

ESG Performance, R&D Investment, and Firm Performance: Evidence from Chinese A-Share Listed Companies

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Abstract: Whether ESG engagement improves financial performance is still debated: many firms treat ESG spending as a cost, while regulators promote it as a route to high-quality development. We study this question with 22,724 firm-year observations on Chinese A-share listed companies from 2012 to 2021. Firms with higher Huazheng ESG scores have significantly higher return on total assets. The effect runs through innovation: ESG performance raises R&D intensity, and after R&D is controlled for, the direct effect of ESG on ROA is no longer significant. The effect is also uneven. It is concentrated in large firms, and it is stronger under state ownership and under concentrated ownership. The results hold when we exclude the pandemic years, use ROE instead of ROA, and instrument ESG with its industry-year mean. The findings argue against uniform ESG requirements and suggest that ESG creates value mainly when it leads to innovation.

Keywords: ESG Performance; Firm Performance; R&D Investment; Moderating Effect; Chinese Listed Companies

1. Introduction

Since China announced its carbon peaking and carbon neutrality goals in 2020, ESG has moved from a voluntary reputation exercise toward a standard part of how listed companies are financed and regulated. Many managers remain skeptical: money spent on emission control or social programs is money not spent on production. Whether ESG spending helps or hurts financial performance is therefore still debated, in practice as well as in research.

This paper uses a panel of Chinese A-share listed companies from 2012 to 2021 (22,724 firm-year observations) to ask whether ESG performance raises profitability, through what

channel, and for which firms. We find a significant positive effect of the Huazheng ESG score on ROA. The effect works through R&D investment, is stronger in state-owned firms and in firms with concentrated ownership, and is limited to large firms.

The paper makes three contributions. First, it tests R&D investment as the channel from ESG to performance; earlier work has focused on financing costs and green image, and innovation input has rarely been examined as a mediator. Second, it examines ownership concentration and firm type within one moderation framework instead of one at a time. Third, the size heterogeneity has a policy implication: uniform ESG requirements may burden small firms without measurable performance gains. The rest of the paper reviews the literature, develops the hypotheses, describes the design, reports the results, and discusses policy implications

2. Literature Review

Early evidence on ESG disclosure and performance in China was largely case based (Datang Powe [1], Youngor [2]) and consistently positive; larger-sample studies [3,4] reach similar conclusions. The relationship is not one-directional: better-performing firms also disclose more and better, and several studies model this feedback explicitly [5-7].

Several channels for the effect have been documented: cheaper debt financing [8], lower agency costs [9], a stronger green image [10], and better resource allocation under digitalization [11]. How strong these effects are depends on environmental regulation [12,13], on managers' value cognition [10], and on venture capital shareholding [14]. Board characteristics affect disclosure quality itself [15,16].

The outcome side of the literature has also widened, from financial performance to innovation output [17,18], governance quality [19], and high-quality development [20], with

newer work on peer effects of disclosure [21] and on mandatory disclosure policies [22]. Internationally, a meta-analysis covering more than 2,000 studies finds a non-negative ESG–performance relation [23], and reviews of governance mechanisms have shifted the question from whether ESG matters to how it matters [24].

Two gaps remain. Mediation studies concentrate on financing constraints and green image; R&D investment, arguably the most direct way for ESG requirements to become productive capability, has rarely been tested as the channel. And moderators are usually examined one at a time, so little is known about how ownership structure and firm type jointly condition the ESG payoff. We address both gaps with a 2012–2021 A-share panel, testing the baseline effect, the R&D channel, two moderators, size heterogeneity, and robustness within one design.

3. Theoretical Analysis and Research Hypotheses

Stakeholder theory and the resource-based view point in the same direction. Meeting environmental and social responsibilities stabilizes a firm's relationships with customers, employees, creditors, and governments, which lowers supply-chain frictions, financing costs, and compliance risk. Good ESG performance is also a reputational asset that is hard to imitate, and it helps the firm obtain scarce resources such as subsidies and credit, which eventually show up in operating income.

H1: ESG performance improves firm performance

Why would ESG engagement show up in profits? We expect innovation to be the main channel. The environmental pillar raises the cost of dirty processes and pushes firms toward green process redesign and new products; the governance pillar restrains managerial short-termism, so long-horizon projects such as R&D are less likely to be cut to meet near-term targets. Both forces should raise R&D intensity, and R&D in turn raises margins through technology upgrading and product iteration

H2: ESG improves firm performance by stimulating R&D investment.

