

Impact of ESG Performance on Corporate Default Risk in State-Owned Enterprises: A Comparative Analysis of Manufacturing and Non-Manufacturing Sectors

Chih-Hsing Hung¹, Chien-Ho Lin^{2,*}, Ching-Hong Wang³, Chin-Ming Chen⁴

¹Chih-Hsing Hung, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

²Chien-Ho Lin, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

³Ching-Hong Wang, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

⁴Chin-Ming Chen, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

*Corresponding author: yuchih0317@gmail.com

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Abstract This study examines the association between environmental, social, and governance (ESG) performance and a default-risk proxy for Taiwanese state-owned enterprises (SOEs). Using Bloomberg financial data, Taiwan Economic Journal (TEJ) ESG ratings, and 147 firm-year observations from 2015 to 2021, we estimate ordinary least squares models separately for manufacturing and non-manufacturing SOEs. Higher total ESG scores (TESG) are positively associated with Altman Z-scores in both sectors in the controlled specifications, implying lower default risk, although the manufacturing coefficient changes sign across model specifications. At the dimensional level, higher environmental (E) scores are associated with lower Z-scores in manufacturing SOEs, whereas the corresponding association for non-manufacturing SOEs becomes statistically insignificant after additional covariates are included. The pooled full-sample analysis likewise yields an insignificant E-score coefficient in the controlled model. Social (S) and governance (G) scores are generally insignificant. Overall, the evidence indicates that the ESG-default-risk relationship is sector- and specification-dependent, and that the negative environmental association is concentrated in manufacturing SOEs. The findings inform the design of sector-sensitive sustainability policies while underscoring the need for cautious causal interpretation.

Keywords: ESG, default risk, TESG score, state-owned enterprises, Altman Z-score

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1. Introduction

Environmental, social, and governance (ESG) considerations entered mainstream financial analysis through the United Nations Global Compact's Who Cares Wins initiative [1]. The United Nations subsequently adopted the 2030 Agenda for Sustainable Development [2], reinforcing the integration of sustainability objectives into policy and investment decisions. ESG investing has since expanded rapidly as investors increasingly evaluate sustainability alongside financial performance [3,4]. Taiwan initiated the development of its Taiwan Sustainable Development Goals in 2016 [5]. The Financial Supervisory Commission later issued a sustainability roadmap requiring listed companies to disclose greenhouse gas inventories by 2027 and obtain verification by 2029 [6]. These regulatory developments increase the importance of understanding how ESG performance is associated with corporate financial

resilience. Prior evidence suggests that stronger ESG performance may reduce some forms of risk but may also impose short-term costs, particularly when environmental investments require substantial resources [7,8].

This study uses the Bloomberg-reported Altman Z-score as a continuous proxy for financial stability. The measure combines working capital, retained earnings, operating earnings, equity value, liabilities, sales, and total assets; higher values indicate stronger solvency and lower default risk. Because published Z-score variants use different formulas and distress-zone thresholds across firm types, this study does not impose a uniform bankruptcy cutoff on the sector subsamples. International evidence nevertheless supports the usefulness of Z-score models as comparative indicators of financial distress [9,10].

The application of this framework to state-owned enterprises is important because SOEs combine commercial objectives with public-policy responsibilities. The OECD defines an SOE as an enterprise over which the state exercises ownership or control [11]. From a political-economy perspective, government appointees

may face objectives that differ from firm-value maximization [12,13]. Although government ownership can be positively associated with performance in some settings [14], soft budget constraints and policy burdens may also generate agency problems [15,16]. Taiwanese SOEs operate in strategically important industries, making them an appropriate setting in which to examine whether ESG performance is associated with financial stability and whether that association differs between manufacturing and non-manufacturing sectors.

2. Literature Review and Research Hypotheses

2.1. The Strategic Importance of SOEs and Sustainable Development

Corporate social responsibility (CSR), grounded in sustainable development, has evolved into a framework encompassing economic, environmental, and social objectives. Ref. [17] argue that CSR can shape the relationship between firms and their stakeholders. Ref. [1] brought environmental, social, and corporate-governance considerations into financial-market discussions, while the 2030 Agenda further encouraged the use of measurable sustainability indicators [2]. ESG investing now represents an important financial strategy that places greater emphasis on long-term sustainability, disclosure quality, and stakeholder expectations [4].

