

The Impact of ESG Practices on Corporate Performance: An Empirical Analysis

Wujian Zhang^{1,2,3}, Jinyuan Guo³, Jiahui Zhou³, Jinpeng Fang¹, Miao Tian¹, Yazhu Wang^{3,*}

¹Hunan Research Academy of Environmental Science, Changsha 410004, China

²Shannan Municipal Bureau of Ecology and Environment, Shannan 856100, China

³Research Center for Environment and Health, Zhongnan University of Economics and Law, Wuhan 430073, China

*Corresponding author (WANG Yazhu)

Abstract: The impact of ESG performance on corporate financial outcomes was examined using panel data from A-share listed companies in China spanning 2014-2024, with 2020 excluded due to exceptional circumstances. A mediation model was employed to explore the underlying mechanisms. The results indicated that strong ESG performance positively affected financial performance, with financing constraints and agency costs acting as partial mediators. Additionally, the effect of ESG performance was found to be more pronounced among low-pollution firms and small- and medium-sized enterprises. These findings provided important insights for strengthening ESG integration and advancing corporate sustainability.

Keywords: ESG performance; Corporate performance; Financing constraints; Agency costs; Heterogeneity.

1. Introduction

China's economy is transitioning from high-speed growth to high-quality development, with green and sustainable pathways playing a central role in this paradigm shift. ESG, introduced by the United Nations Global Compact in 2004, serves as a framework for evaluating corporate sustainability across environmental, social, and governance dimensions. Companies increasingly integrate ESG factors into strategic decision-making, placing greater emphasis on long-term social value rather than short-term shareholder gains. As ESG principles continue to evolve, stakeholders, including investors and consumers, place increasing emphasis on ESG disclosures, which reduce information asymmetry and promote sustainability-oriented performance evaluation.

A growing body of research suggests that strong Environmental, Social, and Governance (ESG) performance is positively associated with corporate financial outcomes. ESG practices are associated with enhanced profitability¹, reduced financing costs², and lower corporate risk³. Furthermore, superior ESG performance enhances brand image and social reputation, thereby improving competitiveness and firm value⁴. Empirical evidence from various contexts, including German listed firms⁵ and cross-national samples⁶⁻⁷, indicates that ESG performance not only correlates positively with financial outcomes but also mitigates internal conflicts, consistent with stakeholder theory.

In contrast, some studies suggest that ESG performance may negatively affect corporate financial outcomes. Some scholars argue that ESG commitments impose additional costs, thereby suppressing financial performance⁸. Consistent with this view, Sassen et al. (2016)⁹ show that European firms with higher ESG performance exhibit lower corporate value. Garcia et al. (2017)¹⁰ further show that, among 365 BRICS-listed firms in sensitive industries, higher ESG performance is associated with lower profitability. Additionally, Garcia and Orsato (2020)¹¹ argue that institutional deficiencies in emerging markets may lead firms to prioritize capital accumulation over ESG investments, thereby resulting in a negative relationship between ESG and financial

performance. Some studies suggest that ESG performance does not have a significant effect on corporate value. Atan et al. (2018)¹² find no significant relationship between ESG performance and either profitability or firm value. However, Liu et al. (2024)¹³ show that improved ESG performance can alleviate financing constraints by reducing agency costs, with this effect being most pronounced in growth-stage enterprises.

The relationship between ESG performance and corporate outcomes remains complex and context-dependent, varying across industries and institutional contexts. Balancing economic objectives with social responsibilities remains a key challenge, underscoring the need for further research to clarify the mechanisms through which ESG performance affects corporate financial outcomes.

This study examines the impact of ESG performance on corporate outcomes using a sample of A-share listed companies from 2014 to 2024 and conducts a comparative analysis across firm characteristics. It makes the following contributions: (1) It incorporates financing constraints and agency costs as mediating variables to examine the mechanisms through which ESG performance affects corporate outcomes. (2) It provides policy-relevant implications for improving ESG practices and promoting sustainable corporate development. (3) It explores heterogeneity across firm characteristics, such as firm size and pollution intensity.