State-owned enterprises implement ESG under different constraints than private firms. They have readier access to fiscal subsidies and green credit, so ESG initiatives are better resourced and more likely to be carried through. Private

firms face tighter financing constraints, which limits both the scale of ESG investment and its conversion into performance

H3: State ownership strengthens the positive effect of ESG on firm performance.

Concentrated ownership lengthens the shareholder's horizon. A dominant shareholder internalizes more of the long-run value created by ESG and innovation, is less tempted by short-term arbitrage, and can push sustained investment through the board.

H4: Ownership concentration strengthens the positive effect of ESG on firm performance.

4. Research Design

4.1 Sample Selection

The initial sample covers all A-share listed companies from 2012 to 2021, 25,250 firm-year observations in total. Trimming at the 1st and 99th percentiles leaves 22,724 valid observations. Financial data come from CSMAR; ESG scores are the Huazheng (Sino-Securities) annual composite ratings, which grade listed firms' ESG disclosure across multiple dimensions. In the grouped regressions reported later, firms contributing only one period within a subsample are automatically dropped by the fixed-effects estimator, so group totals differ slightly from the full sample.

4.2 Variable Definition

The dependent variable is return on total assets (ROA), net profit over period-end total assets: it captures the profitability of all assets and is not mechanically affected by capital structure [1,8]. The explanatory variable is the Huazheng annual composite ESG score [1]. Because the raw score is right-skewed, we use its natural logarithm, which also lets coefficients be read approximately as the ROA response to a one-percent change in the score. Following work on green innovation [17], R&D intensity (R&D expense over total assets, %) is the mediating variable. The moderators are firm type (SOE=1) and ownership concentration, measured as the largest shareholder's stake [16]. Controls are firm age, leverage, firm size, and operating cash flow. Table 1 defines all variables.

4.3 Model Construction

To examine the impact of a company's ESG performance on its firm performance, this paper constructs the following model:

(1) Benchmark regression model

$$ROA_{it} = \alpha_0 + \alpha_1 ESG_{it} + \sum \alpha_k Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In the above formula, i refers to the individual enterprise and t refers to the year; ROA_{it} is the explained variable enterprise financial performance, ESG_{it} is the core explanatory

variable ESG comprehensive score; $\sum Controls_{i,t}$ is the set of control variables, $\sum \mu_i$ is the fixed effect of individual enterprise, $\sum \lambda_t$ is the fixed effect of year, and ε_{it} is the random disturbance term.

Table 1. Variable Definitions

type of variable	variable symbol	Variable Name	variable declaration
Dependent variable	ROA	Return on total assets	Net Profit / Total Assets at Period-End: A measure of a company's financial performance
explanatory variable	ESG	Corporate ESG Composite Score	Taking the logarithm of the scores and applying a trimming procedure yields score values ranging from 0 to 5.87.
Mediating variable	RD	R&D investment intensity	R&D Expenses / Total Assets at Period End $\times 100$ (%)
Moderating variable	TOP	Equity Concentration	The largest shareholder's shareholding percentage (%)
	SOE	Business Type	State-owned enterprise = 1; Non-state-owned enterprise = 0
Control variables	CX1	Number of years since establishment of the enterprise	The number of months between the establishment date of the enterprise and the sample year, followed by taking the logarithm of this value.
	CX2	asset-liability ratio	Total Liabilities / Total Assets
	CX3	Enterprise Size	Natural logarithm of total assets
	CX4	cash flow	Net operating cash flow / Total assets

(2) Mediation Effect Model

$$\begin{cases} ROA_{it} = \alpha_0 + \alpha_1 ESG_{it} + \sum \alpha_k Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it} \\ RD_{it} = \alpha_0 + \alpha_1 ESG_{it} + \sum \alpha_k Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it} \\ ROA_{it} = \varphi_0 + \varphi_1 ESG_{it} + \varphi_2 RD_{it} + \sum \alpha_k Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{cases} \quad (2)$$

Equation (2) follows the stepwise logic: the first line restates the total effect; the second regresses R&D intensity on ESG; the third includes ESG and R&D together, so that φ_1 captures the direct effect and the change in the ESG coefficient signals mediation.

