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Too Much of a Good Thing? Two-Sided Effect of ESG on Corporate Financial Performance

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The purpose of this research is to clarify the curvilinear link between Environmental, Social and Governance (ESG) and corporate financial performance (CFP), and draws upon the "too much of a good thing" (TMGT) theory to verify whether the curvilinear relationship supports the conflicting results of previous studies. The sample comprises 69 listed companies in Taiwan with ESG disclosures over 2005 to 2020. The findings reveal that ESG impacts CFP in an inverted- U shaped, which is predominantly evident in the environmental and social pillars. This study validates the rising popularity of ESG investments. To enhance CFP, businesses must meticulously assess the allocation of capital to ESG to prevent under or over-investment. Managers should be aware of the TMGT effect and ensure the threshold of ESG is identified, as this is essential to balancing the cost/value trade-off, improving the CFP, and maintaining sustainable development.

Keywords: *ESG; Corporate Financial Performance; Inverted-U Shaped; TMGT Effect; Sustainable Development.*

Introduction

Attention to the sustainable development of enterprises has been constantly increasing, particularly during the COVID-19 pandemic and other financial crises. The impact of listed companies' ESG (environmental, social, and governance) performance on corporate market capitalization attracts widespread attention (Zhou *et al.*, 2022), making ESG performance disclosure a key factor in measuring a firm's sustainability (Khovrak, 2020). Many stakeholders believe ESG analysis and reporting are core elements contributing to investment decisions (Jenkins & Yakovleva, 2006). As environmental awareness increases, corporations are experiencing additional pressure from stakeholders to engage in ESG disclosure and, therefore, must focus on non-financial factors rather than financial information (Al-Shaer & Zaman, 2018; Santamaria *et al.*, 2021). Consequently, ESG disclosure is now a critical component of corporate reporting and is of great concern to academics and practitioners.

As ESG gradually becomes more mainstream, an increasing number of articles study the impact of ESG on corporate financial performance (CFP), making the link between ESG and CFP a prominent research topic at present (Lopez-Toro *et al.*, 2021). Although an abundance of study has been conducted on the ESG-CFP connection, it is still unclear how ESG practices impact CFP. According to the stakeholder theory (Freeman, 1984), managers owe fiduciary responsibilities to all stakeholders, not just shareholders, this indicates a firm's ESG investments should generate returns for stakeholders (Behl *et al.*, 2021). Thus, by focusing on ESG, companies will reap sustainable benefits from their engagement with the larger society. In this regard, many scholars argue the ESG-CFP relationship is positive (Lopez-Toro *et al.*, 2021; Okafor *et al.*, 2021).

In contrast, according to the shareholder theory (Friedman, 1970), the sole responsibility of managers is to enhance the wealth of shareholders and, consequently, they are not authorized to utilize any funds for anything other than boosting profits (Nollet *et al.*, 2016). In the agency theory (Jensen & Meckling, 1976), managers may be incentivized to invest in ESG to further their own interests, and ESG could pose a possible agency cost. Empirical evidence suggests that while insiders capture the benefits of ESG investment, other shareholders bear the risks and costs (Barnea & Rubin, 2010). This indicates that ESG investment has a negative impact on CFP (Duque-Grisales

&Aguilera-Caracuel, 2019; Di Tommaso & Thornton, 2020; Ruan & Liu, 2021). There are few studies that propose a neutral association between ESG and CFP (Buallay *et al.*, 2022), suggesting that the association between ESG and CFP is insignificant. So far, it is still controversial whether ESG is an increase or a decrease in CFP.

The inconclusive findings suggest the possibility of curvilinear relationships and the "too much of a good thing" (TMGT) effect. As suggested by Pierce and Aguinis (2013), the TMGT effect occurs when a favorable antecedent (ESG) reaches an inflection point, after which their relationship with expected outcomes (CFP) is no longer linear and negative (Ahmadova *et al.*, 2022). Recently, some literatures referenced the U-shaped (Naimy *et al.*, 2021; El Khoury *et al.*, 2023) or inverted-U shaped ESG-CFP nexus (Pu, 2022). The preceding discussion demonstrates the methodological impact of ESG on CFP by means of an OLS regression model, and reports outcomes that are negative, positive, neutral, U-shaped, and inverted-U shaped. This suggests that further studies of this relationship are needed to improve understanding. Given the diverging findings, the aim of this article is to explore the curvilinear relationship between ESG and CFP in both theoretical and empirical terms. This enables detailed understanding of how strategic choices relating to ESG mechanisms impact a firm's performance levels. Hence, based on ESG literature, the aim is to answer the primary research question of whether, and specifically how, ESG effects CFP.

There are three objectives for this study. Its first objective is to fill a current gap in the literature by elucidating the ESG-CFP nexus and extending the present scope of prior research by determining how ESG influences CFP, and more specifically, in what way. The second aim is to evaluate the ESG-CFP relationship, delving into the specific impacts of the ESG pillar on CFP. The third objective is to further understand the ESG-CFP nexus and the potential distinctness considering industry type and firm size.

To achieve these objectives, ESG and other financial data pertaining to Taiwan publicly listed firms over 2015 to 2020 was collected. Results are based on the quadratic regression with robust standard error correction for heteroscedasticity, reveal a curvilinear association between ESG and CFP. Moreover, the findings of ESG pillars reveal the curvilinear ESG-CFP connection is significant only in the environmental and social pillars. Additionally, the findings validate an inverted-U shaped ESG-CFP nexus in both environmentally sensitive and non-environmentally sensitive industries. The results validate a correlation between ESG and CFP in larger firms that adheres to an inverted-U shaped pattern, whilst this correlation is not apparent in small and medium-sized enterprises (SMEs). Overall, the comprehensive research findings evidence the double-edged sword effect ESG activities have on CFP, thereby bridging the gap between the conflicting results of previous research. These findings provide substantive insights into the complexities of the trade-off between cost and value, and encourage enterprises to maintain balance between value and cost to ensure sustainable development.

The current study contributes to the existing literature and theory, and provides numerous important insights for managers. The study evidences the nonlinear association between ESG and CFP, thus refining Pierce and Aguinis's (2013) inconclusive TMGT meta-theory findings. By utilizing OLS analysis, the research identifies the curvilinear impact of ESG on CFP. Additionally, based on the extant literature regarding the U-shaped correlation (Lind & Mehlum, 2010; Haans *et al.*, 2016), this article conducts further investigation on the existence of a curvilinear ESG-CFP relationship. The practical implications for enterprises, as inferred from the empirical outcomes, are that they should identify their optimal ESG level because exceeding or lacking in ESG is disadvantageous.

Studying this subject is significant as it assists in gaining a deeper comprehension of the connection between ESG and CFP. It could provide evidence of a double-edged sword effect of ESG on CFP. It helps managers to be aware of the double-edged effect and ensure that ESG thresholds are identified, as this is critical to balancing cost and value trade-offs, improving CFP and maintaining sustainability.

The remaining sections are organized as follows. First, the literature is reviewed, and hypothesis development is provided. Then the data sources and measures of variables are provided in Section 3. The results and discussion are presented in the next two sections. The final section offers conclusions.

Literature Review and Hypothesis Development

Curvilinear ESG-CFP Relationship

The academic literature that addresses the ESG-CFP relationship is, so far, conflicting and inconclusive. One view argues a positive ESG-CFP link, suggesting being socially responsible enhances CFP (Brogi & Lagasio, 2019; Long *et al.*, 2020; Conca *et al*., 2021; López-Toro *et al.*, 2021; Okafor *et al.*, 2021). Based on this reasoning, sustainability initiatives could more effectively meet the stakeholder needs (Lee *et al.*, 2013a) and create competitive advantage (Lee *et al.*, 2013b).

Another argument asserts a negative ESG-CFP nexus, stating that ESG inflates costs (Duque-Grisales *et al.*, 2019; Ruan & Liu, 2021). Studies examining a potential negative correlation between ESG and CFP from the viewpoint of agency theory (Barnea *et al.*, 2010; Di Tommaso *et al.*, 2020) posit that managers may prioritize investments in ESG over shareholders' interests in order to enhance their own professional image. Other studies indicate a neutral relationship between ESG and CFP, suggesting that socially responsible actions have no impact on profitability (Lahouel *et al*., 2019; Buallay *et al.*, 2022), as the positive effects offset the negative ones.

The more recent varied results on the impact ESG have on CFP and FV (firm value) have raised doubts about their proposed linear relationship, which has led to the adoption of non-linear models. Several articles dealing with the non-linear ESG-CFP nexus, it is described as either a U-shaped (convex) or an inverted-U shaped (concave). Barnett and Salomon (2012) prove the U-shaped (convex) linkage between ESG and CFP. ESG activities have a negative impact on the CFP in the initial phase because the costs outweigh the benefits, and in the later stages the relationship recovers and becomes positive (Naimy *et al.*, 2021; El Khoury *et al.*, 2023). The U-shaped ESG-CFP relationship is supported by Han *et al.* (2016) and Nollet *et al.* (2016).

Conversely, Trumpp and Guenther (2017) provide evidence of an inverted-U shaped relationship between ESG and both firm profitability (FP) and firm value (FV). El Khoury *et al.* (2023) also discovered a concave relationship between ESG and CFP. Furthermore, Wu and Chang (2022) evidence a concave-convex nexus between ESG performance and firm value. Given the arguments above, the first hypothesis is:

Hypothesis 1. The ESG-CFP relationship is nonlinear and could be concave (inverted-U shaped) or convex (U-shaped).

