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A Research on the Relationship between ESG Performance of Companies and Systematic Risk

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Abstract

Today, companies have started to focus on sustainability efforts to maximize market value and reduce risks. One of the measures used to express the sustainability performance of companies is environmental, social and governance (ESG) scores. High ESG performance is expected to contribute to the systematic risk reduction by lowering the cost of capital, therby increasing market value. This study aims to analyze this relationship for companies traded in Borsa Istanbul that possess ESG ratings. Findings reveal that ESG components have a long-term relationship with the Beta coefficient, which represents systematic risk. In addition, causality tests produce significant findings and a bidirectional causality relationship was detected between the corporate governance score and beta coefficient. When evaluating the results within the scope of environmental and social scores, the causality relationships from ESG environmental and social scores to the beta coefficient are determined. These results offer insights into how sustainability practices can contribute to firms' risk management processes.

Keywords: Sustainability, Systematic Risk, ESG Performance.

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1. INTRODUCTION

Today, global warming, famine, food crisis and exhaustion of natural resources remain at the forefront. The rapid increase in the demand for consumption by individuals encourages companies to be sustainable in environmental, social and corporate governance (ESG) issues. Galletta and Mazzù (2023, p. 274) define sustainability as ensuring development by satisfying the necessities of the current generation without reducing the capacity of future generations to fulfill their own demands. Socially responsible investing is integrating non-financial issues such as ESG and its sub-components into the portfolio selection process (Dorfleitner et al., 2015, p. 451). The concept of ESG is derived from the phenomenon sustainability and social responsibility in investment. Although environmental footprint is seen as a non-financial concept in relation to social responsibility and corporate governance concepts, it is becoming increasingly common to associate the performance of companies in these parameters with financial performance (Maiti, 2021, p. 199). The phenomenon of sustainability, which has expanded in scope over time, has accelerated the sustainability activities of companies and highlighted the importance of sustainability performance measurement. In this context, some organizations (Thomson Reuters, Bloomberg and MSCI) have started to measure the ESG performance of companies.

The phenomenon of sustainability, the measurement of sustainability performance and the increasing sustainability awareness of investors encourage companies to continuously adopt sustainable business practices. This increase in sustainability awareness changes the economic environment and involves fundamental changes in capital markets (Hübel & Scholz, 2020, p. 66). Within the scope of these changes, companies take ESG factors into account in their business decisions and in the evaluation phase of listed companies in order to meet the various needs of their shareholders, limit legal and operational threats, and catch the sustainable investment trend (Mikołajek-Gocejna, 2022, p. 598). In this context, companies are looking for ways to minimize possible risks since they know that they will have to allocate more resources to ensure a successful process at the stage of including ESG factors in their business processes. Because ESG investments, despite their inherent advantages, may weaken a company’s financial stability and harm its corporate image if risks are ignored (Cohen, 2023, p. 16). Investors want to know the opportunities and risks in the context of sustainable investments, combating climate change and reducing carbon emissions, and want both financial and sustainability risks to be comprehensively articulated in their investment portfolios (Folqué et al., 2021, p. 876). In addition, investors recognize the competitive advantage of incorporating ESG factors into their investment strategies (Jin, 2018, p. 72), As a result, they may not focus solely on the financial returns but also favor stocks of companies with strong ESG performance (Cornell, 2021, p. 12). As a result, both firms and investors face certain risks while benefiting from the advantages of sustainability and question how these risks will affect their returns. Systematic risk concerns the entire economy and reflects a firm’s sensitivity to broad market movements (Luo & Bhattacharya, 2009, p. 209). Systematic risks include industry-wide issues such as commodity prices, interest and inflation rates, regulatory changes, technological developments and idle assets (Gregory et al., 2014, p. 635). In contrast, firm-specific risk stems from internal or external factors affecting only that particular firm's operations (Jo & Na, 2012, p. 441). The measure of systematic risk was shaped by the emergence of the Markowitz Portfolio Selection Model and the Capital Asset Pricing Model (CAPM), and the beta concept became a general measure to identify the degree of the systematic risk in financial markets (Martín-Cervantes & Valls Martínez, 2023, p. 2). A beta value higher than 1 indicates that the stock is riskier than the market index (Mikołajek-Gocejna, 2022, p. 597). The distinction between systematic and firm-specific risk is crucial for corporate valuation because firm-specific risk can be diversified but systematic risk cannot (Giese et al. 2019, pp. 2-3). In this context, when the environmental-systematic risk relationship is analysed, firms that meet environmental criteria or have high environmental performance have increased flexibility to cope with wide market shocks (Sharfman & Fernando, 2008, p. 586). According to Giese et al. (2019); Eccles et al. (2014); El Ghoul et al. (2011) and Gregory et al. (2014), firms with a strong ESG profile have better defenses against economic fluctuations and, therefore will exhibit lower systematic risk; low systematic risk reduces cost of capital; and finally, low cost of capital will lead to high valuation for firms. This study aims to contribute to the literature by analysing the postulated relationships. For this pupose the long run cointegration and causality relationships between firm performance in ESG sub-dimensions and systematic risks is analized for firms traded in Borsa Istanbul between 2013 and 2021. Results reveal both cointegration and causality relations among variables.

