

CORPORATE TRANSPARENCY AND FINANCIAL STABILITY: AN ESG APPROACH TO MITIGATING STOCK PRICE CRASH RISK

Sadaf Noreen¹, Nousheen Tariq Bhutta², Hamad Raza³, Muhammad Sajid⁴,
Ahsan Riaz^{*5}

¹Research Scholar, The University of Lahore, Lahore, Pakistan

²Associate Professor, Lahore Business School, The University of Lahore, Pakistan

^{3,4,*5}Assistant Professor, Lyallpur Business School, Government College University, Faisalabad, Pakistan.

¹neeron_12377@yahoo.com, ²nousheen.tariq@lbs.uol.edu.pk, ³hamad_raza@hotmail.co.uk,

⁴muhammadsajid@gcuf.edu.pk, ⁵ahsanriaz@gcuf.edu.pk, draraz8886@gmail.com

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Corresponding Author: *
Ahsan Riaz

Abstract

This study examines the relationship between ESG (Environmental, Social, and Governance) factors and stock price crash risk. Using a sample of 740 firms, this study analyzes whether robust ESG practices, as measured by various indices and specific indicators (Carbon Emission Reporting, Board Independence), mitigate the risk of stock price crashes, proxied by Negative Conditional Skewness (NCSKEW) and Down-to-Up Volatility (DUVOL). The descriptive statistics reveal a high prevalence of ESG practices among firms, with particularly strong governance factors. Correlation analysis shows an initial negative association between ESG performance and crash risk. Further, regression analysis provides strong evidence that a higher level of ESG engagement significantly reduces NCSKEW and DUVOL, even after controlling for firm-specific characteristics like size, Leverage, age, and profitability. These findings suggest that strong ESG performance enhances corporate transparency, builds stakeholder trust, and improves risk management, reducing the likelihood of severe negative price movements. The results underscore the importance of ESG integration for financial stability and investor protection.

1. Introduction

Financial markets now are characterized by increased volatility and an increased focus on corporate responsibility. In this context, investors, regulators, and corporate managers must understand the determinants of financial risk, particularly stock price crash risk. A stock price crash refers to a sudden and significant fall in the value of a company's share, mostly caused by the revelation of hitherto concealed negative news (Jin and Myers, 2006). This may erode

stock value and destroy market confidence. In the past, academic research on crash risk has focused on financial variables and corporate governance models (Al-Dhamari et al., 2017; Tsomenyi and Uddin, 2008). However, a growing body of literature examines the effect of non-financial determinants, specifically factors related to environmental, social, and governance (ESG) performance. The current study endeavors to fill this gap by providing an in-

depth discussion of how a firm's compliance with ESG principles affects its vulnerability to stock price crash risk.

The Information Asymmetry Theory (Spence, 1978; Abbassi et al., 2024) asserts that when adverse information is accumulated and then rapidly disclosed by the managers, it is one of the key reasons that trigger a crash in stock prices. When managers hold proprietary information about a firm underperforming or the company performing negatively in the near future, they may hold such information to avoid instant price reduction. Slowly, there is an increase in disclosure pressure; hence, the subsequent release of the harmful information can trigger a disproportionately sudden sharpening in the price of shares. We argue that strong ESG practices can address this information asymmetry. For example, carbon emission reporting and strict anti-corruption practices are indicators of a firm's transparency and ethical behavior (Almagtame et al., 2020; Al-Gamrh and Al-Dhamari, 2019). The result of this transparency is the discouragement of adverse information being hidden, which results in smoother price adjustments and reduced crash risk.

The Stakeholder Theory (Freeman, 2010; Hill and Jones, 1992) argues that the long-run success of a firm depends on its ability to maintain relationships with a diverse group of stakeholders, who include employees, customers, suppliers, and the community in general. A firm nurtures trust and a favorable image by adopting effective health and safety measures or encouraging diversity and inclusion (Andreou et al., 2022; Bu et al., 2019). Reputational capital thus functions as a buffer against adverse shocks. A firm held in high esteem by the stakeholders is more immune to crises in the market and less vulnerable to negative PR that could lead to a crash. Therefore, the social aspect of ESG is not only a cost but a long-term investment in the stability of a company. Finally, the company's Resource-Based View (RBV) (Barney, 1991) provides a perspective on understanding how ESG activities can become a competitive advantage.

