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The Impact of Green Credit Policy on the Corporate Value of High-Polluting Enterprises

Jun Li[1,*]

[1]*SILC Department, Shanghai University, China*

Abstract: China's 1980s strategic focus on economic development initiated comprehensive reforms, propelling rapid industrialization and modernization. Concurrently, this growth, alongside accelerated urbanization and industrial advancements, has exacerbated environmental challenges, severely impacting urban areas and public health. To reconcile economic progress with environmental stewardship and mitigate associated risks, the China Banking Regulatory Commission introduced the Green Credit Guidelines in 2012. These guidelines aimed to foster green credit within banking institutions, support the transformation of traditional industries, and facilitate sustainable economic restructuring. This paper analyzes the impact of the Green Credit Guidelines' implementation on the valuation of high-polluting enterprises following the policy's 2012 release. The analysis encompasses theoretical underpinnings, a review of existing literature, and rigorous empirical testing. For the empirical component, the study employs a dataset of nearly 30,000 observations from Chinese A-share listed companies. Categorizing firms based on industry heterogeneity, a difference-in-differences model with firm fixed effects is utilized for the empirical investigation. Robustness checks and parallel trend tests are conducted to ensure the reliability and validity of the results. The regression results indicate a statistically significant positive effect of the green credit policy on the value of high-polluting firms. This suggests that the issuance of the Guidelines has played a constructive role in promoting the transformation and upgrading of enterprises in China, thereby supporting the nation's sustainable economic development objectives.

Keywords: green credit policy, high-polluting enterprises, difference-in-differences (DiD) model

1. Introduction

Since the 1980s, when China initiated the strategy of "prioritizing economic development," the country has undertaken comprehensive economic reforms and embarked on a path of rapid industrialization and modernization. However, alongside rapid economic growth, accelerated urbanization, and rising levels of industrialization, environmental issues have become increasingly prominent. Such pollution has not only severely deteriorated the urban landscape but has also posed considerable threats to public health.

In response to this escalating environmental crisis, the Chinese government and financial regulators began to explore policy instruments that leverage economic mechanisms to promote environmental protection. Among these, green finance emerged as a critical tool.

China's banking regulator introduced the Green Credit Guidelines in 2012 as a measure to address environmental and social risks alongside economic development priorities. The directives encourage banking institutions to foster green credit, aiming to support the transformation of established industries and contribute to a more optimized economic structure. Since the 18th National Congress of the Communist Party of China, the central leadership, with Xi Jinping at its core, has articulated the strategic significance of ecological civilization, emphasizing the integration of environmental considerations into all areas of economic, political, cultural, and social development.

To further implement the dual-carbon goals of "carbon peaking and carbon neutrality," a series of national policy meetings was convened in 2024. The Key Points of Energy Work for 2024, released at the National Energy Work Conference, reiterated the importance of adjusting the energy structure, promoting the development and utilization of renewable energy, and reducing dependence on fossil fuels. Particular emphasis was placed on accelerating the development of clean energy sources such as wind and solar power.

With strong policy support, China's green credit sector has expanded rapidly, showing continuous year-on-year growth. As of year-end 2023, the total outstanding green credit balance in China, encompassing both domestic and foreign currencies, stood at 28.58 trillion RMB. This figure marked a 36.8% increase compared to the previous year, outpacing the growth rate of all loans by 26.6 percentage points (from the People's Bank of China). This reflects China's significant progress in promoting green finance and sustainable development and also indicates that the green credit market still holds substantial growth potential. As the earliest, most rapidly developing, and most mature policy-driven product in China's green finance landscape, green credit plays a vital role in guiding the allocation of capital, optimizing industrial structures, and promoting economic transformation. Therefore, examining the impact of green credit policies on the value of high-polluting enterprises—especially traditional industries—is of considerable academic and practical importance. Such research offers valuable insights into how green credit can support industrial upgrading and enhance corporate value.

***Corresponding author:** Jun Li, SILC Department, Shanghai University, China. Email: li_jun@shu.edu.cn

Despite these policy efforts, the actual firm-level impact is not yet fully understood. This effect is driven by the distinct mechanisms of green credit, which differ from traditional finance.

Green credit is a distinct financial instrument compared to conventional credit. Through incentive and constraint mechanisms, it channels financial resources toward environmentally friendly sectors and exerts a profound influence on firms' operational decisions and innovation strategies. It also strengthens green technological innovation by injecting financial momentum. However, green credit in China is still in a developmental phase and faces numerous challenges requiring further investigation.