2. LITERATURE REVIEW

Studies examining the ESG performance-systematic risk relations are presented in this section. The findings obtained in the analysed studies vary. In this respect, some of the previous studies are briefly summarised below.

Sassen et al. (2016) analysed 8752 European firms between 2002 and 2014 and found that unsystematic and total risk decreased as firms' ESG scores increased. They also found that when the ESG dimensions are analysed individually, the social score has a significant negative impact on risk measures; the environmental score generally reduces unsystematic risk, while the corporate governance score doesn't have an impact on firm risk. Benlemlih et al. (2018) examined whether ESG is associated with systematic risk by using panel data analysis on stocks traded in the United Kingdom between 2005 and 2013 and found that firms' environmental and social performance is related to stock volatility and unsystematic risk, but not related to systematic risk. In a similar study, Annisa and Hartanti (2021) investigated the impact of ESG performance on firm risk factors. The authors used a sample of 145 firms from ASEAN-5 between 2011 and 2017. Results suggest that ESG scores don't affect systematic risk, but affects total risk and unsystematic risk significantly. Farah et al. (2021) examined 4004 international firms from 43 countries between 2005-2017. They found that the ESG-systematic risk relation is non-linear, and follows an inverted U-shaped course. In other words, as ESG performance increases, the systematic risk increases due to operating costs; after ESG performance reaches a moderately high level, i.e. a threshold level, the systematic risk decreases as ESG scores increase. Similarly, Korinth and Lueg (2022) aimed to determine the ESG scores' relationships with different types of risks in their research examining 454 firms in the German stock market between 2012 and 2019. They found that ecological investments initially reduce systematic risk (beta), but increase systematic risk. Eratalay and Cortés Ángel (2022) focused on S&P Europe 350 stocks between 2016-2020. The study found that high ESG performance reduces systematic risk. Mikołajek-Gocejna (2022) examined the stocks of ESG-rated firms traded in the Polish capital market between 2019 and 2022. Results suggest that the risks of ESG-rated stocks are lower than those of the market portfolio. Aevoae et al. (2023) examine whether changes in banks' ESG scores affect systematic risk. They applied a dynamic panel analysis of 367 publicly traded banks from 47 countries from 2007 to 2020. The findings revealed that improved investments in corporate social responsibility (CSR) reduce both bank-specific and systematic risks. Similarly, Sharfman and Fernando (2008); Cerqueti et al. (2021); Jo and Na (2012); Giese et al. (2019); Jacobsen et al. (2019) are among the studies studies that detected the systematic risk-reducing effect of high ESG performance. In addition, Wamba et al. (2020); Salama et al. (2011) stated that positive environmental performance can reduce systematic risk by acting as insurance against the possible effects of adverse events. Albuquerque et al. (2019); El Ghoul et al. (2011) state that firms with high CSR performance are characterised by a lower cost of equity capital. Authors also reveal that responsible relations with employees, establishment of environmental policies and product strategies can lead to lower systematic risk.