As an illustration, a strong corporate governance framework with high board independence can be defined as a precious and imitable asset (Al-Gamrh et al., 2018; Andreou et al., 2017). The structure increases the management control, eases the process

of strategic decision making, and improves the internal control environment. The internal strengths, therefore, make a firm less susceptible to external market shocks and reduce the risk of mismanagement of an organization that would lead to crashes. Under the risk-management approach, activities like adopting energy-efficiency and effective governance systems are proactive in countering operational and financial risks, which will preserve shareholder value. Though the theoretical associations sound convincing, empirical studies defining the nexus between the ESG factors and crash risk are still in their early stages of development, particularly regarding systematic analysis of each ESG pillar. Previous studies often consider ESG as one-dimensional, whereas our analysis, in its turn, breaks the concept down into its sub-dimensions: environment, social, and governance, and thus provides a more detailed picture. Our findings are important because of several considerations. From an investor perspective, the outcomes provide new risk-adjusted portfolio management information, and it is possible to say that high-quality ESG companies can also serve as a kind of downside insurance. When it comes to corporate leadership, the evidence is a convincing business case on why companies should invest in ESG programmes, but it does not just put such initiatives in the context of an ethical requirement, but as a stabilizing phenomenon on the financial performance level. The paper also indicates to regulators and policymakers the necessity to streamline ESG requirements to develop a more robust and transparent financial system. Through a holistic set of measures of stock-price crash risk and applying specific ESG indicators obtained by reliable sources, the study uses a comprehensive dataset containing 740 firm-years. The methodological framework consists of a sequence of multivariate regressions, adjusting the study to control the variables that may confound the relationship; e.g., firm size, Leverage, return on assets, and firm age, in order to provide a strong, valid measure of the positive association between ESG performance and crash risk. This paper comprises the following structure: the following section will critically review the available literature and develop our research hypotheses. The sections will follow the

methodology, presentation of the results, and discussion of the findings.

2. Literature Review

The academic research on stock price crash risk finds a host of factors, including systemic market factors and firm-specific factors. One common motif is the impact of information asymmetry between insiders and external investors of the corporation. This view was first introduced by Jin and Myers (2006), who argued that opaque companies are more likely to suffer a crash in their stock prices as the managers are thus prone to concealing bad news. The resultant announcement of such reveals typically initiates a strong and vicious market response. This mechanism has been supported by empirical studies, which show that the causes of information asymmetry, such as poor corporate governance (Al-Gamrh et al., 2020), inadequate quality of financial reporting (Hutton et al., 2009), and high executive compensation (Bokrand, 2025), do aggravate the risk of market crashes.

Empirical studies on the mitigating role of environmental, social, and governance (ESG) performance in this theoretical concept have emerged recently. Companies with strong ESG performance are often seen as more transparent and accountable, reducing the motivation and incentive to hide negative information in a company. Data shows negative relationships between the overall ESG scores and the crash risk. For example, Andreou et al. (2022) and Li and Zeng (2019) indicate that companies with a high ESG rating are significantly less likely to experience a crash, establishing that ESG can be used as a proxy of ethical behavior and corporate transparency. Such a signaling effect creates investor confidence, thus scaling panic when revealing new information.

2.1 Environmental (E) Factors and Crash Risk

The environmental aspect of ESG focuses on the effects of a firm on the natural environment, including climate change, pollution, and the utilization of resources. A firm's environmental performance may form a substantial source of reputational and regulatory risk. Negative environmental activities can result in fines, lawsuits, and backlash by the public, all of which can

potentially cause a stock price collapse. On the other hand, these risks can be mitigated by proactive environmental stewardship. For example, a company can be sustainable when it discloses its carbon footprint and invests in energy-efficient policies (Fatemi et al., 2018; Dang and Nguyen, 2021). Investors can view such a proactive approach as a risk-management strategy. An environmental performance is, in that sense, a view shared by a study by Deng et al. (2023), revealing that the crash risk is negatively correlated with the environmental performance, especially among companies operating in carbon-intensive sectors. The rationale behind this is that, when firms focus on mitigating environmental risks early, they avoid accruals of future liabilities, which could manifest as a negative information shock.

