Association between firm performance, cost of debt and environmental, social, and governance scores: Evidence from the Taiwan equity market

*Jo-Yu Wang**

* Assistant Professor, National Formosa University, Yunlin, Taiwan. Email: jywang@nfu.edu.tw

Association between firm performance, cost of debt and environmental, social, and governance scores: Evidence from the Taiwan equity market

Abstract

This study examines the influence of ESG scores on firm financial performance, using data on listed companies in Taiwan from 2016 to 2023. It analyzes the ESG performance of 2,168 firms, including 13,236 firm-year observations. The empirical findings reveal that firms with higher integrated ESG scores exhibited higher financial performance, both in the pre- and post-coronavirus disease 2019 periods. The evidence also shows that firms' environmental efforts do not contribute significantly to their financial performance. These results imply smaller firms might face difficulties in ESG investment, especially within sub-environmental pillars. The empirical results were robust, particularly considering outliers and endogeneity.

This study further demonstrates that ESG scores have a certain impact on various corporate financing announcement effects, including SEO, corporate bond, and convertible bond. Overall, there is a positive relationship between a company's total ESG score (TESG) and the effects of various financing announcements. In addition, the results also indicate that the firms with higher ESG scores generally have a lower cost of debt from the bank loan.

JEL Classification: G11, G14, G34, Q56,

Keywords: firm performance, ESG scores, equity market, Taiwan, sustainability

1. Introduction

A firm's social responsibility is generally extended to three dimensions: environmental, social, and governance (ESG). Various regulations and rules have been put in place in developed countries to ensure that the rights of all stakeholders are protected. For example, in the United Kingdom, the Financial Stability Board created the Task Force on Climate-Related Financial Disclosures (TCFD) to mandate disclosure of firms' climate-related financial information in 2017. The European Union announced the Corporate Sustainability Reporting Directive (CSRD) in January 2023, which requires companies to report their sustainability activities. Similar rules have been introduced in the U.S.A as well (Cicchiello et al., 2023). According to Global Sustainable Investment Review (GSIR), global investment related to sustainability reached US$35.3 trillion in the five major markets in 2020: the United States, Canada, Japan, Australasia, and Europe. Taiwan, an economy with a trade dependence of over 90%, proposed many carbon reduction policies and regulations in response to the European Union's Carbon Border Adjustment Mechanism (CBAM), which is expected to take effect from 2026. For example, the Climate Change Response Act and Regulations Governing the Collection of Carbon Fees Act were approved by the Taiwanese authority in 2024; this integration of Taiwan's related Acts helps Taiwanese capital markets align with international ESG trends. However, the question of whether a firm's all ESG activities can be translated into operational performance is still open. The majority of the previous studies have revealed a positive relationship between ESG and firm financial performance (Chen & Yang, 2020; Giese et al., 2019; Nguyen et al., 2022; Verheyden et al., 2016), while some studies showed a negative nexus (Duque-Grisales & Aguilera-Caracuel, 2021; Narula et al., 2024) or even no correlation (Nelling & Webb, 2009). Thus, no previous studies have reached a general conclusion on the association between ESG score and firms' financial performance. This study investigates the association between Taiwanese listed firms' ESG score and operational performance.

The remainder of this paper is organized as follows: Section 2 describes the sample, variable definition, and research method; Section 3 presents the empirical results and their implications; Section 4 concludes the paper.

2. Methodology

2.1 Data

This study applies the measures of ESG disclosure provided by the Taiwan Economic Journal (TEJ), the largest economic and financial database in Taiwan. The 17

submeasures of ESG dimensions are shown in Table 1. In this study, the ESG performance of 2,168 firms, including 13,236 firm-year observations from 2016 to 2023 are applied, while the observations of financial institutions and de-listed firms are excluded.

Table 1. Sub-measures of Taiwan's ESG framework based on TEJ's model

Environmental	Social	Governance
GHG Emissions Score	Human Rights & Community Relations Score	Business Model & Innovation Score
Energy Management Score	Data Security Score	Controlling Share Score
Water & Wastewater Management Score	Product Quality & Safety Score	Fair Treatment Score
Waste & Hazardous Materials Management Score	Labor Practices Score	Governance Transparency Score
Environment Disclosure Score	Employee Health & Safety Score	Governance Disclosure Score
	Social Disclosure Score	Leadership & Governance Score

Figure 1 illustrates the general ESG pattern, which shows a marginally declining trend during the coronavirus disease 2019 (COVID-19) period. Looking at ESG score in detail shows that the declining trend mainly concentrates on the following industries: steel, e-commerce, tourism, electronics, and information technology. Table 2 describes the data used in the paper.

