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The Relationship of Environmental, Social, and Governance (ESG) Score and Firm Performance

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Abstract - This study examines the impact of ESG scores on firm performance. The sample for this study consists of manufacturing companies in the United States during the period 2018–2022. We analyze the data using OLS regression with firms' fixed effects model. The results indicate that ESG scores have a positive impact on firm performance.

***Keywords*:** ESG Score, Firm Performance, Manufacturing Companies, Sustainability

1. Introduction

Unlike decades ago, companies must pay more attention to social and environmental responsibilities. Companies need to gain support and trust from the community, as well as legitimacy for their social role and concern for the environment, which can positively impact their survival in the future. Therefore, investors must ensure their investments are sustainable and ethical by considering environmental changes, corporate governance frameworks, and social responsibility in decision-making [1].

Environmental performance, social responsibility, and corporate governance (ESG) represent risks and opportunities that impact a company's long-term value creation [2]. The increasing number of studies on ESG performance shows researchers' interest in this topic. These studies encourage companies worldwide to start complying with sustainability reporting. Companies that disclose ESG well will be more attractive to financial investors and other stakeholders and benefit financially in the long term due to sustainability concerns.

The ESG concept, rooted in the "Principles for Responsible Investment" issued by the United Nations in 2006, emphasizes that companies should pay attention to ESG as part of their sustainability strategy. ESG is an extension and refinement of Corporate Social Responsibility (CSR) and is an essential indicator for assessing a company's sustainability and green development. A Global Sustainable Investment Alliance report noted that global sustainable investment surged to $35.3 trillion in 2020, up 15% from 2018. This trend reflects the widespread recognition of ESG as a key strategic element, especially in the manufacturing sector, which faces heightened scrutiny over environmental impacts and labor practices [3].

Adopting sustainable practices and ESG reporting has become a significant focus in response to regulatory pressures and investor demands. Reference[4] shows that companies with high ESG ratings tend to attract more investment, demonstrate better financial stability, and survive global economic crises. Other studies have revealed that implementing ESG can improve overall firm performance. For example, references [1], [5], [6], [7] show that companies with improved ESG performance tend to have better market value measures.

However, several studies state that ESG performance has a negative or insignificant impact on company performance [8], [9], [10]. This may be due to several reasons, such as the high cost of ESG implementation, which can reduce short-term profit margins, such as the case where Ford invested billions of dollars to develop electric vehicles (EVs) as their ESG strategy. To this extent, the production costs are very high, and with the fierce competition in the EV market, the company has to emphasize profit margins. A lack of understanding of ESG can also lead to negative sentiments about the company's share price. Greenwashing effect or market distrust that the company is only trying to do ESG branding without any real action that negatively impacts the company's valuation. However, this impact can be contextual. In the long run, if the market increasingly values ESG, the negative impact may diminish or turn positive.

This study explores the nuanced relationship between ESG practices and firm performance within the manufacturing sector in the United States. In addition to prior research that often generalizes the ESG impact across industries, this study focuses exclusively on the unique dynamics of manufacturing companies, which are particularly exposed to environmental regulations, social expectations, and governance complexities. By dissecting the individual contributions of Environmental (E), Social (S), and Governance (G) components, this research aims to provide fresh insights into how these dimensions drive or hinder value creation in this critical industry. Ultimately, this study seeks to enhance the understanding of ESG practices as a strategic lever for manufacturing firms while offering practical implications for policymakers, industry leaders, and investors navigating the transition toward sustainable business practices.

The structure of this article is as follows: The second section discusses the literature review related to ESG practices and their implications for corporate performance. The methodology section details the research design and data analysis techniques. The research findings are presented in the results and discussion section, which ends with a conclusion summarizing the main insights and implications of this study's results.

2. Literature Review

2.1. Environmental, Social, and Governance (ESG)

ESG scores refer to activities related to a company's operations focusing on profit while prioritizing environmental, social, and corporate governance principles. ESG is one of the criteria companies use in planning long-term investments, namely, the company's ability to integrate and implement policies that consider environmental, social, and governance aspects. In recent years, investor interest in investing by considering ESG factors has increased significantly [11].