2. Relevant Theory and Hypothesis Formulation

Data on the concentrations of As, Cd, Pb, and Hg in vegetables, published between 2017 and 2021, were collected from the CNKI and Web of Science (WoS) databases. The analysis focused primarily on vegetables, including Chinese cabbage, rapeseed, cauliflower, broccoli, celery, parsley, spinach, lettuce, and water spinach. The literature was selected and screened according to the following criteria: (1) studies published between 2017 and 2021 that clearly identified vegetable types; (2) exclusion of pot experiments, studies conducted in mining or industrially contaminated

areas, and those with unclear sampling locations; (3) reporting at least the arithmetic mean of heavy metal (HM) concentrations; and (4) measurement or extrapolation of wet-weight concentrations of As, Cd, Pb, and Hg in vegetables. A total of 119 studies were included in the final dataset.

In the contemporary business environment, ESG performance plays an increasingly critical role. Existing research suggests that strong ESG performance not only enhances corporate image but also contributes to improved financial outcomes.

H1: Strong ESG performance is positively correlated with financial performance.

Effective ESG practices enhance brand image, strengthen customer loyalty, and improve revenue performance. High ESG ratings signal strong risk management capabilities, thereby attracting investment and reducing capital costs. Moreover, ESG performance mitigates operational risks and facilitates long-term growth.

H2: ESG performance alleviates financing constraints.

High ESG ratings enhance corporate credibility and transparency, thereby strengthening trust with investors and financial institutions. This, in turn, reduces financing constraints, lowers both debt and equity costs, and facilitates more efficient capital acquisition, ultimately improving corporate performance.

H3: ESG performance reduces agency costs.

Superior ESG performance helps align the interests of shareholders and management, reduces information asymmetry, and lowers agency costs. It also enhances employee loyalty, reduces turnover, and promotes long-term decision-making. In addition, ESG practices strengthen external monitoring, which further constrains managerial opportunism, ultimately improving corporate performance.

3. Research Design

3.1. Sample Selection and Data Source

Panel data from A-share listed companies over the period 2014–2024 were used, with 2020 excluded due to exceptional circumstances related to the COVID-19 pandemic. To ensure data reliability, several screening procedures were implemented: (1) observations from 2020 were excluded due to pandemic-related disruptions; (2) financial and insurance

firms were removed; (3) ST and *ST companies were excluded; (4) observations with missing data were deleted; and (5) continuous variables were winsorized at the 1st and 99th percentiles. The final sample comprised 32462 observations, with data obtained from the Huazheng Index, Guotai An Database, and Wind Database.

3.2. Variable definitions

3.2.1. Explained variable

Corporate performance was used as the dependent variable and was measured using Return on Assets (ROA) and Return on Equity (ROE). Following previous studies^{14–15}, ROE was selected as the primary metric, as it reflects higher returns on shareholder investment and improved capital efficiency and profitability.

3.2.2. Explanatory variable

ESG performance was regarded as a key indicator of corporate sustainability. The Huazheng ESG Rating, a nine-tier alphabetical grading system (AAA to C), was used as a proxy for corporate ESG performance, following Xie et al. (2022)¹⁶. The ratings were converted into a numerical scale ranging from 1 to 9, with higher values indicating better ESG performance.

3.2.3. Mediating variable

Financing constraints were measured using an index constructed following Xie and Xueyan (2018)¹⁷, which was derived from an ordered logistic regression model incorporating variables such as operating cash flow, the debt-to-asset ratio, Tobin's Q, the cash holding ratio, and the dividend payout ratio. A higher index value indicated more severe financing constraints.

3.2.4. Control Variable

Based on prior research on the determinants of corporate performance, this study controls for ten firm-level variables when analyzing the impact of ESG performance, including firm size (Size), leverage (Lev), independent director ratio (Indep), cash flow (Cashflow), growth (Growth), board size (Board), ownership concentration (Top10), equity balance degree (Balance), firm age (FirmAge), and major shareholder fund occupation (Occupy), as well as industry and year fixed effects.

Table 1. Variable definition.

Variable type	Variable name	Variable symbol	Variable definition
Explained variable	Corporate Performance	ROE	Net profit/Net assets
Explanatory variable	ESG	ESG	Huazheng ESG Rating, AAA-C quantified as 9-1
Mediating variable	Financing constraint	KZ	Calculated based on the KZ index formula
	Agency costs	ATO	Operating Revenue/Total Assets
	Enterprise scale	Size	$\ln(1 + \text{total assets})$
	Debt-to-Asset Ratio	Lev	Total liabilities/Total assets
	Cash flow	Cashflow	Operating net cash flow / Total assets
	Growth	Growth	Revenue Growth Rate
Control variables	Board size	Board	$\ln(\text{board size} + 1)$
	Proportion of independent directors	In dep	In dep directors / Board size
	Equity concentration	Top10	Top Ten Shareholders' Holding Ratio
	Equity balance	Balance	(Shareholding of 2nd–10th largest shareholders) / (Shareholding of the largest shareholder)
	Firm age	Firm Age	$\ln(\text{sample year} - \text{establishment year} + 1)$
	Major shareholder's funds occupation	Occupy	Other receivables/Total assets
Group variables	Enterprise scale	Size G	Above industry annual median: large-scale = 1; others: SMEs = 0.
	Enterprise type	Pollute	Heavily polluting enterprises = 1, non-heavily polluting = 0