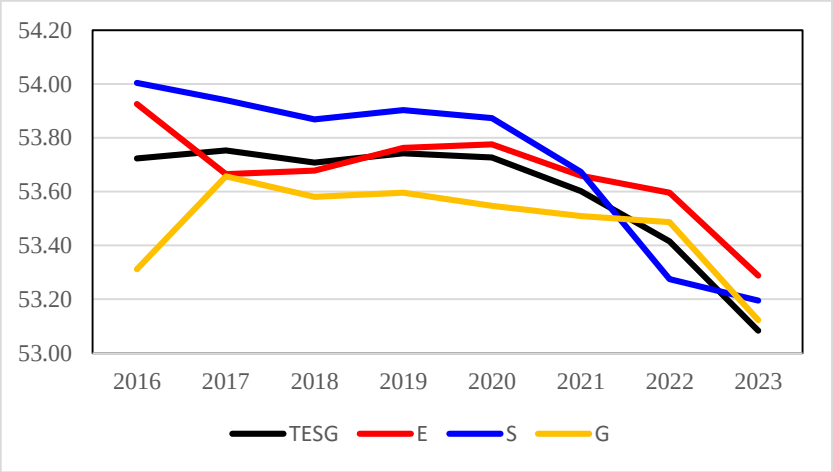


Figure 1. The ESG pattern of listed firms in Taiwan

Table 2. Data description

	Mean	Median	S.E. Mean	Min.	Max.
ROE	3.9887	6.7400	0.3091	-2729.4700	681.2300
Tobin's Q	1.4298	1.0300	0.0139	0.0200	52.3000
TESG	53.6638	52.9150	0.0672	29.8900	83.7300
Environmental	53.7206	51.4000	0.0921	25.3500	90.9600
Social	53.7830	52.6450	0.0890	26.4400	91.0000
Governance	53.5272	54.0500	0.0931	19.6500	84.4100
MB(%)	2.2599	1.5600	0.0339	0.2200	261.1600
Debt(%)	41.7981	41.9850	0.1645	0.3800	81.8791
Size	15.2029	15.0468	0.0133	9.7566	22.3256
Independence(%)	36.1742	36.3636	0.0835	0.0000	80.0000
Boardholdings(%)	24.0083	19.5800	0.1442	0.0000	99.0300
Institutionals(%)	43.1413	42.3200	0.2009	0.0000	100.0000
Export(%)	54.4615	65.0400	0.3324	0.0000	100.0000
	Pre-COVID-19		Post-COVID-19		*Difference*
ROE	2.6086		6.1522		3.5436***
Tobin's Q	1.3255		1.5292		0.2037***
TESG	53.7479		53.5874		-0.1605
Environmental	53.7692		53.6808		-0.0884
Social	53.9489		53.6114		-0.3375*
Governance	53.5483		53.5224		-0.0259
MB(%)	1.9842		2.5519		0.5677***
Debt(%)	40.9853		42.9376		1.9523***
Size	15.1500		15.2811		0.1311***
Independence(%)	34.3577		38.4813		4.1236***
Boardholdings(%)	23.5571		24.5705		1.0134***
Institutionals(%)	42.6835		43.6277		0.9442**
Export(%)	55.8311		52.9802		-2.8509***

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The numbers of observation before (after) the pandemic year are 7,331 (5,905).

2.2 Research method

To examine the association between the ESG score and firm financial performance, we run the following empirical regression specifications:

$$CFP_{i,t} = \beta_0 + \beta_1 \cdot Escore_{i,t-1} + \beta_2 \cdot Sscore_{i,t-1} + \beta_3 \cdot Gscore_{i,t-1} + \beta_4 \cdot ESGscore_{i,t-1} + \sum_{j=5}^{n} \beta_j \cdot control_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where $CFP_{i,t}$ is corporate financial performance of firm i at year t proxied by return on equity (ROE) and Tobin's Q. In addition, $control_{i,t}$ are the control variables used in this

study, including market-to-book value, firm size (natural logarithm of a firm's assets), debt ratio, independent director percentage, percentage of the shares held by institutional investors holdings, percentage of the shares held by board directors (Boardhold), percentage of firms' revenue from exports (exports), and industrial effect (dummy is set as 1 for high-tech industry and 0 for others).

In addition, we applied two approaches to ensure the robustness of our empirical results. First, we winsorized firm performance at the 1st and 99th percentiles to avoid the influence of extreme observations in the regression analysis. Second, to account for the potential effect of endogeneity, a two-stage regression approach is adopted as a robustness test (Nguyen et al., 2022; Zhao et al., 2023). In the first stage, we apply industrial effect (probit model) and firm exporting percentage as a dependent variable on the other determinant variables, as shown in Eq. (1). In the second stage, we run a regression of firm CFP on ESG variables, firm's characteristics and the inverse Mills ratio obtained from the first stage.