The mechanisms by which green credit influences economic activities are not yet fully understood, and their impacts vary across industries. Furthermore, the impact of green credit policies on high-polluting enterprises is dual-faceted. On the one hand, such policies increase the difficulty for these firms to obtain financing. Given that bank loans remain the primary channel for external financing in China, this could adversely affect corporate value. On the other hand, more stringent lending requirements may exert pressure on high-polluting enterprises to accelerate transformation and upgrading. To meet green credit standards, firms must increase environmental investments and improve production technologies and processes. While these firms may face financing challenges in the short term, over the long term, innovation and green development could enhance their competitiveness, reduce environmental risks, and foster sustainable growth.

This paper aims to empirically assess whether the implementation of China's Green Credit Guidelines in 2012 has had a significant impact on the market valuation (Tobin's Q) of high-polluting enterprises.

Specifically, it tests two hypotheses:

H1: The implementation of the green credit policy leads to an increase in the firm value of high-polluting enterprises.

H2: The implementation of the green credit policy leads to a decrease in the firm value of high-polluting enterprises at first and increase then.

Thus, studying the implementation effects of green credit policies can enrich theoretical analyses in green finance and broaden the scope of related research. Research in this field not only aligns with China's national development strategies but also holds significant academic relevance and theoretical value, offering a more comprehensive framework to support the development of green credit and guide broader economic and industrial transformation. This study intends to offer meaningful insights for enterprises striving toward green transformation and sustainable development.

2. Literature Review

The concept of "green credit" gained prominence following the work of Thompson and Cowton [1], who argued that banks should extend their focus beyond internal financial stability to encompass the societal and environmental consequences of their lending decisions, thereby promoting support for environmentally conscious enterprises. This foundational perspective, outlined in their study on integrating environmental factors into bank lending [1], laid the groundwork for subsequent research. Subsequent literature, particularly after 2017, often situated green credit within the broader framework of green finance policy and its practical implementation. Research during this period frequently emphasized green credit's role as a key instrument for directing capital toward specific environmental objectives, such as responding to climate change and improving resource efficiency, often analyzing its status and development within national or global green finance initiatives [2, 3]. The concept of "green credit" has evolved significantly in recent years, gaining scholarly attention as a pivotal component of green finance. Early notions emphasized its environmental alignment, but recent studies from 2020 onward have expanded its scope and empirical analysis. Xu [4] highlights green credit as a financial innovation and underscores its global relevance by comparing international practices, suggesting the importance of diversified credit products and policy frameworks for effective implementation. Lei et al. [5] explored the spatial effects of green credit in China, demonstrating that green credit not only enhances the local green economy but also exerts positive spillover effects on surrounding regions, thereby supporting broader sustainable development goals. More recently, Bao [6] examined the impact of green credit on enterprise development, showing that it reduces financing costs and improves both environmental and financial performance, especially in high-polluting industries.

In the context of China, the understanding and implementation of green credit are strongly influenced by national policy frameworks, notably the Green Credit Guidelines issued by the China Banking Regulatory Commission in 2012. These guidelines formally direct financial institutions to manage environmental and social risks and support sustainable development. Scholarly work further elucidates this policy-driven approach. Initial evidence suggests that the policy significantly improved energy efficiency across sectors and regions. A study using data up to 2020 confirmed that green credit has a positive effect on regional energy efficiency and exhibits spatial spillover effects, especially through green innovation mechanisms [7].

In recent years, green credit has emerged as a critical instrument in China's transition toward sustainable development, attracting widespread scholarly attention. As a policy-led financial innovation, green credit not only directs funds toward environmentally friendly industries but also reshapes enterprise behavior, regional development, and macroeconomic structures. Research consistently shows that green credit significantly contributes to reducing carbon emissions by enhancing technological innovation and alleviating financial mismatches, especially in regions with lower coal consumption [8].

One major area of focus has been the impact of green credit on corporate Environmental, Social and Governance (ESG) performance. Empirical studies demonstrate that green credit policies incentivize environmentally responsible behavior, particularly among heavily polluting enterprises [9, 10]. In addition, green credit has been shown to improve investment efficiency in polluting firms, suggesting it acts as a disciplining mechanism that promotes more rational and efficient resource allocation [11].

Beyond the firm level, green credit also yields positive macroeconomic outcomes. Several studies affirm that it contributes to high-quality economic development by facilitating industrial upgrading and diffusing green technologies across sectors [12]. Their findings align with those of other scholars using different econometric techniques—such as Xiong et al. [13] with a super-efficiency Slacks-Based Measure model and Global-Malmquist-Luenberger Productivity index, as well as Xie and Liu [14] who employed a dynamic panel Gaussian Mixture Module approach—each reinforcing the role of green credit in advancing green economic growth.

At the societal level, green credit is also associated with broader public benefits. A quasi-natural experimental study revealed that it improves public health outcomes by elevating environmental quality and strengthening public services, with particularly strong effects in western and resource-based cities [15]. Meanwhile, its influence on financial markets is multifaceted:

while it reduces financing access for heavily polluting firms, it also increases their financing costs, particularly in state-owned enterprises [7].