Curvilinear ESG pillars- CFP nexus

This subsection further disaggregates the ESG ratings into its three sub-components and investigates the curvilinear nexus between ESG three pillars (EGSE, ESGS and ESGG) and CFP.

Firstly, many studies identify positive (e.g., Lee *et al*., 2016) and negative connections (e.g., Brammer *et al.*, 2006) between environmental disclosure performance (ESGE) and CFP; nevertheless, these results are conflicting and indeterminate. Conversely, in other research, the nonlinear ESGE-CFP nexus is the focus, with several articles reporting it to be a U-shaped or an inverted-U shaped. Fujii *et al.* (2013) found that ESG and CFP present an inverted-U shaped (concave) relationship. Other studies (Misani & Pogutz, 2015; Teng et al., 2022) observe a concave linkage between ESGE and CFP; nevertheless, Trumpp and Guenther (2017) indicate a convex linkage between ESGE and CFP. According to the aforementioned research, Hypothesis 2 is:

Hypothesis 2. The ESGE-CFP relationship is nonlinear and could be concave (inverted-U shaped) or convex (U-shaped).

Secondly, the research findings on the nexus between social disclosure performance (ESGS) and CFP are not consistent. One view argues the ESGS-CFP relationship is positive and that CFP is improved by being socially aware (Shen *et al.*, 2016; Buallay, 2019). These studies state that ESGS can assist businesses with improving operation margins (Cannon *et al.*, 2020), CFP (Velte, 2017), and public perception (Gangi, 2019) and reputation (Buallay *et al.*, 2020). The opposing argument states the ESGS-CFP relationship is negative, which is attributed to the negative perception stakeholders place on ESGS (El Khoury *et al.*, 2023). A third view focusses on a curvilinear ESGS-CFP relationship, with several studies evidencing it to be an inverted-U shaped pattern (Siueia *et al.*, 2019; Naimy *et al.*, 2021; Teng *et al.*, 2022). As a consequence, the third hypothesis is:

Hypothesis 3. The ESGS-CFP relationship is nonlinear and could be concave (inverted-U shaped) or convex (U-shaped).

Thirdly, the agency theory (Jensen & Meckling, 1976) recommends that corporate governance can reduce agency costs and thus improve CFP. Nevertheless, analysis of the governance disclosure performance (ESGG)-CFP nexus remains conflicting and inconclusive. There are arguments supporting a positive relationship between ESGG and CFP, indicating that governance-focused activities increase CFP (Miras-Rodríguez et al. 2015) through the enhancement of reputation, regulation strengthening, and mismanagement reduction (Zehri & Zgarni, 2020). Other findings have reported no significant association between ESGG and CFP (Shakil *et al.*, 2019; Teng *et al.*, 2022); however, some articles state it has a concave (Han *et al.*, 2016; Naimy *et al*., 2021) or convex (Nollet *et al.*, 2016; Xie *et al.*, 2019) pattern. According to the aforementioned research, Hypothesis 4 is:

Hypothesis 4. The ESGG-CFP relationship is nonlinear and could be concave (inverted-U shaped) or convex (U-shaped).

Material and Methods

Sample and Data

ESG data for publicly listed companies in Taiwan are available from Bloomberg, while other data related to companies, such as size and financial leverage, has been obtained from the financial database of Taiwan Economic Journal (TEJ). The final data set includes 69 enterprises, with 789 firm-year observations from 2005 to 2020, after excluding insurance and financial holding companies.

Variable

Dependent variables. As the assessment of CFP is multi-dimensional, this research includes two measures: ROE (return on equity) and ROA (return on assets).

Explanatory variable. This study measures ESG disclosure performance using ESG scores from the Bloomberg database, in accordance with prior ESG research (Teng *et al.*, 2022; Wu & Chang, 2022). In order to measure the relative performance of a company in terms of ESG disclosure, Bloomberg provides comprehensive, transparent and objective ESG scores. Additionally, ESG disclosure score is also separated into the single pillars (ESGE, ESGS and ESGG) to investigate the impact of each disclosure on CFP.

Control variables. The control variables for this research were chosen as prior research evidence they determine ROE. They are as follows: firm size (SIZE), as calculated by the natural logarithm of total assets; financial leverage (FL), calculated by the ratio of total debts to total assets; firm age (FA) is the firm's age; net profit margin (NPM) is the ratio of net income to sales; and growth rate of owner's equity (GROE), is the percentage change in owner's equity over the previous period (Chang & Wu, 2022; Kuo & Chang, 2021; Saygili *et al.*, 2022; Teng *et al.*, 2022).

Research Model and Methods

Referring to Teng et al. (2022), this study utilizes the subsequent equation to evaluate the curvilinear connection between ESG and CFP.

$$CFP_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 ESG2_{it} + \beta_3 CON_{it} + \mu_t + \gamma_i + \varepsilon_{it} \quad (1)$$

where CFP_{it} is the CFP of *i* firm in year *t*; ESG_{it} is the ESG of *i* firm in year *t*; ESG2 is the square of ESG of *i* firm in year *t*. The control variables are referred to as CON_{it}, while μ_t stands for the time fixed effect, γ_i is an industry unobservable influence, and ε_{it} stands for the residual disturbance. Furthermore, building upon the literature concerning the U-shaped correlation (Lind & Mehlum, 2010; Haans *et al.*, 2016), we conduct a more in-depth analysis of the curvilinear link between ESG and CFP.

Results

Descriptive Statistics

The data descriptions of the variables are shown in Table 1. With regard to the dependent variable, the mean value of ROE is 12.638 %. According to Bloomberg's ESG ratings, Taiwan listed companies excel in governance (ESGG), with higher social scores (ESGS) than environmental scores (ESGE). The average score for ESGE was 33.071, indicating insufficient efforts to incorporate environmental management policies from industries in Taiwan.

Furthermore, the VIF (variance inflation factor) values (Table 2) vary between 1.01 and 1.23, which is below the threshold of 5 set by Hair et al. (2017). Therefore, the presence of multicollinearity is not deemed to be a concern.

Table 1

Summary Statistics of the Main Variables

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
ROE	789	12.53	19.663	-292.53	152.76
ESG	782	36.999	16.49	1.24	84.3
ESGE	716	33.071	19.25	2.33	88.37
ESGS	733	38.927	17.906	3.13	91.23
EGSG	782	53.018	8.237	5.36	87.42
SIZE	789	18.779	1.138	15.456	21.949
FL	789	50.469	17.389	7.14	98.21
NPM	789	8.895	15.994	-107.42	206.84
FA	789	33.054	15.631	1	71
GROE	789	74.525	1849.39	-92.09	51950.621

Table 2

Bivariate Correlation Matrix

Variable	1	2	3	4	5	6	7
1. ROE	–						
2. ESG	-0.080*	–					
3. SIZE	-0.192*	0.375*	–				
4. FL	-0.232*	0.085*	0.131*	–			
5. NPM	0.687*	-0.069	-0.073*	-0.426*	–		
6. FA	-0.113*	0.019	0.195*	0.039	-0.036	–	
7. GROE	0.012	-0.016	0.011	-0.004	-0.011	-0.072*	–
Variance inflation factor	—	1.17	1.22	1.23	1.22	1.05	1.01

*Note: * represents statistical significance at 10 %.*

Non-Linear Nexus between ESG and CFP

When considering whether to choose a fixed or random effects model, the Hausman test (1978) was utilized. The result rejects the null hypothesis (Chi-square value = 38.62, $p<0.01$), indicating that a fixed effect model is employed for the article. Table 3 shows the results of the fixed effect regressions with White's (1980) adjustment for hetero-scedasticity.

The estimation results show a significantly positive slope ($p<0.05$) for ESG, and a significantly negative slope ($p<0.05$) for ESG2, suggesting the presence of a concave curvilinear ESG-CFP relationship. In terms of control variables, NPM and GROE significantly positively impacts CFP ($p<0.05$), and SIZE significantly negatively impacts CFP ($p<0.01$). FL and FA have no significant influence on CFP.

Drawing on the existing literature on the U-shaped relationship (Lind & Mehlum, 2010; Haans *et al*. 2016), the findings show that both slopes are significant, 0.3331 for the positive slope of ESG_{low} and -0.0036 for the negative slope of ESG_{high} with the expected signs (positive and then negative). Completion of the Sasabuchi (1980) test confirms there is an overall presence of an inverted-U shaped relationship ($t=1.96$, $p<0.05$). The results also suggest the estimated inflection point (threshold value) is 46.264, which lies in the explanatory variable range and within the Fieller (1954) confidence interval for the extremum [22.62, 89.99] (Table 3, column 1). These findings provide strong evidence for an ESG-CFP relationship that follows an inverted-U pattern, thereby lending support to Hypothesis 1.

Relationships between the three ESG Pillars and CFP

This section investigates the curvilinear association between the three ESG pillars (ESGE, ESGS and ESGS) and CFP. In relation to ESGE, the slope for ESGE shows significant positivity ($p<0.01$), while the slope for ESGE2 shows significant negativity ($p<0.01$). This indicates the presence of a concave curvilinear ESGE-CFP nexus (Table 3, column 2). The $ESGE_{low}$ slope is positively significant, while the $ESGE_{high}$ slope is negatively significant. Moreover, both ESGE's threshold (42.7754) and the Fieller's 95 % confidence interval (CI) are situated within the data range, confirming the existence of a concave ESGE-CFP nexus (Table 3, column 2). As a result, Hypothesis 2 is supported.