3. Empirical Results

3.1 Environmental, social, and governance effects on firm financial performance

The evidence in Panel A of Table 3 demonstrates the positive effects of listed firms' ESG on their ROE; generally, firms with higher governance and total ESG (TESG) performance have higher returns on equity. In Panel B, we use Tobin's Q as firms' financial performance to replace ROE; the parameter of social dimension is more significant (0.0859), while the TESG is significant at 1%. In addition, firms' efforts in the environmental dimension have less impact on their performance and may even have a negative effect. The evidence points out that capital expenditure on energy conservation and carbon reduction makes firms less profitable. In 2023, for example, TSMC increased reclaimed water substitution rate to 12% (annual additional water savings: 4.27 million m^3) and increased renewable energy usage to 11.2% (saving 3.9 billion KW-hours of electricity).

Figures 2 shows the horizontal pattern of the association between ESG scores and firm performance. In general, the annual relationship between a firm's ESG efforts and financial performance was influenced by the COVID-19 pandemic, particularly from 2020 to 2023. In addition, the evidence in Table 4 indicates that there is a positive association between firms' ESG scores and ROE (Tobin's Q) in the post-COVID19 period, although the parameters of the associations are smaller than those in the pre-COVID19 period. Unexpectedly, the environmental score is positively associated with ROE after COVID-19.

Table 3. Regression results of ESG effects on firm financial performance

Panel A: ROE	model 1	model 2	model 3	model 4	model 5
Intercept	-66.1809***	-66.2395***	-71.5801***	-71.4916***	-69.7348***
Environmental	-0.0173			-0.0213	
Social		0.0333		0.0078	
Governance			0.1971***	0.1995***	
TESG					0.2211***
MB	-1.8946***	-1.8973***	-1.9042***	-1.9028***	-1.9151***
Size	5.1096***	5.0458***	4.8624***	4.8956***	4.6006**
Debt	-0.2956***	-0.2940***	-0.2862***	-0.2861***	-0.2857***
Export	0.0180**	0.0187**	0.0175**	0.0179**	0.0182**
Independence	0.1405***	0.1420***	0.1141***	0.1133***	0.1372***
Institutionals	0.0128	0.0131	0.0124	0.0123	0.0143
Boardhold	0.0745*	0.0745*	0.0666*	0.0665*	0.0715*
Hightech	-1.1933*	-1.2067*	-1.2364**	-1.2200**	-1.3525**
Adjusted R^2	0.1116	0.1117	0.1147	0.1146	0.1133
Panel B: Tobin's Q					
Intercept	2.6329***	2.6082***	2.5397***	2.5273***	2.5223***
Environmental	-0.0016			-0.0010	
Social		0.0859**		0.0058***	
Governance			0.0039***	0.0033**	
TESG					0.0075***
MB	0.2403***	0.2397***	0.2403***	0.2396***	0.2398***
Size	-0.0851**	-0.1008***	-0.0862**	-0.1022***	-0.0994**
Debt	-0.0207***	-0.0204***	-0.0205***	-0.0202***	-0.0204***
Export	-0.0002	-0.0001	0.0039***	-0.0001	-0.0002
Independence	0.0010	0.0013	0.0004	0.0009	0.0008
Institutionals	0.0079***	0.0080***	0.0079***	0.0080***	0.0080***
Boardhold	-0.0031	-0.0031	-0.0033	-0.0033	-0.0032
Hightech	0.0655**	0.0613**	0.0661***	0.0616**	0.0612**
Adjusted R^2	0.4247	0.4257	0.4252	0.4260	0.4256

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The observations in the table are 13,236.

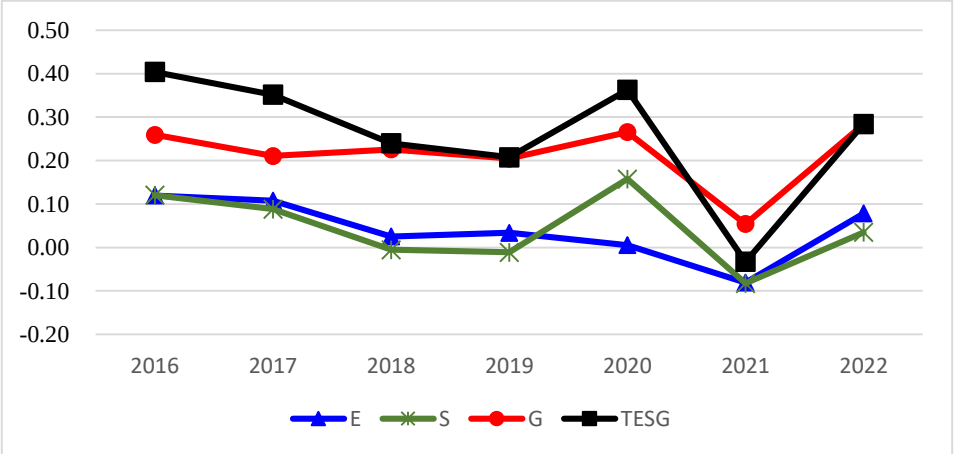


Figure 2. Annual association of ESG to ROE

Table 4. Associations of ESG to firm performance before and during COVID-19 periods

