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The Effect Of Environmental, Social, And Governance (ESG) Score On Firm's Bankruptcy Risk

Gustian Wiwaha [1]; Zuliani Dalimunthe [2]
[1,2] Universitas Indonesia
Email: [1] gustianwiwaha@gmail.com ;[2] zuliani_d@ui.ac.id

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ABSTRACT

Avoiding bankruptcy is vital for corporate risk management and governance, impacting both companies and stakeholders. This study analyzes the effect of Environmental, Social, and Governance (ESG) practices on bankruptcy risk in G20 countries (2016–2023). Using panel data regression analysis, results indicate that strong ESG performance significantly reduces bankruptcy risk, as evidenced by higher Altman Z-Scores. Among the three pillars, the social dimension has the most substantial impact, with initiatives focused on employee welfare and community engagement enhancing operational stability. The study also finds ESG practices more effective in top carbon-emitting countries (China, the U.S., India, Russia, Japan) due to stronger stakeholder demands and access to sustainability investments, whereas other nations face challenges like limited ESG funding and weaker stakeholder pressures.

INTRODUCTION

Climate change has reached a very alarming point, with rising global temperatures, extreme weather and melting polar ice caps. The main causes are high carbon emissions from the industrial sector, low awareness of the use of public transportation, excessive energy consumption, and deforestation (UN Indonesia, 2022). UN member states agreed to the Paris Agreement in 2015 to reduce emissions and achieve net zero emissions (UNFCCC, 2015). Since then, the issue of sustainability has been growing, marked by the publication of ESG (Environmental, Social, and Governance) which became one of the Sustainable Development Goals (SDGs) agenda to support the Paris Agreement (UNFCCC, 2015).

The high global attention to ESG triggers companies to balance profit, planet and people (social welfare) (Ghillyer, 2012). The trend of sustainability reporting shows a significant increase, from 20 companies in the 1990s to nearly 9,000 in 2016 (Amel-Zadeh et al., 2018). However, ESG implementation presents high cost challenges, such as investments in waste management technology, renewable energy systems, employee welfare programs, and better governance

infrastructure. In fact, some companies have to fundamentally change their business models to integrate ESG in their operations (Bezzera et al., 2024).

According to Mckinsey (2022), an estimated $275 trillion is needed during the transition period to net zero emissions from 2021 to 2050, which means that an average cost of $9.2 trillion per year must be borne by governments and companies in carrying out this initiative. However, to realize this transition, companies are still faced with funding issues. Green funds or specialized credit to support ESG investments are not widely available, especially in developing countries (Bezerra et al., 2024). This results in companies having to provide additional funds for ESG implementation independently without external assistance/financial institutions.

However, on the other hand, the implementation of ESG (formerly known as CSR or GCG) can be a corporate strategy to achieve financial stability and avoid financial difficulties (Choi et al., 2024; Habib A.M., 2023). ESG improves the company's image in the eyes of consumers and suppliers, thereby strengthening its negotiating position in selling products or procuring raw materials efficiently (Rotharmael, 2024). In addition, ESG boosts productivity, lowers employee turnover (Choi et al., 2024), and results in a low cost of capital, which in turn increases firm profitability (Asimakopoulos et al., 2023; Apergis et al., 2022). ESG disclosure practices have also been shown to positively improve firm performance, as measured by ROA, Tobin's Q, and P/E ratio (Veeravel et al., 2024).

Corporate bankruptcy has attracted great attention from creditors, investors, and regulators due to its far-reaching impact. Anton et al. (2019) emphasized that creditors actively monitor the company's financial condition to avoid defaulting on loan interest and principal payments, because corporate bankruptcy and severe financial damage have caused economic crises, such as what happened in Asia in 1998. The same thing was expressed by Song et al. (2024), who stated that the impact of bankruptcy is not only limited to the company itself, but also affects stakeholders such as employees, creditors, suppliers, customers, and the wider community. Bankruptcy not only disrupts company operations but also poses greater economic risks, such as decreased regional productivity, increased unemployment, and greater reliance on social welfare programs. This emphasizes the importance of bankruptcy risk mitigation to protect both the company and the economy as a whole.

In this study, we will examine the impact of ESG implementation by looking at the overall score or for each pillar, namely environmental, social, and governance, on the risk of bankruptcy of companies in the G20 member countries. According to data from the Statistical Review of World Energy (2024), G20 countries are the largest carbon emitters in the world. In 2023, 9 G20 countries entered the top 10 largest carbon emitters in the world. Even from 2015 to 2022, 5 (five) G20 countries consistently ranked in the top 5, namely China, the United States, India, Russia and Japan (Global Carbon Atlas, 2024). This condition may increase the pressure for companies in G20 countries to implement ESG.

Based on the description above, this study will try to fill the gap to explore the impact of ESG implementation as a whole on the risk of bankruptcy of the Company in the G20 member countries, either in total score or per each aspect environmental, social, and governance. In addition, to fully explore the relationship between the effect of ESG implementation on bankruptcy risk, researchers will add a mediating variable, namely profitability. It is hoped that this research can contribute to companies, investors, government, academics, and other related parties in understanding the effect of ESG implementation on the risk of corporate bankruptcy.

LITERATURE REVIEW

Agency Theory

From an agency theory perspective, the link between ESG and bankruptcy risk highlights conflicts between shareholders (principals) and management (agents). ESG initiatives often involve significant costs and reduced short-term profits, potentially clashing with agents' focus

on immediate rewards over shareholders' long-term goals (Zahid et al., 2023; Bezerra et al., 2024). These conflicts can increase financial risk if misaligned priorities persist. However, effective ESG practices enhance transparency, align interests, and reduce bankruptcy risk through improved governance and profitability (Choi et al., 2024). Conversely, weak governance may worsen agency issues, undermining the benefits of ESG initiatives.