For ESGS, the results evidence that the $ESGS_{low}$ slope is significantly positive, while the $ESGS_{high}$ slope is significantly negative ($p<0.05$). Furthermore, it has been confirmed that both the threshold of ESGE (42.7754) and the 95 % CI of Fieller (1954) fall within the data range, indicating the presence of a concave ESGE-CFP nexus

(Table 3, column 3), thus supporting Hypothesis 3. Lastly, the estimation results demonstrate the relationship between ESGG and CFP is insignificant, which does not support Hypothesis 4 (Table 3, column 4).

Robustness Check

Robustness was explored with an additional sensitivity analysis that utilizes ROA as an alternate measure of CFP, as suggested in other studies (Conca *et al.*, 2021; Saygili *et al.*, 2022; Teng *et al.*, 2022), and was measured using the aforementioned Equation (1). The robustness test reinforces the main results which confirm that ESG affects CFP, and a concave curvilinear ESG-CFP nexus exists. The U-test for return on assets (ROA) indicates the presence of an inverted-U shaped curvilinear relationship, as aligned with the baseline regression shown in Table 4. The linkages between each ESG pillar (ESGE, ESGS, and ESGG) and CFP are also congruent with the baseline regression (Table 4).

To tackle the problem of endogeneity, a reverse causality test was carried out. A regression was conducted to validate this assumption. As there exists a chance of reverse causation between ESG and ROE, it is probable that ROE has a nonlinear influence on ESG. In this regression, ROE acted as the independent variable, whereas ESG served as the dependent variable. The findings are shown in Table 5 and confirm ROE has insignificant impact on ESG, thus reverse causality is not an issue (Table 5).

Table 3

Baseline Nonlinear Model Using ROE

	ROE			
Variables	(1)	(2)	(3)	(4)
ESG	0.3331**			
	(0.1539)			
ESG2	-0.0036**			
	(0.0017)			
ESGE		0.4373***		
		(0.1645)		
ESGE2		-0.0051***		
		(0.0016)		
ESGS			0.3344*	
			(0.1775)	
ESGS2			-0.0037*	
			(0.0019)	
ESGG				-0.1717
				(0.4069)
ESGG2				0.0011
				(0.0034)
SIZE	-2.4916***	-2.3065**	-2.0245**	-2.2631**
	(0.8628)	(0.9921)	(0.8484)	(0.9135)
FL	0.0886	0.0664	0.0718	0.1021
	(0.1196)	(0.1315)	(0.1228)	(0.1232)
NPM	0.8692***	0.8630**	0.8561**	0.8621***
	(0.3229)	(0.3590)	(0.3565)	(0.3234)
FA	-0.0770	-0.0654	-0.0791	-0.0799
	(0.0630)	(0.0752)	(0.0653)	(0.0639)
GROE	0.0002**	0.0002**	0.0002**	0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Constant	43.2897**	39.9490**	35.4846*	50.9608**
	(16.7685)	(17.6684)	(19.7709)	(20.0015)
Hausman chi-square (p-value)	38.62 (0.0000)	43.57 (0.0000)	40.97 (0.0000)	30.47(0.0000)
Sample size	782	715	732	782
Adjusted R-squared	0.5003	0.4810	0.4749	0.4951
F value	8.689***	9.643***	6.308***	8.054***
Slope at lower bound X_{low} ($\beta_1+2*\beta_2*X_{low}$)	0.3242**	0.4125***	0.3112**	—
Slope at upper bound X_{high} ($\beta_1+2*\beta_2*X_{high}$)	-0.2739**	-0.4651***	-0.3407**	—
Sasabuchi statistic	1.96**	2.63***	1.85**	—
95% confidence interval (Filler method)	[22.62, 89.99]	[26.49, 52.89]	(-∞,∞)	—
Extreme point/within data range	46.264/Yes	42.775/Yes	45.189/Yes	—

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10 %, 5 %, and 1 %, respectively.*

Table 4

Regression Results Using ROA

	ROA			
Variables	(1)	(2)	(3)	(4)
ESG	0.1692***			
	(0.0629)			
ESG2	-0.0020***			
	(0.0007)			
ESGE		0.1335**		
		(0.0584)		
ESGE2		-0.0018***		
		(0.0006)		
ESGS			0.1646**	
			(0.0627)	
ESGS2			-0.0019***	
			(0.0007)	
ESGG				-0.1494
				(0.2336)
ESGG2				0.0011
				(0.0022)
SIZE	-1.2580***	-1.1162**	-1.0855***	-1.1958***
	(0.4200)	(0.4668)	(0.4044)	(0.4401)
FL	-0.0922***	-0.1009***	-0.0982***	-0.0851**
	(0.0342)	(0.0353)	(0.0350)	(0.0352)
NPM	0.2961***	0.2818***	0.2857***	0.2934***
	(0.0720)	(0.0733)	(0.0744)	(0.0713)
FA	-0.0459**	-0.0464**	-0.0464**	-0.0458**
	(0.0204)	(0.0221)	(0.0205)	(0.0208)
GROE	0.0000**	0.0001**	0.0001**	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	31.3863***	30.5482***	28.5775***	37.7757***
	(7.5781)	(8.0779)	(7.7146)	(8.8023)
Sample size	782	715	732	782
Adjusted R-squared	0.6826	0.6740	0.6741	0.6765
F value	31***	30.6***	27.56***	29.3***
Slope at the lower bound X_{low} ($\beta_1+2*\beta_2*X_{low}$)	0.1642***	0.1251**	0.1527***	—
Slope at the upper bound X_{high} ($\beta_1+2*\beta_2*X_{high}$)	-0.168***	-0.1846***	-0.182***	—
Sasabuchi statistic	2.68***	2.25**	2.61***	—
95% confidence interval (Filler method)	[27.61, 54.55]	[14.26, 47.11]	[30.70, 54.79]	—
Extreme point/within data range	42.3/Yes	37.0833/Yes	43.3158/Yes	—

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10 %, 5 %, and 1 %, respectively.*

Table 5

Reverse Causality Test

Variables	ESG	ESGE	ESGS	ESGG
ROE	0.0312	0.0394	0.0187	-0.0254
	(0.0586)	(0.0885)	(0.0678)	(0.0362)
ROE2	0.0001	0.0000	0.0002	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0001)
SIZE	5.0764***	6.7937***	4.2389***	2.4992***
	(1.4694)	(1.8888)	(1.5811)	(0.5888)
FL	-0.0167	-0.1420	0.0641	-0.0380
	(0.0967)	(0.1028)	(0.1142)	(0.0462)
NPM	-0.1344*	-0.2385**	-0.1313*	-0.0129
	(0.0770)	(0.1097)	(0.0775)	(0.0506)
FA	-0.1516	-0.2600**	-0.1461	-0.0395
	(0.0916)	(0.1178)	(0.1006)	(0.0403)
GROE	-0.0000	-0.0002**	-0.0001	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0000)
Constant	-51.7133**	-77.0370**	-38.3500	9.7958
	(24.0891)	(33.3686)	(25.8242)	(9.3149)
Sample size	783	715	732	782
Adjusted R-squared	0.3076	0.2281	0.1806	0.3312
F value	11.49***	4.663***	10.14***	7.129***

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10 %, 5 %, and 1 %, respectively.*

Industry and Firm Size Heterogeneity

Industries Analysis

Previous articles have shown that different industry attributes may affect the nexus between ESG and CFP (Cahan *et al*., 2016). Moore (2001) highlights noteworthy variances in ESG involvement and ESG-related topics across distinct sectors. Garcia *et al.* (2017) states environmentally sensitive industries affect the impact of ESG on CFP. Research by Matakanye *et al.* (2021) shows industries respond differently to ESG performance pressures. Naeem and Cankaya (2021) reveals a significant positive association between the ESG performance of environmentally sensitive enterprises, ROE, and Tobin's Q. According to Ruan and Liu (2021), the ESG performance of non-environmentally sensitive industries significantly positively effect on ROA, whereas for environmentally sensitive industries the is no significant impact. The aforementioned literature suggests that ESG performance varies in different industries.

To examine potential variances in the connection between ESG and CFP for industries that are and are not environmentally sensitive, the selected companies were divided into two groups: those operating in the environmentally sensitive (ES) industry and those in the non-environmentally sensitive (non-ES) industry. The environmentally sensitive subsample comprises 113 firms and the non-environmentally sensitive firms subsample consists of 679 firms. Firms operating in the ES sector, which includes chemical, gas, metal manufacturing, oil, and paper industries, are commonly regarded as polluting sectors with a high environmental risk (Yoon *et al.*, 2018). These industries have a direct influence on ESG issues (Garcia *et al.*, 2017; Chairani & Siregar, 2021). Table 6 and Table 7 display the estimated outcomes for the respective categories.

In relation to environmentally sensitive industries, the U-test (Lind & Mehlum, 2010; Haans *et al.*, 2016) provides evidence of an ESG-CFP nexus that follows an inverted-U shaped (Table 6, column 1). Nevertheless, the relationships between ESGE, ESGS, and ESGG and CFP are different. ESGE and CFP, ESGS and CFP present an inverted-U shaped relationship (Table 6, columns 3 and 4), whereas the ESGG-CFP relationship is insignificant (Table 6, column 2).

