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The Dynamic Impact of Corporate Environmental Responsibility on Corporate Value

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Abstract. This paper investigates the effect of corporate environmental responsibility (CER) on firm value, employing data from Chinese A-share listed firms over the period from 2009 to 2022. The findings reveal a significant U-shaped nonlinear relationship between CER and firm value, with results robust across a series of robustness tests. Mediation analysis indicate that CER enhances firm value by alleviating financing constraints and reducing firm costs, while the mediation effect of human capital is not significant. Furthermore, the effect is more pronounced for firms in eastern and central China, non-state-owned enterprises, and those in non-high-pollution industries.

Keywords: Corporate environmental responsibility, corporate value, dynamic impact

1. Introduction

Corporate environmental responsibility (CER), refers to the obligation of firms to maintain the integrity of environmental systems during resource development and utilization, constitutes a critical component of corporate social responsibility (CSR). Despite extensive academic inquiry, the impact of CER on firm value remains contentious, with divergent conclusions across the literature. From a benefit perspective, CER is argued to foster innovation, enhance resource acquisition, and bolster corporate reputation, thereby increasing firm value [1]. Conversely, from a cost perspective, fulfilling environmental responsibilities imposes substantial financial burdens on firms, which may hinder value creation [2]. Some studies further contend that engaging in environmental and social responsibilities often comes at the expense of shareholder interests [3]. However, the impact of CER on firm value may not be strictly positive or negative, suggesting a potential non-linear relationship [4]. Moreover, empirical research exploring the internal mechanisms through which CER affects firm value remain limited. Therefore, this research investigates the dynamic impact of CER on firm value from a long-term perspective.

2. Literature review and hypothesis

Based on the cost perspective, high environmental performance may correlate with reduced accounting-based profitability, suggesting that for some firms, the economic advantages of environmental non-compliance surpass the financial burden of penalties [5]. Some scholars believe

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that enterprises often face multiple pressures such as corporate financialization and operating costs when fulfilling their environmental responsibilities [6]. These costs may erode corporate profits and reduce corporate market performance in the short term.

Based on the benefit perspective, according to sustainable development theory and resource-based theory, good ESG performance is regarded as a strategic resource to enhance the core competitiveness of enterprises, which helps to improve the long-term profitability and market performance of enterprises [7]. Enterprises with excellent environmental responsibility performance can build reputation capital, enhance customer loyalty, attract long-term investors, and gain competitive advantages through green innovation in the long run, thereby enhancing corporate value [1, 8].

Combining the dynamic trade-off logic of cost view and benefit view, this paper believes that there is no simple linear relationship between CER and corporate value. In the early stage of corporate responsibility fulfillment, CER fulfillment may bring resource occupation and cost burden, and the company faces short-term profit squeeze; however, with the in-depth fulfillment of environmental responsibility, the company will form advantages in cost savings and reputation accumulation, which will eventually be transformed into value enhancement. Based on this, hypothesis 1 is proposed.

H1: CER exhibits a U-shaped relationship with firm value in the long term.

Excellent environmental performance helps to enhance the company's sustainable image and governance transparency, alleviate the external capital market's concerns about the company's potential risks, reduce financing costs and financing constraints, and indirectly promote corporate value enhancement [9]. Based on this, hypothesis 2 is proposed.

H2: CER improves corporate value by weakening financing constraints.

In the process of fulfilling CER, firms may optimize production efficiency through process improvements, green procurement, and energy-saving practices, leading to a more efficient cost structure [10]. Consequently, cost optimization serves as a critical mediating mechanism through which CER influences firm value. Thus, hypothesis 3 is proposed.

H3: CER influences firm value by affecting firm costs.

A robust workforce enhances organizational knowledge capital and innovation capacity, contributing to long-term value creation. Based on this, hypothesis 4 is proposed.

H4: CER enhances firm value by strengthening human capital.