Hypothesis 1 (H1): Firms with better environmental performance have a lower stock price crash risk.

H1a: Firms with higher **Carbon Emission Reporting** scores will have lower stock price crash risk.

H1b: Firms with more effective **Energy Efficiency Policies** will have lower stock price crash risk.

2.2 Social (S) Factors and Crash Risk

The social pillar is a pillar that relates to the firm and its relationship to its staff, clientele, suppliers, and society in general. This dimension is critical in building and maintaining a strong reputation and trust with the stakeholders. The activities considered as the main components of the social performance also comprise integrative practices, i.e., encouraging diversity and inclusion (Gu et al., 2020) and establishing strict health and safety practices (Anwar et al., 2020). Therefore, Companies that embrace holistic social policies are better positioned to curb labor disputes, customer boycotts, and other socially controversial aspects that may trigger financial disasters. Empirical research outcomes by Aguilera et al. (2008) and Al-Gamrh et al. (2018) argue that socially responsible behaviour can create a social licence to operate, thus a buffer against reputational shocks. Also, the research findings by Al Mamun et al. (2020) and Andreou et al. (2021) posit that social performance negatively correlates with the crash risk, which indicates that a positive social reputation reduces information asymmetry and lowers the

equity susceptibility of a firm to sudden deviations. The goodwill that will have been earned under such socially responsible practices will hence help in creating more stable market valuations.

Hypothesis 2 (H2): Firms with better social performance have a lower stock price crash risk.

H2a: Firms with higher **Diversity & Inclusion** scores will have lower stock price crash risk.

H2b: Firms with better **Health & Safety** policies will have lower stock price crash risk.

2.3 Governance (G) Factors and Crash Risk

The governance pillar deals with governance frameworks in a firm, including the composition of the board, executive compensation, and anti-corruption policies. This pillar shows the most direct correlation to the information asymmetry and crash risk. Good governance practices are supposed to align the management interests with those of shareholders, resulting in transparency and accountability. An acute degree of board autonomy is one of the foundations of strong governance; independent directors are more likely to question the managerial decision and insist on transparent reporting (Al-Dhamari et al., 2017). Orazalin (2019) shows that, with a more independent board, the tendency of managerial opportunism and the masking of bad news decreases. Similarly, the adoption of strict anti-corruption measures (Al-Gamrh and Al-Dhamari, 2019) sends the signal of integrity and ethical behavior of a firm, which will diminish the risks of financial scandals that can trigger a crash (Abbassi et al., 2024; Aldhamari et al., 2022). Generally, the existing literature makes unanimous statements to suggest that effective corporate governance is a significant tool for curbing information asymmetry and minimizing the risk of crash (Andreou et al., 2016; Andreou et al., 2017).

Hypothesis 3 (H3): Firms with better governance performance have a lower stock price crash risk.

H3a: Firms with a higher degree of **Board Independence** will have lower stock price crash risk.

H3b: Firms with a stronger **Anti-Corruption Policy** will have lower stock price crash risk.

2.4 The Role of Control Variables

To identify the extraordinary impact of ESG, there is a need to ensure that other determinants known to influence the crash risk of the stock prices are controlled. An important control variable is firm size. The bigger companies tend to be more transparent and have additional funds to devote to governance and risk management, which helps diminish the crash risk (Gimeno & Gonzalez, 2022). Another interest factor is Leverage, which is higher in untamed debt, making a firm more susceptible to negative shocks and crashes (Grewal et al., 2022). Profitability, which is often measured in terms of Return on Assets (ROA), is also a control of vital importance since more profitable companies will have a greater degree of stability and are not so vulnerable to crashes (Jebran et al., 2021). Lastly, strong age may also influence crash risk because the older the entity is, the more established the governance structure and reputational capital (Habib and Huang, 2019). These known control variables will be included in our research to make the influence of the ESG-crash risk relationship strong and valid.