ESG is a framework that assesses a company's performance in three dimensions: environmental, social, and governance. It indicates how a company carries out its social and environmental responsibilities and manages internal governance. Implementing ESG can improve a company's reputation, strengthen stakeholder relationships, and create sustainable economic value. In the corporate social responsibility (CSR) context, ESG broadens the company's focus from mere economic profit to broader social and environmental contributions [4].

Environmental reflects the application of optimal management principles by a company for risk avoidance and performance environmental opportunities to create long-term shareholder value. The social pillar demonstrates the health of a company's respectability and license to work, which are essential to its capacity to produce persistent shareholder value. Corporate governance reflects a company's ability to generate shareholder value by adopting perfect management, directing and controlling its rights and obligations by establishing incentives, checks, and balances [12].

2.1. Prior Empirical Studies

ESG is not a new concept in the business and investment world, as it is becoming a key indicator for assessing sustainability and responsibility. Various studies have examined the impact of ESG on company performance. High ESG scores can enhance green innovation through resource coordination and market fulfillment effects [13]. In addition, reference [4] identified that firms with high ESG scores are more resilient to economic shocks, indicating better financial stability. However, this relationship is not uniform across ESG dimensions. The "Environmental" dimension consistently has a significant positive impact on green innovation [7].

On the other hand, some studies also show a negative or non-linear relationship. For example, a study [7] finds that ESG scores can incur additional costs that potentially reduce company value in the short term. Authors [4] note that the social and governance dimensions often have a less significant effect on green innovation than the environmental dimension. This study shows the importance of in-depth analysis of specific ESG dimensions to understand their impact on company value.

Numerous studies examine the impact of ESG on corporate performance, indicating that this topic is still debatable. Based on a recent meta-analysis, researchers investigated more than 1000 papers on ESG and financial performance [14]. This analysis revealed that 58% of the studies yielded positive results, 8% had a negative correlation, 21% were mixed, and 13% had no relationship between ESG and firm performance.

On the one hand, many studies have shown the positive impact of ESG scores on corporate performance. Reference [15] examines the relevance of accounting numbers and sustainability information in Europe. The author shows that ESG scores favor and considerably affect firm value. However, the significance of ESG scores may vary depending on industry characteristics—some sectors show a stronger correlation between ESG performance and market valuation than others. Reference [16] finds that ESG has a positive relationship with manufacturers' technical efficiency. They also find that sustainable practices and environmental considerations align with operational effectiveness. The findings suggest that companies with high ESG scores exhibit better technical efficiency, which is essential for investors and stakeholders as it highlights the potential of sustainability initiatives to drive efficiency and profitability. A robust methodological framework is used to analyze the effect of ESG scores on firm performance metrics, precisely market value to book value [17]. Based on comprehensive data from healthcare companies across Europe, the study highlights that higher ESG scores are statistically significantly associated with higher valuation, reflecting increased investor confidence and perceived value. ESG scores positively impact firm performance in Indian companies, suggesting that ESG disclosure affects investor perceptions and enhances the firm's reputation [18]. In addition, the significance of ESG scores may vary depending on the firm's characteristics. Firms in sectors that are relatively sensitive to sustainability issues (e.g., energy, manufacturing, and others) demonstrate a more robust correlation between ESG disclosure and firm value. Reference [19] investigates a sample of 22 emerging countries worldwide, finding a positive relationship between ESG and firm valuation. Thus, firms that demonstrate ESG initiative practices tend to exhibit enhanced performance.

On the other hand, prior studies also find a negative relationship between ESG and firm performance. For instance, ESG activities and financial performance have a negative relationship in the Indian healthcare sector due to investors' bias toward short-term profit orientation [20]. ESG ratings negatively impact firm value during the COVID-19 period in China and Korea [21] and in Gulf countries [10]. This negative impact is likely due to factors such as high implementation costs, market maturity, and initial transition challenges [9].

2.3. Hypothesis

The literature review above shows that the effect of ESG on firm performance is still debatable; therefore, it needs to be clarified.