Table 6

Regression Results: Environmentally Sensitive Industries

	ROE			
Variables	(1)	(2)	(3)	(4)
ESG	0.2249**			
	(0.1033)			
ESG2	-0.0023**			
	(0.0010)			
ESGE		0.0656		
		(0.0909)		
ESGE2		-0.0007		
		(0.0010)		
ESGS			0.1872**	
			(0.0762)	
ESGS2			-0.0018***	
			(0.0007)	
ESGG				1.2462***
				(0.3585)
ESGG2				-0.0104***
				(0.0032)
SIZE	-1.6207***	-1.5514***	-1.3532***	-2.2343***
	(0.4729)	(0.4934)	(0.4779)	(0.5186)
FL	0.1084*	0.0774	0.0711	0.1350**
	(0.0590)	(0.0597)	(0.0575)	(0.0588)
NPM	0.9752***	0.9434***	0.9197***	0.9642***
	(0.1111)	(0.1177)	(0.1089)	(0.1070)
FA	-0.2886***	-0.2885***	-0.2819***	-0.2932***
	(0.0322)	(0.0324)	(0.0323)	(0.0345)
GROE	0.1544***	0.1573***	0.1553***	0.1424***
	(0.0447)	(0.0460)	(0.0460)	(0.0424)
Constant	37.0715***	40.7533***	34.4481***	16.5689**
	(8.8469)	(9.6244)	(8.8014)	(7.8356)
Sample size	114	111	110	114
Adjusted R-squared	0.7028	0.6969	0.6998	0.7192
F value	32.89***	30.42***	36.00***	32.35***
Slope at lower bound X_{low} ($\beta_1+2*\beta_2*X_{low}$)	0.1812**	—	0.1683***	0.6147***
Slope at upper bound X_{high} ($\beta_1+2*\beta_2*X_{high}$)	-0.1629**	—	-0.1412***	-0.3698***
Sasabuchi statistic	2.14**	—	2.44***	2.81***
95% confidence interval (Filler method)	[32.04, 67.17]	—	[33.35, 60.2]	[55.44, 68.67]
Extreme point/within data range	48.891/Yes	—	52/Yes	59.914/Yes

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10 %, 5 %, and 1 %, respectively.*

Regarding the non-environmentally sensitive industries, the U-test also confirm the presence of a quadratic concave curvilinear ESG-CFP relationship (Table 7, column 1). Both ESGE and ESGS have a concave curvilinear effect on CFP (Table 7, columns 3 and 4), whereas the ESGG-CFP relationship is insignificant (Table 7, column 2).

Table 7

Regression Results: Non-Environmentally Sensitive Industries

	ROE			
Variables	(1)	(2)	(3)	(4)
ESG	0.2640**			
	(0.1307)			
ESG2	-0.0031**			
	(0.0015)			
ESGE		0.4787***		
		(0.1047)		
ESGE2		-0.0057***		
		(0.0012)		
ESGS			0.4372***	
			(0.1117)	
ESGS2			-0.0050***	
			(0.0013)	
ESGG				-0.1313
				(0.2109)
ESGG2				0.0005
				(0.0021)
SIZE	-2.5107***	-2.4084***	-1.9943***	-2.2854***
	(0.4842)	(0.5760)	(0.5386)	(0.4549)
FL	0.1048	0.0826	0.0829	0.1202*
	(0.0708)	(0.0788)	(0.0736)	(0.0680)
NPM	0.8787***	0.8742***	0.8728***	0.8822***
	(0.1952)	(0.2184)	(0.2166)	(0.1946)
FA	-0.0813*	-0.0694	-0.0758	-0.0653
	(0.0466)	(0.0506)	(0.0488)	(0.0442)
GROE	0.0002**	0.0002**	0.0002**	0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Constant	44.4101***	40.3248***	32.2900**	-2.2854***
	(9.2994)	(10.5462)	(12.7810)	(0.4549)
Sample size	669	605	623	669
Adjusted R-squared	0.4991	0.4808	0.4759	0.4954
F value	31.47***	33.66***	26.65***	27.23***
Slope at the lower bound X_{low} ($\beta_1+2*\beta_2*X_{low}$)	0.2563**	0.4521***	0.4059***	—
Slope at the upper bound X_{high} ($\beta_1+2*\beta_2*X_{high}$)	-0.2484**	-0.5110***	-0.4751***	—
Sasabuchi statistic	1.98**	4.3***	3.39***	—
95% confidence interval (Filler method)	[13.62, 79.57]	[35.98, 48.56]	[37.17, 52.80]	—
Extreme point/within data range	42.581/Yes	41.991/Yes	43.72/Yes	—

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10 %, 5 %, and 1 %, respectively.*

Firm Size Analysis

Previous research argues the trade-offs associated with corporate ESG performance disclosure differ, particularly with respect to the characteristics of large firms and SMEs (Yoon & Chung, 2018; Drempetic *et al.*, 2020; Gholami *et al.*, 2022). Rabaya and Saleh (2022) conducted analysis of large and small companies and found an increase in ESG implementation and CFP, despite the percentage difference between the large and small companies. Gholami *et al.* (2022) explored whether firms' ESG disclosure performance is correlated with greater CFP, and whether this varies between large firms and SMEs. Their empirical results argued a positive connection with profitability for large firms but not SMEs.

To investigate whether there is a non-linear relationship between ESG and CFP that varies across large firms and SMEs, the sample firms were separated into sub-samples of large firms and SME. According to prior literature, firm size is calculated using the natural logarithm of total assets (NLTA) (Shalit & Sankar, 1977; Gholami *et al.*, 2022). The large firm subsample includes 416 firms above the mean of NLTA, and the SMEs subsample includes 367 enterprises below the NLTA mean. The subsample estimation results are exhibited in Table 8 and Table 9.

For large companies, the empirical results infer the ESG slope is significantly positive ($p<0.1$), and the ESG2 slope is significantly negative ($p<0.1$), suggesting a concave curvilinear ESG-CFP relationship (Table 8, column 1). Furthermore, the U-test results show that at the lower bound (ESG_{low}) is positive and significant ($p<0.01$), while at the

upper bound (ESG_{high}) is significantly negative. Additionally, ESG's threshold (42.296) and the Fieller's 95 % CI [29.83, 47.37] both are located within the data range, which confirms the presence of a concave ESG-CFP nexus in the large firms (Table 8, columns 2–4).

With regard to the SMEs, the empirical results infer the signs of ESG and ESG2 are not statistically significant (Table 9). This means the ESG-CFP nexus is insignificant in the SMEs subsample.

Table 8

Regression Results for Large Firms

	ROE			
Variables	(1)	(2)	(3)	(4)
ESG	0.3722***			
	(0.1328)			
ESG2	-0.0044***			
	(0.0014)			
ESGE		0.3706***		
		(0.1314)		
ESGE2		-0.0046***		
		(0.0014)		
ESGS			0.3431***	
			(0.1061)	
ESGS2			-0.0038***	
			(0.0011)	
ESGG				0.9954*
				(0.5113)
ESGG2				-0.0089**
				(0.0044)
FL	0.0785**	0.0592**	0.0719**	0.1034***
	(0.0305)	(0.0300)	(0.0311)	(0.0287)
NPM	0.7522***	0.7441***	0.7676***	0.7705***
	(0.0875)	(0.0888)	(0.0886)	(0.0924)
FA	-0.0765***	-0.0659**	-0.0722***	-0.0734***
	(0.0224)	(0.0256)	(0.0222)	(0.0222)
GROE	0.0001***	0.0001***	0.0001***	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	-4.0520	-2.2213	-3.8228	-26.4280*
	(3.3948)	(3.5225)	(2.7946)	(15.4329)
Sample size	416	391	406	416
Adjusted R-squared	0.4844	0.5099	0.4911	0.4658
F value	41.07***	43.38***	41.03***	38.47***
Slope at lower bound X_{low} ($\beta_1+2*\beta_2*X_{low}$)	0.2886***	0.3206***	0.3193***	0.3914**
Slope at upper bound X_{high} ($\beta_1+2*\beta_2*X_{high}$)	-0.3696***	-0.4424***	-0.3502***	-0.5607**
Sasabuchi statistic	2.79***	2.79***	3.21***	1.94**
95% confidence interval (Filler method)	[29.83, 47.37]	[27.93, 44.66]	[36.49, 50.78]	[-18.56, 64.28]
Extreme point/within data range	42.296/Yes	40.283/Yes	45.145/Yes	55.92/Yes

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10%, 5%, and 1%, respectively.*

Table 9

Regression Results for SMEs

	ROE			
Variables	(1)	(2)	(3)	(4)
ESG	-0.0127			
	(0.2337)			
ESG2	-0.0000			
	(0.0035)			
ESGE		0.2413		
		(0.1976)		
ESGE2		-0.0029		
		(0.0031)		
ESGS			0.3558	
			(0.3100)	
ESGS2			-0.0052	
			(0.0045)	
ESGG				-0.0821
				(0.4029)
ESGG2				-0.0011
				(0.0050)
FL	-0.0759	-0.0881	-0.0800	-0.0773

	ROE			
Variables	(1)	(2)	(3)	(4)
	(0.0995)	(0.1087)	(0.1030)	(0.0975)
NPM	0.6882***	0.6866***	0.6772***	0.6923***
	(0.2104)	(0.2412)	(0.2398)	(0.2130)
FA	-0.0137	-0.0008	0.0007	0.0178
	(0.0739)	(0.0841)	(0.0796)	(0.0756)
GROE	0.2874***	0.2808***	0.2843***	0.2844***
	(0.0410)	(0.0411)	(0.0416)	(0.0397)
Constant	9.9855**	5.8276	3.9605	15.4497
	(4.9079)	(6.4215)	(8.9342)	(10.4410)
Sample size	367	325	327	367
Adjusted R-squared	0.6155	0.5876	0.5891	0.6154
F value	21.90***	19.50***	18.42***	19.49***

*Note: Robust standard errors in parentheses. *, **, *** represents statistical significance at 10 %, 5 %, and 1 %, respectively.*

Discussion

The novelty of this study is that it is one of the few studies that investigates whether ESGs affect CFP, and more specifically, how they affect CFP. To answer this research question, information was collected from Taiwanese listed companies with ESG reporting from 2005 to 2020. The U-test was used to determine the results.