Importantly, even earlier research had already confirmed the effectiveness of green credit in promoting energy efficiency. For instance, Ma et al. [16] demonstrated that green credit significantly enhances regional energy-efficient utilization, though they also highlighted regional disparities in policy effectiveness.

Nevertheless, these studies have not been able to precisely quantify the level of green economic growth; they primarily depict general development trends. Given that green finance in China is still in its early stages, precise quantification remains difficult. Therefore, this study selects the capital market and GDP as control variables to provide a rough depiction of economic trends. The capital market is often regarded as a "barometer" of the economy, while GDP remains the most direct indicator of macroeconomic performance. Thus, this study seeks to offer a novel perspective for analyzing economic trends influenced by green credit.

On the microeconomic level, the impact of green credit is mainly observed at the firm level, particularly concerning its effects on high-polluting enterprises (often termed "two high and one surplus" firms in China). Recent studies published in academic journals delve into these effects. For instance, when studying high-polluting listed companies in China, Li et al. [17] found that the green credit policy weakened the external financing capacity of enterprises and increased their financial pressure. As a result, some enterprises resorted to illegal pollutant discharge behaviors, indicating that the regulatory cost of policies imposed a considerable burden on such enterprises. Other research highlights potential asymmetries and time-varying effects; Xu and Li [18] found that while green credit development could be broadly beneficial, the stringent policy aspect significantly impacted the performance of high-polluting firms, particularly negatively in the short run. Hao and Yan [19], using the least squares dummy variable method, discovered that green credit policies reduced the financial performance of high-polluting and high-energy-consuming firms, though this negative impact tends to diminish over time. While their conclusion contrasts with some previous findings, the difference is likely due to the varying timeframes of analysis. The overall trend remains consistent: the short-term negative impact of green credit policies on firm value weakens over time and may eventually become positive.

In summary, the dual impact of green credit on high-polluting firms—as previously mentioned—does exist. In the short term, green credit policies may suppress firm value in high-polluting industries; however, in the long term, they may drive transformation and upgrading, ultimately enhancing firm value.

Taken together, the existing body of research shows that a growing number of scholars have contributed to the study of green credit. There is a broad consensus that green credit plays a significant role in macroeconomic development and can promote economic growth both directly and indirectly at both the macro and micro levels. On the micro level, green credit can improve firms' financial performance and enhance their value over time. In the context of domestic research, studies often focus more on the effects of policy shocks—examining how green credit policies introduced at specific time points influence firms or the broader economy and evaluating their effectiveness and outcomes. This paper also adopts such an approach to assess the direct effects brought about by green credit policy implementation.

2.1. Theoretical mechanism

2.1.1. Sustainable development theory

The most influential articulation of sustainable development stems from the landmark 1987 UN report "Our Common Future" (often called the Brundtland Report). In the report, the standard definition characterizes sustainable development as that which "meets the needs of the present without compromising the ability of future generations to meet their own needs." This widely accepted concept is understood to rest upon three foundational components: economic progress, social well-being, and ecological protection. It emphasizes that economic growth must be long-term and stable, rather than focused solely on short-term gains at the expense of resource depletion and ecological degradation. Social justice is another core element, highlighting the importance of equitable resource distribution, poverty alleviation, and the promotion of education and public health. Environmental stewardship is equally critical, advocating for reduced environmental destruction, energy conservation, pollution control, and biodiversity protection.

From the perspective of China's economic system, the government has played a pivotal, and at times decisive, role in the development of green finance. By formulating relevant policies and institutional frameworks, the government effectively supervises and guides corporate production and operational behaviors. Through a combination of policy incentives and semi-mandatory mechanisms, enterprises are encouraged to pursue transformation and upgrade strategies, actively fulfill their social responsibilities, and contribute to the nation's sustainable economic development.

2.1.2. Green reputation theory

Green reputation theory is built upon the foundations of environmental management, sustainable development, and corporate reputation theory, incorporating insights from research on green marketing and the long-term performance impact of environmental behavior. The term typically refers to a company's public image in the domains of environmental protection and sustainable development, reflecting its commitment and actions in environmental responsibility.

This theory posits that a firm's green reputation not only affects consumer purchasing decisions but also enhances investor trust, strengthens employee loyalty, and promotes positive interactions with governments and social organizations.

As society evolves, public concern about corporations extends beyond financial performance and product quality to include their environmental and social responsibility. In the context of increasing environmental awareness, both consumers and investors are paying more attention to the environmental reputation of firms, making it a vital indicator of comprehensive corporate competitiveness. Empirical studies, such as Chen et al. [20], using data from Chinese listed manufacturing firms, show that strong ESG practices—closely linked to green reputation—significantly enhance firm performance, particularly through green technological innovation and moderated by corporate reputation itself. Similarly, Xu and Zheng [21] provide evidence that ESG performance significantly improves corporate value, with corporate reputation acting as a key mediating mechanism in this relationship.