Stakeholder Theory

In stakeholder theory, ESG plays a role in creating long-term value for stakeholders through a holistic approach that enhances transparency, relationships and operational sustainability (Mallin, 2013; Apergis et al., 2022). Companies with high ESG scores manage cash flow more effectively, strengthen stakeholder relationships, reduce the cost of capital, and increase shareholder value (Zahid et al., 2023; Giese et al., 2019). However, ESG implementation that is irrelevant to the core business can strain resources and increase the risk of bankruptcy (Bezerra et al., 2024). Therefore, ESG should be aligned with business strategy and financial capability to maintain sustainability.

Signaling Theory

Signaling theory highlights how companies reduce information asymmetry by sending signals of their commitment to sustainability and governance to external stakeholders (Spence, 1973; Aronson et al., 2025). A high ESG score serves as a positive signal, showcasing efforts to mitigate risks and ensure long-term sustainability, which can boost trust, consumer loyalty, and financial stability (Benlemlih, 2019; Li et al., 2024). However, without transparency and efficient resource use, such signals risk backfiring, as seen in greenwashing practices, potentially eroding stakeholder trust and increasing bankruptcy risks. Thus, credible ESG practices are crucial to ensure signals reflect genuine sustainability commitments (Aronson et al., 2025).

Legitimacy Theory

Legitimacy theory highlights the alignment between corporate actions and societal norms, where legitimacy reflects the perception of an entity's actions as socially acceptable (Suchman, 1995). In ESG (Environmental, Social, Governance) contexts, this theory explains how ESG implementation can influence bankruptcy risk. Companies adhering to sustainability norms through meaningful ESG practices enhance their reputation, strengthen stakeholder relationships, and improve access to capital and stability (Deegan et al., 2002). However, symbolic ESG efforts, like greenwashing, risk undermining legitimacy, eroding trust, and increasing bankruptcy risk (Silva, 2021). Effective ESG implementation requires aligning actions with public perceptions of genuine sustainability commitment.

Hypothesis Development

1. Overall ESG Score and Firm’s Bankruptcy Risk

   A company's success depends largely on its competitiveness, which requires a sound business strategy to create a competitive advantage over competitors (Porter, 1985). With the development of sustainability issues, the focus of companies is shifting from CSR and GCG to ESG (UNFCCC, 2015), which includes three main pillars: environmental, social, and governance. ESG increases the transparency of business activities, attracts investors, and becomes a benchmark in global investment decision-making (Apergis et al., 2022; Eccles & Klimenko, 2019). ESG practices not only improve firm performance and value but also reduce the risk of bankruptcy through reducing information asymmetry (agency theory), signaling commitment to sustainability (signaling theory), and increasing stakeholder trust (stakeholder theory) (Zahid et al., 2023). ESG implementation includes emissions reduction, green innovation, employee and consumer welfare, and transparent governance (Refinitiv, 2019). The integration of ESG into business strategy provides a competitive advantage that impacts

corporate performance, good reputation, and stakeholder loyalty and trust, all of which contribute to mitigating the risk of bankruptcy (Habib, 2023).

H1: ESG score affects the firm's bankruptcy risk of G20 member countries.

2. Each ESG Pillar and Firm's Bankruptcy Risk

   The environmental pillar of ESG is vital for operational sustainability and managing long-term financial risks. Commitments to green practices, like reducing emissions and sustainable resource use, enhance investor confidence, stakeholder support, and reduce bankruptcy risks (Dhaliwal et al., 2011; Garel & Petit-Romec, 2021). Environmental investments signal long-term stability, mitigating regulatory penalties and legal risks (Qian et al., 2024; Apergis et al., 2022). However, high environmental costs can strain finances, especially in uncertain economies or low-margin industries, potentially lowering firm value if economic benefits are unclear (Di Giuli & Kostovetsky, 2014; Blitz & Fabozzi, 2017; Zhang, 2023).

   H2a: The environmental pillar score affects the firm's bankruptcy risk of G20 member countries.

3. The social pillar of ESG emphasizes stakeholder welfare, including public health, human rights, job training, and safety, aligning with stakeholder theory, which extends corporate responsibility beyond shareholders (Refinitiv, 2023). Prioritizing social initiatives, such as corporate social responsibility (CSR), enhances reputation, financial stability, and resilience to crises by reducing bankruptcy and default risks (Boubaker et al., 2020). Active social engagement also attracts investors and employees while fostering strong community ties. Gangi et al. (2020) found a significant negative link between social activity and financial distress, highlighting its dual role in benefiting society and strengthening financial foundations.

   H2b: The social pillar score affects the firm's bankruptcy risk of G20 member countries.

4. The company's efforts to improve its reputation in environmental and social aspects also require good governance. Governance has an important role in minimizing agency conflicts and the incidence of agency costs. Lagasio, et al. (2023) state that the presence of non-executive members in the remuneration and audit committees, and the frequency of more frequent remuneration committee meetings can increase company stability and prevent the company from the risk of bankruptcy.

   H2c: The governance pillar score affects the firm's bankruptcy risk of G20 member countries.