Model 1: Benchmark Regression Model

$$ROE_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \beta_1 Size_{i,t} + \beta_2 Lev_{i,t} + \beta_3 Cashflow_{i,t} + \beta_4 Growth_{i,t} + \beta_5 Board_{i,t} + \beta_6 Indep_{i,t} + \beta_7 Top10_{i,t} + \beta_8 Balance_{i,t} + \beta_9 FirmAge_{i,t} + \beta_{10} Occupy_{i,t} + \sum Firm_i + \sum Year_t + \varepsilon_{i,t} \quad (1)$$

In the equation: i and t represent data for the i -th enterprise in the t -th year, α_0 is the intercept, α_1 is the coefficient of the explanatory variable, $\beta_1 - \beta_{10}$ is the coefficient of the control variable, $\sum Firm_i$ is the individual fixed effect of the enterprise, $\sum Year_t$ is the time fixed effect, $\varepsilon_{i,t}$ is the random disturbance term.

In terms of the mediation effect model, the three-step method proposed by Wen et al. (2014) is adopted to construct the mediation effect model.

Model 2: Mediation Effect Model (I)

$$Med_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \beta_1 Size_{i,t} + \beta_2 Lev_{i,t} + \beta_3 Cashflow_{i,t} + \beta_4 Growth_{i,t} + \beta_5 Board_{i,t} + \beta_6 Indep_{i,t} + \beta_7 Top10_{i,t} + \beta_8 Balance_{i,t} + \beta_9 FirmAge_{i,t} + \beta_{10} Occupy_{i,t} + \sum Firm_i + \sum Year_t + \varepsilon_{i,t} \quad (2)$$

In the equation: $Med_{i,t}$ denotes the mediating variable,

comprising two variables KZ and ATO; the meanings of the remaining symbols are as in Model 1.

Model 3: Mediation Effect Model (II)

$$ROE_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \gamma_1 Med_{i,t} + \beta_1 Size_{i,t} + \beta_2 Lev_{i,t} + \beta_3 Cashflow_{i,t} + \beta_4 Growth_{i,t} + \beta_5 Board_{i,t} + \beta_6 Indep_{i,t} + \beta_7 Top10_{i,t} + \beta_8 Balance_{i,t} + \beta_9 FirmAge_{i,t} + \beta_{10} Occupy_{i,t} + \sum Firm_i + \sum Year_t + \varepsilon_{i,t} \quad (3)$$

In the equation, γ_1 denotes the coefficient of the mediating variable; all other variables are defined as in Model 1.

4. Empirical Results and Analysis

4.1. Descriptive statistical analysis

The descriptive statistics were based on a sample of 32462 observations. Variable definition was shown in Table 2. The mean return on equity (ROE) was 0.035, with a median of 0.060, a standard deviation of 0.167, a minimum of -1.017, and a maximum of 0.309. The left-skewed distribution suggested that a substantial proportion of firms exhibited below-average ROE, including negative values, while the relatively large standard deviation indicated considerable heterogeneity in firm profitability.

Table 2. Variable definition.

VarName	Obs	Mean	Median	SD	Min	Max
ROE	32462	0.035	0.060	0.167	-1.017	0.309
ESG	32462	4.120	4.000	1.110	1.000	7.000
Size	32462	22.333	22.127	1.288	20.058	26.389
Lev	32462	0.418	0.409	0.203	0.059	0.894
Cashflow	32462	0.047	0.046	0.067	-0.148	0.241
Board	32462	2.218	2.303	0.174	1.792	2.708
Indep	32462	0.379	0.364	0.054	0.333	0.571
Top10	32462	0.574	0.579	0.153	0.226	0.902
Balance	32462	0.999	0.779	0.811	0.057	4.017
FirmAge	32462	3.031	3.045	0.297	2.197	3.638
Occupy	32462	0.013	0.006	0.021	0.000	0.135

The mean ESG score was 4.120 (median = 4.000, standard deviation = 1.110, range = 1–7), indicating above-average performance with moderate variation. The close proximity of the mean and median suggested a relatively symmetric distribution. While most firms exhibited relatively strong ESG performance, there remained room for improvement and notable variation in sustainability practices.