2.1.3. Signaling theory

Signaling theory, first proposed by Spence in 1973, originally focused on applications in education and the labor market. The central premise is that job applicants signal their capability to employers through educational attainment, which employers use to infer applicant quality in the face of informational asymmetry.

In the context of green finance, signaling theory can be extended to two dimensions:

From the perspective of government policy, the implementation of green credit policies sends a strong signal of national support for environmentally friendly enterprises, while simultaneously indicating expectations for high-polluting industries to

undergo transformation. Banks respond accordingly by favoring green enterprises in their lending strategies and imposing stricter credit conditions on high-polluting firms.

From the corporate perspective, in response to tighter credit conditions, high-polluting firms must convey credible "green" signals to financial institutions and the government to obtain loans at lower costs and gain competitive advantages.

In summary, external investors are more likely to perceive firms that actively align with national policy directives as being more capable and more likely to receive state support. This positive perception enhances the market valuation of environmentally friendly firms over time.

Since the issuance of the Green Credit Guidelines in 2012, various sectors of society have actively responded to the national call, resulting in a series of impacts on heavily polluting enterprises. These impacts include stricter lending standards imposed by banks and increasing investor concerns regarding the future prospects of such firms. As a result, these enterprises are under growing pressure to seek new paths for adapting to evolving societal and regulatory expectations.

Specifically, when a firm proactively discloses its environmental information and maintains emissions below regulatory thresholds, it becomes eligible for financing with lower interest rates, longer loan terms, and larger credit amounts. In contrast, when a firm's pollution levels exceed policy thresholds, it faces significantly higher financing costs and stricter borrowing requirements. However, for traditional high-polluting enterprises, transformation and upgrading require time and resources. This implies that to access financing under the same conditions as before, they must now bear higher borrowing costs, which in turn increases their overall operational expenses and reduces firm value. Furthermore, certain high-polluting business segments that are likely to exceed emission limits may even need to suspend operations temporarily, causing additional pressure on the firm.

This mechanism first leads to the phasing out of weaker, resource-constrained polluting enterprises. Subsequently, it exerts pressure on the remaining firms to adjust their business models, pursue cleaner production processes, and engage in green transformation. Over time, such adjustments can enhance the firm's green reputation, attract environmentally conscious investors, and ultimately contribute to an increase in firm value.

Finally, the sample used in this study consists solely of stable, publicly listed firms—excluding long-term unprofitable or structurally weak companies.

3. Research Methodology

3.1. Research design

This research analyzes the influence of China's 2012 Green Credit Guidelines on the corporate value of high-polluting enterprises through the application of a difference-in-differences (DID) design.

The DID approach is chosen based on the natural experiment conditions created by the policy implementation, drawing on methodological precedents established in the existing literature reviewed earlier.

In line with prior studies on similar topics, this paper adopts the DID framework and incorporates well-established variables for model specification to ensure robust empirical analysis.

Firm fixed effects are included to control for all time-invariant unobserved firm characteristics that could affect corporate value, such as corporate culture, managerial quality, or stable geographical advantages. This helps to mitigate omitted variable bias and isolate the causal effect of the policy.

The key assumption for the validity of the DiD model is the parallel trend assumption. This assumption requires that, in the absence of policy intervention, the average firm value (the outcome variable) for both the high-polluting (treatment) and other (control) firms would have followed the same trend over time. This assumption is formally tested and verified in Section 5.3 of the paper.

3.2. Participants

The selected dataset consists of Chinese A-share listed companies from 2009 to 2023, excluding financial firms, ST and ST* companies, companies with data inception dates after 2010, and recently listed companies, resulting in approximately 30,000 firm-year observations. The data for this study are collected from the China Stock Market & Accounting Research (CSMAR) database, the Wind database, and the RESSET database, among others.

Based on the Guidelines on Industry Classification of Listed Companies (2012) from the China Securities Regulatory Commission, the Administrative Catalogue of Industry Classification for Environmental Verification of Listed Companies (Huan Ban Han [2008] No. 373) issued by the Ministry of Environmental Protection in 2008, and the Guidelines on Environmental Information Disclosure for Listed Companies (Huan Ban Han [2010] No. 78), 16 heavily polluting industries are identified. These industries mainly include coal, mining, textiles, leather, papermaking, petrochemicals, pharmaceuticals, chemicals, metallurgy, and thermal power. The industry codes are B06, B07, B08, B09, C17, C19, C22, C25, C26, C27, C28, C30, C31, C32, C33, and D44.