Curvilinear ESG-CFP, ESGE-CFP, ESGS-CFP Relationships

The study affirms the existence of an inverted-U shaped correlation between ESG and CFP. This implies that CFP rises with ESG initially. However, once the ESG threshold (inflection point) is reached, CFP begins to fall as ESG increases. This exhibit diminishing marginal returns. This relationship is described as the TMGT effect by Trump and Guenther (2017). It elucidates why ESG's effect on CFP becomes undesired after it surpasses the threshold. Equally, these findings are in line with the outcomes of prior investigations (Buallay *et al.*, 2022; Teng *et al.*, 2022; El Khoury *et al.*, 2023).

Computing the first-order derivation reveals the optimum ESG value is 46.264 (Table 3, column 1 and Figure 1A). The threshold of ESG (42.264) is larger than the ESG sample mean (36.999), pointing out that most companies are situated to the left of the threshold (Table 3, column 1 and Figure 1A). This indicates that investing in ESG has a significant and positively curved effect on CFP, demonstrating its benefits for the majority of companies. Nonetheless, identifying and preserving the ideal ESG quantity is crucial for attaining maximum CFP.

For ESGE, the findings indicate a relationship between ESGE and CFP that follows an inverted-U curve. This implies that, in the short term, the majority of companies investing in ESGE activities will ensure greater CFP. However, investing in ineffective ESGE activities can ultimately harm CFP. Equally, these findings are in agreement with the TMGT principle and are consistent with previous literature (Buallay *et al.*, 2022; Teng *et al.*, 2022; El Khoury *et al.*, 2023).

The threshold (42.775) is larger than the ESGE sample mean (33.071), indicating that the majority of companies operate in the ESGE low regime (Table 3, column 2 and Figure 1B). Thus, the influence of ESGE on CFP is positive, curvilinear, and significant. Each firm should verify their optimum resource level to commit to ESGE activity in order to increase CFP and enhance the expectations of stakeholders.

With regard to ESGS, the results again evidence an inverted-U shaped ESGS-CFP nexus. To some extent, ESGS exposure was positively associated with improvements in CFP. However, once EGSS reaches a threshold, the relationship with CFP reverses to a negative relationship. Again, these results support the TMGT principle and in sync with the outcomes of previous research (Naimy *et al.*, 2021; Teng *et al.*, 2022; El Khoury *et al.*, 2023).

The ESGS threshold (45.189) is higher than the ESGS average (38.927), indicating that most companies are situated to the left of the threshold (Table 3, column 3 and Figure 1C). Consequently, the majority of companies benefit from ESGS investment. In other words, when companies commit assets to non-profit social projects, there are less long-term resources available for investment into positive net present value activities, which can significantly disadvantage companies (Balabanis *et al.*, 1998). Therefore, in the long run, ESGS costs exceed benefits, explaining the inverted U-shaped association with CFP.

Finally, unlike ESGE and ESGS, ESGG has a negligible effect on ROE (ROA), indicating that the execution of a corporate governance strategy may not instantaneously enhance CFP. However, companies listed on the TSE should aim to implement corporate governance measures that advance sustainable development and contribute to enhancing their CFP. This conclusion aligns with assertions made in earlier studies (Teng *et al.*, 2022; Wu & Chang, 2022) that indicate the insignificance of ESGG evidence in relation to ROA and ROE.

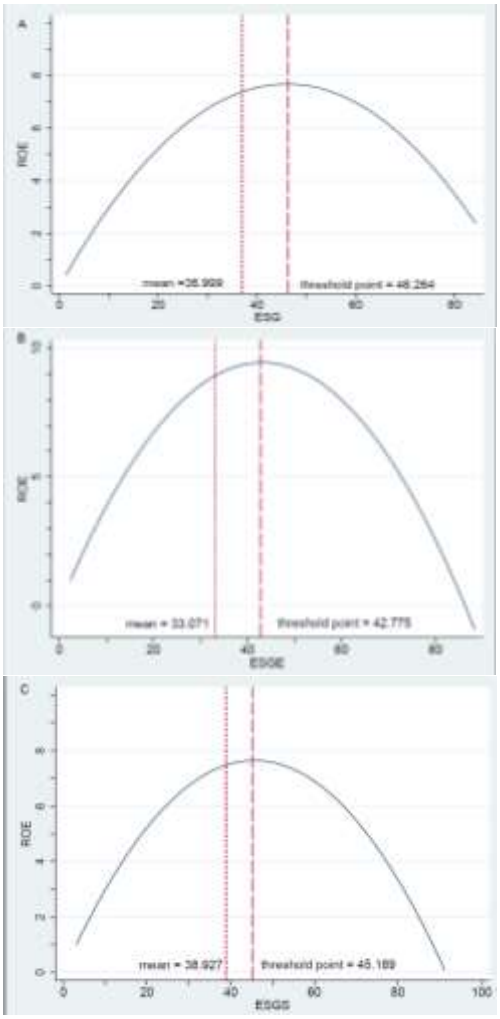

Figure 1. (A) The Inverted-U Shaped ESG-CFP Nexus; (B) Inverted-U Shaped ESGE-CFP Nexus; (C) Inverted U-Shape ESGS-CFP Nexus

Inverted-U Shaped Relationships for Environmentally Sensitive and Non-Sensitive Industries

Regarding environmentally sensitive industries, the findings suggest that there is a curvilinear relationship between ESG and CFP, following an inverted-U shaped. This indicates that ESG investments are advantageous up to a certain threshold, beyond which they become less effective. Furthermore, there exists an inverted-U shaped correlation between ESGS and CFP, as well as ESGG and CFP, whereas the effect of ESGE on CFP can be considered negligible. These findings comply with the research conducted by Naeem and Cankaya (2021).

The threshold values of ESG, ESGS, and ESGG are 48.891, 52, and 59.914 respectively (Table 6 and Figure 2A to 2C). The threshold points are above the average ESG (38.143), ESGS (38.062), and ESGG (53.61) value, which infers the majority of environmentally sensitive industries operate in the lower regime of ESG, ESGS, and ESGG respectively. This indicates the effects ESG, ESGS, and ESGG have on CFP are positive, non-linear, and significant. Most environmentally sensitive firms, however, should verify their optimum resource level to commit to ESG (ESGS and ESGG) activity, in order to increase CFP and enhance the expectations of stakeholders.

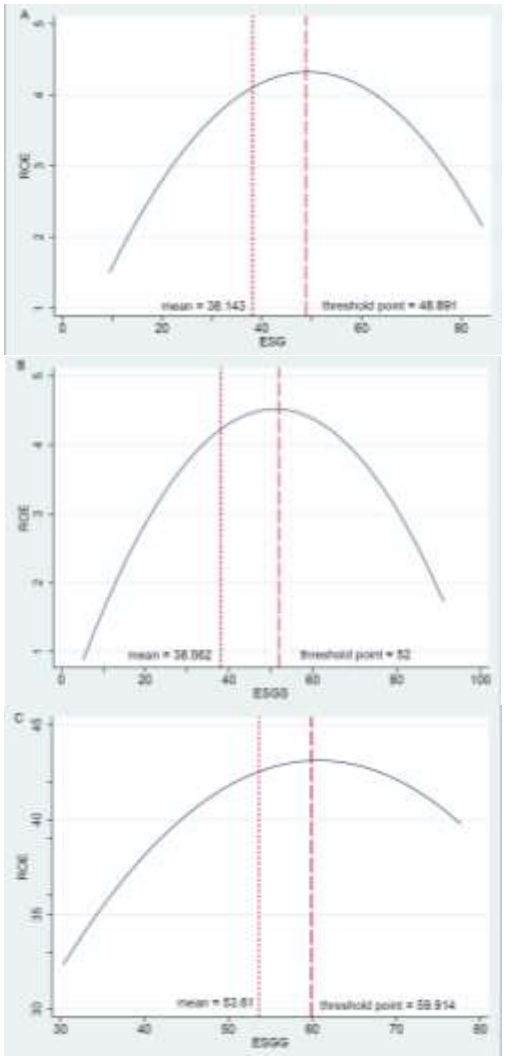

Figure 2. (A) The Inverted-U Shaped ESG-CFP Nexus; (B) Inverted-U Shaped ESGS-CFP Nexus; (C) Inverted U-Shape ESGG-CFP Nexus in Environmentally Sensitive Industries

Concerning non-environmentally sensitive sectors, the factual evidence substantiates the presence of a curved ESG-CFP correlation. Additionally, the ESGE and ESGS relationships with CFP are also an inverted U-shape, whereas ESGG has insignificant influence on CFP. This finding concurs with Ruan and Liu (2021).

The threshold values of ESG, ESGE, and ESGS are 42.581, 41.991 and 43.72 respectively (Table 7 and Figure 3A to 3C). The threshold values are higher than the average ESG (36.804), ESGE (33.122), and ESGS (39.079) value, which suggests that most non-environmentally sensitive industries are in the low regime of ESG, ESGE, and ESGS respectively. This indicates the effects ESG, ESGE, and ESGS have on CFP are positive, non-linear, and significant. Thus, most non-environmentally sensitive firms should verify their optimum resource level to commit to ESG (ESGE and ESGS) activity, in order to increase CFP and enhance the expectations of stakeholders.