4.2. Correlation Analysis

A correlation analysis was further conducted, and the results were reported in Table 3. The results indicated that the correlation coefficient between ESG and return on equity (ROE) was 0.216 and was statistically significant at the 1% level. This finding suggested a significant positive association, indicating that firms with higher ESG performance tended to exhibit higher profitability.

Table 3. Correlation Analysis

	ROE	ESG	Size	Lev	Cashflow	Board	Indep	Top10	Balance	FirmAge	Occupy
ROE	1										
ESG	0.216***	1									
Size	0.115***	0.233***	1								
Lev	0.266***	-0.112***	0.473***	1							
Cashflow	0.324***	0.110***	0.092***	-0.159***	1						
Board	0.043***	0.030***	0.269***	0.135***	0.046***	1					
Indep	-0.019***	0.055***	-0.021***	-0.017***	-0.007	-0.580***	1				
Top10	0.219***	0.141***	0.129***	-0.092***	0.152***	0.029***	0.017***	1			
Balance	-0.043***	-0.003	-0.106***	-0.092***	-0.037***	0.024***	-0.034***	-0.078***	1		
FirmAge	-0.069***	-0.045***	0.175***	0.166***	0.003	0.082***	-0.024***	-0.196***	-0.057***	1	
Occupy	-0.158***	-0.090***	0.077***	0.226***	-0.145***	0.006	0.012**	-0.101***	-0.004	0.043***	1

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

4.3. Multicollinearity Test

Multicollinearity diagnostics are conducted for the

variables used in this paper, with the results reported in Table 4.

Table 4. Correlation Analysis.

Variable	VIF	1/VIF
Board	1.680	0.596
Size	1.660	0.602
Indep	1.560	0.642
Lev	1.520	0.658
ESG	1.150	0.869
Top10	1.130	0.887
FirmAge	1.100	0.911
Cashflow	1.090	0.916
Occupy	1.080	0.930
Balance	1.030	0.974
Mean	VIF	1.300

The VIFs for all variables ranged from 1.03 to 1.68, while the corresponding tolerance values (1/VIF) ranged from 0.59 to 0.97. These results indicated that multicollinearity was not a serious concern in the model, thereby supporting the reliability of the subsequent regression analysis.

4.4. Regression analysis

Based on the baseline regression model, regression analysis was conducted, and the results were reported in Table 5.

Table 5. Regression analysis.

	(1) ROE	(2) ROE
ESG	0.0135*** (0.0014)	0.00325*** (0.0012)
Size		0.0721*** (0.0044)
Lev		-0.512*** (0.0197)
Cashflow		0.401*** (0.0227)
Board		-0.0163 (0.0160)
Indep		-0.0121 (0.0399)
Top10		0.190*** (0.0202)
Balance		-0.0111*** (0.0037)
FirmAge		0.0993*** (0.0302)
Occupy		-0.501*** (0.0897)
_cons	-0.0207*** (0.0057)	-1.746*** (0.1360)
Firm	Yes	Yes
Year	Yes	Yes
N	32460	32460
F	94.16***	120.96***
r ²	0.3709	0.4780

Standard errors clustered at the firm level are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 5 reported the baseline regression results. Column (1) showed that ESG was positively and significantly associated with return on equity (ROE) ($\beta = 0.0135$, $p < 0.01$). In Column (2), after including control variables, the coefficient of ESG decreased to 0.00325 but remained statistically significant, suggesting that the positive association between ESG and ROE was robust, although part of the effect was absorbed by the control variables. Firm size, cash flow, and ownership concentration were positively associated with ROE, whereas the debt-to-equity ratio and firm age were negatively associated with ROE. The model exhibited an R² of 0.4932, indicating strong explanatory power and further supporting a

significant positive association between ESG and ROE.

4.5. Robustness test

To ensure the robustness of the baseline results, several additional tests were conducted. First, all baseline regressions were estimated using standard errors clustered at the firm level, while heteroskedasticity-robust standard errors were employed in the robustness tests. Second, the sample period was restricted to 2014–2019. Finally, industry fixed effects were additionally included. Robustness test was shown in Table 6.