The ESG scores might positively impact firm performance due to the focus of the company on building its reputation. This reputation could lead to an increase in investor trust who prioritize sustainability and public loyalty trust. This could affect to lower cost of capital and financial stability. Investing in sustainability could possibily reduced the short-term profitability but could significantly achieve efficiency in the long run such as energy savings and waste reduction.

The ESG score might negatively impact firm performance since the company is investing in sustainability in the short-term run. It is plausible that investing in sustainability may negatively impact the company's financial performance due to the diversion of funds to other stakeholders from shareholders. The cost of this investment will be considered as an additional expense resulting in reduced short-term profits.

Due to the consideration above, this study formulates the hypothesis as follows:

H1: ESG scores have an impact on firm performance.

3. Research Method

3.1. Sample Data

This study's sample consists of listed companies in the US market. We focus our research on manufacturing companies in the United States, selecting a sample from the period 2018 to 2022. We obtained the ESG scores and financial report data from the Refinitiv Database. Finally, we analyzed the hypothesis using OLS regression with firms' fixed effects model.

3.2. Dependent Variable

The dependent variable is firm performance, proxied by Tobin's Q and market-to-book value. These measures are reliable and commonly adopted in various studies to measure firm performance. Tobin's Q is the ratio of the company's market value to the replacement costs of the assets. It helps determine whether a company's value is overpriced or underpriced. However, due to the difficulty of determining the total replacement cost of assets, researchers often use the total asset instead. Meanwhile, the market-to-book value is the ratio of the company's equity value to the equity book value. It helps to measure value creation placed by the market on the company's equity [7].

3.3. Independent Variable

The primary independent variable is the company's ESG performance from Refinitiv Database. The ESG score is a comprehensive company rating based on self-reported environmental, social, and corporate governance information. It represents the average of E, S, and G scores. To this extent, the E score measures the company's impact on living and non-living, including air, land, and water. The S score measures a company's quality to bring trust and loyalty to its workforce, customers, and society. Meanwhile, the G score measures a company's system and processes, which ensure that its management and executive behave in the best interests of its long-term shareholders.

3.4. Control Variable

In addition, this study also includes other independent variables to control the firm's characteristics, such as firm size, profitability, and leverage, using the following proxies. The natural logarithm of total assets (TA) measures the firm size. The return-on-assets ratio (ROA) measures profitability. Finally, the debt-to-equity ratio (DER) measures leverage. Table 1 presents details for all variables.

Table 1. Operational Variables.

Variables	Symbol	Description/Size
Tobin's Q	Tobin's Q	(Market Capitalization + Total Liabilities) / Total Assets.
Market to Book Value	M/B	Market Capitalization/ Total Equity
ESG Score	ESG	ESG total score
E Score	E	Environmental dimension score
S Score	S	Social dimension score
G Score	G	Governance dimension score
Total Asset	TA	Natural logarithm of Total Assets
Debt to Equity Ratio	DER	Total Liabilities/Total Equity
Return on Asset	ROA	Net Profit / Total Assets

Empirical Models

This study employs the regression analysis on the empirical model in Equation (1) to investigate the hypothesis.

$$DepVar_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 DER_{i,t} + \beta_3 TA_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_i \quad (1)$$

In addition, we conducted regression analyses of the empirical model in Equations (2) to (5) to further examine the impact of each ESG dimension on firm performance.

$$DepVar_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 DERi_{,t} + \beta_3 TA_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$DepVar_{i,t} = \beta_0 + \beta_1 S_{i,t} + \beta_2 DERi_{,t} + \beta_3 TA_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$DepVar_{i,t} = \beta_0 + \beta_1 G_{i,t} + \beta_2 DERi_{,t} + \beta_3 TA_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_{i,t} \quad (4)$$

4. Results and Discussion

4.1. Descriptive Statistics

Table 2 presents the result of descriptive statistics. Descriptive statistics in this study show a significant difference compared to the data in the reference research [5]. The mean value of Tobin's Q in this study is 2.5, lower than the reference journal, which has an average value of 4.81 before the crisis and 4.56 during the crisis. This indicates that the companies sampled in this study have a smaller market value relative to the asset value compared to the companies in the reference journal. For the market-to-book value variable, this study shows an average of 2.9, also lower than the Market Value (MV) value in the reference journal, which has an average of 6.02 before the crisis and 5.83 during the crisis. The decline in these values in the benchmark journals is attributed to the impact of the COVID-19 pandemic crisis.

