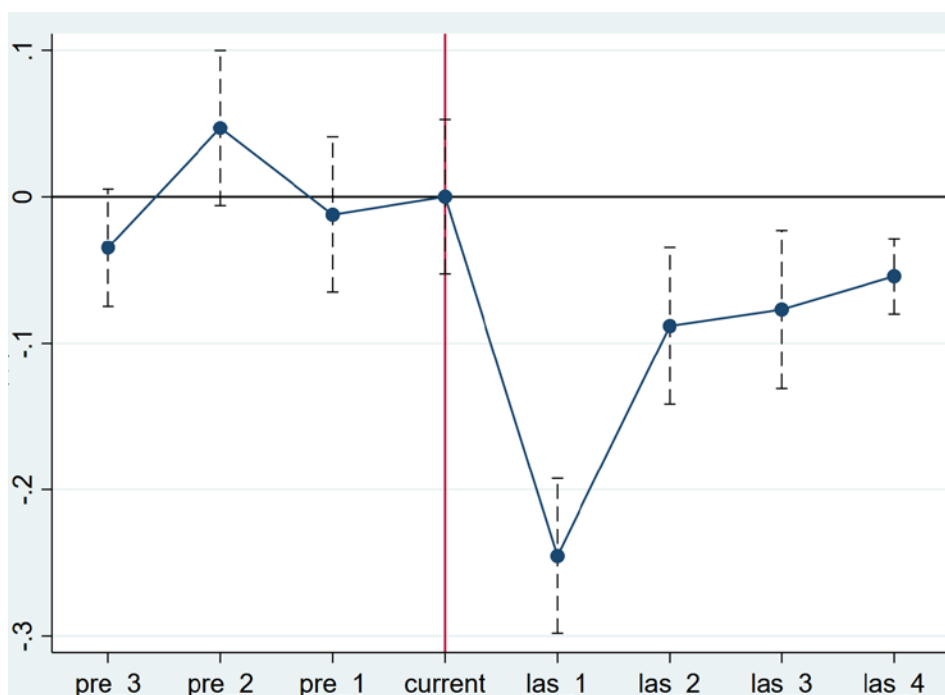


Figure 1. Parallel Trends Test

When using the Difference-in-Differences (DID) method, there is a prerequisite: before the external policy or event shock occurs, the trend changes of the experimental group and the control group should be consistent. That is to say - the assumption of "parallel trend" must be met. Therefore, to verify whether the model in this paper satisfies the above condition, we take 2012 as the policy shock year and divide the sample into pre-policy and post-policy periods to conduct a

parallel trend test. According to the method of Jacobson et al. [12], the results are shown in Figure 1. The results indicate that before the implementation of the green credit policy in 2012, the coefficient of the DID variable was not obvious, but after the policy implementation, the coefficient became significant. This suggests that the data generally pass the parallel trends test, further confirming that using the DID method to analyze the impact of green credit policy on stock price volatility is reasonable and effective.

5.3.2. Baseline Regression Results

This paper establishes a dual difference model based on Equation (1). First, a regression is conducted without including other control variables, only controlling for the fixed effects of time and individual; then, control variables are added, but the fixed effects of time and individual are still controlled. The results of the benchmark regression are presented in Table 4. The first column of Table 4 is the result of controlling only for the fixed effects of time and individual. In this column, the coefficient of DID is a significantly negative number, preliminarily indicating that the green credit policy can indeed significantly reduce the stock price fluctuations of polluting enterprises. The R-square of this model is 0.320.

The second column of Table 4 presents the baseline regression results after including the control variables. The results show that after adding the control variables, the coefficient of the interaction term is -0.0592, which remains significantly negative at the 1% level. This indicates that the implementation of the green credit policy does indeed significantly reduce the stock price fluctuations of polluting enterprises. In other words, the green credit policy has a clear inhibitory effect on the stock price fluctuations of polluting enterprises, which verifies the previous hypothesis 1. At the same time, after adding the control variables, the R-square of the model increased to 0.378. From the perspective of the fitting effect, adding the control variables makes this conclusion more robust and reliable.

From the perspective of controlling variables, the coefficient of ROA is -0.351, the coefficient of BM is -0.923, the coefficient of Inst is 0.00226, and the coefficient of Lev is 0.241. All these four coefficients are significant at the 1% level. In general, after the implementation of the green credit policy, the stock price volatility of polluting enterprises will be significantly reduced. At the same time, the higher the book-to-market ratio of the enterprise, the higher the return on assets, the lower the leverage ratio, and the lower the proportion of institutional investors' holdings, the smaller the stock price volatility of this enterprise will be.