SOEs remain important participants in the global economy and take multiple ownership and governance forms [18]. In emerging economies, they may support industrial development and act as macroeconomic stabilizers during periods of uncertainty [19]. SOEs have also played substantial roles in infrastructure and social development in Europe and North America [20,21]. At the same time, policy burdens and soft budget constraints may reduce operating discipline and create agency problems [15,16]. These competing features make SOEs a distinctive setting for examining the association between ESG performance and default risk.

2.2. ESG Performance and Default Risk in Non-manufacturing SOEs

The Altman Z-score integrates accounting and market information to assess corporate financial stability. In this study it is treated as a continuous measure, with higher values indicating stronger solvency and lower default risk [22]. Beyond traditional financial metrics, ESG performance may affect creditworthiness through reputation, information transparency, and investor attention. Evidence from listed Chinese firms indicates that ESG performance is positively associated with corporate reputation and that investor attention can mediate this relationship [23].

Higher ESG performance may also lower debt-financing costs by reducing information asymmetry and strengthening creditor support. Ref. [24] finds that this relationship varies across stages of the family-business life

cycle, including succession and power-transfer stages. Z-score research likewise indicates that financial stability deteriorates as firms approach distress [25], and updated Z-score specifications have shown useful predictive ability in non-manufacturing settings such as the European aviation industry [10]. On this basis, the following hypothesis is proposed:

Hypothesis 1. Higher TESG scores are positively associated with Z-scores, and therefore with lower default risk, among non-manufacturing SOEs.

2.3. ESG Performance and Default Risk in Manufacturing SOEs

Manufacturing firms generally operate with greater asset intensity and may face larger compliance and capital-adjustment costs than service-oriented firms. Ref. [26] show that bankruptcy-risk assessment can be improved by considering non-financial characteristics alongside accounting measures. Ref. [9] also demonstrate that Z-score models retain useful classification performance across a broad international sample of non-financial firms. These findings support the use of a financial-stability proxy while recognizing that ESG implementation costs and benefits may differ across industries. The following hypothesis is therefore proposed:

Hypothesis 2. Higher TESG scores are positively associated with Z-scores, and therefore with lower default risk, among manufacturing SOEs.

2.4. Environmental Performance and Default Risk

A firm's capacity to pursue sustainability objectives depends partly on its underlying operational and financial resources. Ref. [17] note that economic constraints can limit the priority assigned to CSR activities. Environmental improvements may be especially resource intensive because they can require equipment replacement, process redesign, and other investments whose benefits emerge only over time. Firms may therefore perceive environmental initiatives as costly when immediate economic returns are difficult to quantify [8]. This potential short-term trade-off motivates the following hypothesis:

Hypothesis 3. Higher environmental scores are negatively associated with Z-scores, and therefore with higher default risk, among SOEs.

3. Data and Methodology

3.1. Sample Selection

The sample comprises state-owned enterprises listed on the Taiwan Stock Exchange from 2015 to 2021. SOE status and industry classification follow the source-database classifications. Financial information is obtained from Bloomberg, and ESG ratings are obtained from the Taiwan Economic Journal (TEJ) database. The main TESG analysis contains 147 firm-year observations: 91

for non-manufacturing SOEs and 56 for manufacturing SOEs. Because disaggregated E, S, and G scores are not available for every firm-year, the dimension-specific analysis uses 63 complete observations, consisting of 39 non-manufacturing and 24 manufacturing observations. The reduction in sample size is considered when interpreting the dimension-specific estimates.

3.2. Variable Definitions

Table 1 defines the variables used in the analysis. The dependent variable, Z_score , is the Bloomberg-reported Altman Z-score and is treated as a continuous indicator of financial stability; higher values imply lower default risk. The principal explanatory variable, $TESG_score$, is TEJ's

composite assessment of environmental, social, and governance performance. The analysis also considers the separate environmental (E), social (S), and governance (G) pillar scores.

The controlled specifications include six additional TEJ subdimension scores: Energy Management (EM), Greenhouse Gas Emissions (EGG), Human Rights and Community Relations (HRCM), Employee Health and Safety (EHS), Fair Treatment of Stakeholders (TSF), and Control of Ownership and Seats (CO). Each score ranges from 0 to 100, with higher values indicating stronger performance. Because these covariates are conceptually nested within the broader ESG pillars, coefficients from the controlled models are interpreted as conditional associations rather than total causal effects.