(3) Moderation effect model

$$ROA_{it} = \delta_0 + \delta_1 cESG_{it} + \delta_2 cTOP_{it} + \delta_3 Inter_{it} + \sum \gamma_k Controls_{kit} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

The variables are decentralized in advance. $cESG_{it}$ and $cTOP_{it}$ are ESG and equity concentration after centralization, and $Inter_{it} = cESG_{it} \times cTOP_{it}$ are interactive items. The meaning of other variables remains

unchanged.

5. Empirical Analysis**5.1 Descriptive Statistics**

Table 2 reports descriptive statistics. Mean ROA is 3.7% with a wide spread (−27% to 20%), so the sample contains both loss-makers and highly profitable firms. The logged ESG score averages 3.06 (SD 1.23), placing most firms in the middle of the rating scale with substantial dispersion. R&D intensity averages 1.43% of assets and varies widely across firms. State-owned enterprises make up roughly one third of the sample, and the largest shareholder holds 33.7% on average, ranging from 8.4% to 72.9%.

Table 2. Descriptive Statistics

VarName	Obs	Mean	SD	Min	Max
roa	22724	0.0372	0.0637	-0.2700	0.2000
esg	22724	3.0550	1.2272	0.0000	5.8700
rd	22724	1.4290	1.2016	0.0000	3.8300
soe	22724	0.3259	0.4687	0.0000	1.0000
top	22724	33.6705	14.5653	8.3800	72.8800
cx1	22724	6.2427	1.2146	0.0000	6.7100
cx2	22724	0.4139	0.1974	0.0600	0.8800
cx3	22724	22.2561	1.2881	20.0600	26.3300
cx4	22724	0.0502	0.0642	-0.1300	0.2300

5.2 Correlation Analysis

Pairwise correlations (Table 3) are consistent with the hypotheses: ESG correlates positively

with ROA (0.0124, $p < 0.10$), and R&D intensity correlates with both ROA (0.379) and ESG (0.109) at the 1% level, which is the pattern the mediation test requires. Multicollinearity is not a

concern: the largest VIF is 1.98 and the mean is 1.30 (Table 4), well below conventional thresholds.

Table 3. Correlation Analysis

Variables	(roa)	(esg)	(rd)	(soe)	(top)
roa	1.0000				
esg	0.0124*	1.0000			
rd	0.3790***	0.1093***	1.0000		
soe	-0.0953***	-0.1294***	-0.0374***	1.0000	
top	0.1145***	-0.1118***	0.0713***	0.2349***	1.0000
cx1	0.2309***	0.0549***	0.1663***	-0.0434***	0.0562***
cx2	-0.3404***	-0.0258***	-0.0202***	0.3037***	0.0518***
cx3	0.0105	0.0751***	0.3765***	0.3798***	0.1889***
cx4	0.4072***	-0.0231***	0.2253***	-0.0357***	0.1006***

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

Table 4. Multicollinearity Test

variable	VIF	1/VIF
cx3	1.978	.505
cx2	1.564	.639
rd	1.394	.717
soe	1.32	.758
top	1.13	.885
cx4	1.108	.902
esg	1.062	.942
cx1	1.06	.943
Mean VIF	1.301	.

5.3 Benchmark Regression Analysis

An F test rejects pooled OLS ($F(3167, 19551) = 2.83$, $p < 0.001$) and a Hausman test rejects random effects ($\chi^2(5) = 674.15$, $p < 0.001$), so all regressions use two-way fixed effects with robust standard errors. Table 5 reports the baseline. Without controls the ESG coefficient is 0.0045 ($t = 5.03$); adding controls halves it to 0.0023 ($t = 2.95$), still significant at 1%. The magnitude is modest: a one standard deviation increase in the ESG score (1.23) corresponds to about 0.28 percentage points of ROA, roughly 8% of the sample mean. R^2 rises from 0.439 to 0.525 with controls. These results support H.