5. ESG and Bankruptcy Risk by Country Type

   Country characteristics, such as the financial system, laws, national culture, as well as ESG-related policies, affect firm performance, including profitability and bankruptcy risk (Arai et al., 2023; Bloch et al., 2024). In high carbon emission countries such as China, the US and India, environmental regulatory pressures make Environmental (E) scores more significant to bankruptcy risk than non-high emission countries. The Social (S) pillar has a greater impact in developed countries, such as Japan and Europe, which have high social awareness, while in developing countries, ESG disclosures are often neglected (Barros et al., 2024). The Governance (G) pillar is more effective in countries with strong laws and transparency, giving investors greater confidence. These differences suggest that the effect of ESG on profitability and bankruptcy risk varies across countries, especially in G20 countries, as ESG policies vary (UNCTAD, 2022).

   H3a: There is a difference effect of ESG score on the firm's bankruptcy risk in countries that are in the top 5 carbon emitters in the world.

   H3b(1): There is a difference effect of environmental pillar score on the firm's bankruptcy risk in countries that are in the top 5 carbon emitters in the world.

   H3b(2): There is a difference effect of social pillar score on the firm's bankruptcy risk in countries that are in the top 5 carbon emitters in the world.

   H3b(2): There is a difference effect of governance pillar score on the firm's bankruptcy risk in countries that are in the top 5 carbon emitters in the world.

METHODS

Research Data

This research will use secondary data collected from the Refinitiv Eikon Datastream platform. The population in this study is all non-financial sector companies listed on the Stock Exchange of the G20 countries during the period 2016 to 2023. Sample selection is done with criteria such as having complete total ESG score data, complete ESG score of each pillar, and complete financial statement data such as total assets and total liabilities.

Research Model

This study is conducted to examine the effect of total ESG score and ESG score per each pillar on the Company's bankruptcy risk. Furthermore, the mediating effect of profitability variables in the relationship between ESG and bankruptcy risk will also be investigated. In addition, this study will explore the differences that may occur in the top five largest carbon emitters and countries outside this category. Therefore, four models will be built.

Model 1:

Model 1 uses the independent variable ESG total score to test its impact on bankruptcy risk (Hypothesis 1). The first research model is organized as follows:

$$BR_{i;t} = \beta_0 + \beta_1 ESG + \beta_2 SIZE_{i;t} + \beta_3 LEV_{i;t} + \beta_4 AGE_{(i;t)} + \beta_5 COV_{;t} + \varepsilon_{(i;t)} \quad (1)$$

Model 2:

Model 2 uses independent variables from the environmental, social, and governance pillars to test their impact on bankruptcy risk (Hypotheses H2a, H2b, and H2c). The second research model is organized as follows:

$$BR_{i;t} = \beta_0 + \beta_1 ENV_{i;t-1} + \beta_2 SOC_{i;t-1} + \beta_3 GOV_{i;t-1} + \beta_4 SIZE_{(i;t)} + \beta_5 LEV_{(i;t)} + \beta_6 AGE_{(i;t)} + \beta_7 COV_{(i;t)} + \varepsilon_{(i;t)} \quad (2)$$

Model 3:

Model 3 aims to compare the effect of overall and individual pillar ESG scores on corporate bankruptcy risk in the world's top 5 carbon emitters and countries outside these categories (hypotheses H3a, H3b(1), H3b(2), H3b(3)). The third research model is organized as follows:

$$BR_{i;t} = \beta_0 + \beta_1 ESGDCOUNTRY_{;t-1} + \beta_2 SIZE_{(i;t)} + \beta_3 LEV_{(i;t)} + \beta_4 AGE_{(i;t)} + \beta_5 COV_{(i;t)} + \varepsilon_{(i;t)} \quad (3)$$

$$BR_{i;t} = \beta_0 + \beta_1 ENVDCOUNTRY_{;t-1} + \beta_2 SOCDCOUNTRY_{i;t-1} + \beta_3 GOVDCOUNTRY_{(i;t-1)} + \beta_4 SIZE_{i;t} + \beta_5 LEV_{i;t} + \beta_6 AGE_{i;t} + \beta_7 COV_{(i;t)} + \varepsilon_{(i;t)} \quad (4)$$

Dependent Variable

The dependent variable, bankruptcy risk, is assessed using the Altman Z-Score method, which evaluates financial ratios to predict the likelihood of bankruptcy. Initially introduced in 1968 for public companies, the model incorporates five key financial ratios that significantly influence the Z-Score. Altman (1983) later identified limitations in the original model, as it was only applicable to public companies. To address this, adjustments were made in 1983, replacing the market value of equity with the book value of equity, enabling the model to be used for private companies (Hiphana & Dalimunthe, 2022).

Further refinements to the Altman Z-Score were implemented in 1995, including changes to coefficients and the removal of the sales-to-total-assets ratio. These updates made the model versatile for various types of companies, such as manufacturing, non-manufacturing, and bond-issuing firms. This revised version, known as the Altman Z'' Score, demonstrates high accuracy, with a 90.9% success rate in identifying bankrupt companies and 97.0% for non-bankrupt firms

(Meressa, 2018; Cindik & Artumutlulu, 2021; Ayinaddis & Tegegne, 2023). The Altman Z'' Score formula applied in this study reflects these enhancements to improve predictive reliability.