Table 1. Variable Definitions

Name	Item	Description	Data Period	Source
Dependent Variable				
Z_score	Altman Z-score	Higher values indicate lower default risk	Annual	Bloomberg
Independent Variables				
$TESG_score$	Composite ESG	Overall ESG performance score	Annual	TEJ database
E_score	Environmental	Environmental pillar score	Annual	TEJ database
S_score	Social	Social pillar score	Annual	TEJ database
G_score	Governance	Governance pillar score	Annual	TEJ database
Additional Covariates				
EM	Energy management	Energy-management subdimension score	Annual	TEJ database
EGG	GHG emissions	GHG-emissions subdimension score	Annual	TEJ database
HRCM	Rights/community	Human-rights/community-relations score	Annual	TEJ database
EHS	Health and safety	Employee-health-and-safety score	Annual	TEJ database
TSF	Stakeholder treatment	Stakeholder-treatment subdimension score	Annual	TEJ database
CO	Ownership and seats	Ownership-and-board-seats subdimension score	Annual	TEJ database
DV_MFG	Manufacturing indicator	1 = manufacturing SOE; 0 = non-manufacturing SOE	Annual	Authors' calculation

Note. Z_score is continuous; TEJ ESG indicators are unitless scores from 0 (worst) to 100 (best).

3.3. Empirical Models

Ordinary least squares (OLS) regressions are used to estimate conditional associations between ESG performance and Z_score . The sector-specific models are estimated separately for manufacturing and non-manufacturing SOEs. Additional ESG subdimension covariates and year indicator variables are included where reported in the regression tables. Firm fixed effects are not included in the reported specifications. The tables present coefficient estimates with t-statistics in parentheses.

(i) Aggregate ESG model

The first model estimates the association between a firm's total ESG score and its Z-score:

$$Z_{i,t} = \alpha + \beta_1 TESG_{i,t} + \sum_j \beta_j Controls_{j,i,t} + \sum_l \gamma_l Year_l + \varepsilon_{i,t} \quad (1)$$

In Equation (1), $Z_{i,t}$ denotes the Altman Z-score of SOE i in year t , $TESG_{i,t}$ is the TEJ composite ESG score, $Controls$ represents the additional ESG subdimension covariates, and $Year$ denotes year indicators included in

the relevant specifications. The model is estimated separately for the two sector groups.

(ii) ESG dimension model

The second model decomposes the composite score into the environmental, social, and governance pillars:

$$Z_{i,t} = \alpha + \beta_1 E_{i,t} + \beta_2 S_{i,t} + \beta_3 G_{i,t} + \sum_j \beta_j Controls_{j,i,t} + \sum_l \gamma_l Year_l + \varepsilon_{i,t} \quad (2)$$

Equation (2) evaluates whether the three ESG pillars have distinct associations with financial stability and is used to assess Hypothesis 3. As in Equation (1), the additional ESG subdimension covariates and year indicators are included only in the specifications identified in the regression tables.

4. Empirical Results

4.1. Descriptive Statistics and Correlations

Table 2 reports descriptive statistics. The mean

TESG_score is 66.4635, while the mean E_score, S_score, and G_score values are 68.0846, 71.1967, and 69.4325, respectively. The number of available observations differs across the pillar scores, reflecting incomplete disaggregated ESG coverage. Z_score has a mean of 0.9810 and ranges from -0.4829 to 4.1332. Because Z-score variants use different industry-specific thresholds, the analysis treats Z_score as a continuous measure and

does not classify observations into uniform distress zones.

Table 3 presents Pearson correlations. Z_score is positively correlated with S_score ($r = 0.4223$, $p < 0.01$) and negatively correlated with E_score ($r = -0.2524$, $p < 0.05$). These bivariate relationships motivate the multivariate analysis but should not be interpreted as causal evidence. Pairwise sample sizes may differ because disaggregated ESG-score coverage varies across variables.