3.2.1. Instruments

1) Dependent variable: firm value (Tobin's Q)

The study uses Tobin's Q as a dependent variable to measure firm value. Most existing research adopts Tobin's Q as a standard metric for evaluating firm value, as it compares a firm's market value with its asset replacement cost, thus effectively mitigating the distortions caused by short-term accounting fluctuations. For instance, Zhang [22] applied Tobin's Q to assess valuation in China's A-share market, arguing it helps reflect the shift in pricing power and reduces valuation bias associated with non-tradable shares. More recently, Chen et al. [20] confirmed that Tobin's Q remains a widely accepted and robust indicator in modern firm performance studies, particularly in relation to ESG and innovation-driven corporate competitiveness.

2) Independent variable: treat*time

The key explanatory variable is the interaction term of two dummy variables, representing whether a firm is affected by the green credit policy. Specifically, "Treat" is a grouping dummy variable indicating whether a firm belongs to the treatment group (i.e., high-polluting enterprises, coded as 1) or the control group (coded as 0). "Time" is a time dummy variable. The year 2012, when the Green Credit Guidelines were issued, is used as the policy shock point. Accordingly, the period from 2009 to 2012 is coded as 0 (pre-shock), while the period from 2012 to 2023 is coded as 1 (post-shock).

Control variables: The study incorporates various control variables to account for firm-level and macroeconomic factors, including growth potential (Growth), firm size (Size), profitability (ROA, return on assets), leverage (Lev, measured as asset-liability ratio), macroeconomic conditions (GDP), and the year-end closing price of the company's shares on the main board market (P).

Table 1
Interpretation of the mean scale for belief, concern, and practice

Variable type	Name	Symbol	Calculation method
Dependent Variable	Firm Value	TobinQ	Market value of the firm / Total assets
Independent Variable	DiD variable	Treat*Time	Treat means group dummy variable, 1 for treatment group firms, 0 for control group; Time means year dummy variable, 1 for years 2012 onward, 0 for pre-2012
Control Variable	Firm size	Size	Natural logarithm of total assets
	Firm profitability	ROA	Net profit / Total assets
	Firm leverage ratio	LEV	Total liabilities / Total assets
	Firm growth potential	Growth	(Current year operating revenue - Prior year operating revenue) / Prior year operating revenue
	Macroeconomic conditions	LnGDP	Natural logarithm of regional GDP
	The year-end closing price of the company's shares on the main board market	LnP	Natural logarithm of stock market index

Detailed definitions and descriptions of these variables are provided in Table 1.

3.2.2. Model specification

This study investigates the consequences of the 2012 policy intervention for the outcome variable of interest. Informed by a review of relevant research and theoretical frameworks, we selected a single-period DID methodology for the empirical assessment. The model used is specified below:

$$TonbinQ_{i,t} = \beta_0 + \beta_1 Treat_i \times Time_t + \gamma Controls + \delta_i + \varepsilon_{it} \quad (1)$$

Where:

$TonbinQ_{i,t}$ is the dependent variable, representing the corporate value of firm i in year t. $Treat_i \times Time_t$ is the explanatory variable, representing the interaction term between the dummy variable for high-polluting industries and the time dummy variable. *Controls* denotes the set of control variables. δ_i represents firm fixed effects.

Since the model includes macroeconomic control variables, adding time fixed effects would introduce multicollinearity. Therefore, following the references, time fixed effects are not included.

3.2.3. Dataset collection and preparation

The dataset comprises A-share listed companies in China, with exclusions applied to financial sector firms, ST and ST* companies, enterprises with data inception dates after 2010, and recently listed companies, yielding approximately 30,000 observations. Table 2 presents the descriptive statistics of these observations.

To mitigate multicollinearity concerns, we conducted a correlation analysis among the variables. Table 3 displays the correlation coefficients, with the highest value being 0.494 between Lev and Tobin's Q, indicating no significant multicollinearity among independent variables. For additional verification, we performed Variance Inflation Factor (VIF) tests, with results shown in Table 4.

As evidenced in Table 4, all variables demonstrate VIF values clustered around 1, substantially below the threshold of 10, thereby confirming the absence of multicollinearity issues.

4. Results and Discussion

As shown in Table 5, the core explanatory variable, did (the interaction term), exerts a significantly positive impact on firm value, thereby validating Hypothesis 1: the implementation of the green credit policy significantly enhances the value of listed high-polluting enterprises.

Among the control variables, only Growth (enterprise growth potential) fails to show a significant relationship with firm value. This may be attributed to the fact that, in the capital market, investors tend not to assess a firm's stock value based on its revenue growth rate. Instead, they prefer relative financial indicators, such as return on assets (ROA) and leverage ratio (Lev), to evaluate firm performance. According to the regression results, both profitability and leverage exhibit significantly positive effects on firm value.