When studies related to Turkiye are analysed, to the best of our knowledge there is no study analysed the ESG performance of firms and systematic risk relationship. Borak and Doğukanlı (2022) investigated the between CSR and systematic risk, unsystematic risk and total risk between 2009 and 2020 for firms traded in Borsa Istanbul and having a corporate governance rating. Within the scope of the aforementioned study, the authors found that CSR has no significant effect on unsystematic, systematic and total risk. This study differentiates from the existing literature both in terms of the sample and in terms of investigating the relationship between ESG and Beta.

3. DATA AND METHODOLOGY

The study aims to investigate the relationship between firms' ESG scores and systematic risk. For this purpose, firm ESG scores are analysed in three dimensions: Environmental Score (ESG1), Governance Score (ESG2) and Social Score (ESG3). The study covers 22 stocks included in the BIST30 index for the 10-year period between 2013 and 2022 and whose data can be accessed uninterruptedly during the relevant period. Although ESG scores were calculated starting from 2010, the backdating of the analysis period caused data loss. Since it was aimed to include as many firms as possible in the analysis, the period started in 2013.

Data on ESG scores were obtained from the Refinitiv database. Beta coefficients of firms' stock returns are utilised as the proxy of systematic risk. The relevant data are obtained from the Finnet database. Table 1 presents the descriptive statistics.

Table 1. Summary Statistics

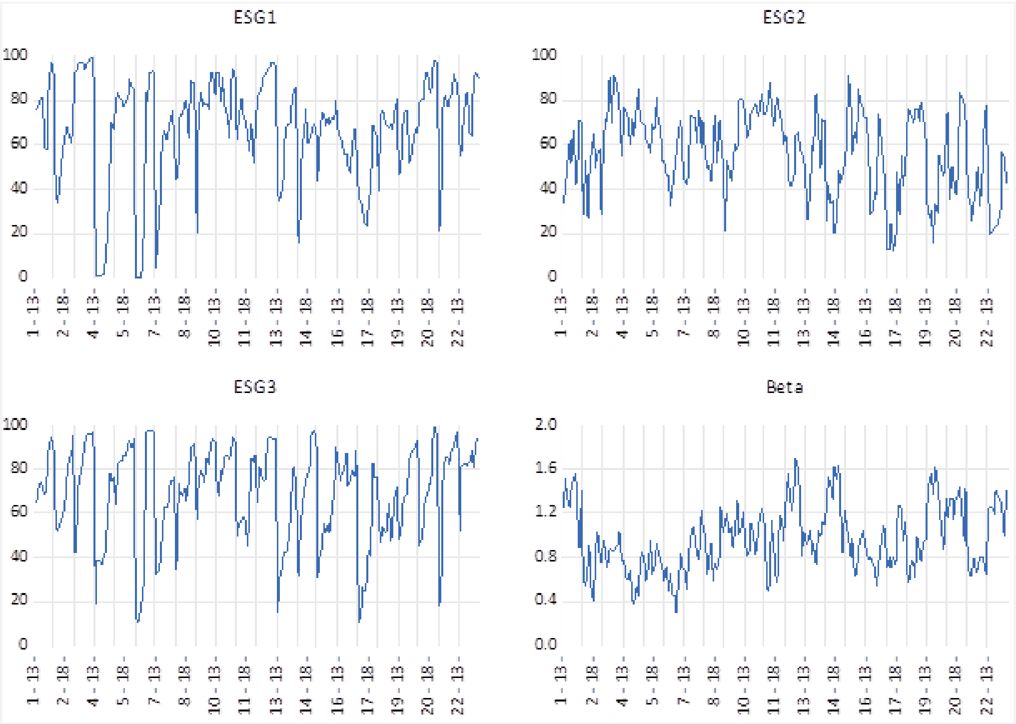
	ESG1	ESG2	ESG3	Beta
Mean	66.9224	56.0291	69.0962	0.9644
Median	71.685	56.915	74.72	0.9396
Maximum	99.22	91.1	98.61	1.6915
Minimum	0.00	11.5	10.21	0.3042
Std. Dev.	24.0686	18.5839	21.8265	0.3008
Skewness	-1.1493	-0.3586	0.7896	0.2943
Kurtosis	3.8904	2.2814	2.8441	2.3485
Jarque-Bera	55.7069	9.4487	23.0870	7.0661
Probability	0.0008	0.0088	0.0009	0.02921
Observations	220	220	220	220