Table 2. Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
CO	56.3818	58.52	97.69	10.93	27.1345	147
E_SCORE	68.0846	69.63	73.02	56.22	4.5687	63
S_SCORE	71.1967	71.01	90.67	58.61	6.9445	67
G_SCORE	69.4325	70.9	72.66	58.61	3.5557	63
EM	74.2483	88.33	99.55	33.52	23.6136	147
EGG	53.1121	70.56	99.28	1.39	36.1114	147
HRCM	77.6286	92.74	99.46	36.96	23.5713	147
EHS	82.0420	88.87	99.86	0.4	20.5802	147
TSF	55.4737	56.52	94.68	2.4	12.3923	147
Z_SCORE	0.9810	0.4857	4.1332	-0.4829	1.0750	147
TESG_SCORE	66.4635	67.27	79.27	52.27	5.8783	147

Note. Except for Z_score and the sector indicator, variables are TEJ scores ranging from 0 to 100. Observation counts differ because disaggregated ESG scores are not available for all firm-years.

Table 3. Pearson Correlation Matrix

	CO	DV_MFG	E	S	G	EM	EGG	HRCM	EHS	TSF	Z	TESG
CO	1											
DV_MFG	-0.4542***	1										
E	-0.1155	0.2008	1									
S	0.2015	-0.0912	0.0699	1								
G	0.02196	0.2075	0.4026***	0.6300***	1							
EM	-0.1928**	-0.0139	0.3149**	-0.0668	0.2798**	1						
EGG	0.1281	-0.0402	-0.2282*	0.2130*	-0.0930	-0.2992***	1					
HRCM	-0.0294	-0.3395***	-0.0528	0.2632**	0.0827	0.0306	-0.0492	1				
EHS	-0.0133	0.1842**	0.3857***	-0.1466	0.5561***	0.2177***	-0.3189***	-0.0700	1			
TSF	0.0185	-0.0122	-0.3254***	0.5299***	0.01669	0.0780	0.0413	0.0784	-0.1010	1		
Z	-0.1078	0.2222***	-0.2524**	0.4223***	0.03282	-0.0282	0.1795**	0.0438	-0.2181***	0.2358***	1	
TESG	0.3352***	-0.0837	0.2358*	0.2038*	0.5318***	0.4482***	0.1670**	0.0849	0.3451***	0.1939**	0.0698	1

Note. DV_MFG denotes the manufacturing indicator; other abbreviations are defined in Table 1. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Pairwise sample sizes may vary because of missing disaggregated ESG scores.

4.2. Sector-specific Results

Table 4 reports the sector-specific estimates from Equation (1). Columns (1) and (2) present results for non-manufacturing SOEs, while Columns (3) and (4) present results for manufacturing SOEs. Positive coefficients indicate higher Z-scores and therefore lower default risk.

For non-manufacturing SOEs, TESSG_score is positively associated with Z_score in both specifications. In the controlled model with year indicators, the coefficient is 0.0941 ($p < 0.01$). This result supports Hypothesis 1 and indicates that higher aggregate ESG performance is associated with lower default risk in the non-manufacturing subsample. The estimate is an association and should not be interpreted as evidence of a causal risk-reduction mechanism.

For manufacturing SOEs, the TESSG_score coefficient is negative and marginally significant in Column (3) ($\beta = -0.0376$, $p < 0.10$). After the additional covariates and year indicators are included in Column (4), however, the

coefficient becomes positive and statistically significant ($\beta = 0.0703$, $p < 0.05$). This sign reversal indicates sensitivity to model specification. Hypothesis 2 is supported by the controlled specification but not consistently across the two manufacturing models.

Taken together, the aggregate ESG results do not provide consistent evidence of an adverse manufacturing effect. Both controlled specifications show positive associations between TESSG_score and Z_score, but the sign change in the manufacturing subsample warrants cautious interpretation.

Table 5 presents the sector-specific estimates for the environmental, social, and governance pillars. As in Table 4, Columns (1)-(2) refer to non-manufacturing SOEs and Columns (3)-(4) refer to manufacturing SOEs.

For non-manufacturing SOEs, E_score is negative and marginally significant in Column (1) ($\beta = -0.0774$, $p < 0.10$), but the coefficient becomes smaller and statistically insignificant after additional covariates are included in Column (2) ($\beta = -0.0235$). The negative environmental

association is therefore not robust in the non-manufacturing subsample.

For manufacturing SOEs, E_score is negative and statistically significant in both Column (3) ($\beta = -0.0556$, $p < 0.05$) and Column (4) ($\beta = -0.0712$, $p < 0.05$). Thus, higher environmental scores are associated with lower Z-scores and higher default risk in the manufacturing subsample. Hypothesis 3 receives partial support, with the evidence concentrated in manufacturing SOEs.