Table 6. Robustness test.

	(1) Replace standard errors ROE	(2) Shorten the period ROE	(3) Industry fixed ROE
ESG	0.00325*** (0.0011)	0.00621*** (0.0020)	0.00350*** (0.0012)
Size	0.0721*** (0.0037)	0.0887*** (0.0075)	0.0734*** (0.0044)
Lev	-0.512*** (0.0155)	-0.513*** (0.0313)	-0.516*** (0.0195)
Cashflow	0.401*** (0.0194)	0.303*** (0.0307)	0.399*** (0.0225)
Board	-0.0163 (0.0144)	0.000219 (0.0271)	-0.0164 (0.0159)
Indep	-0.0121 (0.0356)	-0.0553 (0.0614)	-0.00752 (0.0396)
Top10	0.190*** (0.0160)	0.134*** (0.0300)	0.186*** (0.0199)
Balance	-0.0111*** (0.0031)	-0.0298*** (0.0051)	-0.00997*** (0.0037)
FirmAge	0.0993*** (0.0220)	0.00915 (0.0528)	0.100*** (0.0298)
Occupy	-0.501*** (0.0830)	-0.391*** (0.1184)	-0.476*** (0.0897)
_cons	-1.746*** (0.1065)	-1.801*** (0.2348)	-1.777*** (0.1354)
Firm	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry			Yes
N	32460	15432	32462
F	181.89***	44.78***	125.38***
r ²	0.4780	0.4718	0.4833

(1) Robust Standard errors in parentheses. (2)-(5) Standard errors clustered at the firm level are in parentheses.

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

Robustness checks on the ESG–ROE relationship were conducted using three approaches: alternative standard error specifications, a restricted sample period, and the inclusion of industry fixed effects. Across all specifications, the coefficient on ESG remained positive and statistically significant: 0.00325 ($p < 0.01$) with alternative standard errors, 0.00621 ($p < 0.01$) for the restricted sample period, and 0.00350 ($p < 0.01$) with industry fixed effects. These findings supported the robustness of the positive association between ESG and ROE. The control variables exhibited consistent effects: firm size, cash flow, and ownership concentration were positively associated with ROE, whereas the debt-to-equity ratio and ownership balance were negatively associated. The R² values (0.47–0.48) and statistically significant F-statistics indicated a stable model fit, further supporting the main findings.

4.6. Endogeneity Test

To address potential endogeneity arising from omitted variables and measurement error, the Two-Stage Least Squares (2SLS) method was employed. The results of robustness test was shown in Table 7. Following Zhang et al. (2025)¹⁸, the instrumental variable was constructed as the firm-level ESG score minus the corresponding industry-year average (excluding the firm itself). The instrument was expected to satisfy the three key identification conditions: relevance, exogeneity, and the exclusion restriction. First, the industry-level ESG reflected common trends and influenced firm-level ESG through peer effects and competitive pressure, thereby satisfying the relevance condition. Second, as an aggregate measure, it was unlikely to directly affect firm-level performance or the error term, supporting the exogeneity assumption. Third, the instrument was assumed to affect firm performance only through its impact on firm-level ESG, satisfying the exclusion restriction. Overall, the instrumental

variable approach helped mitigate endogeneity concerns in the model.

Table 7. Robustness test.

	(1) 2SLS First ESG	(2) 2SLS Second ROE
ESG		0.0297*** (0.0084)
IV	0.782*** (0.0450)	
Size	0.383*** (0.0227)	0.0617*** (0.0056)
Lev	-1.256*** (0.0797)	-0.479*** (0.0221)
Cashflow	-0.116 (0.1061)	0.405*** (0.0226)
Board	0.101 (0.0983)	-0.0189 (0.0161)
Indep	1.114*** (0.2515)	-0.0428 (0.0413)
Top10	0.124 (0.1224)	0.190*** (0.0202)
Balance	-0.0407** (0.0204)	-0.0100*** (0.0037)
FirmAge	0.000597 (0.2123)	0.0896*** (0.0305)
Occupy	-1.075*** (0.4013)	-0.472*** (0.0904)
Firm	Yes	Yes
Year	Yes	Yes
N	32460	32460
F	79.32***	122.18***
r ²	0.5098	0.1514

Standard errors clustered at the firm level are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

In the first-stage regression, the instrumental variable (IV) had a coefficient of 0.782 on ESG ($p < 0.01$), with an F-

statistic of 79.322, exceeding the conventional threshold of 10. The significant LM statistic further confirmed the strong relevance of the instrument. In the second stage, the estimated coefficient of ESG on return on equity (ROE) was 0.029 ($p < 0.01$), with an R^2 of 0.1514, indicating a positive and statistically significant association.