Source: Own calculations from data

Table 1 shows that the lowest average score is found in the institutional dimension. The highest average is found in the social dimension. The fact that the averages are far from 1 in all three dimensions can be interpreted as the sustainability performance of the companies in the sample is not very good.

In Figure 1 graphical lines of the series are presented. Graphs show that the variables fluctuate around a constant mean. This gives a preliminary idea about the stationarity of the variables.

Figure 1. Graphical Line of Series



Source: Own calculations.

In this study, panel cointegration and panel causality tests are used to analyze the relationship between ESG scores and the Beta variable. In order to determine the appropriate tests, the model should first be examined for homogeneity and horizontal cross-section dependence. For this purpose Hisao (2003)[1] the homogeneity test is applied first. Breusch and Pagan (1980)[2] LM test, Pesaran et al. (2008)[3] LMadj test, Baltagi et al. (2012)[4] CDlmadj test and Pesaran (2004, 2021)[5] CDlm test were used to detect horizontal cross-section dependence. For the determination of stationarity, Westerlund and Hosseinkouchack (2016)[6] unit root tests that takes into account horizontal cross-section dependence were performed. Westerlund and Edgerton (2007, 2008)[7] panel cointegration test is applied to analyze the long-run relationships between the series. As causality tests, Emirmahmutoglu and Kose (2011)[8] and Dumitrescu and Hurlin (2012)[9] panel causality tests are used. Detailed information on the methodology can be found in the footnotes.

Table 2. The Results of Hsiao (2003) Homogeneity Test

Hypotheses	H_1		H_2		H_3	
Variables	**F-Stat**	**P-Value**	**F-Stat**	**P-Value**	**F-Stat**	**P-Value**
ESG_1-Beta	9.8892	1.26E-28	1.4888	0.0115	17.5117	1.98E-34
ESG_2-Beta	10.6021	2.57E-30	1.7083	0.0331	18.1271	2.38E-35
ESG_3-Beta	11.0485	2.35E-31	1.9735	0.0093	18.2314	1.67E-35

Source: Own calculations.

According to Table 2, the null hypotheses of hypotheses H_1, H_2 and H_3 are rejected. According to the related results, it is understood that the data are heterogeneous.

Due to the horizontal cross-section dependence and heterogeneity in the data, second-generation unit root tests were conducted.

Table 3. The Results of the Cross-Section Dependency Test

ESG_1 Test	T-stat	P-Value	ESG_2 Test	T-stat	P-Value
LM (Breusch & Pagan, 1980)	426.525	0.0000	LM (Breusch & Pagan, 1980)	394.218	0.0000
LMadj (Pesaran et al., 2008)	8.828	0.0000	LMadj (Pesaran et al., 2008)	7.329	0.0000
CDlm (Pesaran, 2004, 2021)	9.097	0.0000	CDlm (Pesaran, 2004, 2021)	7.594	0.0000
CDlmadj (Baltagi et al., 2012)	7.874	0.0000	CDlmadj (Baltagi et al., 2012)	6.371	0.0000
CD (Pesaran, 2004, 2021)	13.460	0.0000	CD (Pesaran, 2004, 2021)	6.308	0.0000