On the ESG Score variable, this study shows an average of 38.564, which is much higher than the benchmark journal which has an mean of 3.31 before the crisis and 3.28 during the crisis. This difference can be explained by the difference in measurement scale, In addition, the mean values of each ESG component in this study, E Score (Environment) of 36.780, S Score (Social) of 42.109, and G Score (Governance) of 45.924, also show significant differences with the reference journal, which reports an mean value of ENV of 2.80 before the crisis and 2.56 during the crisis, SOC of 2.80 before the crisis and 2.75 during the crisis, and GOV of 3.31 before the crisis and 3.28 during the crisis. The reference journal highlighted the decline in these values during the pandemic as an indication of deteriorating environmental, social and corporate governance performance amid the crisis. The variation in results may also be due to differences in the profile of the companies sampled or the time scope of the study, which should be further explained in this report.

Table 2. Descriptive Research Data.

Variables	Mean	Standard Deviation	Min	Max
Tobin’s Q	2.567	3.721	0.021	28.254
Market to Book Value	2.950	5.194	-7.964	36.598
ESG Score	38.564	20.126	7.257	86.476
E Score	36.780	26.770	0.904	91.705
S Score	42.109	22.077	4.516	93.035
G Score	45.924	22.947	3.742	91.702
Total Assets	6833.548	18545.62	2.914	134211
DER	1.510	7.216	-40.159	39.248
ROA	0.158	0.210	0.002	1.291

4.2. Regression Analysis

We begin the analysis by selecting the appropriate regression model. Significant results from the Chow and Hausman tests indicate that the fixed-effect model is the most suitable model for our data compared to the common and random-effect models. For brevity, the results are not shown in the table and are available upon request.

Table 3. Panel Data Regression Model of Variables Tobin’s Q.

Independent	Model 1	Model 2	Model 3	Model 4
C	0.564***	0.721***	0.583***	0.629***
	(23.13)	(38.40)	(26.13)	(27.81)
ESG Score	0.017***			
	(10.52)			
E Score		0.007***		
		(4.06)		

S Score			0.014***	
			(11.04)	
G Score				0.009***
				(8.04)
Total Assets	-9.14e-6*	-6.54e-6	-8.72e-6*	-5.45e-6
	(-1.80)	(-1.28)	(-1.72)	(-1.08)
DER	0.176***	0.199***	0,123	0.202***
	(9.27)	(10.41)	(9.40)	(10.81)
ROA	2.193***	2.324***	2.154	2.239***
	(15.43)	(16.37)	(15.14)	(15.75)
Rsquare	0.124	0.086	0.129	0.115
Prob > F	0.000	0.000	0.000	0.000

Note: The t-statistics in parentheses are based on heteroskedastic and serial correlated robust standard errors adjusted for clusters in firms. The signs ***, **, and * indicate significance at 1%, 5%, and 10% levels (two-tailed).

The analysis results in Table 3 explain that total ESG performance positively and significantly impacts Tobin's Q of manufacturing companies, as seen in model 1. Meanwhile, models 2, 3, and 4 show the positive impact of the three ESG indicators (environmental, social, and governance) on the Tobins Q of manufacturing companies.

Table 4. Panel Data Regression Model of Variables Market-to-Book Value.

Independent	Model 1	Model 2	Model 3	Model 4
C	0.664***	0.763***	0.652***	0.686***
	(22.07)	(32.99)	(23.61)	(24.58)
ESG Score	0.007***			
	(3.45)			
E Score		-0.003		
		(-1.17)		
S Score			0.007***	
			(4.66)	
G Score				0.004
				(2.87)
Total Assets	-9.46e-6	-6.09e-6	-9.90e-6	-8.04e-6
	(-1.51)	(-0.97)	(-1.58)	(-1.29)
DER	1.454***	1.477***	0.450***	1.464***
	(61.83)	(62.44)	(61.91)	(63.31)
ROA	2.286***	2.338***	2.251***	2.302***
	(13.02)	(13.36)	(12.80)	(13.13)
Rsquare	1.777	1.570	0.181	0.172
Prob > F	0.000	0.000	0.000	0.000