In addition, the stock index also shows a highly significant and positive effect on firm value. Since Tobin's Q is essentially a ratio, the influence of macroeconomic factors such as GDP and firm size (SIZE) is more likely reflected in the denominator—that is, the total

Table 2
Descriptive statistical analysis

VarName	Obs	Mean	SD	Min	Max
TobinQ	29378	2.688	87.279	0.611	14810.306
did	29915	0.244	0.429	0.000	1.000
SIZE	29913	22.070	1.470	10.842	28.644
ROA	29912	0.808	135.936	–51.947	23509.769
Lev	29912	0.529	1.855	–0.195	178.345
Growth	29717	0.400	10.390	–1.046	1497.156
LnGDP	29915	12.857	0.788	11.504	14.039
LnP	29866	8.391	0.768	6.571	9.781

Table 3
Variable correlation coefficient results

	TobinQ	did	SIZE	ROA	Lev	Growth	LnGDP	
TobinQ	1							
did	–0.00300	1						
SIZE	–0.059***	0.240***	1					
ROA	–0.352***	–0.00300	–0.044***	1				
Lev	0.494***	–0.00200	–0.074***	0.441***	1			
Growth	0.00400	0.00200	–0.00300	–0.00100	0.00100	1		
LnGDP	0.00300	–0.430***	–0.455***	0.00400	0.00900	0.00900	1	0

Note: t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4
VIF test

Variable	VIF	1/VIF
LnGDP	1.64	0.608209
SIZE	1.28	0.783219
did	1.23	0.813627
LnP	1.16	0.86526
Lev	1.13	0.882333
ROA	1.13	0.882821
Growth	1	0.999789
Mean VIF	1.22	

Table 5
Baseline regression results table

VARIABLES	TobinQ
did	0.4479***
	(6.977)
SIZE	–1.3926***
	(–49.401)
ROA	1.1348***
	(46.655)
Lev	0.8001***
	(56.000)
Growth	–0.0000
	(–0.003)
LnGDP	–0.8809***
	(–22.803)
LnP	1.2312***
	(24.942)
Constant	33.2770***
	(29.294)
Observations	29,158
R-squared	0.386
ID	YES

Note: t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

asset value. When the growth rate of a firm's assets outpaces the growth in its market valuation, this leads to a decline in Tobin's Q.

5. Robustness Tests

5.1. Baseline regression results verification

This study defines Tobin's Q as "Market Value of the Firm / Total Assets." Alternative definitions include:

1) (A-share Closing Price × Outstanding A-shares + B-share Closing Price × Outstanding B-shares)/Total Assets
2) [(Total Shares Outstanding – Outstanding B-shares) × A-share Closing Price + Outstanding B-shares × B-share Closing Price]/(Total Assets - Net Intangible Assets - Net Goodwill)

To test robustness, we replace the dependent variable with these alternative Tobin's Q measures. Results are presented below.

Table 6
Table of robustness tests for baseline regression results

VARIABLES	(1) TobinQ	(2) TobinQ1	(3) TobinQ2
did	0.4479***	0.4856***	0.4181***
	(6.977)	(6.623)	(5.373)
SIZE	–1.3926***	–1.4645***	–1.6719***
	(–49.401)	(–45.755)	(–49.217)
ROA	1.1348***	–0.0058***	–0.0098***
	(46.655)	(–33.368)	(–52.911)
Lev	0.8001***	0.6385***	1.1986***
	(56.000)	(41.665)	(73.690)
Growth	–0.0000	0.0004	0.0020
	(–0.003)	(0.217)	(0.968)
LnGDP	–0.8809***	–0.9991***	–0.6739***
	(–22.803)	(–22.589)	(–14.356)
LnP	1.2312***	1.2631***	1.4811***
	(24.942)	(22.441)	(24.794)
Constant	33.2770***	36.3487***	34.8717***
	(29.294)	(28.032)	(25.339)
Id	YES	YES	YES
Observations	29,158	29,667	29,667
R-squared	0.386	0.327	0.399

Note: t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 displays the results obtained when using an alternative measure for the dependent variable. It reveals that the estimated

Table 7
Table of placebo test results

	Coefficient	Std. err.	z	P>|z|	[95% conf.interval]	
did						
F1.	0.392046	0.435525	0.9	0.368	–0.46157	1.245659
F2.	0.450048	0.465532	0.97	0.334	–0.46238	1.362474
F3.	0.758389	0.511264	1.48	0.138	–0.24367	1.760447

impact on the dependent variable maintains statistical significance, and the direction of the relationship remains unchanged. This outcome lends additional support to the inference that green credit positively influences the value of high-polluting enterprises, thereby enhancing the reliability of the main regression analysis.

5.2. Placebo test: time-based validation

To perform a time-based placebo test, a set of fictitious time variables is constructed by artificially shifting the policy implementation time three periods earlier. This test aims to verify whether the core explanatory variable remains significant when the policy is assumed to be implemented prior to its actual introduction.