[1] For a detailed formulation of homogeneity test, please see Hsiao (2003).
[2] For a detailed formulation of cross section dependency tests, please see Breusch and Pagan LM (1980).
[3] For a detailed formulation of cross section dependency tests, please see Pesaran et al. (2008).
[4] For a detailed formulation of cross section dependency tests, please see Baltagi et al. CDlmadj (2012).
[5] For a detailed formulation of cross section dependency tests, please see Peseran (2004, 2021).
[6] For a detailed formulation of panel unit root tests, please see Westerlund and Hosseinkouchack (2016).
[7] For a detailed formulation of cointegration tests, please see Westerlund and Edgerton (2007, 2008).
[8] For a detailed formulation of panel causality test, please see Emirmahmutoglu and Kose (2011).
[9] For a detailed formulation of panel causality test, please see Dumitrescu and Hurlin (2012).

(Table 3 cont.)

ESG3			Beta		
Test	**T-stat**	**P-Value**	**Test**	**T-stat**	**P-Value**
LM (Breusch & Pagan, 1980)	475.167	0.0000	LM (Breusch & Pagan, 1980)	566.663	0.0000
LMadj (Pesaran et al., 2008)	11.068	0.0000	LMadj (Pesaran et al., 2008)	15.616	0.0000
CDlm (Pesaran, 2004, 2021)	11.360	0.0000	CDlm (Pesaran, 2004, 2021)	14.394	0.0000
CDlmadj (Baltagi et al., 2012)	10.137	0.0000	CDlmadj (Baltagi et al., 2012)	8.1443	0.0000
CD (Pesaran, 2004, 2021)	32.985	0.0000	CD (Pesaran, 2004, 2021)	2.0327	0.0000

Source: Own calculations.

For ESG1, ESG2, ESG3 and Beta variables, H_0 hypothesis of no cross-sectional dependence was rejected and the alternative hypothesis could not be rejected and results were obtained indicating that cross-sectional dependence exists. Test results reveal the existence of horizontal cross-section dependence in ESG1, ESG2, ESG3 and Beta panel data. Accordingly, it is concluded that the ESG structures of the selected firms are not similar to each other.

Table 4. The Unit Root Test Results

Test	**Constant**					**Constant and Trend**				
	CADF	**LM**	**M-CADF**	**pval**	**Lags**	**CADF**	**LM**	**M-CADF**	**pval**	**Lags**
ESG1	-6.291	34.037	-5.531	0.063	0	-6.787	38.792	-7.271	0.064	0
ESG2	-4.976	23.779	-0.977	0.613	6	-4.987	23.986	-0.887	0.829	6
ESG3	-6.065	31.991	-4.788	0.091	0	-4.336	18.475	-0.328	0.955	5
Beta	-5.164	25.621	-1.048	0.592	7	-5.154	25.651	-0.916	0.822	7
	M-CADF Critical Values					**M-CADF Critical Values**				
	%1		%5		%10	%1		%5		%10
	9.210		5.991		4.605	11.345		7.815		6.251

Source: Own calculations.

The series was selected according to horizontal cross-section dependence. Westerlund and Hosseinkouchack (2016) conducted unit root tests (modified Pesaran CIP and CADF with standard limiting distributions), which are second-generation unit root tests. Based on the unit root test results, the H_0 hypothesis (unit root) couldn't be rejected for all variables. This result implies that all variables contain unit root processes. In other words, ESG1, ESG2, ESG3 and Beta variables are not stationary at level and contain unit roots. This situation can be interpreted as the environmental, social and corporate structures and systematic risks that are not sustainable for the selected firms.

After determining that all of the series are I(1), Westerlund and Edgerton (2007, 2008) panel cointegration test, which is one of the panel cointegration tests, is applied to investigate the existence of a long-run relationship. Table 5 presents the cointegration test results.