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3. Research design

3.1. Variable definitions

Table 1. Variables

Type	Variable Name	Symbol	Variable Definition
Dependent Variable	Long-term Firm Value	Tobinq	Tobin's Q = Market Value A / Total Assets
	Short-term Firm Value	EPS	EPS = Net Profit / Paid-in Capital
Explanatory Variable	CER	Eval	E-score from ESG Rating
	CSR	Esg_score	Huazheng ESG Rating
Mechanism Variable	Financing Constraints	Fc	FC Index
	Firm Costs	Cost	Total Costs / Total Revenue
	Human Capital	Staff	Total Number of Employees
Control Variable	Firm Size	Size	Natural Logarithm of Total Assets
	Leverage Ratio	Lev	Total Liabilities / Total Assets
	Cash Flow Ratio	Cashflow	Net Cash Flow / Total Assets
	Fixed Assets Ratio	Fixed	Fixed Assets / Total Assets
	CEO Duality	Dual	Chairman and CEO are the Same Person
	Board Size	Board	Number of Board Members
	Marketing Expense Ratio	Market	Marketing Expenses / Operating Revenue

3.2. Data source

The sample consists of Chinese A-share listed companies from 2009 to 2022, excluding firms with abnormal trading status (ST, *ST) and those in the financial industry, resulting in 35,650 firm-year observations. ESG ratings and scores are sourced from the Huazheng Index, while other data are obtained from the CSMAR database.

3.3. Model

An industry-year two-way fixed effect model is constructed:

$$TobinQ_{it} = \beta_0 + \beta_1 Eval_{it} + \beta_2 Eval_{it}^2 + \sum \beta_j Control_{jit} + \mu_{ind} + \delta_t + \varepsilon_{it} \quad (1)$$

4. Results

4.1. Benchmark regression

Table 2 presents the basic regression results. Across all specifications - whether controlling for industry and year fixed effects or including control variables - the estimated coefficient on CER (eval) is consistently negative and significant at the 1% level, while the estimated coefficient on its squared term (eval2) is consistently positive and significant at the 1% level. These findings indicate

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a U-shaped relationship between CER and long-term firm value, suggesting that firm value initially declines as CER increases but rises after a certain threshold. Thus, Hypothesis 1 is supported.

Table 2. Basic regression

	(1)	(2)	(3)	(4)
	Tobin'Q	Tobin'Q	Tobin'Q	Tobin'Q
eval	-0.0268***	-0.0926***	-0.0614***	-0.0632***
	(0.001)	(0.016)	(0.020)	(0.010)
eval2		0.0005***	0.0004**	0.0004***
		(0.000)	(0.000)	(0.000)
_cons	3.6679***	5.6662***	8.5594***	8.4433***
	(0.089)	(0.467)	(0.756)	(0.405)
Control	No	No	YES	YES
Year FE	Yes	Yes	No	Yes
Industry FE	Yes	Yes	No	Yes
Cluster	Industry	Industry	Industry	Industry
AdR^2	0.155	0.157	0.163	0.258
N	35650	35650	35636	35636

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2. Robustness checks

This study conducts a series of robustness checks using four alternative approaches. The results are reported in Table 3.

First, Alternative Explanatory Variables. Specifically, the environmental rating (E-score) and a composite ESG score at a broader level are used as alternative measures of CER. As shown in columns (1) - (2), the coefficient of CER remains significantly negative, while the squared term remains significantly positive, confirming the non-linear relationship. Second, Alternative Dependent Variables. Columns (3) - (4) present the estimation results using alternative measures of Tobin's Q and using earnings per share (EPS), which remain statistically significant and consistent with the main findings. Third, Lagged Explanatory Variables. To address potential endogeneity arising from reverse causality, the explanatory variables (eval and $eval^2$) are lagged by one period. As shown in column (5), the results remain robust. Fourth, High-Dimensional Fixed Effects. To account for unobserved firm-specific factors that may influence the results, firm fixed effects are incorporated in addition to the baseline industry and year fixed effects. The estimation results, reported in column (6), remain consistent in both direction and significance with the baseline findings.

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Table 3. Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
	Change X		Change Y		Lag CER	Firm FE
	E_score	Esg_score	Tobinq_b	EPS	L1.eval	Tobinq
eval	-0.1234***	-0.3594***	-0.0724***	-0.4889**	-0.0465***	-0.0119**
	(0.030)	(0.041)	(0.014)	(0.232)	(0.012)	(0.005)
eval2	0.0139***	0.0405***	0.0005***	0.0041**	0.0003***	0.0001*
	(0.004)	(0.005)	(0.000)	(0.002)	(0.000)	(0.000)
_cons	6.4607***	7.1137***	9.4432***	22.6062*	7.9130***	9.7716***
	(0.247)	(0.227)	(0.444)	(11.229)	(0.484)	(0.320)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
AdR^2	0.255	0.258	0.254	-0.001	0.282	0.613
N	35636	35636	35636	36171	30902	35196