As shown in Table 7, the placebo tests labeled F1, F2, and F3 represent the policy being hypothetically introduced one, two, and three years earlier, respectively. The corresponding P>|Z| values are 0.368, 0.334, and 0.138—all above the 10% significance threshold. This indicates that if the Green Credit Guidelines were implemented three years earlier, the did variable would not show a statistically significant effect on firm value.

Moreover, Figure 1 visually illustrates the results of the placebo tests. It clearly shows that the confidence intervals of the estimated effects all contain zero when the policy is assumed to have been implemented in 2009, 2010, or 2011. This suggests that the policy's impact is not significant in these placebo periods, thus validating the robustness of the main findings through the time-based placebo test.

5.3. Parallel trend test

In conducting a DID analysis, the parallel trend assumption is one of the fundamental premises, serving as the basis for establishing causal inference. To visually assess the robustness of the model, this paper employs a parallel trend graph.

Following the methodology proposed by Beck et al. [23], the average of the pre-treatment coefficients (pre_i) is calculated to account for any potential pre-policy trends. All regression coefficients and their confidence intervals are then demeaned for graphical representation. The resulting figure is shown below.

Figure 1
In-time placebo test

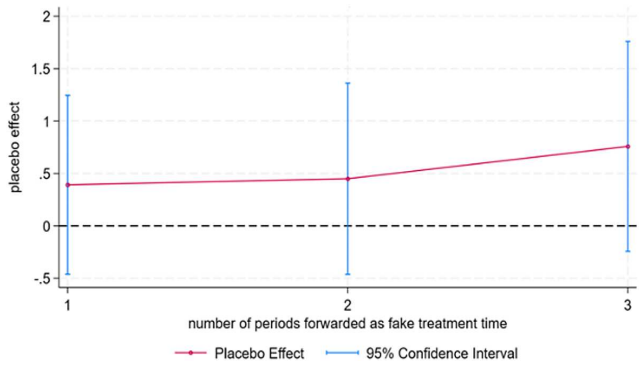
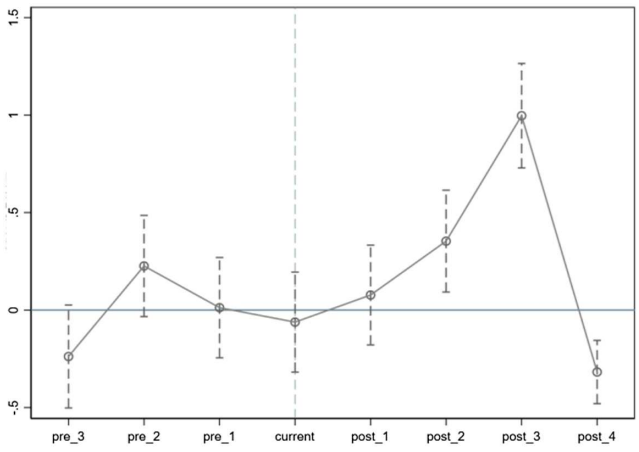


Figure 2
Parallel trend test



From the parallel trend graph excluding the base period (the first pre-treatment period), it is evident that prior to the policy implementation, the confidence intervals intersect the X-axis. This implies that, before the policy change took effect, the evolution of firm value followed comparable paths for both high-polluting enterprises and other firms, thus satisfying the parallel trend assumption.

In the three periods following the policy implementation, the dynamic treatment effect exhibits an upward trend. Beginning from the second post-policy period, the confidence intervals lie distinctly above the X-axis, signifying a significant and persistent policy effect.

It is noteworthy that in the fourth post-policy period, although the confidence interval does not include zero, there is a substantial decline in the estimated treatment effect. According to related data, China experienced a major stock market crash in 2015, which led to a sharp decline in stock prices for most companies and a significant drop in the market index. Considering the regression results discussed earlier—where the market index is positively correlated with firm value—this market event largely explains the sudden drop in post_4.

Taken together, the visual evidence from the graph used for the parallel trend test points to a positive impact from the green credit policy on high-polluting firm value, consistent with the results of our primary regression analysis.

6. Conclusions and Recommendations

This research synthesizes existing theoretical knowledge and empirical work related to green credit policy and its connection to corporate value. Drawing upon principles of sustainable

development, signaling theory, and the concept of green reputation, we propose that implementing green credit measures enhances the worth of high-polluting companies. The study then uses a DID framework to quantitatively assess the valuation impact stemming from green credit policy interventions on these specific enterprises. The key findings from this analysis are as follows:

The introduction of the green credit policy significantly increases corporate value, indicating that the policy plays a positive role in promoting corporate development and facilitating economic transformation in China. Furthermore, among the control variables, corporate profitability, leverage, and the stock index of the market in which the firm is listed all have a significantly positive impact on corporate value. Investors tend to evaluate stock value based on relative indicators—such as return on assets (ROA) and leverage (Lev)—rather than revenue growth. On the other hand, macroeconomic conditions (GDP) and firm size (SIZE) negatively affect Tobin's Q, as these variables influence the denominator of the ratio more strongly, leading to a decline in perceived corporate value.