The results of the analysis in Table 4 explain that total ESG performance has a positive and significant impact on the market-to-book value of manufacturing companies, as explained in model 1. While model 2 shows a negative and insignificant impact of environmental significance on the market-to-book value of manufacturing companies. Meanwhile, social indicators have a positive and significant impact on the market-to-book value of manufacturing companies. In model 4, it can be seen that there is a positive and significant influence of governance on the market-to-book value of manufacturing companies.

5. Discussion

The results of this study confirm the hypothesis that ESG scores influence firm performance in manufacturing companies. A positive coefficient value indicates that ESG scores have a significant and positive influence on firm performance.

Furthermore, the findings of this study align with previous research, which also identified a significant positive influence of environmental, social, and governance (ESG) scores on firm performance [13], [14], [15], [16], [17].

Based on the results of each ESG indicator individually analyzed, the environmental score does not significantly affect firm performance in the form of market-to-book value of manufacturing companies. This may be because environmental initiatives in certain sectors may not immediately result in economic benefits, leading to their impact on firm performance being minimal or even negative. For example, the costs associated with improving environmental scores may be perceived as additional expenses, potentially reducing short-term profits. Moreover, in the manufacturing sector, investors may prioritize financial fundamentals, such as profitability and operational efficiency, over environmental performance.

The ESG score reflects the extent to which a company integrates sustainability and social responsibility into its operations. Companies with high ESG scores often exhibit transparent governance, strong social relationships, and a commitment to environmental stewardship. These qualities enhance investor confidence, attract stakeholders, and mitigate regulatory and reputational risks, as investors perceive such companies to have stronger growth prospects and lower risk. Consequently, ESG scores serve not only as a measure of sustainability but also as an important metric of how market perceptions influence firm performance.

6. Conclusion

Based on the analysis conducted in the previous chapter, this study concludes that ESG scores significantly and positively influence the firm performance of manufacturing companies. This indicates that companies with higher environmental, social, and governance (ESG) scores have a greater opportunity to enhance their overall performance. The implementation of ESG principles not only improves operational efficiency and governance but also boosts stakeholder trust, ultimately leading to better financial outcomes and market perceptions.

Despite its contributions, this study acknowledges certain limitations, which provide avenues for further research. First, it is recommended to incorporate additional variables that may significantly affect firm performance, such as dividend policy, capital structure, or innovation capacity, to provide a more comprehensive understanding of the factors driving corporate success. Second, extending the observation period is advisable to capture long-term trends and provide a more robust analysis of the relationship between ESG practices and firm performance. Additionally, further research could explore sector-specific dynamics to better understand the varying impacts of ESG factors across different industries.

For companies included in the sample, it is imperative to focus on factors that can enhance firm performance, such as improving governance practices, engaging in socially responsible initiatives, and adopting environmentally sustainable processes. Strengthening these areas not only positions the company as a responsible corporate citizen but also increases its attractiveness to investors and stakeholders. By prioritizing ESG implementation, companies can create significant opportunities for growth, improve their competitive advantage, and secure long-term sustainability.

In conclusion, the findings underscore the importance of integrating ESG principles into corporate strategies. Companies that actively implement strong ESG practices are better equipped to meet the expectations of modern investors, navigate regulatory challenges, and foster long-term value creation. Future studies and practical efforts should aim to deepen the understanding of ESG's impact on firm performance, enabling companies to leverage these insights for enhanced growth and sustainability.

7. References

[1] E. Ersoy, B. Swiecka, S. Grima, E. Özen and I. Romanova, "The impact of ESG scores on bank market value? evidence from the U.S. banking industry," Sustainability, vol. 14, no. 15, August 2022.