	Model 1	Model 2	Model 3	Model 4	Model 5
Panel A: ROE	*Pre*-COVID19				
Environmental	-0.0202			-0.0361	
Social		0.0435*		0.0065	
Governance			0.1813***	0.2189***	
TESG					0.2919***
Adjusted R^2	0.1677	0.2081	0.2309	0.2894	0.2654
	Post-COVID19				
Environmental	0.0251***			-0.0650	
Social		0.0177		0.0053	
Governance			0.2331***	0.1942***	
TESG					0.1681**
Adjusted R^2	0.1738	0.1998	0.2675	0.3002	0.3031
Panel B: Tobin's Q	*Pre*-COVID19				
Environmental	-0.0010			-0.0017*	
Social		0.0060***		0.0021**	
Governance			0.0057***	0.0019*	
TESG					0.0198***
Adjusted R^2	0.1021	0.1287	0.1531	0.1809	0.1302
	Post-COVID19				
Environmental	-0.0008			-0.0011*	
Social		0.0015*		0.0041**	
Governance			0.0027*	0.0021*	
TESG					0.0017
Adjusted R^2	0.1130	0.1194	0.1641	0.2298	0.1895

Note: ***, **, and * refer the ones in Table 3. The parameters of the intercept and control variables are not shown because they are similar to those in Table 3.

3.2 Robustness tests

The baseline regression models shown in subsection 3.1 suggest that ESG score generally leads to positive financial performance of firms, although the results of the environmental dimension are weakly significant. The results in Section 3.1 are subjected to robustness tests for potential extreme observation and endogeneity issues. In Table 5, financial performance is winsorized based on 1% and 99%, and the evidence shows that the TESG, governance, and social dimensions are positively associated with ROE and operational profits.

In addition, the results in Table 6 show the robustness tests based on Heckman (1979) two-stage regression approach. Two variables (export- and high-tech driven firm) are used as dependent variable in the first regression model, and the results of second-stage regression model are presented in Panels A and B of Table 6. The social, governance, TESG are positively associated with ROE, consistent with the results in section 3.1. As we use operational profit to replace Tobin's Q, individual ESG and total ESG, including environmental dimension, are significantly associated with firm's profit.

Table 5. Robustness test: alternative (winsorized) regression model

Panel A: Winsorized ROE	Model 1	Model 2	Model 3	Model 4	Model 5
Environmental	-0.0271			-0.0027	
Social		0.0273*		-0.0002	
Governance			0.1658**	0.1463**	
TESG					0.1918***
Adjusted R^2	0.2021	0.2987	0.2725	0.3276	0.2903
Panel B: Operational profit					
Environmental	-1.5455*			-1.1911	
Social		2.0851***		3.8849**	
Governance			8.2760***	2.6008*	
TESG					5.8613**
Adjusted R^2	0.0931	0.1387	0.1445	0.1908	0.1755

Note: In the table, operational profit is used to replace ROE as a robustness test. ***, **, and * refer the ones in Table 3. The parameters of the intercept and control variables are not shown because they are similar to those in Table 3.

Table 6. Robustness tests: second regression results of Heckman's approach on the impact of ESG on firm financial performance