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.3. Mechanism tests

This paper considers three mechanisms of action: financing constraints, enterprise costs, and human capital, and uses the Baron & Kenny three-step method to test the mediation effects. The results are shown in Table 4. The FC index (fc) is used as a proxy for financing constraints. The results in columns (1) - (2) indicate that CER exhibits a significant inverted U-shaped effect on financing constraints, and financing constraints have a significant negative impact on firm value. These findings suggest that CER indirectly enhances firm value by reducing financing constraints, with a partial mediation effect. The operating cost ratio (cost) serves as a proxy for firm costs. The estimation results, reported in columns (3) and (4), show that CER has an inverted U-shaped effect on firm costs, and firm costs significantly negatively affect firm value, indicating a partial mediation effect. Thus, CER contributes to firm value by reducing firm costs. The total number of employees (staff) is used as a proxy for human capital. The results in columns (5) and (6) reveal that the mediating effect of human capital on the relationship between CER and firm value is not significant.

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Table 4. Mediation effect

	(1)	(2)	(3)	(4)	(5)	(6)
	fc	tobinq	cost	tobinq	lnstaff	tobinq
eval	0.0092***	-0.0347***	0.1045***	-0.0619***	-0.0175	-0.0630***
	(0.002)	(0.010)	(0.022)	(0.010)	(0.011)	(0.010)
eval2	-0.0001***	0.0002**	-0.0007***	0.0004***	0.0002*	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
fc		-2.3536***				
		(0.311)				
cost				-0.0120*		
				(0.011)		
lnstaff						0.0101
						(0.017)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
AdR^2	0.774	0.329	0.997	0.259	0.643	0.258
N	34623	34623	36171	35636	36171	35636

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.4. Heterogeneity analysis

The positive U-shaped effect of CER on firm value may vary across different types of firms. This study conducts subgroup analyses based on firm location, ownership type, and industry characteristics. The results are reported in Table 5. First, firms are grouped by geographic regions: Eastern, Central, Western, and Northeastern China. As shown in columns (1) - (4), the U-shaped relationship between CER and firm value is more pronounced and statistically significant in eastern and central regions, while the results for firms in western and northeastern regions are not statistically significant. Second, firms are divided into state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs). The estimation results, shown in columns (5) and (6), reveal that the positive U-shaped effect of CER on firm value is more pronounced for non-SOEs. Third, following the classification of 16 heavily polluting industries issued by the Ministry of Ecology and Environment (MEE) of China, firms are divided into polluting and non-polluting. The regression results in columns (7) - (8) show that the U-shaped effect of CER is significant only among non-polluting firms, while the relationship is weaker and not statistically significant among firms in heavily polluting sectors.

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Table 5. Heterogeneity analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Eastern	Central	Western	Northeast	SOE	Non-SOE	Polluting	Non-Polluting
eval	-0.0765***	-0.0810**	0.0230	0.0403	-0.0232	-0.0823***	-0.0863	-0.0582***
	(0.009)	(0.036)	(0.026)	(0.045)	(0.021)	(0.011)	(0.030)	(0.014)
eval2	0.0005***	0.0005*	-0.0002	-0.0004	0.0002	0.0006***	0.0006	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
_cons	8.3698***	10.4805***	6.9498***	5.5877***	6.8448***	9.3684***	9.6200**	8.0967***
	(0.499)	(1.233)	(1.095)	(1.663)	(0.685)	(0.614)	(1.299)	(0.793)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AdR^2	0.254	0.307	0.283	0.328	0.339	0.225	0.253	0.264
N	24241	5114	4769	1507	13176	22459	10542	25094

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5. Conclusion and discussion

Corporate environmental responsibility (CER) serves as an effective strategy for achieving sustainable development for both firms and society. Drawing on Chinese A-share firm data from 2009 to 2022, this study confirms a long-term positive U-shaped relationship between CER and firm value. The findings suggest that, despite short-term pressures from increased costs and financing constraints that may reduce firm performance, firms can achieve sustained value enhancement in the long run by proactively fulfilling environmental responsibilities. Further analysis reveals that the positive effect of CER on firm value is more pronounced among firms located in eastern and central regions, private enterprises, and enterprises in non-high-pollution industries.

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