4.7. Mediation effect

Mediation analysis was conducted using the mediation model proposed in this study, and the results were reported in Table 8. Table 8, Column (1) showed that ESG significantly

reduced financing constraints (KZ), with a coefficient of -0.0419 ($p < 0.01$). Column (2) confirmed the mediation effect, with ESG positively associated with return on equity (ROE) ($\beta = 0.00256$, $p < 0.05$) and KZ negatively associated with ROE ($\beta = -0.0166$, $p < 0.01$). Table 8, Columns (3) and (4) examined the mediating role of agency costs (ATO). Column (3) showed that ESG was positively associated with ATO ($\beta = 0.00479$, $p < 0.01$). Column (4) confirmed that ATO partially mediated the relationship between ESG and ROE, with ESG remaining statistically significant ($\beta = 0.00268$).

Table 8. Mediation effect test.

	(1) KZ	(2) ROE	(3) ATO	(4) ROE
ESG	-0.0419*** (0.0073)	0.00256** (0.0012)	0.00479*** (0.0018)	0.00268** (0.0012)
KZ		-0.0166*** (0.0011)		
ATO				0.118*** (0.0101)
Size	-0.588*** (0.0273)	0.0624*** (0.0044)	-0.0550*** (0.0093)	0.0786*** (0.0046)
Lev	6.616*** (0.0983)	-0.403*** (0.0213)	0.0857*** (0.0293)	-0.522*** (0.0193)
Cashflow	-14.59*** (0.1413)	0.159*** (0.0307)	0.546*** (0.0323)	0.336*** (0.0228)
Board	-0.0649 (0.0985)	-0.0174 (0.0159)	0.00579 (0.0282)	-0.0170 (0.0162)
Indep	0.472* (0.2511)	-0.00426 (0.0396)	0.0114 (0.0657)	-0.0134 (0.0397)
Top10	-1.824*** (0.1383)	0.160*** (0.0202)	0.0202 (0.0402)	0.188*** (0.0199)
Balance	0.0305 (0.0209)	-0.0105*** (0.0037)	-0.00465 (0.0063)	-0.0105*** (0.0037)
FirmAge	0.994*** (0.2190)	0.116*** (0.0296)	0.192*** (0.0595)	0.0766** (0.0301)
Occupy	1.697*** (0.4966)	-0.473*** (0.0884)	0.0329 (0.1487)	-0.505*** (0.0899)
_cons	10.51*** (0.8940)	-1.571*** (0.1355)	1.122*** (0.2811)	-1.878*** (0.1397)
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	32460	32460	32460	32460
F	1660.05***	156.63***	36.89***	124.03***
r ²	0.8672	0.4846	0.8232	0.4916

Standard errors clustered at the firm level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Higher ESG ratings were associated with lower financing costs by alleviating information asymmetry and improving access to capital, whereas lower ESG ratings were associated with greater financing constraints. ESG practices were also associated with improved corporate governance, reduced agency costs, and enhanced asset turnover (ATO), which in turn were linked to higher firm profitability, measured by return on equity (ROE). In conclusion, ESG performance was positively associated with firm performance through the channels of alleviating financing constraints and reducing agency costs, supporting the mediating effects identified in the analysis.

4.8. Heterogeneity analysis

Heterogeneity analysis was conducted based on industry pollution levels and firm size. High-pollution industries were classified according to Guo Ye et al. (2019)¹⁹ and the Zhong Shang Xie classification standards, including industries coded as B06, B07, B08, B09, B10, B11, B12, C13, C15, C17, C19,

C22, C25, C26, C27, C28, C29, C30, C31, C32, D44, and D45. Firm size was categorized based on the industry median of listed companies, distinguishing between large firms and small- and medium-sized firms. The results were reported in Table 9. The empirical analysis revealed that the association between ESG performance and corporate profitability exhibited significant heterogeneity across industry attributes and firm size. The results in Columns (1) and (3) showed that, for non-polluting firms and small and medium-sized enterprises (SMEs), ESG performance was positively and significantly associated with return on equity (ROE) ($p < 0.05$ and $p < 0.01$), suggesting that ESG engagement was linked to improved financial performance in these firms. In contrast, Columns (2) and (4) showed no statistically significant association between ESG performance and ROE for high-polluting industries and large firms, suggesting that the potential benefits of ESG investment may be attenuated or offset in these firms.