Table 5. Benchmark Regression Analysis

	(1)	(2)
VARIABLES	roa	roa
esg	0.0045*** (5.033)	0.0023*** (2.945)
cx1		0.0045*** (7.010)
cx2		-0.1605*** (-25.352)
cx3		0.0173*** (10.686)
cx4		0.2129*** (19.722)
Constant	0.0234***	-0.3278***

	(8.519)	(-9.325)
Observations	22,724	22,724
R-squared	0.439	0.525
Individual FE	YES	YES
Year FE	YES	YES
F	25.33	232.9

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

5.4 Mediation Effect Test

We test the R&D channel with the stepwise procedure of Wen and Ye [25], keeping two-way fixed effects throughout (Table 6). ESG raises R&D intensity (0.1013, $t = 7.86$). When ROA is regressed on both, R&D is strongly significant (0.0143, $t = 24.25$) while the ESG coefficient falls from 0.0023 to 0.0009 and loses significance ($t = 1.17$). The pattern is consistent with full mediation: the performance payoff of ESG appears to run through increased innovation input rather than a direct channel. We use the term with some caution, since stepwise tests can overstate mediation when the direct effect is imprecisely estimated, but the indirect path is strong and clearly signed. These results support H2.

Table 6. Mediation Effect Test for R&D Investment

	(1)	(2)	(3)
VARIABLES	roa	rd	roa
esg	0.0023*** (2.945)	0.1013*** (7.863)	0.0009 (1.168)
rd			0.0143*** (24.252)
cx1	0.0045*** (7.010)	0.0257*** (4.517)	0.0041*** (6.646)
cx2	-0.1605*** (-25.352)	-1.0338*** (-11.896)	-0.1458*** (-23.635)
cx3	0.0173*** (10.686)	0.5609*** (20.994)	0.0093*** (5.606)
cx4	0.2129*** (19.722)	0.7448*** (6.345)	0.2023*** (19.616)

Constant	-0.3278*** (-9.325)	-11.1329*** (-19.245)	-0.1687*** (-4.726)
Observations	22,724	22,724	22,724
R-squared	0.525	0.728	0.545
Individual FE	YES	YES	YES
Year FE	YES	YES	YES
F	232.9	139.2	317.0

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

5.5 Regulation Effect Test

Table 7 Firm type also moderates the relation (Table 7). The interaction between centered ESG and SOE status is 0.0051 ($t = 3.90$): the marginal ESG payoff is larger in state-owned enterprises, supporting H3 and consistent with their easier access to subsidies and green credit. The SOE main effect is negative (-0.0117, $t = -2.95$): SOEs earn lower ROA on average, which fits the policy burdens and layered agency problems documented in earlier work. The two findings are compatible. The level effect reflects the structural costs of the state sector, while the interaction shows that when SOEs do implement ESG, they convert it into performance more efficiently than private firms.

Table 7. Moderating Effect of Firm Type

VARIABLES	(1) roa
c_esg	0.0022*** (2.818)
c_soe	-0.0117*** (-2.945)
W2X	0.0051*** (3.901)
cx1	0.0044*** (6.867)
cx2	-0.1583*** (-24.961)
cx3	0.0178*** (11.055)
cx4	0.2119*** (19.599)
Constant	-0.3319*** (-9.419)
Observations	22,724
R-squared	0.526
Individual FE	YES
Year FE	YES
F	176.6

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

We next examine whether the ESG effect depends on ownership structure. ESG and TOP are centered and their interaction is added to the model (Table 8). The interaction coefficient is 0.0002 ($t = 6.35$): the ESG slope becomes

steeper as the largest shareholder's stake grows. At the mean stake the ESG effect equals the baseline 0.0023; one standard deviation more concentration (14.6 points) adds about 0.0029, which is larger than the main effect itself. Large shareholders appear to sustain the long-horizon investment that ESG requires. These results support H4.

5.6 Robustness Tests

The COVID-19 years are an obvious threat to identification: supply-chain disruptions and demand shocks in 2020-2021 may have shifted both ESG behavior and profitability. We therefore drop the two years (Table 9) and re-estimate the baseline on the 2012-2019 subsample (16,420 observations). The ESG coefficient is 0.0022 ($t = 2.55$), nearly identical to the full-sample 0.0023, and model fit is unchanged ($R^2 = 0.559$). The baseline result is not an artifact of the pandemic period.