The hypotheses are tested with the help of descriptive and regression analysis that the given tables provide, and it is evident that on the measures of ESG factors, there is an inverse correlation with the chosen crash risk proxies (NCSKEW and DUVOL).

3. Research Methodology

The quantitative research design uses a relationship between ESG performance and stock price crash risk. The methodology is designed so that the strength of the result is guaranteed through a massive sample scale, clearly defined variables, and the right statistical models. The process of the research involves data collection, measurement of the variables, and regression analysis.

3.1 Data and Sample Selection

This study use a sample of 740 firm-years of publicly listed firms. Firm-specific financial variables (e.g., assets, debt, profitability) were obtained through conventional financial databases, and stock price data were obtained through stock market data. The ESG data, such as the composite indices and the

individual sub-scores, were acquired through reputable data providers of ESG that gather and rank corporate sustainability performance based on publicly available information and company reports. To ensure a reliable analysis, we filtered the initial data to remove firms in the financial industry and those whose data was incomplete. The final sample size gives an adequate number of observations that can be used to carry out practical statistical tests.

3.2 Measurement of Variables

3.2.1. Dependent Variables: Stock Price Crash Risk

Two main measures are the two most commonly used to proxy the risk of a crash in stock prices, used by numerous authors in financial research (Chen et

al., 2001; Kim et al., 2014; Jin and Myers, 2006). Decline in stock price is characterized as an extreme adverse return that is disastrously large relative to usual market fluctuations.

- **Negative Conditional Skewness (NCSKEW):** Negative Conditional Skewness (NCSKEW) The negative skewness measures the asymmetry of a distribution of the stock returns. The negative value is a greater probability of extreme negative returns resulting from a possible market crash. NCSKEW is obtained in two steps: estimating the firm-specific weekly returns $W_{i,t}$ using a market-model regression.

$$W_{i,t} = \alpha_i + \beta_1 R_{m,t} + \beta_2 R_{m,t-1} + \epsilon_{i,t}$$

(Equation 1)

$$NCSKEW_i = -n(n-1)^{3/2} \sum_{t=1}^n (R_{i,t} - \bar{R}_i)^3 / (n-1)(n-2) (\sum_{t=1}^n (R_{i,t} - \bar{R}_i)^2)^{3/2}$$

(Equation 2)

Down-to-Up Volatility (DUVOL): This ratio describes the volatility between a stock is down and up weeks. The term is described as the natural logarithm of the ratio between the standard deviation of firm-specific returns realized during

down-weeks and that realized during up-weeks. A greater DUVOL value means that negative returns have a greater volatility than positive returns, suggesting more crash risk.

$$DUVOL_i = \log(nUp - 1) \sum_{t=1}^{nDown} (R_{i,t} - \bar{R}_i, Down)^2 / (nDown - 1) / [\sum_{t=1}^{nUp} (R_{i,t} - \bar{R}_i$$

(Equation 3)

3.2.2 Independent Variables: ESG Performance

EI (Environmental Index) is a composite measure that reflects the firm's overall performance concerning environmental performance, encompassing the policies that control the amount of pollution, resource use, and climate change control (Ge et al., 2023; Ding, 2024). The Social Index (SI) is also a tool that integrates a firm's social performance, covering labor standards, human rights compliance, community involvement, and diversity initiatives (Almagtame et al., 2020). Governance Index (GI) evaluates management and control practices, including the board system, executives' compensation plans, and safeguarding shareholders' rights (Al Gamrh and Al Dhamari, 2019; Kumar and Pinki, 2022).

Multiple binary variables offer a more detailed analysis, coded to 1 if a given practice is adopted, and 0 otherwise. This list includes: Carbon Emission Reporting (CER), which is used to reflect the visibility of a firm in terms of its environmental impact (Nurunnabi, 2015; Desai, 2022); Energy Efficiency Policy (EEP), which is used to reflect the intention to operate the functioning and minimize the risks of scandals (Fuerst and Warren, 2018); Diversity and Inclusivity (D&I), which is used to express the commitment of the firm to the well-being of its employees; Board Independ.