Table 4. Baseline Regression

Variable	(1)	(2)
	VOL	VOL
treattime	-0.0790***	-0.0592***
	(0.0152)	(0.0146)
ROA		-0.351***
		(0.0590)
Lev		0.241***
		(0.0267)
BM		-0.923***
		(0.0240)
Inst		0.00226***
		(0.000323)
Size		0.00987
		(0.00695)
Constant	0.521***	0.798***
	(0.0127)	(0.133)
Observations	24,150	24,150
Number of code	1,545	1,545
R-squared	0.320	0.378

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

5.3.3. Heterogeneity Analysis

Based on the nature of firm ownership, firms are divided into SOEs and non-SOEs. The SOE group is coded as 1, and the non-SOE group as 0. A sub-sample regression is performed on the full sample to determine whether there are significant differences in the impact of the green credit policy on stock price fluctuations for state-owned enterprises and non-state-owned enterprises. The regression results are shown in Table 5. The table shows that the interaction term coefficients for both the SOE and non-SOE groups are significantly negative after grouping, but compared to SOEs, the marginal effect of green credit policy in reducing stock price volatility is larger for non-SOEs. To further verify whether the interaction term coefficients between the two groups are significantly different, this paper uses the Fisher's permutation test to test the significance of the coefficient differences of the core independent variable across groups. The P-value for the coefficient difference significance obtained through 1,000 bootstrap samples is 0.002, indicating a significant difference in the coefficients between the SOE and non-SOE groups. Thus, Hypothesis H2 is supported.

As analyzed in the hypothesis section, SOEs have a higher responsiveness to national environmental regulations and policies compared to non-SOEs, and the punitive effect of green credit policy is stronger for SOEs. Therefore, the volatility-reducing effect of green credit policy on SOEs is weakened, with a smaller marginal effect. However, there is no doubt that regardless of ownership nature, corporate green investment behavior can stabilize stock prices. Especially for non-SOEs, whose stock price volatility is more severe, they should more actively implement green credit policies to fully leverage their positive effect in reducing stock price volatility and promote stable stock price performance.

Table 5 Heterogeneity Analysis Based on Firm Ownership

Variable	SOEs	Non-SOEs
	GreenTI	GreenTI
Treat*time	-0.0229*	-0.0901***
	(0.0137)	(0.0163)
Observations	13,757	10,393
Number of code	1,024	786

*Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.*

6. Research Conclusions and Policy Recommendations

6.1. Research Conclusions

In order to study the impact of green credit policies on the stock price fluctuations of listed companies, this paper selects A-share companies from 2008 to 2023 as the research objects. The introduction of the green credit policy in 2012 is taken as a key time point, and it ensures that the model meets the prerequisite of "parallel trends". Through the construction of a difference-in-differences model, the impact of the green credit policy on stock price fluctuations is empirically analyzed. In addition, a heterogeneity analysis from the perspective of enterprise ownership is also conducted. Based on the above empirical analysis, the paper reaches the following conclusions:

1. In the empirical results of DID method, the coefficient of the interaction term is a significantly negative number, indicating that the green credit policy can significantly reduce the stock price fluctuations of polluting enterprises. Green credit policy guides financial resources toward green enterprises and projects by providing preferential credit conditions, promoting the green transformation and technological innovation of polluting firms. This not only serves as a specific means for firms to fulfill their environmental responsibilities but also has gradually become an effective tool to stabilize investor confidence, reduce stock price volatility, and thereby promote the stable operation of the stock market to a certain extent.

2. The influence of green credit policy on the volatility of corporate stock price exhibits heterogeneity in terms of ownership nature. The volatility-reducing effect of green credit policy is larger for non-SOEs. The ability to secure credit resources varies significantly between SOEs and non-SOEs, mainly stemming from the ownership characteristics of SOEs, which subject them to more stringent market and regulatory scrutiny regarding environmental protection and social responsibility performance. The implementation of green credit policy further strengthens the regulatory standards for SOEs, especially state-owned heavy polluters, requiring them to pay more attention to environmental and social responsibility performance in the financing process.

6.2. Policy Recommendations

The green credit policy is an important policy tool in China's economic transition towards sustainability. It has established a bridge between economic development and environmental protection, enabling the financial industry to closely integrate with modern green development. In order to ensure that the green credit policy can better exert its incentive effect in the future, based on the research findings presented in this article, the following suggestions are proposed:

1. Improve the green credit system, fully consider the differences in policy effects, and promote differentiated management.

There is still a certain gap between the current development level of green credit and actual demand. Therefore, unified norms for identifying green industries and projects should be formulated at the policy level by finance, environmental protection, and financial regulatory authorities, providing clear guidance for banks and other financial institutions in extending green credit. At the same time, the current green finance system is dominated by green credit, while the effectiveness of other financial instruments is relatively weak. Relevant authorities should actively leverage the power of other green financial instruments such as green bonds and green insurance to build a multi-dimensional, multi-business, multi-sector green finance system. Second, it is necessary to pay attention to the differences in policy effectiveness. For those enterprises whose policy effects are not obvious, appropriate support should be provided. Banks and other financial institutions should pay attention to the issue of firm heterogeneity, avoid a “one-size-fits-all” crude policy, reasonably formulate credit standards for such enterprises, increase support, and reduce credit discrimination.

2. Enterprises should strengthen green investment to achieve a positive interaction between green credit and capital market performance.

Driven by green credit policies, corporate environmental performance has become a key criterion for financial institutions to assess their green credentials and provide green loans. To enhance corporate value and stock price stability, enterprises must actively assume responsibility for environmental governance in their business activities, proactively participate in environmental protection, green innovation, and technology R&D, thereby establishing a good reputation for environmental governance. In daily operations, they should transform the original extensive model into a refined green operation model, thereby improving production efficiency and product competitiveness.

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