Table 9. Heterogeneity analysis test.

	(1) Non-heavy pollution ROE	(2) heavy pollution ROE	(3) SMEs ROE	(4) Large-scale enterprise ROE
ESG	0.00396** (0.0015)	0.00152 (0.0018)	0.00578*** (0.0020)	0.00161 (0.0015)
Size	0.0772*** (0.0054)	0.0726*** (0.0086)	0.0932*** (0.0086)	0.0779*** (0.0067)
Lev	-0.512*** (0.0237)	-0.517*** (0.0359)	-0.580*** (0.0292)	-0.506*** (0.0292)
Cashflow	0.320*** (0.0273)	0.532*** (0.0380)	0.361*** (0.0325)	0.428*** (0.0313)
Board	-0.0140 (0.0180)	-0.0224 (0.0316)	0.00182 (0.0255)	-0.0289 (0.0203)
Indep	-0.0192 (0.0468)	-0.00960 (0.0742)	-0.0294 (0.0670)	0.0225 (0.0491)
Top10	0.218*** (0.0259)	0.102*** (0.0298)	0.187*** (0.0341)	0.223*** (0.0287)
Balance	-0.0145*** (0.0045)	-0.00264 (0.0066)	-0.0164*** (0.0059)	-0.0101* (0.0055)
FirmAge	0.119*** (0.0353)	0.0240 (0.0553)	0.113** (0.0542)	0.102*** (0.0370)
Occupy	-0.604*** (0.1105)	-0.169 (0.1468)	-0.495*** (0.1271)	-0.565*** (0.1200)
_cons	-1.923*** (0.1582)	-1.489*** (0.2724)	-2.228*** (0.2509)	-1.909*** (0.1939)
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	22339	10123	16036	16426
F	79.64***	47.19***	60.32***	62.50***
r ²	0.4854	0.5222	0.5260	0.5121

Standard errors clustered at the firm level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The analysis revealed that, for non-polluting firms and small and medium-sized enterprises (SMEs), ESG investments were associated with relatively low costs and high returns, primarily through improvements in energy efficiency and cost optimization, thereby contributing to enhanced profitability. SMEs, characterized by more focused business models, were also associated with more efficient transmission of ESG investments and reduced financing constraints.

For high-polluting industries and large firms, the lack of a statistically significant association was attributed to higher compliance costs, earnings dilution, and weaker signaling effects. High-polluting firms faced substantial remediation costs, with ESG investments primarily undertaken for compliance purposes, which were unlikely to generate immediate incremental returns. Large firms experienced diminishing returns from more dispersed ESG investments and typically had more stable access to external financing, thereby reducing the marginal financial benefits of ESG engagement. Additionally, capital-intensive and long-term ESG investments in these firms were associated with short-term profit compression, further attenuating the observed financial effects of ESG performance.

5. Conclusion and Recommendations

Based on panel data from A-share listed companies over the period 2014–2024 (excluding the exceptional year of 2020), this study constructed a mediation model to examine the association between ESG performance and corporate performance, as well as its underlying transmission mechanisms. The results indicated that: (1) ESG performance

was positively and significantly associated with financial performance, and this relationship remained robust across a series of robustness checks, including restricting the sample period, incorporating industry fixed effects, and applying instrumental variable methods. (2) ESG performance was associated with improved corporate performance through the channels of reducing financing constraints and agency costs. (3) The ESG–performance relationship exhibited significant heterogeneity across industry pollution levels and firm characteristics, with stronger effects observed among low-pollution firms and small and medium-sized enterprises.

Based on the research conclusions, the following recommendations were proposed:

(1) Firms are encouraged to integrate ESG factors into strategic planning and operational decision-making, supported by internal training programs to strengthen organizational sustainability culture. Strengthening collaboration with stakeholders across the supply chain may enhance ESG awareness and overall effectiveness. Small and medium-sized enterprises (SMEs) are encouraged to improve ESG ratings to enhance their market competitiveness. High-pollution and large firms are advised to prioritize green technology investments, optimize ESG portfolios to improve synergies, and place greater emphasis on long-term value creation rather than short-term profitability.