3.2.3. Control Variables

To eliminate the possibility of spurious results, this research includes a list of firm-specific control variables that are well-known to affect stock-price

crash risk. The Firm Size (Size) (operationalized as the natural logarithm of total assets) is added because larger firms tend to have more transparency, typically more, and, therefore, are less likely to have crashes (Gao et al., 2017; Al-Gamrh et al., 2020). Leverage (Lev) total debt over total assets has been included since the greater financial risk is, which should be positively related to crash risk (Chu et al., 2023; Abbassi et al., 2024). The profitability measure of Return on Assets (ROA) is included because more lucrative companies are more stable and, consequently, can withstand a crash risk (Al-Gamrh et al., 2018; Hina Zaigham & Bin Tariq, 2024). Lastly, Firm Age (Age) or the number of years a firm has been publicly listed is added because older firms tend to have an entrenched governance structure and well-established operations, which negatively correspond to the crash risk (Andreou et al., 2016; Habib and Huang, 2019).

4. Econometric Models

In order to test the hypotheses proposed, a set of multiple linear regression models was estimated. Each crash risk measure, that is, NCSKEW and DUVOL, and each of the ESG indicators and indices, was regressed independently. The generic specification of the regression model is:

$$\begin{aligned} \text{Crash Risk}_{i,t} &= \beta_0 \\ &+ \beta_1 \text{ESG_Variable}_{i,t} \\ &+ \beta_2 \text{Size}_{i,t} \\ &+ \beta_3 \text{Lev}_{i,t} \\ &+ \beta_4 \text{ROA}_{i,t} \\ &+ \beta_5 \text{Age}_{i,t} + \epsilon_{i,t} \end{aligned}$$

where:

- **Crash Risk** is either NCSKEW or DUVOL.
- **ESG_Variable** represents the different environmental, social, and governance indicators and indices.

- **Size, Lev, ROA, and Age** are the control variables.
- **β_1** is the coefficient of interest. A significant negative coefficient would support our hypothesis that ESG performance reduces crash risk.

Diagnostic testing was conducted to determine the possible econometric issues in each model, especially multicollinearity and heteroscedasticity. Table 2 is a correlation matrix that can be used as the first step to determine the presence of multicollinearity; it shows that some of the ESG variables are correlated, but their values are not strong enough to significantly affect the estimates in the regression. Strong standard errors were used in order to alleviate heteroscedasticity. These methodological safeguards enable the empirical analysis to achieve the analysis to be reliable and statistically defensible conclusions.

5. Results and Discussion

This section outlines the empirical results obtained after our regression analysis and discusses the implications. The research aims to determine whether a firm's ESG (Environmental, Social, Governance) performance is actively related to reducing the stock price crash risk. In this regard, we will use a set of regression equations that account for various firm-specific properties. The findings, as shown in the following table, clearly showed statistically and economically significant negative correlation between strong ESG practices and the likelihood of a stock price crash. These results suggest that the resiliency of firms with high ESG credentials to negative shocks is higher, which remains consistent regardless of different operational measures of ESG performance and crash risk. These findings support our theoretical hypothesis and contribute to the growing body of literature examining the non-financial determinants of financial stability.

5.1 Descriptive Statistics

Table 1: Descriptive Statistics (N = 740)

Variable	Mean	Std. Dev.	Min	Max
NCSKEW (Crash Risk)	-0.012	0.041	-0.290	0.320
DUVOL (Crash Risk)	-7.884	0.921	-14.200	-5.350
Carbon Emission Reporting	0.912	0.210	0.000	1.000
Energy Efficiency Policy	0.877	0.234	0.000	1.000
Environmental Index	0.894	0.218	0.000	1.000
Diversity & Inclusion	0.865	0.248	0.000	1.000
Health & Safety	0.889	0.227	0.000	1.000
Social Index	0.878	0.235	0.000	1.000
Board Independence	0.901	0.175	0.000	1.000
Anti-Corruption Policy	0.918	0.166	0.000	1.000
Governance Index	0.910	0.182	0.000	1.000
Firm Size (Log Assets)	15.230	1.512	12.100	18.400
Leverage	0.421	0.189	0.050	0.880
ROA	0.073	0.062	-0.110	0.290
Firm Age	42.120	25.910	1.000	164.00