Altman Z'' = 6.56(X1) + 3.26(X2) + 6.72(X3) + 1.05(X4) (9)

The operational definition of the Altman equation is X1 used to define Working Capital divided by Total Assets, X2 used to define Retained Earnings divided by Total Assets, X3 used to define EBIT divided by Total Assets, and X4 used to define Book Value of Equity divided by Book Value of Total Liabilities. If the Z-score ≥ 2.6, then the entity is classified as a healthy company. Meanwhile, for a Z-score that is between 1.1 > Z Score > 2.6, the entity is classified as an entity that is in the gray zone, which is a less healthy condition. Meanwhile, for Z Score ≤ 1.1, the entity can be classified as potentially bankrupt (Meressa, 2018; Cindik & Artumutlulu, 2021; Ayinaddis & Tegegne, 2023).

Independent Variable

This study examines ESG implementation and country classification as the independent variables. ESG metrics are derived from ESG scores provided by Refinitiv Eikon via Datastream (Apergis et al., 2022), encompassing the overall ESG score as well as individual scores for the environmental, social, and governance pillars during the 2015-2023 period. Country classification is represented as a dummy variable, where a value of 1 is assigned to nations among the world's top five carbon emitters (China, the United States, India, Russia, and Japan), and a value of 0 is assigned to other countries, based on data from the Statistical Review of World Energy and the Global Carbon Atlas.

Control Variables

This study uses control variables to neutralize the effect of the independent variable on the dependent so that it is not biased (Sugiyono, 2019). The control variables used include firm size (natural logarithm of total assets), leverage (total liabilities/total assets), firm age (natural logarithm of IPO listed year to year t), and the COVID-19 pandemic (dummy: 1 for covid years, and 0 for non-covid years) (Habib, A. M., 2023).

RESULTS

Data and Samples

Based on the purposive sampling method, the research population which initially amounted to 33,911 companies for the period 2016 to 2023 has been reduced in number through several criteria as follows:

Table 1. Sample Selection Process

Description	Total
Total companies listed on the stock exchanges of G20 countries	33.911
(-) Financial industry sector companies	(3.405)
(-) Companies that do not have complete ESG data	(28.154)
(-) Companies that do not have complete financial data	(205)
(-) Companies identified as having outlier data	(163)
Number of company samples for the period 2016 to 2023	**1.984**
Number of observations (1,856 x 8 years)	**15.872**

Most of the sample comes from the United States with a sample of 660 companies (33.27%). While the country with the least sample is Argentina with one company (0.05%). Detailed results can be seen in the following table:

Table 2. Sample Size Per Country

Country	Status	Company	Observation	%
United States of America	Top 5 Carbon Emitters	660	5.280	33,27%
Japan	Top 5 Carbon Emitters	318	2.544	16,03%
English	-	178	1.424	8,97%
Australia	-	143	1.144	7,21%
Canada	-	135	1.080	6,80%
South Korea	-	83	664	4,18%
France	-	73	584	3,68%
South Africa	-	67	536	3,38%
Germany	-	62	496	3,13%
China	Top 5 Carbon Emitters	55	440	2,77%
Brazil	-	49	392	2,47%
India	Top 5 Carbon Emitters	48	384	2,42%
Indonesia	-	27	216	1,36%
Mexico	-	25	200	1,26%
Italy	-	19	152	0,96%
Turkey	-	18	144	0,91%
Russia	Top 5 Carbon Emitters	18	144	0,91%
Saudi Arabia	-	5	40	0,25%
Argentina	-	1	8	0,05%
Total	**-**	**1.984**	**15.872**	**100,00%**

Descriptive Statistics

Descriptive statistics is an overview or description of data that explains the characteristics of the data used in this study. Descriptive statistics will display data on the average value (mean), maximum value, minimum value, and standard deviation.

Table 3. Summary of Descriptive Statistics

Variables	Obs	Mean	Max	Min	Std. Dev
ZSCORE	15.872	2,6062	27,5647	-11,6056	2,2369
ESGSCORE	15.872	53,1973	95,4583	1,3591	20,1748
ENVSCORE	15.872	48,8123	98,7503	0,0000	27,6010
SOCSCORE	15.872	53,8546	98,7705	0,3133	23,5200
GOVSCORE	15.872	55,6154	99,4079	0,1007	21,7825
COUNTRY	15.872	0,5539	1,0000	0,0000	0,4970
ROA	15.872	0,0473	0,3798	-0,3255	0,0632
SIZE (Ln)	15.872	22,7342	27,2193	17,1192	1,4714
LEV	15.872	0,5665	2,2100	0,0679	0,2103
AGE (Ln)	15.872	3,2557	5,0238	0,6931	0,6879
COV	15.872	0,3750	1,0000	0,0000	0,4841

From table 3, the average Altman Z Score value of 2.60 indicates that generally companies in G20 countries are in a healthy financial condition or do not experience the risk of bankruptcy because they are above the value of 2.60 (Meressa, 2018; Cindik & Artumutlulu, 2021). The average overall ESG score of 53.19 indicates that companies in G20 countries have ESG performance in the B- or good category. The minimum score of 1.35 and maximum score of 95.45 indicate a large gap in ESG performance between companies in G20 countries. The

environmental pillar score has the lowest average of 48.81 compared to the other pillars where the social pillar is 53.85 and the Governance pillar is 55.61. Meanwhile, when viewed from the proportion of country categories, it can be seen that most of the samples come from countries that fall into the category of the world's top 5 (five) carbon emitters, namely companies from China, the United States, India, Russia and Japan. This condition is shown through the mean of 55.39%. With such a proportion, the proportion of samples from countries outside the top 5 (five) world carbon emitters amounted to 44.61%.