Table 5. The Cointegration Test Results

Westerlund-Edgerton (2007, 2008)							
Variables	**Bootstrap panel coint.**			**Panel data coint. with structural breaks**			
	lm_{Stat}	bootst p-val	asymp p-val		t-Stat	P-Value	
ESG_1-Beta	1.520	0.240	0.064	PD-Tau	0.033	0.513	
				PD-Phi	0.303	0.619	
ESG_2-Beta	1.903	0.090	0.029	PD-Tau	-1.787	0.062	
				PD-Phi	-0.384	0.351	
ESG_3-Beta	-1.207	0.990	0.848	PD-Tau	-5.118	0.000	
				PD-Phi	-3.512	0.000	
					Critical Values		
					%1	%5	%10
				PD-Tau	-2.326	-1.645	-1.282
				PD-Phi	-2.326	-1.645	-1.282

Source: Own calculations.

Westerlund-Edgerton (2007, 2008) cointegration tests can be used when the dependent variable is I(1) or I(0) and the independent variables are I(1) or I(0). Therefore, bootstrap panel cointegration and structural break panel cointegration tests are used to investigate the long-run relationship between ESG1-2-3 and beta variables. In the case of horizontal cross-section dependence, critical values obtained by the bootstrap procedure are used. The null hypothesis of cointegration is accepted for all three relationships, by considering the bootstrap probability values. In this sense, it is accepted that the series is in a cointegration relationship. In conclusion, bootstrap panel cointegration results quantify the long-run relationship between ESG1, ESG2, ESG3 and Beta. According to the panel cointegration results with structural breaks, the asypm p value is less than 0.05 meaning that H_0 hypothesis could be rejected for the relationship between ESG3 and Beta variables. Thus, there is no evidence of a long-run relationship between the two variables obtained. On the other hand, H_0 hypothesis could not be rejected for ESG1 and Beta, and ESG2 and Beta variables and there was evidence of the existence of a long-run relationship between the variables. In summary, both cointegration test results confirm the existence of a long-run relationship between the variables.

After deciding that the relationships for all three groups of variables are cointegrated, panel causality tests were applied to investigate whether there is a causality relationship between the variables.

Both tests based on Emirmahmutoglu and Kose (2011) and Dumitrescu and Hurlin (2012) panel causality tests aim to detect the existence of a short-run relationship between variables in panel data analysis. These tests are preferred because they are frequently used in heterogeneous panels. The statistics of the tests that can obtain effective results in heterogeneous and homogeneous panels are given in Table 6.

Table 6. The Causality Test Results

H_0	Causality Test	Statistics			Critical Values		
		(W-Stat)	t-Stat (Zbar-Stat)	P-Value	%1	%5	%10
ESG_1=>Beta	EK		65.709	0.019	349.069	184.321	139.693
	DH	1.148	0.491	0.623	10.543	6.553	4.825
Beta=> ESG_1	EK		55.783	0.110	395.286	185.486	143.941
	DH	1.518	1.718	0.186	9.788	5.281	4.025
ESG_2=>Beta	EK		137.134	0.000	325.687	169.374	140.493
	DH	1.836	2.774	0.006	8.674	5.660	4.213
Beta=> ESG_2	EK		59.743	0.057	337.880	172.513	133.471
	DH	1.737	2.444	0.015	8.602	5.404	4.149
ESG_3=>Beta	EK		168.932	0.000	393.098	191.484	139.127
	DH	2.225	4.164	0.000	11.316	7.045	5.316
Beta=> ESG_3	EK		162.405	0.000	289.092	179.836	141.250
	DH	1.448	1.485	0.137	10.877	5.634	4.475

Source: Own calculations.

According to the Emirmahmutoglu and Kose (2011) (EK in Table 6) results between ESG1 and Beta, there is a unidirectional relationship between ESG1 and Beta and this relationship is from ESG1 variable to Beta variable. As a result, while there is a short-term causality relationship from ESG1 to Beta, there is no causality relationship from Beta to ESG1. According to Dumitrescu and Hurlin (2012) (DH in Table 6) test results, no causality relationship between ESG1 and Beta was found.