One possible explanation is that environmental improvements in manufacturing require capital expenditures whose financial benefits emerge only over a longer horizon. Because environmental investment and liquidity constraints are not directly measured, however, this explanation is suggestive rather than a confirmed causal mechanism.

The S_score and G_score coefficients are generally statistically insignificant. Although S_score is positive in the baseline non-manufacturing model, it loses significance after the additional covariates are included. The limited S and G associations may reflect the regulatory and governance environment of SOEs, but this mechanism is not directly tested and should therefore be interpreted cautiously.

4.3. Full-sample Analysis

Table 6 reports pooled estimates for the full SOE sample. In the aggregate ESG model, TEGS_score is positive but insignificant in Column (1). After year indicators are included in Column (2), the coefficient remains positive and becomes marginally significant ($\beta = 0.0243$, $p < 0.10$). This result is consistent with a modest positive association between aggregate ESG performance and financial stability in the pooled sample.

For the ESG pillars, E_score is negative and marginally significant in Column (3) ($\beta = -0.0568$, $p < 0.10$). After the additional covariates and year indicators are included in Column (4), the E_score coefficient remains negative but becomes statistically insignificant ($\beta = -0.0236$). The pooled controlled model therefore does not confirm a robust negative environmental association across all SOEs.

The S_score and G_score coefficients are also insignificant in the pooled models. Overall, the full-sample analysis indicates that the environmental association is specification-dependent and supports the sector-specific conclusion that the negative relationship is concentrated primarily in manufacturing SOEs.

Table 4. Regression Results for Aggregate ESG Performance by Sector

	Non-manufacturing SOEs		Manufacturing SOEs	
	(1) Z_score	(2) Z_score	(3) Z_score	(4) Z_score
TEGS_score	0.0406** (2.0333)	0.0941*** (2.8513)	-0.0376* (-1.9850)	0.0703** (2.1098)
EM		-0.0080 (-1.2834)		-0.0063 (-0.9839)
EGG		0.0092** (2.1474)		-0.0103*** (-2.7379)
HRCM		-0.0076 (-1.2523)		0.01112** (2.1147)
EHS		-0.0209** (-2.5049)		-0.0078 (-1.5557)
TSF		0.0048 (0.4660)		-0.0044 (-0.4877)
CO		0.0013 (0.1863)		-0.0011** (-2.2324)
Constant	-1.9176 (-1.4317)	-3.4506 (-2.6416)	3.7609 (3.0050)	-1.7585 (-0.9628)
Firm fixed effects	NO	NO	NO	NO
Year fixed effects	NO	YES	NO	YES
Observations	91	91	56	56
R-square	0.044	0.3865	0.068	0.4616

Note 1. Columns (1)-(2) report non-manufacturing SOEs; Columns (3)-(4) report manufacturing SOEs. The dependent variable is Z_score. Additional covariates are EM, EGG, HRCM, EHS, TSF, and CO.

Note 2. t-statistics are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 5. Regression Results for ESG Dimensions by Sector

	Non-manufacturing SOEs		Manufacturing SOEs	
	(1) Z_score	(2) Z_score	(3) Z_score	(4) Z_score
E_score	-0.0774* (-1.7238)	-0.0235 (-0.4217)	-0.0556** (-2.1859)	-0.0712** (-2.906)
S_score	0.0613 (1.6764)	0.02285 (0.4218)	-0.0772 (-0.9500)	-0.0384 (-0.5457)
G_score	-0.0127 (-0.2064)	-0.0262 (-0.2640)	-0.0835 (-0.5580)	0.0189 (0.1349)
EM		0.0005 (0.4700)		0.0019 (0.2886)
EGG		0.0156** (2.5637)		-0.0057 (-1.6478)

	Non-manufacturing SOEs		Manufacturing SOEs	
	(1)	(2)	(3)	(4)
	Z_score	Z_score	Z_score	Z_score
HRCM		-0.0168 (-1.6016)		0.0012 (0.2497)
EHS		0.01246 (0.5355)		0.0011 (0.2432)
TSF		0.0625 (1.0201)		0.0053 (0.8788)
CO		0.0067 (0.6820)		-0.0097* (-2.0353)
Constant	2.6196 (0.8229)	-2.1288 (-1.5932)	16.4089 (2.3113)	7.6625 (1.2108)
Firm fixed effects	NO	NO	NO	NO
Year fixed effects	NO	YES	NO	NO
Observations	39	39	24	24
R-square	0.1906	0.4809	0.3281	0.7607

Note 1. Columns (1)-(2) report non-manufacturing SOEs; Columns (3)-(4) report manufacturing SOEs. The dependent variable is Z_score. The principal explanatory variables are E_score, S_score, and G_score; additional covariates are EM, EGG, HRCM, EHS, TSF, and CO. Note 2. t-statistics are in parentheses. * p < 0.10; ** p < 0.05; *** p < 0.01.