Hypothesis Testing

After performing the model selection and classical assumption tests, the Fixed Effects Model (FEM) using GLS regression was applied to evaluate the research model. FEM was selected as the Chow and Hausman tests rejected the null hypothesis (H0). According to the results of the classical assumption tests, all research models were found to be free from multicollinearity issues. However, the tests also indicated the presence of heteroscedasticity across all models. To address this issue, robust standard errors can be employed (Gujarati, 2004).

The regression analysis will be carried out to examine three research models. The first model explores the overall impact of ESG on bankruptcy risk. The second model assesses the influence of each ESG pillar—Environmental, Social, and Governance—on bankruptcy risk individually. The third model analyzes the variation in the impact of total ESG and its pillars on bankruptcy risk among the world's top five carbon-emitting countries.

Table 4. Regression Results of the Effect of ESG and Each Pillar on Bankruptcy Risk

Variables	Model 1			Model 2		
	Coef	t-stat	Prob	Coef	t-stat	Prob
ESG	0,0038	2,42	0,015**			
ENV				0,0009	0,86	0,391
SOC				0,0025	1,98	0,048**
GOV				-0,0004	0,57	0,568
SIZE (Ln)	-0,4109	-5,48	0,000***	-0,4140	-5,87	0,000***
LEV	-7,5730	-23,12	0,000***	-7,5686	-23,13	0,000***
AGE (Ln)	0,0822	0,82	0,415	0,0759	0,75	0,454
COV	0,0422	3,00	0,003***	0,0406	2,89	0,004***
R^2	**0,4964**			**0,4961**		
F-Stat		**118,52**			**85,41**	
Prob F			**0,000*** **			**0,000*** **

*Notes: *p<0.1; **p<0.05; p<0.01*

The R-squared value for model 1 is 0.4964, indicating that 49.64% of the variance in the dependent variable is accounted for by the independent variables, which include the overall ESG score and the control variables in this model. In contrast, for model 2, which uses the individual ESG pillars as independent variables, the adjusted R-squared value is 0.4961. This implies that 49.61% of the variation in the dependent variable is explained by the independent and control variables.

The F-statistic for model 1 is 118.52, with a p-value of 0.0000, which is below the 0.01 significance threshold. Similarly, the F-statistic for model 2 is 85.41, also with a p-value of 0.0000, which is less than the 0.01 significance level. These results indicate that the overall ESG score, as well as the environmental, social, and governance pillars, along with the control variables in this hypothesis, have a significant influence on bankruptcy risk for companies in G20 countries during the 2016-2023 period.

For further hypothesis testing, the sample companies are divided into the top 5 largest carbon emitters in the world and countries outside this category. This test also uses the *Fixed Effect Model* (FEM). The comparison of regression results from this test is as follows:

Table 5. Comparison of Regression Results of ESG Variables on Bankruptcy Risk in the 5 largest Carbon Emitters and Non 5 largest Carbon Emitters

Variables	Top 5 Carbon Emitters			Non Top 5 Carbon Emitters		
	Coef	t-stat	Prob	Coef	t-stat	Prob
ESG	0,0058	2,58	0,010***	-0,0001	-0,06	0,956
SIZE (Ln)	-0,5759	-6,09	0,000***	-0,2029	-2,08	0,038**
LEV	-6,9727	-14,77	0,000***	-8,2467	-19,49	0,000***
AGE (Ln)	0,2305	1,45	0,147	-0,0316	-0,24	0,810
COV	0,0364	2,03	0,043**	0,0517	2,35	0,019
R^2	**0,5022**			**0,5847**		
F-Stat		**49,58**			**83,96**	
Prob F			**0,000*** **			**0,000*** **

*Notes: *p<0.1; **p<0.05; p<0.01*

Table 6. Comparison of Regression Results of Each ESG Pillar on Bankruptcy Risk in the 5 largest Carbon Emitters and Non 5 largest Carbon Emitters Countries

Variables	Model 1			Model 2		
	Coef	t-stat	Prob	Coef	t-stat	Prob
ENV	0,0014	0,94	0,391	-0,0007	-0,49	0,624
SOC	0,0029	1,78	0,075*	0,0018	0,89	0,372
GOV	0,0017	1,57	0,117	-0,0011	-0,89	0,374
SIZE (Ln)	-0,5779	-6,07	0,000***	-0,2062	-2,11	0,035**
LEV	-6,9708	-14,75	0,000***	-8,2392	-19,54	0,000***
AGE (Ln)	0,2223	1,39	0,166	-0,0366	-0,28	0,781
COV	0,0356	2,00	0,045**	0,0508	2,30	0,022**
R^2	**0,5026**			**0,5852**		
F-Stat		**36,14**			**61,20**	
Prob F			**0,000*** **			**0,000*** **

*Notes: *p<0.1; **p<0.05; p<0.01*

As shown in Table 5, the R-squared values are 0.5022 and 0.5847, indicating that 50.22% of the dependent variable for the world's top five carbon-emitting countries and 58.47% for non-top five emitters are explained by the independent variables, including the overall ESG score and control variables. Similarly, Table 6 presents R-squared values of 0.5026 and 0.5852, showing that 50.26% of the variance in the dependent variable for the top five emitters and 58.52% for non-top five emitters can be attributed to the independent variables (the individual ESG pillars) and control variables in this model.

The significance level for all models is 0.0000, which is below the 0.01 threshold. This suggests that both the ESG variables and control variables, such as firm size, company age, leverage, and the COVID year, have a significant impact on bankruptcy risk for firms, both in the top five carbon-emitting countries and those outside this category.