According to the Emirmahmutoglu and Kose (2011) results between ESG2 and Beta, it is found that there is a bidirectional relationship between ESG2 and Beta. It is determined that there is a bidirectional short-term causality relationship between these two variables. Dumitrescu and Hurlin (2012) test results show the same results with Emirmahmutoglu and Kose (2011) results. Based on the results of both causality tests, it can be concluded that there is a bidirectional short-run causality relationship between ESG2 and Beta variables.

According to the Emirmahmutoglu and Kose (2011) results between ESG3 and Beta, it is determined that there is a bidirectional causality relationship between ESG3 and Beta. It is concluded that there is a short bidirectional causality relationship between these two variables. According to Dumitrescu and Hurlin (2012) test results, while there is a short-term relationship from ESG3 to Beta, there is no causality relationship from Beta to ESG3. These results provide evidence for the existence of a causality from ESG3 to Beta.

4. CONCLUDING REMARKS

Risk factors, another parameter influencing investors' firm preferences along with expected returns, have evolved and diversified over time. It is noteworthy that new threats to businesses include economic, social and governance issues. The rapid depletion of natural resources and sustainability concerns that have started to manifest themselves with climate change have brought environmental factors to the agenda as a risk factor. Increased access to education as well as the strengthening of non-governmental organisations have increased the level of awareness of stakeholders, and laws have forced businesses to act more sensitively in terms of occupational safety, employee rights and consumer rights. According to Rai (2024), ignoring the issues of commitment to ethical values, transparent sharing of information and effective internal communication may expose firms to threats such as legal processes, scandals and loss of trust in the eyes of investors.

Ding et al. (2024), referring to the 'Major Global Risks' report prepared by the World Economic Forum organised in 2022, stated that eight of the top ten critical risks to which the world is exposed are related to economic and social issues. Therefore, it has become essential for businesses today to include ESG components in their risk management applications.

The views evaluating the impact of sustainable activities on firms' risk are divided into two. According to the stakeholder or risk management view, successful ESG practices can reduce the firms' risks by increasing their financial soundness as they focus on improving their relationships with stakeholders (Anwer et al., 2023). Giese et al. (2019) conclude that improvement in firms' ESG performance improves both systematic risks and firm-specific risks. According to the overinvestment theory, managers' focus on sustainability investments is either to gain fame or to divert attention from the firm's poor financial results or failures (Anwer et al., 2023). Landi et al. (2022) found that ESG assessments increase the systematic risks of firms, which they attributed to the possibility that sustainability investments create uncertainty for investors.

In this study, the Beta coefficient, which indicates the individual stock risk relative to the market, is used as a measure of systematic risk. Investors can diversify firm-specific risks; therefore, the risk component taken into account in the formation of expected return is systematic risk (Giese et al., 2019). According to Ding et al. (2024), who measure systematic risk with the Beta coefficient in a similar study, the larger the Beta coefficient, the more likely the firm is to be affected by the various external systemic risk factors. The authors stated that when a firm can effectively mitigate systemic risk, it is more likely to perform well in ESG (Ding et al., 2024). In another study, Pistolesi and Teti (2024) stated that the relationship between ESG scores and Beta is inverted U-shaped. This finding is interpreted as sustainability investments increase the risk of firms up to a certain threshold, but when this threshold is exceeded, high ESG investments contribute to the reduction of systematic risk.

The findings from this study show that all ESG dimensions exibit a long-term relationship with Beta coefficients, which express the extent to which companies are affected by systematic risks. Causality tests also yielded significant results for all ESG dimensions. While causality relationships from ESG scores to Beta coefficient were determined for Environmental and Social scores, it was observed that the causality relationship between the ESG2 variable representing the Corporate

Governance score and the Beta coefficient was bidirectional. The results confirm the thesis that sustainability efforts can have an impact on companies' risks.