Panel A: ROE (export)	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	51.2173***	51.7380***	45.0447***	44.9546***	51.0965***
Environmental	-0.0246			-0.0117	
Social		0.0904*		0.0011	
Governance			0.1981***	0.1999***	
TESG					0.2233***
MB	-1.5631***	-1.5633***	-1.5739***	-1.5731***	-1.5742***
Size	2.5554***	2.5157***	2.3448***	2.3771***	1.9911**
Debt	-0.2981***	-0.2969***	-0.2888***	-0.2889***	-0.2882***
Independence	-0.2706**	-0.2712**	-0.2949**	-0.2950**	-0.2864**
Institutionals	0.0208	0.0209	0.0205	0.0204	0.0222
Boardhold	0.2886***	0.2896***	0.2790***	0.2786***	0.2921***
IMR	-8.4328***	-8.4684***	-8.3722***	-8.3614***	-8.6814***
Adjusted R^2	0.0986	0.1149	0.2091	0.2433	0.2076
Panel B: ROE (hightech)					
Intercept	-31.1457***	-31.0903***	-32.3911***	-32.3606***	-32.0819***
Environmental	-0.0291			-0.0078	
Social		0.0912*		-0.0010	
Governance			0.2069***	0.2083***	
TESG					0.2324***
MB	-0.1863*	-0.1902*	-0.1473*	-0.1477*	-0.1683*
Size	3.5966***	3.5806***	3.3297***	3.3562***	3.0611***
Debt	-0.7780**	-0.7760**	-0.7816**	-0.7813**	-0.7787**
Independence	1.2201	1.2193	1.2219	1.2204	1.2409
Institutionals	0.0303	0.0302	0.0302	0.0301	0.0322
Boardhold	-1.8540	-1.8508	-1.9162	-1.9145	-1.9016
IMR	26.3721***	27.3228***	30.1949***	30.1687***	30.0559***
Adjusted R^2	0.1077	0.2190	0.1985	0.2674	0.1812

Note: ***, **, and * refer the ones in Table 3.

3.3 Capital raising announcement effects and cost of capital

Taiwanese equity market is one of the top ten equity market in the world, and It is renowned for listing a large number of technology and semiconductor companies, which are key drivers of Taiwan's economy. This section examines how the investors' reactions to the firms' funds raising based on their ESG scores. (Choi, Ryu, & You, 2024) explores the relationship between financial firms' environmental, social, and governance (ESG) activities in Korea and their results indicate a positive association between financial stability and ESG activities. In addition, they also show that overall ESG scores, as well as the individual environmental, social, and governance pillars, potentially enhance financial stability. Taiwan's regulatory authorities have required listed companies to disclose their ESG performance in 2015. In recent years, many listed companies have announced financing activities, however, none previous studies explored the comprehensive relationship between the impact of financing announcements and ESG scores from the investors' perspective.

Some previous studies have proposed several potential explanations to address the relationship between ESG scores and the cost of debt, and generally they illustrate a negative association between ESG scores and firm's cost of debt. For example, Atif and Ali (2021) apply US, European, and Brazilian companies to investigate the relationship between ESG scores and cost of debt. They find that companies with higher ESG scores manage ESG risks better, as well as good to climate change and labor challenges. That can lead to improved financial performance and lower default risk. Thus, the firms with higher ESG scores can deliver lower borrowing costs and improved access to credit. The most critical implication of Atif and Ali (2021) is that firms with a higher ESG disclosure have lower default risk. Li, Hu, and Hong (2024) focus on 2,440 listed firm in China A-share market from 2015 to 2020, and examine if green finance policy (GFP; mainly using ESG scores as a proxy) reduce firm's cost of debt. They find higher ESG rating effectively drop the firm's cost of debt. Although more evidence above show that higher ESG scores can reduce firm's cost of debt, however, Gigante and Manglaviti (2022) did not find similar results. In addition, most of the previous studies focus on the relationship between cost of debt and ESG scores, not the whole cost of fund raising (particularly the relationship between SEO and ESG scores). Therefore, it is crucial to examine the relationship between investors' perceptions of ESG scores of listed

companies in the Taiwan stock market and the impact of financing announcements. In this subsection, the study collects capital raising announcement from TEJ, including seasonal equity offering (SEO), corporate bonds, and convertible bonds announced in the Taiwan stock market from 2016 to 2023 and tests the associations between these announcement effects and ESG. The novelty lies in examining how market investors respond to companies' ESG performance and various financing methods.

In the sample set of capital raising announcements (excluding the observations of financial institutions and 18 announcements data missing), and firms that have announced similar capital raising events within the 240 trading days prior to the announcement date will be excluded from the data. Thus, there are 499 SEO, 309 straight bond, and 420 convertible bond announcements. 71.25% of the samples are from industries related to electronics, machinery, textiles, steel, chemicals-related, and shipping. Approximately 15% of the samples are from purely domestic cultural, department store, and hotel-related industries.

In the first step, considering the risk issue and the difference between industries of Taiwan stock market, a two index model (market index and industrial index) is applied to measure the parameters of expected return of stock *i*. And then average cumulative abnormal return (ACAR) is easily obtained. The expected return model as:

$$\hat{\mathrm{R}}_{i,t} = \alpha_i + \beta_{1,i} R_{m,t} + \beta_{2,t} R_{indus,t} + \varepsilon_{i,t} \tag{2}$$

where $R_{indus,t}$ is the sector (or called industrial) return of firm *i* (R_i.)