To summarize, the impact of each independent variable (overall ESG score, as well as scores for the environmental, social, and governance pillars) on bankruptcy risk in the world's largest carbon-emitting countries and those outside this category is outlined in the following table:

Table 7. Summary of Regression Results of the Effect of ESG and Each of its Pillars on the Likelihood of a Company Avoiding Bankruptcy Risk by Country Category

Variables	Top 5 Carbon Emitters		Non Top 5 Carbon Emitters	
	Coef	t-stat	Coef	t-stat
ESG	(+)	Significant	(-)	Not Significant
ENV	(+)	Not Significant	(-)	Not Significant
SOC	(+)	Significant	(+)	Not Significant
GOV	(+)	Not Significant	(-)	Not Significant

DISCUSSION

ESG and Bankruptcy Risk

Table 4 reveals a positive ESG coefficient of 0.0038, with a p-value of 0.015, which is statistically significant at the 5% level. This suggests that an increase in the ESG score corresponds with a higher Altman Z-Score, indicating that companies with better ESG performance are more capable of avoiding bankruptcy risk. Consequently, hypothesis 1 (Ha) is supported. This result aligns with the findings of Habib (2023) and Choi et al. (2024), who argue that strong ESG performance helps businesses manage environmental, social, and governance risks, thereby lowering unexpected costs.

These findings are also consistent with agency, stakeholder, and signaling theories. The implementation of ESG can reduce information asymmetry (agency theory), signal the company's commitment to addressing social and environmental concerns (signaling theory), and enhance stakeholder trust (stakeholder theory) (Zahid et al., 2023). As a result, ESG serves as an essential mechanism for strengthening a company's relationship with its stakeholders.

Firms with high ESG scores are frequently regarded as lower-risk investments, making it easier for them to secure capital at a lower cost (Choi et al., 2024; Apergis et al., 2022). Additionally, increased public attention to ESG provides companies with opportunities to enter new environmentally conscious markets, boost revenues and profits, and reduce their financial distress or bankruptcy risk.

Environmental, Social, Governance Pillars and Bankruptcy Risk

From table 4, it can be seen that the coefficient of the environmental pillar is positive (0.0009) with a p-value of 0.391, indicating that the higher the value on the environmental pillar (E), the higher the Z-Score value. This means that the company can better avoid the risk of bankruptcy. However, since the p-value is greater than 0.05, this relationship is not significant. This finding is different from the research of Choi et al. (2024) who limited the scope to the financial sector in South Korea, where exposure to environmental aspects is relatively low. The impact of environmental practices tends to be felt in the long term (Dhaliwal et al., 2011; Garel & Petit-Romec, 2021; Qian et al., 2024) making it difficult to measure at a lag period of 1 year as in this study.

In contrast, the coefficient of the social pillar is positive (0.0009) with a p-value of 0.048, which is significant at the 5% level. This means that the higher the value of the social pillar (S),

the higher the company's Z-Score value. This finding is in line with the research of Boubaker et al. (2020), Gangi et al. (2020), and Choi et al. (2024), which show that corporate involvement in social activities improves reputation, financial stability, and lowers the risk of bankruptcy. Signaling theory explains that good social practices provide positive signals to investors and creditors, improving credit rating and lowering the cost of capital (Li et al., 2024; Asimakopoulos et al., 2023). In addition, effective CSR implementation can increase consumer loyalty (De Pelsmacker et al., 2005; Upadhye et al., 2019) and employee productivity (Aguilera et al., 2007).

For the governance pillar, the coefficient is positive (0.0004) with a p-value of 0.568, which is also not significant. This result may be related to the established governance standards in G20 countries, where improvements in governance scores do not have a significant impact on financial stability. Lagasio et al. (2023) explain that governance elements are more impactful in environments with weak governance regulations. In addition, developed G20 countries have generally integrated good governance practices in their daily operations (OECD, 2023).

The findings in this study indicate that the social pillar (S) has a significant impact on avoiding the risk of bankruptcy so that companies in G20 countries can pay more attention to social factors, such as employee welfare, community relations, and social responsibility. However, although environmental and governance are not statistically significant in this study, companies still need to pay attention to both aspects to mitigate long-term risks and maintain reputation in the global market considering that overall ESG has a positive and significant impact.

ESG and Bankruptcy Risk by Country Category

Table 7 above shows the different effects of ESG implementation and its pillars (ENV, SOC, GOV) on bankruptcy risk in the largest carbon emitters. Overall, this difference can be explained through stakeholder, signalling and legitimacy theories. Good ESG practices in the largest carbon emitters (China, US, India, Russia, Japan) provide positive signals to stakeholders, increase consumer confidence (Aguilera et al., 2007), purchase intentions (De Pelsmacker et al., 2005; Upadhye et al., 2019), and become a major factor in investment decisions (Apergis et al., 2022). This helps companies avoid the risk of bankruptcy.

Legitimacy theory emphasizes the importance of corporate actions conforming to social norms and global expectations. The largest carbon emitters have supporting instruments, such as government policies and access to substantial funding, that strengthen their legitimacy (Bezerra et al., 2024; Suchman, 1995). This reduces the risk of bankruptcy through compliance with global regulations.

Interestingly, ESG implementation (except the social pillar) in the largest non-carbon emitting countries has a negative effect on Altman Z-Score. Increasing ESG scores without the support of green financing or special credits, especially in developing countries, may worsen the financial condition of companies (Bezerra et al., 2024). The high cost of ESG investments without adequate returns is often a major challenge in the transition to sustainability.