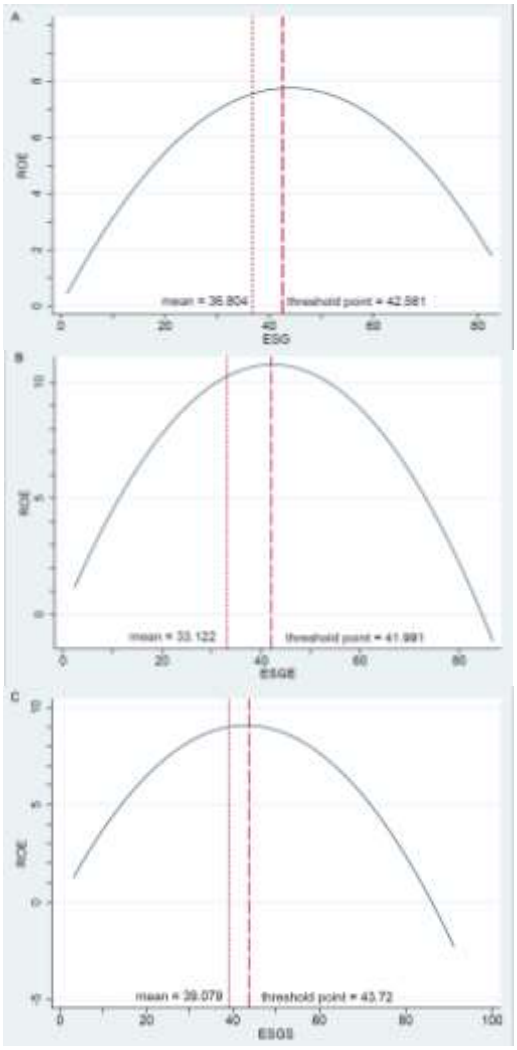

Figure 3. (A) The Inverted-U Shaped ESG-CFP Nexus; (B) Inverted-U Shaped ESGE-CFP Nexus; (C) Inverted U-Shape ESGS-CFP Nexus in Non-Environmentally Sensitive Industries

Inverted-U Shaped Relationships for Large Firms

The findings demonstrate an inverted-U shaped relationship between ESG factor (including ESGE, ESGS and ESGG) and CFP for large firms. Equally, these findings support the TMGT viewpoint and also concur with Gholami *et al.*'s (2022) results. The threshold values of ESG, ESGE, and ESGS are 42.296, 40.283, and 45.145 respectively, and are slightly higher than the average ESG (42.274), ESGE (39.025), and ESGS (42.609) value. Most large companies are positioned to the left of the inflection points for ESG, ESGE, and ESGS, as indicated. This suggests the predominant effects ESG, ESGE, and ESGS have on CFP are positive, non-linear, and significant (Table 8 and Figure 4A to 4C), and the majority of large firms benefit from ESG (ESGE and ESGS) investment. Consequently, on a long-term basis, large firms should engage in the optimal value of ESG (ESGE and ESGS) to gain greater CFP. Furthermore, the ESGG threshold value (55.92) is almost equal to the mean value of ESGG (55.93), meaning most large firms are in an optimal state of corporate governance.

With regard to SMEs, the results evidence the association between ESG (including ESGE, ESGS, and ESGG) and CFP is not significant (Table 9).

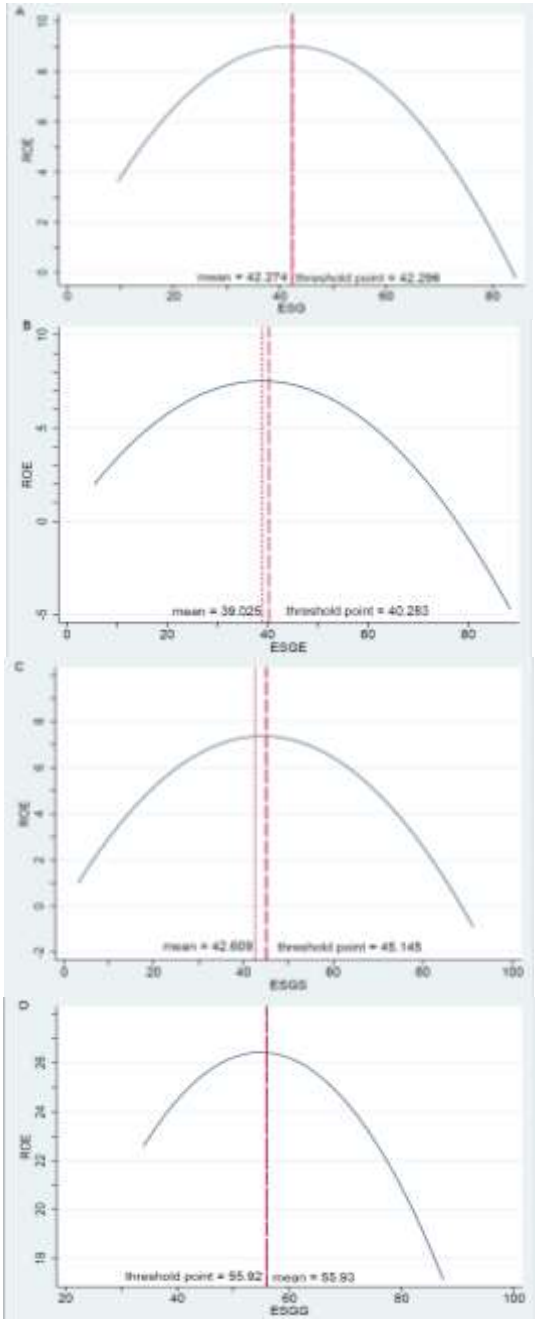

Figure 4. (A) The Inverted-U Shaped ESG-CFP Nexus; (B) Inverted-U Shaped ESGE-CFP Nexus; (C) Inverted U-Shape ESGS-CFP Nexus; (D) Inverted-U shaped ESGG-CFP Nexus in Large Enterprises

Conclusions

Nonetheless, ESG has a variable effect on CFP. This study endeavors to fill the gap in present ESG research by examining how ESG influences CFP and by demonstrating a concave (inverted-U shaped) ESG-CFP relationship. Moreover, the results demonstrate that each ESG component has a unique influence on CFP. The environmental and social aspects exhibit a curvilinear, inverted-U shaped correlation with CFP, which is in line with the TMGT phenomenon. This suggests managers of firms listed on the TSE should remain vigilant regarding the reduced marginal benefits of increased ESG (ESGE and ESGS) activity as once the threshold is surpassed,

reallocating resources away from ESG projects is more beneficial to the enterprise.

The research findings endorse the correlation between ESG and CFP in industries that are both environmentally sensitive (ES) and non-environmentally sensitive (non-ES), following an inverted-U shaped pattern. With regard to the individual ESG pillars, ESGE and CFP also presents the inverted-U shaped connection for non-ES industries, but not for ES industries. For both ES and non-ES industries, ESGS has an inverted-U shaped effect on CFP. For the ESGG-CFP relationship, ES industries have an inverted U-shape, but non-ES industries do not.

Furthermore, the findings affirm a concave ESG-CFP nexus for large enterprises, aligning with the TMGT effect. Three individual pillars of ESG (ESGE, ESGS, and ESGG) have the same results for large firms; however, ESG (including three pillars) has insignificant effect on the CFP of SMEs.

Theoretical Implications

This study makes contributions to three areas of the literature. First, even though the literature on ESG is extensive, it is still constantly expanding, and opening new possibilities for research. The purpose of this study is not only to spotlight the relationship between ESG and CFP, but also examine the potential distinctness between environmentally sensitive and non-sensitive industries, and between large firms and SMEs, in terms of the link between ESG and CFP. Based on the contradictory findings of ESG and CFP, this research verifies the TMGT effect of ESG on the basis of in-depth understanding of TMGT theory, thus fully explaining the mechanism of the nonlinear ESG-CFP nexus. Secondly, the results verify that ESG has an inverted U-shaped impact on CFP in both environmentally sensitive and non-sensitive sectors. Furthermore, there is evidence to affirm a concave ESG-CFP relationship for large firms, but not for SMEs. Third, by utilizing U-test (Lin & Mehlum, 2010; Haans *et al.*, 2016), the empirical results verify a concave curvilinear ESG-CFP nexus exists. Aligning with Lahouel *et al.* (2019), the identification of the influence of curves is a noteworthy development in business research, which not only enrich is the study of the ESG-CFP relationship from different perspectives (i.e., marginal gain and marginal loss effects), but also highlights the TMGT effect of ESG.

Practical Implications

The results provide essential implications for businesses, investors, and stakeholders. With regard to business, the findings indicate firms should manage ESG practices as effectively as possible and managers should be aware of the TMGT effect. The findings confirm ESG (including ESGE & ESGS) exhibits a curvilinear (inverted-U shaped) effect on CFP and suggests ESG (ESGE and ESGS) can potentially enhance CFP. That is why the incorporation of ESG (including ESGE and ESGS) into a company's differentiation strategy can enhance stakeholders' acceptance. This finding also emphasizes the need to be vigilant regarding ESG activities, as if they are in excess, they can negatively impact CFP. Additionally, it can be observed that the inverted-U shaped curve's threshold is situated to the right of the mean ESG score, suggesting that most businesses reap benefits from investing in ESG. The managerial implication of this is that the optimal level of ESG should be established and maintained, as neither excess nor insufficient ESG is beneficial.

The findings are dominated by information disclosure under the environmental and social pillar, which shows that stakeholders are more interested in corporate compliance with environmental and social responsibility issues than in corporate governance. According to the stakeholder theory and resource-based view perspective, TSE listed companies that allocate current resources towards environmental and social efforts are more likely to enhance their CFP.

For stakeholders or investors, the results can be used to evaluate portfolio performance and make investment decisions for Chinese listed companies. Given the recent rise of more sustainable investment approaches, investors should consider a company's pre-established ESG thresholds as important screening criteria when evaluating portfolios to help predict future CFP.