The second step considers the issue of endogeneity, that the results might be affected by the research method. Thus, a risk-adjusted expected return model based on a GARCH (1,1) [1]is adopted to measure expected individual stock return. The model is

$$\hat{\mathrm{R}}_{j,t} = \alpha_j + \beta_j R_{m,t} + \varepsilon_{j,t} \tag{3}$$

$$\varepsilon_{j,t} \left| \Psi_{t-1} \sim N(0, h_{j,t}) \right. \tag{4}$$

[1] GARCH(1,1) model is used to describe volatility process, since it is easy to compare with previous studies.

$$h_{j,t} = \varpi_j + \delta_j h_{j,t-1} + \gamma_j \varepsilon^2_{j,t-1} \quad (5)$$

where $\gamma_j + \delta_j < 1$, and $h_{j,t}$ is the conditional variance of stock *j* at time *t*.

The results of the first step are shown in Table 7 presenting the announcement effects are generally negative. And it highlights the critical role of ESG scores, particularly governance, in shaping investor perceptions of fundraising announcements. The overall ESG scores (TESG) generally positively significant when the firms announce SEO and convertible bonds. While market reactions vary by financing type, strong governance and overall ESG scores consistently contribute to mitigating negative market impacts, underscoring their importance in corporate financial decision-making. The results further illustrate that ESG factors have varying levels of influence on different financing methods. For instance, the Environmental and Governance have a more significant positive impact on SEOs, with their effects surpassing those observed in corporate bonds and convertible bonds. This result is consistent with the statement made by Li et al. (2024) that environmental (E) is more important than S or G from the business operations. Additionally, we further analyzed the relationship between corporate ESG performance and the firm's cost of debt. Most previous studies have suggested that ESG can reduce a company's cost of debt (Alves & Meneses, 2024; Li et al., 2024). However, Gigante and Manglaviti (2022) was unable to detect such a result due to a limited sample size. We collected over 9,106 samples of corporate bank loan interest rates from 2016 to 2023. The results show that ESG performance does not effectively reduce borrowing rates in the lower interest rates area. In contrast, the firm's costs of debt are higher, as a company's ESG performance is lower. Generally, there is a left-up to bottom-right corner pattern, particularly the cost of debt larger than 2% [2]. The pattern in Figure 3 implies that the firms with higher ESG scores generally have a lower cost of debt.

Considering the potential endogeneity of the results in Table 7, robustness test is also provided in Table 8. The results are mainly consistent with the evidence shown in Table 7, the TESG scores are statistically significant with the announcement effects (CAR (0,

[2] When we check back the raw data, we find that approximately 76% of the samples with loan interest rates around 2% occurred during the period of severe pandemic conditions (march 2020 to December 2022).

+5)) of SEO and convertible. However, the individual governance (G) is associated with all types of fund raising announcements.

Table 7. Associations of fund raising announcement effects to ESG scores

Dependent variable: CAR(0,+5)	SEO	Corporate bonds	Convertible bonds
CAR (0,+5)	-0.5534***	-0.1120*	-0.0763
	(-2.8491)	(-1.3667)	(-0.7892)
Intercept	0.0094	0.0001	0.0039
	(0.2738)	(0.7107)	(0.6903)
Environmental	0.0651**	0.0023	0.0489*
	(1.7364)	(1.1686)	(1.3294)
Social	-0.0045	-0.0041	0.0009
	(-0.5023)	(-0.4159)	(0.5590)
Governance	0.1004***	0.0761**	0.0263*
	(2.3672)	(1.812)	(1.6531)
TESG	0.0879**	0.0052	0.0773**
	(1.6757)	(0.5147)	(1.7903)
MB ratio	-0.8915**	-1.2271***	-1.3299***
	(-1.6661)	(-2.3768)	(-2.4561)
Firm size	-1.0148**	1.7289***	1.7210**
	(-1.8182)	(2.3383)	(1.7759)
Debt ratio	0.0311	0.1009	0.0981
	(0.4269)	(1.2290)	(0.3892)
Independence	0.7861**	0.6212**	0.6019**
	(1.8929)	(1.3318)	(1.7590)
Institutionals	0.0318	0.0291	0.0420
	(0.8678)	(0.7715)	(0.8900)
Boardhold	0.5167*	0.7001*	0.4091
	(1.3247)	(1.3771)	(0.5523)
Exporting (%)	0.0492	0.0953*	0.1061*
	(0.9210)	(1.3987)	(1.4115)
Year effect	Yes	Yes	Yes
Industrial effect	Yes	Yes	Yes
Adjusted R^2	0.0268	0.0219	0.0341
Obs.	499	309	420