CONCLUSION

This study shows that ESG scores among firms in G20 countries have mixed impacts on corporate bankruptcy risk. In general, ESG implementation in G20 countries is able to reduce corporate bankruptcy risk as shown through an increase in Altman Z-Score, reflecting better management of environmental, social, and governance risks and higher investor confidence. The social pillar is shown to make the largest contribution in reducing bankruptcy risk, while the governance and environmental pillars show more complex results, with effectiveness dependent on the maturity of governance systems and the timing of implementation.

Specially, in the five G20 countries with the highest carbon emissions (China, the United States, Japan, India and Russia), ESG implementation tends to Have a lower bankruptcy risk compare to the others. This finding might due to stronger access to funding and legitimacy from stakeholders. In contrast, in other countries, funding and infrastructure limitations often make ESG investments a financial burden that increases the risk of bankruptcy. These findings emphasise the importance of policy and stakeholder support in determining the success of ESG implementation at the global level.

SUGGESTION

This study has some limitations that are important to acknowledge in order to provide a more holistic understanding of the results obtained. First, this study utilizes accounting data to analyze the relationship between ESG performance and bankruptcy risk. While this approach provides a robust picture of a company's financial condition, it has not incorporated market variables, such as stock price volatility or market capitalization, which may add new dimensions in predicting bankruptcy risk. Future combinations of accounting and market data could potentially bring richer and more contextualized insights.

In addition, this study uses the Altman Z-Score method as the main tool to measure bankruptcy risk. While this method has proven to be reliable and widely used, other predictive approaches, such as the Ohlson or Zmijewski models, have not been explored in this context. Adopting such alternative models may open up opportunities to uncover different findings or complement previous research results, given that each model has a unique approach to bankruptcy risk analysis.

Furthermore, Refinitiv's ESG score is used as a proxy to assess a company's ESG performance. While Refinitiv is one of the globally recognized ESG data providers, this approach does not include methodological variations from other providers, such as MSCI or Bloomberg, which may provide different perspectives. The use of more than one ESG data source can help reduce potential bias and improve the validity of the research results. Considering these limitations, it is expected that future research can integrate more diverse approaches, both in terms of data and methodology, to enrich the literature and provide a more comprehensive understanding of the relationship between ESG and corporate bankruptcy risk.

REFERENCES

Aguilera, R. V., Rupp, D. E., Williams, C. A., & Ganapathi, J. (2007). Putting the S back in corporate social responsibility: A multilevel theory of social change in organizations. *Academy of Management Review*, 32(3), 836–863. https://doi.org/10.5465/amr.2007.25275678

Altman, E. I. (1983). *Corporate Financial Distress: A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy*. John Wiley & Sons, Inc.

Amel-Zadeh, A. & Serafeim, G. (2018). Why and how investors use ESG information: evidence from a global survey. *Financial Analysts Journal*. 74 (3), pp 87-103. http://dx.doi.org/10.2139/ssrn.2925310

Apergis, N., Poufinas, T., & Antonopoulos, A. (2022). ESG scores and cost of debt. *Energy Economics*. 112 (106186). https://doi.org/10.1016/j.eneco.2022.106186

Aronson, O. Hanson, S. & LaFont, M. (2025). Innovative organizations CSR signaling: consumer perceptions, expectations, and outcomes. *Journal of Business Research*. 186 (115041). https://doi.org/10.1016/j.jbusres.2024.115041

Asimakopoulos, P., Asimakopoulos, S., & Li, X. (2023). The role of environmental, social, and governance rating on corporate debt structure. *Journal of Corporate Finance*. 83 (102488). https://doi.org/10.1016/j.jcorpfin.2023.102488

Ayinaddis, S. G. & Tegegne, H. G. (2023). Uncovering financial distress conditions and its determinant factors on insurance companies in Ethiopia. *PLoS ONE*. 18 (10). https://doi.org/10.1371/journal.pone.0292973

Benlemlih, M. (2019). Corporate social responsibility and dividend policy. *Research in International Business and Finance*. 47. 114–138. https://doi.org/10.1016/j.ribaf.2018.07.005

Bezzera, R. R. R., Martins, V. M. B., & Macedo. A. N. (2024). Validation of Challenges for Implementing ESG in the Construction Industry Considering the Context of an Emerging Economy Country. *Applied Sciences MDPI*. 14 (14), 6024. https://doi.org/10.3390/app14146024

Blitz, F. J., & Fabozzi, D. (2017). Sin stocks revisited: Resolving the sin stock anomaly. *The Journal of Portfolio Management*, 44(1), 105–111.

Boubaker, S., Cellier, A., Manita, R., & Saeed, A. (2020). Does corporate social responsibility reduce financial distress risk?. *Economic Modelling*. 91. 835-851. https://doi.org/10.1016/j.econmod.2020.05.012

Choi, S. Y., Ryu, D., & You, W. (2024). ESG activities and financial stability: The case of Korean financial firms. *Borsa Istanbul Review*. https://doi.org/10.1016/j.bir.2024.05.007

Cindik, Z & Armutlulu, I. H. (2021). A revision of Altman Z Score model and a comparative analysis of Turkish company. *National Accounting Review*. 3 (2), 237-255. https://doi.org/10.3934/NAR.2021012

Deegan, C., 2002. Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation. *Accounting, Auditing & Accountability Journal*. 15, 282e311. https://doi.org/10.1108/09513570210435852.