The primary finding of this study—that the green credit policy significantly enhances the value of high-polluting enterprises—aligns with a substantial portion of existing research and theoretical postulations. This result supports the long-term view of the policy's impact, as theorized through the lenses of sustainable development and green reputation. Empirically, the finding is consistent with recent studies such as Bao [6], who demonstrated that green credit improves the financial performance of firms in high-polluting industries, and Ling et al. [11], who found it enhances investment efficiency.

However, this result stands in contrast to other scholarly findings. For instance, Li et al. [17] provided evidence that green credit policies tended to negatively impact the firm value of heavily polluting companies in China. Similarly, Hao and Yan [19] discovered that the policy initially reduced the financial performance of these firms. This divergence highlights the dual-faceted nature of green credit, which imposes both short-term constraints and long-term incentives.

The discrepancy in findings can likely be attributed to differences in analytical timeframes. The studies reporting negative effects may have focused on the immediate aftermath of the 2012 policy implementation, thereby capturing the initial shock of heightened financing constraints and increased operational costs before firms had sufficient time to adapt. In contrast, this study utilizes a longer panel dataset extending to 2023, which allows for the observation of the policy's evolving impact. The parallel trend test in Figure 2 visually supports this interpretation, showing that the positive policy effect strengthens in the second and third years post-implementation. This suggests that while the initial pressures may be detrimental, they are eventually outweighed by the long-term benefits of transformation, such as enhanced competitiveness, reduced environmental risk, and improved green reputation, ultimately leading to an increase in firm value as captured in our analysis.

In addition, the paper has found a "counter-intuitive" finding and a "dynamic imbalance." Both larger firm size (SIZE) and positive macroeconomic conditions (LnGDP) are significantly and negatively associated with firm value (Tobin's Q). This paper argues that this result does not signify poor performance but instead reveals a dynamic imbalance inherent in the Tobin's Q ratio. Specifically, the findings suggest that asset expansion, whether driven by firm growth or a strong economy, can outpace the corresponding growth in market capitalization. This insight presents a novel perspective, cautioning against a simplistic interpretation of size and GDP in valuation studies and highlighting the imbalanced relationship between a firm's asset base and its market perception.

In light of the conclusions reached, the following recommendations are put forward:

From the government perspective: Under China's economic system, the government plays a crucial role in regulating economic activity and guiding enterprise development. Thus, the government should first act as a policymaker, further improving the green credit framework and the overall green financial system. Although green credit policies are shown to enhance firm value, the principle of moderation should be emphasized during policy implementation. High-polluting enterprises are often from traditional industries that have significantly contributed to economic growth and are closely tied to societal well-being. Their transformation requires time and cannot be achieved through a one-size-fits-all approach. Therefore, the government should focus on playing a guiding rather than coercive role. More detailed and quantifiable assessment indicators should be formulated to facilitate evaluation and regulation.

From the enterprise perspective: High-polluting enterprises urgently need to enhance their environmental awareness and responsibility. Otherwise, they risk elimination or increased operating costs. The green credit policy sends a clear signal from the government, which not only imposes financing constraints through banks but also affects these firms' public image and future prospects in the eyes of investors—potentially reducing investment and lowering firm value. As financing becomes more difficult following the implementation of the green credit policy, government guidance can pressure high-polluting firms to develop green technologies and take on greater social responsibility. In the short term, companies may send "green signals" by acquiring environmentally friendly equipment. However, in the long term, firms must invest in green technology and innovation to achieve sustainable transformation and long-term development.

Eventually, it is important to acknowledge several limitations that frame the interpretation of this study's findings.

First, the study's empirical analysis relies exclusively on data from Chinese A-share listed companies. This focus means the findings may not be generalizable to small and medium-sized enterprises, non-listed companies, or companies operating in different countries with other regulatory and financial systems.

Second, while the model includes controls, this extended timeframe increases the risk that other major economic events or policy changes could confound the results. The paper acknowledges the 2015 stock market crash as an external shock that significantly impacted the results for one period of the parallel trend test.

Finally, green finance is still in its early stages in China, making precise quantification of its broader economic impact difficult. The use of general macroeconomic indicators like GDP is described as a "rough depiction" of economic trends rather than a precise measure of green growth.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by the author.

Conflicts of Interest

The author declares that he has no conflicts of interest to this work.

Data Availability Statement

Data are available from the corresponding author upon reasonable request.

Author Contribution Statement

Jun Li: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition.

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