Limitations and Future Research

The limitations of this study and possible avenues for future research are as follows: Firstly, it should be noted that there were only 69 companies listed in Taiwan with ESG scores available on Bloomberg between 2005 and 2020. Therefore, it is important to exercise caution when interpreting and generalizing the empirical findings of this study to other countries. Although it is not possible to draw universal conclusions, the study offers initial recommendations for the 69 companies listed in Taiwan whose ESG information has been disclosed. Secondly, it would be advantageous to conduct further research that incorporates data from additional countries in order to verify whether the ESG-CFP relationship exhibits an inverted U-shaped pattern in other settings, thus enabling comparative analysis.

Lastly, despite the extensive literature debating whether ESG practices enhance or destroy value, the true impact of ESG practices on firm actions, specifically investment efficiency, remains uncertain. Research conducted by Ellili (2022) displays a positive correlation between ESG and investment efficiency. Moreover, Gomariz and Sánchez Ballesta's (2014) research implies that an increase in investment efficiency can be achieved through higher financial research reports and the use of short-term debt (lower debt maturity). On the other hand, Şeker and Şengür (2022) assert a positive correlation between ESG performance and financial report quality. Additionally, Hussain *et al.* (2022) propose that firms with a voluntary environmental reporting policy have a propensity towards shorter debt maturity structures. Thus, future studies could discuss the mediating role of financial research quality and debt maturity on the relationship between ESG and investment efficiency.

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References

Ahmadova, G., Delgado-M´arquez, B.L., Pedauga, L. E., & Leyva-de la Hiz, D. I. (2022). Too good to be true: The inverted U-shaped relationship between home-country digitalization and environmental performance. *Ecological Economics*, 196, 107393. https://doi.org/10.1016/j.ecolecon.2022.107393

Al-Shaer, H., & Zaman, M. (2018). Credibility of sustainability reports: The contribution of audit committees. *Business Strategy and the Environment*, 27(7), 973–986. https://doi.org/10.1002/bse.2046

Balabanis, G., Phillips, H. C., & Lyall, J. (1998). Corporate social responsibility and economic performance in the top British companies: are they linked? *European Business Review*, 98(1), 25–44. https://doi.org/10.1108/09555349810195529

Barnea, A., & Rubin, A. (2010). Corporate social responsibility as a conflict between shareholders. *Journal of Business Ethics*, 97, 71–86. https://doi.org/10.1007/s10551-010-0496-z

Barnett, M. L., & Salomon, R.M. (2012). Does it pay to be really good? Addressing the shape of the relationship between social and financial performance. *Strategy Management Journal*, 33(11), 1304–1320. https://doi.org/10.1002/smj.1980

Behl, A., Raghu Kumari, P. S., Makhija, H., & Sharma, D. (2021). Exploring the relationship of ESG score and firm value using cross-lagged panel analyses: case of the Indian energy sector. *Annals of Operations Research*, 313, 231–256 https://doi.org/10.1007/s10479-021-04189-8

Brammer, S., Brooks, C., & Pavelin, S. (2006). Corporate social performance and stock returns: UK evidence from disaggregate measures. *Financial Management*, 35(3), 97–116. https://doi.org/10.1111/j.1755-053X.2006.tb00149.x

Brogi, M., & Lagasio, V. (2019). Environmental, social, and governance and company profitability: Are financial intermediaries different? *Corporate Social Responsibility and Environmental Management*, 26(3), 576–587. http://10.1002/csr.1704

Buallay, A. (2019). Is sustainability reporting (ESG) associated with performance? Evidence from the European banking sector. *Management of Environmental Quality*, 30(1), 98–115. https://doi.org/10.1108/MEQ-12-2017-0149

Buallay, A., Al-Ajmi, J., & Barone, E. (2022). Sustainability engagement's impact on tourism sector performance: linear and nonlinear models. *Journal of Organizational Change Management*, 35(2), 361–384. https://doi.org/10.1108/JOCM-10-2020-0308

Buallay, A., Fadel, S. M., Alajmi, J., & Saudagaran, S. (2020). Sustainability reporting and bank performance after financial crisis: Evidence from developed and developing countries. *Competitiveness Review*, 31(4), 747–770. https://doi.org/10.1108/CR-04-2019-0040

Cahan, S. F., De Villiers, C., Jeter, D. C., Naiker, V., & Van Staden, C. J. (2016). Are CSR disclosures value relevant? Cross-country evidence. *European Accounting Review*, 25, 579–611. https://doi.org/10.1080/09638180.2015.1064009

Cannon, J. N., Ling, Z., Wang, Q., & Watanabe, O. V. (2020). 10-K disclosure of corporate social responsibility and firms' competitive advantages. *European Accounting Review*, 29 (1), 85–113. https://doi.org/10.1080/09638180.2019. 1670223.

Chairani, C., & Siregar, S. V. (2021). The effect of enterprise risk management on financial performance and firm value: the role of environmental, social and governance performance. *Meditari Accountancy Research*, 29(3), 647–670. https://doi.org/10.1108/MEDAR-09-2019-0549

Chang, B. G., & Wu, K. S. (2022). Concave effect of financial flexibility on semiconductor industry performance: Quantile regression approach. *Technological and Economic Development of Economy*, 28(4), 948–978. https://doi.org/10.3846/tede.2022.16622

Conca, L., Manta, F., Morrone, D., & Toma, P. (2021). The impact of direct environmental, social, and governance reporting: Empirical evidence in European-listed companies in the agri-food sector. *Business Strategy and the Environment*, 30, 1080–1093. https://doi.org/10.1002/bse.2672

Di Tommaso, C., & Thornton, J. (2020). Do ESG scores effect bank risk taking and value? Evidence from European banks. *Corporate Social Responsibility and Environmental Management*, 27, 2286–2298. https://doi.org/10.1002/csr.1964

Drempetic, S., Klein, C., & Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics*, 167, 333–360. https://doi.org/10.1007/s10551-019-04164-1

Duque-Grisales, E., & Aguilera-Caracuel, J. (2019). Environmental, social and governance (esg) scores and financial performance of multilatinas: Moderating effects of geographic international diversification and financial slack. *Journal of Business Ethics*, 168(2), 1–20. https://doi.org/10.1007/s10551-019-04177-w

El Khoury, R., Nasrallah, N., & Alareeni, B. (2023). ESG and financial performance of banks in the MENAT region: Concavity-convexity patterns. *Journal of Sustainable Finance & Investment*, 13(1), 406–430. http://10.1080/20430795.2021.1929807

Ellili, N. O. D. (2022). Impact of ESG disclosure and financial reporting quality on investment efficiency. *Corporate Governance*, 22(5), 1094-1111. https://doi.org/10.1108/CG-06-2021-0209

Fieller, E. C. (1954). Some problems in interval estimation. *Journal of the Royal Statistical Society: Series B*, 16, 175–185. https://www.jstor.org/stable/2984043

Freeman, R. E. (1984). *Stakeholder management. A strategic approach*. Pitman, Marchfield, MA.

Friedman, M. (1970). A theoretical framework for monetary analysis. *Journal of Political Economy*, 78(2), 193–238. https://doi.org/10.1086/259623

Fujii, H., Iwata, K., Kaneko, S., & Managi, S. (2013). Corporate environmental and economic performance of Japanese manufacturing firms: empirical study for sustainable development. *Business Strategy and the Environment*, 22(3), 187–201. https://doi.org/10.1002/bse.1747

Gangi, F., Meles, A., D'Angelo, E., & Daniele, L.M. (2019). Sustainable development and corporate governance in the financial system: Are environmentally friendly banks less risky? *Corporate Social Responsibility and Environmental Management*, 26(3), 529–547. https://doi.org/10.1002/csr.1699.

Garcia, A. S., Mendes-Da-Silva, W., & Orsato, R.J. (2017). Sensitive industries produce better ESG performance: Evidence from emerging markets. *Journal of Cleaner Production*, 150, 135–147. https://doi.org/10.1016/j.jclepro.2017.02.180

Gholami, A., Murray, P. A., & Sands, J. (2022). Environmental, social, governance & financial performance disclosure for large firms: Is this different for SME firms? *Sustainability* 14, 6019. https://doi.org/10.3390/su14106019

Gomariz, M. F. C., & Sanchez Ballesta. J. P. (2014). Financial reporting quality, debt maturity and investment efficiency. *Journal of Banking & Finance*, 40, 494-506. https://doi.org/10.1016/j.jbankfin.2013.07.013

Haans, Richard F. J., Pieters, C., & He, Z. L. (2016). Thinking about U: theorizing and testing U- and inverted U-shaped relationships in strategy research. *Strategy Management Journal*, 37(7), 1177–1195. https://doi.org/10.1002/smj.2399

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial Least squares structural equation modeling (PLS-SEM).* 2nd ed., Sage, Thousand Oaks.

Han, J. J., Kim, H. J., & Yu, J. (2016). Empirical study on relationship between corporate social responsibility and financial performance in Korea. *Asian Journal of Sustainability and Social Responsibility*, 1(1), 61–76. https://doi.org/10.1186/s41180-016-0002-3

Hausman, J. (1978). Specification tests in econometrics. *Econometrica*, 46, 1251–1271. https://doi.org/10.2307/1913827

Hussain, H. I., Kamarudin, F., Turner, J. J., Thas, T., Hassanudin, M., Mohamad, A., & Nazratul, A. (2022). Environmental reporting policy and debt maturity: Perspectives from a developing country. *Transformations in Business & Economics*, 21(1), 245-262.