De Pelsmacker, P., Driesen, L., & Rayp, G. (2005). Do consumers care about ethics? Willingness to pay for fair-trade coffee. *Journal of Consumer Affairs*, 39(2), 363–385. https://doi.org/10.1111/j.1745-6606.2005.00019.x

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review*, 86(1), 59–100. https://doi.org/10.2308/accr.00000005

Di Giuli, A., & Kostovetsky, L. (2014). Are red or blue companies more likely to go green? Politics and corporate social responsibility. *Journal of Financial Economics*, 111(1), 158–180. https://doi.org/10.1016/j.jfineco.2013.10.002

Eccles, R. G., & Klimenko, S. (2019). The Investor Revolution: Shareholders are getting serious about sustainability. *Harvard Business Review.*

Gangi, F., Meles, A., Monferra, S., & Mustilli, M. (2020). Does corporate social responsibility help the survivorship of SMEs and large firms?. *Global Finance Journal*. 43 (100402). https://doi.org/10.1016/j.gfj.2018.01.006

Garel, A., & Petit-Romec, A. (2021). Investor rewards to environmental responsibility: Evidence from the COVID-19 crisis. *Journal of Corporate Finance*, 68, Article 101948. https://doi.org/10.1016/j.jcorpfin.2021.101948

Ghillyer, A. (2012). *Business Ethics Now (5th edition)*. America: McGraw-Hill (AWG).

Giese, G., Lee, L. E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. *The Journal of Portfolio Management*, 45(5), 69–83. https://doi.org/10.3905/jpm.2019.45.5.069

Gujarati, D. N. (2004). *Basic Econometrics (4th ed.)*. The McGraw Hill.

Habib, A. M. (2023). Do business strategies and environmental, social, and governance (ESG) performance mitigate the likelihood of financial distress? a multiple mediation model. *Heliyon*. 9 (e17847). https://doi.org/10.1016/j.heliyon.2023.e17847

Hiphanna, R. & Dalimunthe, Z. (2022). Calculating corporate default risk: zombie firm model. *Advances in Business Research International Journal*. 8 (3), 22-29. https://doi.org/10.1016/j.heliyon.2023.e17847

Lagasio, V., Brogi, M., Gallucci, C., & Santulli, R. (2023). May board committees reduce the probability of financial distress? a survival analysis on Italian listed companies. *International Review of Financial Analysis*. 87 (102561). https://doi.org/10.1016/j.irfa.2023.102561

Li, W. W., Padmanabhan, P., & Huang, C. H. (2024). ESG and debt structure: Is the nature of this relationship nonlinear? International Review of Financial Analysis, 91, 103027. https://doi.org/10.1016/J.IRFA.2023.103027

Mallin, C. A. (2013). *Corporate Governance (4th edition)*. America: Oxford University Press.

McKinsey & Company. (2022). The net zero trasition what it would cost, what it could bring. McKinsey Global Institute.

Meressa, H. A. (2018). Evaluating financial distress condition of micro finance institutions in Ethiopia using Altman's revised z-score model. *International Journal of Accounting Research*. 3 (4). https://doi.org/10.12816/0044418

Qian, B., Poshakwale, S., & Tan. Y. (2024). 'E' of ESG and firm performance: evidence from China. *International Review of Financial Analysis*. 96 (103751). https://doi.org/10.1016/j.irfa.2024.103751

Refinitiv. (2023). Environmental, Social and Governance Scores from LSEG. LSEG Data & Analytics. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

Rotharmael, F .T. (2024). *Strategic Management (6th edition)*. America: McGraw Hill LCC.

Sekaran, U., & Bougie, R. (2016). *Research method for business (7th edition)*. United Kingdom: John Wiley & Sons Ltd.

Setiawan, A., Dalimunthe, Z., & Rizkianto, E. (2019). Bankruptcy risk among Indonesian Stock Exchange Listed Companies. *GATR Journal of Finance and Banking Review*. 4 (4), 122-127. https://doi.org/10.35609/jfbr.2019.4.4(2)

Silva, S. (2021). Corporate contributions to the sustainable development goals: an empirical analysis informed by legitimacy theory. *Journal of Cleaner Production*. 292 (125962). https://doi.org/10.1016/j.jclepro.2021.125962

Song, H. & Zhao, X. (2024). The unexpected consequences of company bankruptcy: an investigation into the spillover effect of local economic liquidation. *Finance Research Letters*. 61 (104992). https://doi.org/10.1016/j.frl.2024.104992

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, 87(3), 355. https://doi.org/10.2307/1882010

Suchman, M.C. (1995). Managing legitimacy: strategic and institutional approaches. *Acad. Manag. Rev.* 20, 571e610. https://doi.org/10.5465/AMR.1995.9508080331.

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Upadhye, B. D., Das, G., & Varshneya, G. (2019). Corporate social responsibility: A boon or bane for innovative firms?. *Journal of Strategic Marketing*, 27(1), 50–66. https://doi.org/10.1080/0965254X.2017.1384042

Veeravel, V., Murugesan, V. P., & Narayanamurthy, V. (2024). Does ESG disclosure really influence the firm performance? Evidence from India. *The Quarterly Review of Economics and Finance*. 95 (193-202). https://doi.org/10.1016/j.qref.2024.03.008

Zhang, G. (2023). Regulatory-driven corporate greenwashing: Evidence from "lowcarbon city" pilot policy in China. *Pacific-Basin Finance Journal*, 78, Article 101951. https://doi.org/10.1016/j.pacfin.2023.101951

Zahid, R. M. A., Taran, A., Khan, M. K., & Chersan, I. C. (2023). ESG, dividend payout policy and the moderating role of audit quality: Empirical evidence from Western Europe. Borsa Istanbul Review. 23(2). 350–367. https://doi.org/10.1016/J.BIR.2022.10.012