Table 8. Moderating Effect of Ownership Concentration

VARIABLES	(1) roa
c_esg	0.0023*** (2.938)
c_top	0.0007*** (6.856)
W1X	0.0002*** (6.345)
cx1	0.0044*** (6.822)
cx2	-0.1585*** (-25.436)
cx3	0.0175*** (10.723)
cx4	0.2120*** (19.751)
Constant	-0.3235*** (-9.080)
Observations	22,724
R-squared	0.529
Individual FE	YES
Year FE	YES
F	177.8

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

Table 9. Robustness Test: Excluding Pandemic Years

VARIABLES	(1) roa	(2) roa
esg	0.0047*** (4.680)	0.0022** (2.554)

cx1		0.0063***
		(7.832)
cx2		-0.1644***
		(-21.271)
cx3		0.0206***
		(10.172)
cx4		0.1771***
		(14.286)
Constant	0.0239***	-0.4069***
	(8.304)	(-9.330)
Observations	16,420	16,420
R-squared	0.475	0.559
Individual FE	YES	YES
Year FE	YES	YES
F	21.90	158.7

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

Table 10. Robustness Test Table – Substitution Variables

VARIABLES	(1)	(2)
	roe	roe
esg	0.0106***	0.0044**
	(5.081)	(2.333)
cx1		0.0129***
		(7.009)
cx2		-0.3506***
		(-18.953)
cx3		0.0465***
		(11.258)
cx4		0.4004***
		(15.952)
Constant	0.0210***	-0.9503***
	(3.292)	(-10.679)
Observations	22,724	22,724
R-squared	0.319	0.402
Individual FE	YES	YES
Year FE	YES	YES
F	25.81	139.5

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

A second check replaces the dependent variable. ROA measures the productivity of all assets, while ROE captures returns to shareholders' equity and is more sensitive to leverage. Re-running the baseline with ROE (Table 10) gives an ESG coefficient of 0.0106 ($t = 5.08$) without controls and 0.0044 ($t = 2.33$) with the full set, the same pattern as in the baseline. So the conclusion does not depend on the choice of performance measure.

5.7 Heterogeneity Test

Table 11. Test for Firm Size Heterogeneity

	small-scale	large-scale
VARIABLES	roa	roa
esg	0.0010	0.0032***

	(0.765)	(3.240)
cx1	0.0045***	0.0046***
	(4.501)	(5.547)
cx2	-0.1610***	-0.2020***
	(-15.792)	(-21.698)
cx3	0.0224***	0.0206***
	(6.136)	(8.353)
cx4	0.1898***	0.2103***
	(11.741)	(16.126)
Constant	-0.4260***	-0.3906***
	(-5.636)	(-7.055)
Observations	11,110	11,272
R-squared	0.522	0.609
Individual FE	YES	YES
Year FE	YES	YES
F	84.69	159.1

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

Resource endowments differ sharply with size, so we split the sample at the median of firm size and re-estimate the baseline (Table 11). The results differ clearly between the groups. For large firms the ESG coefficient is 0.0032 ($t = 3.24$); for small firms it is 0.0010 ($t = 0.77$), indistinguishable from zero. Large firms can spread the fixed costs of ESG investment, and their reputational and financing gains have scale to work on. For small firms, ESG spending competes directly with operating needs and shows no measurable short-run payoff. Controls behave as in the baseline in both groups. In this sample, the performance benefit of ESG is limited to large firms.

5.8 Endogeneity Test

The baseline regression results indicate that corporate ESG performance has a significant positive impact on financial performance; however, this relationship may be confounded by endogeneity issues, potentially leading to inconsistent and unstable estimation results. Endogeneity issues primarily arise from two sources: first, reverse causality-where superior firm performance may imply a greater inclination for firms to allocate more resources toward ESG development, thereby resulting in higher ESG scores, which would cause the baseline regression results to overestimate the impact of ESG on firm performance; second, omitted variable bias-due to unobservable factors such as corporate cultural characteristics, management preferences, and industry-specific shocks, these factors may simultaneously influence both the ESG practices and operational performance of firms, thereby introducing endogeneity issues. To address the

aforementioned endogeneity problems, this paper employs the instrumental variables method to test for ESG endogeneity, selecting the mean ESG performance across firms within the same industry and fiscal year as the instrumental variable for the core explanatory variable. The regression results obtained using the Two-Stage Least Squares method for the instrumental variables are presented in Table 12.