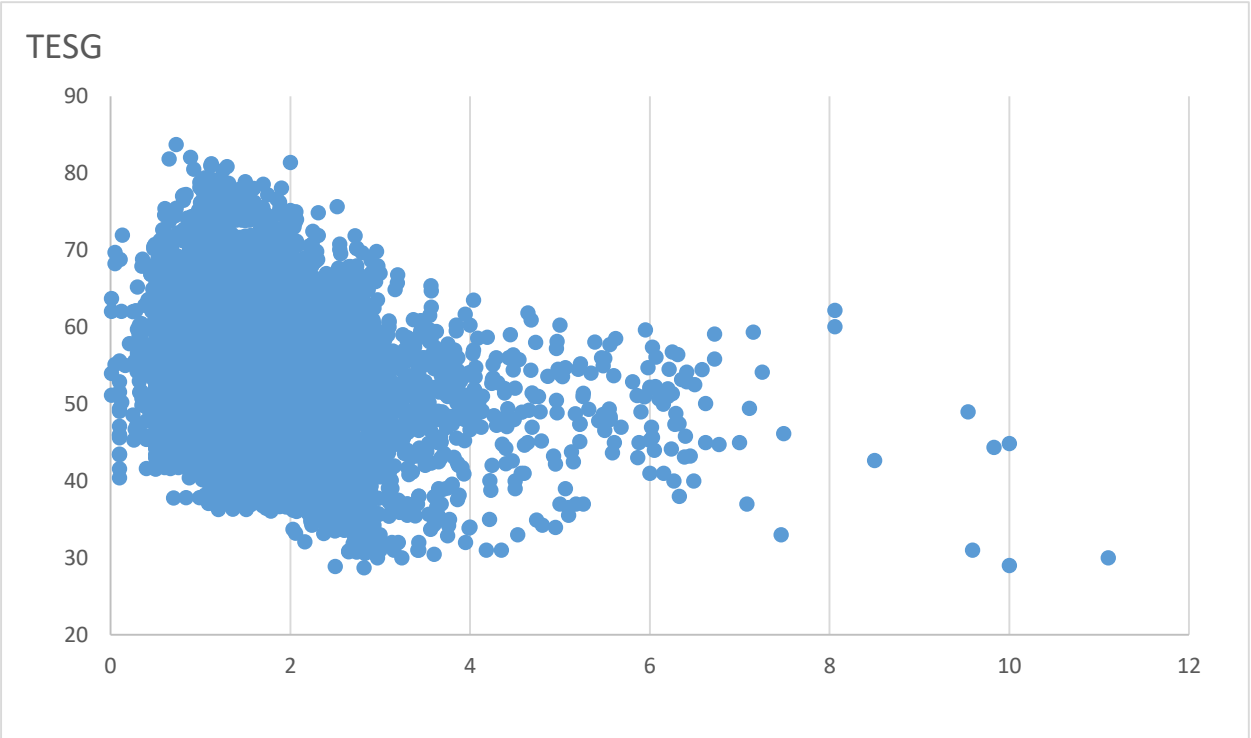
Note: ***, **, and * refer the ones in Table 3. The dependent variable is CAR (0,+5), and the parameter estimation model is $\hat{R}_{i,t} = \alpha_i + \beta_{1,i} R_{m,t} + \beta_{2,t} R_{indus,t} + \varepsilon_{i,t}$, where $R_{m,t}$ is the market portfolio return proxyed by TWSE index return, and $R_{indus,t}$ is sector (industrial) return according to the expected $R_{i,t}$.

Table 8. Robustness test: Associations of fund raising announcement effects to ESG scores

Dependent variable: CAR(0,+5)	SEO	Corporate bonds	Convertible bonds
CAR (0,+5)	-0.5871*** (2.0231)	-0.1993** (1.7892)	-0.0792* (1.7109)
Intercept	-0.1457 (-0.3635)	-0.0903 (-0.4842)	-0.0982 (-0.4985)
Environmental	0.1891** (1.9985)	0.0781 (1.0013)	0.0851 (1.0569)
Social	0.0073 (0.4995)	0.0056 (0.6356)	0.0091 (0.6711)
Governance	0.0674* (1.3904)	0.1003** (1.6897)	0.3991** (1.8954)
TESG	0.0997* (1.6850)	0.0184 (0.1467)	0.0733* (1.5691)
MB ratio	-0.0781 (-0.2379)	-0.0931 (-0.2006)	-0.0137 (-0.5563)
Firm size	1.7803** (1.8955)	1.8006** (1.9054)	1.0317* (1.5412)
Debt ratio	-0.9936* (-1.6908)	-0.8951* (-1.6579)	-0.7006* (-1.5467)
Independence	0.9622* (1.5698)	0.6913 (0.3445)	0.5401 (0.3311)
Institutionals	0.0611 (0.7831)	0.0458 (0.7922)	0.0658 (0.7631)
Boardhold	0.9007* (1.7705)	0.8813* (1.7390)	0.5211 (1.1054)
Exporting (%)	0.1004* (1.0991)	0.0993 (0.9297)	0.1361* (1.1278)
Year effect	Yes	Yes	Yes
Industrial effect	Yes	Yes	Yes
Adjusted R^2	0.1901	0.1390	0.1009

Note: ***, **, and * refer the ones in Table 3.