The causality relationship from the environmental score to Beta is consistent with Huang et al. (2018) view that increasingly adverse climate conditions create greater systematic risk for companies across the global economy. Companies with low environmental scores may face financial losses due to fines and penalties for not complying with current and future regulations due to their environmentally damaging activities (Safdie, 2024). At the same time, the company's image may be negatively affected. When social risks are not managed well, the company's relationships with its employees and customers may deteriorate. Failures in corporate governance may expose the company to scandals that will damage its image and finances (APlanet, 2023).

When the causality relationship from Beta to ESG2 is evaluated, it is seen that results consistent with the study of Ding et al. (2024) are obtained. Accordingly, companies with low Beta values are generally more robust in their management and operations. They can effectively deal with systemic challenges, thus supporting their financial performance as well as being more attentive to the environment, society and governance (Ding et al., 2024).

The findings from this study provide some policy implications. First, the long-run equilibrium relationship between ESG scores and systematic risk suggests that improved performance through environmental, social and corporate governance practices can act as a buffer against systematic risks for firms. Systematic risks, which include inflation, interest rate and exchange rate risks as well as market and political risks, are relatively difficult risks for firms to manage and may lead to higher capital costs. In this context, business processes based on ESG components can increase firms' resilience. It is important for policymakers to support firms' ESG practices through various incentives (e.g., tax benefits) and green financing products. In addition to environmental approaches related to products and production, the social dimension of firms also needs to be strengthened. In this sense, establishing and implementing the necessary laws in terms of factors such as occupational health and safety, employee rights, and equal opportunities in business life can be effective in reducing systematic risks. In the context of corporate governance, the concepts of transparency, ethical principles, accountability and corporate governance come to the fore. It is closely related to the reputation of the firm and the trust of shareholders and other stakeholders. Firms that adhere to corporate governance principles are expected to be more effective in risk management. In order to promote corporate governance, it is important to increase the quality and effectiveness of independent auditing and to complete the necessary legal regulations.

Considering the causality relationships, it is also possible to offer some policy recommendations. First, the environmental score is found to be the cause of beta. Since systematic risks are risks that the firm cannot eliminate by its own means, it is important to understand the dynamics of the relationship between these two variables. While green production processes and the use of renewable energy are encouraged, the additional costs and risks of these processes should be kept under control. A bidirectional causal relationship is found between corporate governance and systematic risk. It is obvious that successful risk management is possible with good corporate governance. It may be useful to raise the awareness of company officials and stakeholders that corporate governance can increase the firm's robustness and resilience in the face of external shocks and perhaps to prepare training programs in this context. Regarding the social dimension, improving wage policies to provide better living standards, empowering employees, making them feel valued to increase their loyalty, and improving the quality of relations with suppliers, customers and all segments of society can positively affect investors' perception of uncertainty about the firm and stabilize shareholder returns. Steps to be taken by legislators, regulators and supervisory bodies to improve the cooperation of firms in achieving the Sustainable Development Goals may also improve ESG performance and mitigate the effects of systematic risks at the firm level.

Although the applied causality tests reveal a kind of cause-effect relationship between the variables, they cannot detect asymmetric effects regarding this relationship. Although it is understood that ESG scores are the cause of the Beta coefficient, no inference can be made as to whether the effect is positive or negative. When ESG risks are not managed well, they are likely to lead to significant impacts on the company's reputation, financial condition and long-term viability (APlanet, 2023). Therefore, ESG performance is expected to improve the firm's risk exposure. On the other hand, the fact that sustainability investments lead to higher costs and involve more uncertainty may increase the risks at the company level, as well as increase the level of exposure to systematic risks. In order to clarify this issue, it would be useful to expand the analyzes to reveal asymmetric effects in future studies. Additionally, studies can be conducted based on alternative measurements of systematic risk (conditional Value at Risk (CoVaR), expected shortfall (SES), etc.).

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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