Jenkins, H., & Yakovleva, N. (2006). Corporate social responsibility in the mining industry: Exploring trends in social and environmental reporting. *Journal of Cleaner Production*, 14, 271–284. https://doi.org/10.1016/j.jclepro.2004.10.004

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3, 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Khovrak, I. (2020). ESG-driven approach to managing insurance companies' sustainable development. *Insurance Markets and Companies*, 11(1), 42–52. http://dx.doi.org/10.21511/ins.11(1).2020.05

Kuo, L., & Chang, B. G. (2021). The affecting factors of circular economy information and its impact on corporate economic sustainability-Evidence from China. *Sustainable Production and Consumption*, 27, 986–997. https://doi.org/10.1016/j.spc.2021.02.014

Lahouel, B. B., Gaies, B., Zaied, Y. B., & Jahmane, A. (2019). Accounting for endogeneity and the dynamics of corporate social–Corporate financial performance relationship. *Journal of Cleaner Production*, 230, 352–364. https://doi.org/10.1016/j.jclepro.2019.04.377

Lee, S., Seo, K., & Sharma, A. (2013a). Corporate social responsibility and firm performance in the airline industry: The moderating role of oil prices. *Tourism Management*, 38, 20–30. https://doi.org/10.1016/j.tourman.2013.02.002

Lee, E. M., Park, S. Y., & Lee, H. J. (2013b) Employee perception of CSR activities: its antecedents and consequences. *Journal of Business Research*, 66(10), 1716–1724. https://doi.org/10.1016/j.jbusres.2012.11.008

Lee, K. H., Cin, B.C., & Lee, E.Y. (2016). Environmental responsibility and firm performance: The application of an environmental, social and governance model. *Business Strategy and the Environment*, 25(1), 40–53. https://doi.org/10.1002/bse.1855

Lind, J. T., & Mehlum, H. (2010). With or without U? The appropriate test for a U-shaped relationship. *Oxford Bulletin of Economics and Statistics*, 72(1), 109–118. https://doi.org/10.1111/j.1468-0084.2009.00569.x

Long, W., Li, S., Wu, H., & Song, X. (2020). Corporate social responsibility and financial performance: The roles of government intervention and market competition. *Corporate Social Responsibility and Environmental Management,* 27(2), 525–541. https://doi.org/10.1002/csr.1817

Lopez-Toro, A. A., Sanchez-Teba, E. M., Benitez-Marquez, M. D., & Rodriguez-Fernandez, M. (2021). Influence of ESGC indicators on financial performance of listed pharmaceutical companies. *International Journal of Environmental Research and Public Health*, 18, 4556. https://doi.org/10.3390/ijerph18094556

Matakanye, R. M., Van Der Poll, H. M., & Muchara, B. (2021). Do companies in different industries respond differently to stakeholders' pressures when prioritising environmental, social and governance sustainability performance? *Sustainability*, 13(21), 12022. https://doi.org/10.3390/su132112022

Miras-Rodriguez, M. del M., Carrasco-Gallego, A., & Escobar-Perez, B. (2015). Has the CSR engagement of electrical companies had an effect on their performance? A closer look at the environment. *Business Strategy and the Environment*, 24(8), 819–835. https://doi.org/10.1002/bse.1848

Misani, N., & Pogutz, S. (2015). Unraveling the effects of environmental outcomes and processes on financial performance: a non-linear approach. *Ecological Economics*, 109, 150–160. https://doi.org/10.1016/j.ecolecon.2014.11.010

Moore, G. (2001). Corporate social and financial performance: An investigation in the U.K. supermarket industry. *Journal of Business Ethics*, 34, 299–315. https://doi.org/10.1023/A:1012537016969

Naeem, N., & Cankaya, S. (2021). Does ESG performance affect the financial performance of environmentally sensitive industries? A comparison between emerging and developed markets. *PressAcademia Procedia*, 14, 135-136. https://doi.org/10.17261/Pressacademia.2021.1509

Naimy, V., EI Khoury, R., & Iskandar, S. (2021). ESG versus corporate financial performance: Evidence from East Asian firms in the industrials sector. *Studies of Applied Economics*, 39(3), 1–24. https://dx.doi.org/10.25115/eea.v39i3.4457

Nollet, J., Filis, G, & Mitrokostas, E. (2016). Corporate social responsibility and financial performance: A non-linear and disaggregated approach. *Economic Modelling*, 52, 400–407. https://doi.org/10.1016/j.econmod.2015.09.019

Okafor, A., Adusei, M., & Adeleye, B. N. (2021). Corporate social responsibility and financial performance: Evidence from US tech firms. *Journal of Cleaner Production*, 292, 126078. https://doi.org/10.1016/j.jclepro.2021.126078

Pierce, J. R., & Aguinis, H. (2013). The too-much-of-a-good-thing effect in management. *Journal of Management*, 39, 313–338. https://doi.org/10.1177/0149206311410060

Pu, G. (2022). A non-linear assessment of ESG and firm performance relationship: evidence from China. *Economic Research-Ekonomska Istrazivanja*, in press, 1–17. https://doi.org/10.1080/1331677X.2022.2113336

Rabaya, A. J., & Saleh, N. M. (2022). The moderating effect of IR framework adoption on the relationship between environmental, social, and governance (ESG) disclosure and a firm's competitive advantage. *Environment, Development and Sustainability*, 24, 2037–2055. https://doi.org/10.1007/s10668-021-01519-5

Ruan, L., & Liu, H. (2021). Environmental, social, governance activities and firm performance: Evidence from China. *Sustainability*, 13, 767. https://doi.org/10.3390/su13020767

Santamaria, R., Paolone, F., Cucari, N., & Dezi, L. (2021). Non-financial strategy disclosure and environmental, social and governance score: Insight from a configurational approach. *Business Strategy and the Environment*, *30*, 1993–2007. https://doi.org/10.1002/bse.2728

Sasabuchi, S. (1980). A test of a multivariate normal mean with composite hypotheses determined by linear inequalities. *Biometrika*, 67(2), 429–439. https://doi.org/10.2307/2335486

Saygili, E., Arslan, S., & Birkan, A. O. (2022). ESG practices and corporate financial performance: Evidence from Borsa Istanbul. *Borsa Istanbul Review*, 22(3), 525-533. https://doi.org/10.1016/j.bir.2021.07.001.

Seker Y., & Sengur E.D. (2021). The impact of environmental, social, and governance (ESG) performance on financial reporting quality: International evidence. *Ekonomika*, 100(2), 190–212. https://doi.org/10.15388/Ekon.2021.100.2.9.

Shakil, M. H., Mahmood, N., Tasnia, M., & Munim, Z. H. (2019). Do environmental, social and governance performance affect the financial performance of banks? A cross-country study of emerging market banks. *Management of Environmental Quality*, 30(6), 1331–1344. https://doi.org/10.1108/MEQ-08-2018-0155

Shalit, S. S., & Sankar, U. (1977). The measurement of firm size. *Review of Economics and Statistics*, 59, 290–298. https://doi.org/10.2307/1925047

Shen, C. H., Wu, M. W., Chen, T. H., & Fang, H. (2016). To Engage or not to engage in corporate social responsibility: Empirical evidence from global banking sector. *Economic Modelling*, 55, 207–225. https://doi.org./j.econmod. 2016.02.007

Siueia, T. T., Wang, J., & Deladem, T.G. (2019). Corporate social responsibility and financial performance: A comparative study in the Sub-Saharan Africa Banking sector. *Journal of Cleaner Production*, 226, 658–668. https://doi.org/10.1016/j.jclepro.2019.04.027

Teng, X., Ge, Y., Wu, K. S., Chang, B. G., Kuo, L., & Zhang, X. (2022). Too little or too much? Exploring the inverted U-shaped nexus between voluntary environmental, social and governance and corporate financial performance. *Frontiers in Environment Science*, 10, 969721. https://doi.org/10.3389/fenvs.2022.969721

Trumpp, C., & Guenther, T. (2017). Too little or too much? Exploring U-shaped relationships between corporate environmental performance and corporate financial performance. *Business Strategy and the Environment*, 26(1), 49–68. https://doi.org/10.1002/bse.1900

Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility*, 8(2), 169–178. https://doi.org/10.1108/JGR-11-2016-0029.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity. *Econometrica,* 48(4), 817–838.

Wu, K. S., & Chang, B. G. (2022). The concave-convex effects of environmental, social and governance on high-tech firm value: Quantile regression approach. *Corporate Social Responsibility and Environmental Management*, 29(5), 1527–1545. https://doi.org/10.1002/csr.2289

Xie, J., Nozawa, W., Yagi, M., Fujii, H., & Shunsuke, M. (2019). Do environmental, social, and governance activities improve corporate financial performance? *Business Strategy and the Environment*,. 28(2), 286–300. https://doi.org/10.1002/bse.2224.

Yoon, B., & Chung, Y. (2018). The effects of corporate social responsibility on firm performance: A stakeholder approach. *Journal of Hospitality and Tourism Management*, 37, 89–96. https://doi.org/10.1016/j.jhtm.2018.10.005

Yoon, B., Lee, J. H., & Ryan, B. (2018). Does ESG performance enhance firm value? Evidence from Korea. *Sustainability*, 10(10), 3635. https://doi.org/10.3390/su10103635

Zehri, F., & Zgarni, I. (2020). Internal and external corporate governance mechanisms and earnings management: An international perspective. *Accounting and Management Information Systems*, 19(1), 33–64. https://doi.org/10.24818/jamis.2020.01008

Zhou, G., Liu, L., & Luo, S. (2022). Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment*, 31(7), 3371–3387. https://doi.org/10.1002/bse.3089

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