Figure 3. The pattern between firms' cost of debt and TESG scores



Note: There are sample 9,106 observations in the figure, and 8,546 observations are fix-rate bank loan. Each firm is included one observation in the figure, and individual bank loan less than 0.5 million NTD is excluded. The bank loan is defined the real borrowing interest rate minus the risk-free rate, and risk-free rate is defined as the average one-year fixed deposit interest rate of Taiwan's six largest public banks.

4. Conclusion

This study investigated the association between ESG scores and the performance of firms listed in the Taiwanese stock market from 2016 to 2023. Our results provide significant evidence that, on average, a firm's total ESG activities increase its return on equity. Firms' environmental efforts do not contribute effectively to their financial performance. Our evidence shows that the individual components of ESG and aggregated ESG contributed less to firm performance during the period of COVID-19. We demonstrate the robustness of the results by showing that the positive associations between social factors, as well as governance, and firm performance are not affected by outliers and endogeneity.

This study further demonstrates that ESG scores have a certain impact on various corporate financing announcement effects, including SEO, corporate bond, and convertible bond. Overall, there is a positive relationship between a company's total ESG score (TESG) and the effects of various financing announcements, particularly environmental (E) and governance (G) factors. As for the impact of ESG on corporate cost of debt from the bank sector, the results show that under low-interest-rate conditions, ESG does not further influence a company's cost of debt. However, under higher interest rate conditions, companies typically exhibit lower ESG scores.

References

Alves, C. F., & Meneses, L. L. (2024). ESG scores and debt costs: Exploring indebtedness, agency costs, and financial system impact. International Review of Financial Analysis, 94, 103240.

Atif, M., & Ali, S. (2021). Environmental, social and governance disclosure and default risk. Business Strategy and the Environment, 30(8), 3937-3959.

Chen, H.-Y., Yang, S.S., 2020. Do investors exaggerate corporate ESG information? Evidence of the ESG momentum effect in the Taiwanese market. Pacific-Basin Fin. J. 63, 101407.

Choi, S. Y., Ryu, D., & You, W. (2024). ESG activities and financial stability: The case of Korean financial firms. Borsa Istanbul Review, 24, 945-951.

Cicchiello, A.F., Marrazza, F., Perdichizzi, S., 2023. Non-financial disclosure regulation and environmental, social, and governance (ESG) performance: The case of EU and US firms. Corp. Soc. Respons. Environ. Manag. 30, 1121–1128.

Duque-Grisales, E., Aguilera-Caracuel, J., 2021. Environmental, social and governance (ESG) scores and financial performance of multilatinas: Moderating effects of geographic international diversification and financial slack. J. Bus. Ethics.168, 315–334.

Giese, G., Lee, L.-E., Melas, D., Nagy, Z., Nishikawa, L., 2019. Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. J. Portfol. Manag. 45, 69–83.

Gigante, G., & Manglaviti, D. (2022). The ESG effect on the cost of debt financing: A sharp RD analysis. International Review of Financial Analysis, 84, 102382.

Heckman, J.J., 1979. Sample selection bias as a specification error. Econometrica. 47, 153–161.

Li, W., Hu, H., & Hong, Z. (2024). Green finance policy, ESG rating, and cost of debt——Evidence from China. International Review of Financial Analysis, 92, 103051.

Narula, R., Rao, P., Kumar, S., Matta, R., 2024. ESG scores and firm performance-evidence from emerging market. Int. Rev. Econ. Fin. 89, 1170–1184.

Nelling, E., Webb, E., 2009. Corporate social responsibility and financial performance: the "virtuous circle" revisited. Rev. Quant. Fin. Acc. 32, 197–209.

Nguyen, D.T., Hoang, T.G., Tran, H.G., 2022. Help or hurt? The impact of ESG on firm performance in S&P 500 non-financial firms. Australas. Acc. Bus. Fin. J.16, 91–102.

Verheyden, T., Eccles, R.G., Feiner, A., 2016. ESG for all? The impact of ESG screening on return, risk, and diversification. J. Appl. Corp. Fin. 28, 47–55.

Zhao, X., Fang, L., Zhang, K., 2023. Online search attention, firms' ESG and operating performance. Int. Rev. Econ. Fin. 88, 223–236.