Table 6. Full-sample Regression Results for Aggregate ESG Performance and ESG Dimensions

	Aggregate ESG model		ESG dimension model	
	(1)	(2)	(3)	(4)
	Z_score	Z_score	Z_score	Z_score
TESG_score	0.0128 (0.8429)	0.0243* (1.910)		
E_score			-0.0568* (-1.8876)	-0.0236 (-0.5134)
S_score			0.0493 (1.5938)	-0.0137 (-0.3103)
G_score			-0.0071 (-0.1433)	-0.033 (-0.5639)
EM				0.0399*** (4.0640)
EGG				0.0087** (2.4475)
HRCM				-0.0004 (-0.6172)
EHS				-0.0093 (-1.3168)
TSF				0.0105 (1.3368)
CO				-0.0011 (-0.1560)
Constant	0.1322 (0.1382)	-0.6318 (-0.7474)	1.8896 (0.7296)	2.7737 (0.8151)
Firm fixed effects	No	No	No	No
Year fixed effects	No	Yes	No	Yes
Observations	147	147	63	63
R-square	0.0049	0.8443	0.1230	0.9165

Note 1. Columns (1)-(2) report the aggregate ESG model; Columns (3)-(4) report the ESG dimension model. The dependent variable is Z_score. Additional covariates are EM, EGG, HRCM, EHS, TSF, and CO.

Note 2. t-statistics are in parentheses. * p < 0.10; ** p < 0.05; *** p < 0.01.

5. Conclusion

This study examines three hypotheses concerning the association between ESG performance and a default-risk proxy for Taiwanese SOEs. For non-manufacturing SOEs, TESG_score is positively associated with Z_score in both specifications, supporting Hypothesis 1. The controlled

estimate suggests that stronger aggregate ESG performance is associated with lower default risk, although the observational design does not establish causality.

For manufacturing SOEs, the TESG_score coefficient changes from negative in the baseline model to positive in the controlled model. Hypothesis 2 is therefore supported only in the controlled specification and not consistently

across models. The sign reversal indicates that the manufacturing result is sensitive to the included covariates and year effects.

Evidence for Hypothesis 3 is partial. E_score is negatively associated with Z_score in the manufacturing subsample, including the controlled specification, but becomes insignificant in the controlled non-manufacturing and pooled models. The results therefore do not support a universal environmental penalty across all SOEs; instead, the negative association is concentrated in manufacturing firms.

The manufacturing pattern is consistent with the possibility that environmental improvements require substantial near-term investment while generating benefits over a longer horizon (Nidumolu et al., 2009). However, the study does not directly observe environmental capital expenditure, financing constraints, or policy-compliance costs. The proposed sustainability-stability trade-off should therefore be viewed as a plausible interpretation rather than an identified mechanism. The generally insignificant S_score and G_score coefficients may reflect the existing oversight of SOEs, but that explanation also requires direct testing.

For policymakers and SOE managers, the findings favor sector-sensitive ESG implementation. Manufacturing SOEs may benefit from phased environmental investment, explicit liquidity planning, and financing instruments that align project costs with long-term benefits. Non-manufacturing SOEs should likewise evaluate ESG initiatives in relation to their operating models rather than applying uniform score-improvement targets.

Several limitations should guide interpretation. The sample is small, and disaggregated ESG scores reduce the dimension-specific sample from 147 to 63 observations. The OLS design cannot resolve reverse causality or time-invariant firm heterogeneity, while the additional covariates overlap conceptually with the principal ESG measures. Moreover, the Altman Z-score is treated as a continuous proxy because its thresholds may vary across industries. Future research should use larger samples, conventional financial controls, firm fixed effects or other endogeneity strategies, lagged ESG measures, alternative default-risk proxies, and comparisons with private firms.

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