[2] pwc, March 2022. [Online]. Available: https://www.pwc.es/es/publicaciones/consejos-y-buen-gobierno/supervision-esg-guia-consejos-administracion.pdf.
[3] M. Arai, V. V. Hoorn, D. Lanz, L. Woll and S. O'Connor, "Global sustainable investment review 2020," 2021.
[4] E. Alexandra, L. Svetlana and K. Alexander, "The impact of ESG indicators on the financial stability of companies," Procedia Computer Science, vol. 242, pp. 1226-1234, August 2024.
[5] A. M. Habib and N. Mourad, "The influence of environmental, social, and governance (ESG) practices on US firms' performance: evidence from the coronavirus crisis," Journal of the Knowledge Economy, vol. 15, pp. 2549-2579, March 2023.
[6] H. Zhan, H. Shen and H. Guo, "Research on the impact of ESG scores on corporate substantive and strategic green innovation Author links open overlay panel," Innovation and Green Development, vol. 4, no. 1, February 2025.
[7] M. Aydoğmuş, G. Gülay and K. Ergun, "Impact of ESG performance on firm value and profitability," Borsa Istanbul Review, vol. 22, no. 2, pp. S119-S127, September 2022.
[8] O. M. Bătae, V. D. Dragomir and L. Feleagă, "The relationship between environmental, social, and financial performance in the banking sector: A European study," Journal of Cleaner Production, vol. 290, March 2021.
[9] P. Dwibedi, D. Pahi and A. Sahu, "Unveiling the Relationship Between ESG Scores and Firm Performance in India: A System GMM Approach," Australasian Accounting Business and Finance Journal, vol. 18, no. 3, June 2024.
[10] W. M. Alahdal, H. A. Hashim, F. A. Almaqtari, Z. Salleh and D. K. Pandey, "The moderating role of board gender diversity in ESG and firm performance: Empirical evidence from Gulf countries," Business Strategy & Development, vol. 7, no. 3, August 2024.
[11] S. S. Dwinda, "Why Do Some Young Investors in Indonesia Integrate Sustainable Investment in their Portfolio?," Review of Integrative Business and Economics Research, vol. 12, no. 3, pp. 70-84, September 2023.
[12] Refinitiv, Measurement of Environmental, Social, and Governance, 2024.
[13] D. Niu and Z. Wang, "Can ESG ratings promote green total factor productivity? Empirical evidence from Chinese listed companies," vol. 10, no. 7, April 2024.
[14] T. Whelan, U. Atz, T. V. Holt and C. Clark, "Uncovering the Relationship by Aggregating Evidence from 1,000 Plus Studies Published between 2015 – 2020," NYU STERN, 2021.
[15] T. Tahmid, M. N. Hoque, J. Said, P. Saona and M. A. K. Azad, "Does ESG initiatives yield greater firm value and performance? New evidence from European firms," Cogent Business & Management, vol. 9, no. 1, November 2022.
[16] S. Stefanoni and A. V. Dorta, "Technical efficiency of car manufacturers under environmental and sustainability pressures: A Data Envelopment Analysis approach," Journal of Cleaner Production, vol. 311, August 2021.
[17] B. A. Alareeni and A. Hamdan , "ESG impact on performance of US S&P 500-listed firms," vol. 20, no. 7, November 2020.
[18] P. Sharma, P. Panday and R. C. Dangwal, "Is ESG disclosure related to corporate performance Empirical evidence from Indian companies," International Journal of Business and Globalisation, vol. 36, no. 2-3, pp. 186-200, January 2024.
[19] S. B. Erdogan and B. Öztürkkal, "The Role of Environmental, Social, Governance (ESG) Practices and Ownership on Firm Performance in Emerging Markets," Emerging Markets Finance and Trade, vol. 59, no. 12, pp. 3776-3797, July 2023.
[20] B. Agarwal, R. S. Gautam, P. Jain, S. Rastogi, V. M. Bhimavarapu and S. Singh, "Impact of Environmental, Social, and Governance Activities on the Financial Performance of Indian Health Care Sector Firms: Using Competition as a Moderator," Journal of Risk and Financial Management , vol. 16, no. 2, p. 109, February 2023.
[21] D. Kim and Y. J. Sun, "The impact of ESG ratings on corporate value during COVID-19 pandemic: evidence from China and South Korea," Journal of Derivatives and Quantitative Studies: 선물연구, vol. 32, no. 3, August 2024.