Two endogeneity concerns remain: reverse causality, since profitable firms can better afford ESG, and omitted factors such as corporate culture or managerial preferences that drive both ESG and performance. We instrument a firm's ESG score with the mean score of other firms in the same industry and year: industry practice shapes a firm's own ESG behavior but should not directly affect its ROA. The first stage is strong (0.3978, $t = 16.34$; Kleibergen–Paap $F = 267.1$, far above the Stock–Yogo critical value of 16.38). The second-stage ESG coefficient is 0.0200 ($t = 3.64$), with the same sign and significance as the baseline. The IV estimate is larger than OLS, a familiar pattern when measurement error in ratings attenuates OLS. More importantly, the positive effect survives instrumenting, so the baseline is not driven by reverse causality or omitted variables.

Table 12. Endogeneity Tests

	(1)	(2)
	first	second
VARIABLES	esg	roa
IV	0.3978*** (16.340)	
esg		0.0200*** (3.636)
cx1	0.0137*** (3.663)	0.0043*** (12.477)
cx2	-0.2617*** (-6.162)	-0.1557*** (-37.746)
cx3	0.2600*** (23.576)	0.0124*** (6.816)
cx4	-0.1775** (-2.368)	0.2146*** (31.552)
Observations	22,643	22,643
R-squared		0.136
Number of id	3,159	3,159
Individual FE	YES	YES
Year FE	YES	YES

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

6. Policy Implications

For regulators, the size heterogeneity argues

against uniform mandates. Disclosure and assessment requirements can be enforced strictly for large listed firms and industry leaders, where the performance payoff is demonstrable. For small firms, standards set too high risk crowding out operating resources without measurable gains. A better sequence is simplified disclosure templates, green transition subsidies, and shared ESG service platforms, with requirements raised as firms grow.

For firms, the mediation result means ESG should be managed as part of the innovation process, not only as disclosure. Treating ESG as compliance plus philanthropy leaves its value unrealized. The payoff comes when ESG goals enter R&D project selection, evaluation, and incentives, for example green process technology and inclusive products, so that ESG spending turns into innovation rather than pure expense.

For owners and boards, how much of the ESG benefit is realized depends on governance. SOEs can use their resource advantages to develop replicable models of integrating ESG with business objectives. Firms with concentrated ownership can turn decisive control into implementation speed through ESG committees and specialist independent directors. For private firms with dispersed ownership, targeted refinancing channels and tax relief can lower the cost of participation.

Three limitations qualify these findings. First, ESG performance is measured by a single rating vendor; Huazheng's methodology embeds choices other vendors do not share, and disagreement across Chinese ESG ratings is known to be large. Second, the mediation evidence rests on the stepwise procedure; bootstrap confidence intervals for the indirect effect would make the full-mediation claim firmer. Third, the sample ends in 2021, before the latest wave of mandatory disclosure rules, so whether the large-firm advantage persists as disclosure becomes universal is a question for future data.

7. Conclusions

7.1 ESG Performance Improves Financial Performance, and the Effect is Robust but Modest in Size

A one standard deviation increase in the ESG score corresponds to about 0.28 percentage points of ROA, roughly 8% of the sample mean.

The estimate holds after excluding the pandemic years, replacing ROA with ROE, and 2SLS estimation. This supports H1 and is consistent with stakeholder theory and the resource-based view: ESG appears to work by lowering financing and regulatory frictions and by building reputational assets.

7.2 The Effect Operates through R&D

ESG performance raises R&D intensity, and once R&D enters the model the direct effect of ESG is no longer significant. ESG seems to pay off not because disclosure itself is rewarded, but because ESG pressure pushes resources into R&D, which then improves profitability through technology upgrading and product iteration.

7.3 Ownership Structure Conditions the Effect

State ownership and ownership concentration both strengthen the marginal effect of ESG (interaction terms 0.0051 and 0.0002, $p < 0.01$). SOEs have more resources to carry ESG initiatives through, and large shareholders protect the long-horizon spending that ESG requires.

7.4 The Effect is Limited to Large Firms

ESG raises ROA significantly above the size median (0.0032, $p < 0.01$) but not below it (0.0010). Scale spreads the fixed costs of ESG investment and turns reputational and financing benefits into measurable returns; for small firms the costs come first and the benefits are hard to see in the short run.

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