(2) At the governmental level, regulatory oversight is recommended to be strengthened, including improvements to ESG disclosure frameworks and stricter enforcement of penalties for non-compliance. Policy instruments such as tax incentives, green financing, and subsidies are recommended to support non-polluting firms and small and medium-sized

enterprises (SMEs) in ESG adoption. For high-pollution industries, targeted incentives, such as environmental subsidies, green technology support, and emission reduction programs, may help reduce compliance costs and promote technological transformation.

(3) With respect to stakeholders, greater emphasis on ESG considerations is recommended. Investors are encouraged to align with national policy directions and evaluate corporate sustainability alongside financial performance. Consumers and other external stakeholders are encouraged to strengthen oversight of corporate ESG practices, thereby promoting broader engagement. Multi-stakeholder participation plays a critical role in improving corporate ESG performance and advancing broader sustainability goals.

References

- [1] Xi, L. S., Zhao, H. "The influence mechanism and data test of enterprise ESG performance on earnings sustainability," *Management Review*, 34(9), 313 (2022).
- [2] Fan, Y. P., Meng, Y. J., Hu, B. "Corporate ESG performance and cost of debt: Theoretical mechanism and empirical evidence," *Business Management Journal*, 45, 123-144 (2023).
- [3] Verheyden, T., Eccles, G. R., Feiner, A. "ESG for all? the impact of esg screening on return, risk, and diversification," *Journal of Applied Corporate Finance*, 28(2), 47-55 (2016).
- [4] Chen, J. "Research on the correlation between ESG and corporate financial performance," Beijing: University of International Business and Economics, 2019.
- [5] Velte, P. "Does ESG performance have an impact on financial performance? Evidence from Germany," *Journal of Global Responsibility*, 8(2), 169-178 (2017).
- [6] Nirino, N., Santoro, G., Miglietta, N., et al. "Corporate controversies and company's financial performance: Exploring the moderating role of ESG practices," *Technological Forecasting and Social Change*, 162, 120341 (2021).
- [7] Abdi, Y., Li, X., Càmarà-Turull, X. "Exploring the impact of sustainability (ESG) disclosure on firm value and financial performance (FP) in airline industry: the moderating role of size and age," *Environment, Development and Sustainability*, 24(4), 5052-5079 (2022).
- [8] Pan, H., Zhu, Y., Xin, F. "ESG performance and corporate financialization—The regulatory effect of both internal and external supervision," *Journal of Nanjing Audit University*, 19, 60-69 (2022).
- [9] Sassen, R., Hinze, A. K., Hardeck, I. "Impact of ESG factors on firm risk in Europe," *Journal of business Economics*, 86(8), 867-904 (2016).
- [10] Garcia, A. S., Mendes-Da-Silva, W., Orsato, R. J. "Sensitive industries produce better ESG performance: Evidence from emerging markets," *Journal of Cleaner Production*, 150, 135-147 (2017).
- [11] Garcia, A. S., Orsato, R. J. "Testing the institutional difference hypothesis: A study about environmental, social, governance, and financial performance," *Business Strategy and the Environment*, 29(8), 3261-3272 (2020).
- [12] Atan, R., Alam, M. M., Said, J., et al. "The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies," *Management of Environmental Quality: An International Journal*, 29(2), 182-194 (2018).
- [13] Liu, S., Yan, M. "ESG Performance, agency costs, and financing constraints—Based on the moderating effect of firm life cycle," *Journal of Industrial Technological Economics*, 43(12), 62-72 (2024).
- [14] Li, P. H., Guo, X. "Insurance institution shareholding, stock price volatility, and agricultural enterprise performance," *Communication of Finance and Accounting*, 12, 72-76 (2025).
- [15] Shi, Z. F., Long, F., Duan, X. M., et al. "Research on the Impact of ESG Performance on Firm Performance and Incentive Mechanism," *Chinese Journal of Environmental Management*, 16(4), 34-43 (2024).
- [16] Xie, H. J., Lv, X. "Responsible multinational investment: ESG and Chinese OFDI," *China Finance and Economic Review*, 14(3), 3-22 (2025).
- [17] Xie, X. Y., Guo, Y. Y., Zhu, X. Y., et al. "Does corporate social responsibility disclosure improve the company's market performance?" *Statistics & Decision*, 20, 180-184 (2018).
- [18] Zhang, H., Zhang, Z. B., Xiong, A. H. "Research on the impact of technology convergence of digital and real economy industries on enterprise new quality productivity: Internal mechanisms and empirical evidence," *Scientific Management Research*, 43(4), 96-103 (2025).