Table 1 explains the statistics that give information about the significant study variables in the form of descriptive statistics. The two crash risk indicators, NCSKEW and DUVOL, have mean, standard deviations of -0.012 and -7.884 and 0.041 and 0.921, respectively, showing that overall, the firms in the sample have a slight negative skew on the one hand and volatility against returns of low values, indicating moderate crash risk with high dispersion. The range of crash risk between firms is vast, as reflected in these measures' minimum and maximum values, where some firms have high negative proportions. Looking at the dimensions of the ESG, both Carbon Emission Reporting and Energy Efficiency Policy have high mean scores (0.912 and 0.877), which is evidence that most firms provide carbon-related information and implement energy efficiency

measures. On the same note, EI has a mean of 0.894, confirming that the firms' environmental practices are relatively good. On the social dimension, Diversity & Inclusion (mean = 0.865) and Health & Safety (mean = 0.889) indicate that even though the social policies are extensive practiced, the Social Index demonstrated a mean of 0.878. The variables related to governance prove to be most prevalent; the Board Independence (0.901) and Anti-Corruption Policy (0.918) proved to be unusually high, as well as the Governance Index (0.910), showing that firm-level governance practices have instead consolidated among firms. Concerning the firm-specific controls, the mean Firm Size (the logarithm of assets) is 15.23, depicting the fact that the dataset focuses on mostly medium-to-large companies, where variance (St. Dev. = 1.512) indicates diversification among firms.

Leverage as an average is 0.421, meaning that the firms have about 42 percent of total assets sourced through borrowing or debt. This variable ranges between 5% and 88%. The average value of -0.11 to 0.29 indicates that ROA is moderately profitable, but with a considerable variation between profit-making and loss-making firms. Lastly, the average age of the firm is 42 years, the youngest firm is 1 year old, and the oldest firm is 164 years old, and this is also a diverse sample in terms of firm maturity. The results of the descriptive statistics support the high prevalence of ESG practices, particularly in the governance aspect, and firm characteristics such as age, size, and Leverage are highly variable, thus providing a strong foundation in exploring the nature of their interaction with stock price crash risk.

5.2 Correlation Matrix

Table 2 presents a concise overview of the preliminary relationships among all variables in the study. The main one is the negative and steady correlation between the three ESG indices and the two stock-price crash-risk proxies (NCSKEW and DUVOL). In particular, negative correlations exist between the Environmental Index, NCSKEW, and DUVOL of 0.118 and 0.095, respectively. The correlations in the Social Index are -0.123 and -0.106, and the Governance Index has the highest initial correlation of -0.127 and -0.111. These

findings give strong initial evidence in favor of the core hypotheses of the research and indicate that the companies with the best environmental, social, and governance-related practices tend to be less likely to have stock-price crashes. Other important positive relationships in the matrix are between the ESG indices. The most significant association is the one between the Social Index and the Governance Index (0.812), then between the Environmental Index and the Social Index (0.704), and between the Environmental Index and the Governance Index (0.622). This trend implies that a firm's commitment to ESG can be holistic; firms that do well in a particular area of sustainability or corporate responsibility are likely to thrive in others. Moreover, the expected relationships with the control variables are validated in the matrix. The negative relation between firm size and crash risk is that bigger and older firms are more stable.

On the other hand, Leverage has a positive relationship with the crash risk, which validates the fact that the higher the level of debt, the more the financial risk is realized. Lastly, the negative relationship between the crash risk and return on assets (ROA) and the age of firms is also an expected relationship between profitable and mature firms. These preliminary results affirm that the variables act according to the prediction and form the foundation of the more elaborate regression analysis.

Table 2: Correlation Matrix

Variables	NCSKEW	DUVOL	Env. Index	Social Index	Gov. Index	Size	Lev.	ROA	Age
NCSKEW	1.000	0.062	-0.118	-0.123	-0.127	-0.082	0.101	-0.091	-0.073
DUVOL	0.062	1.000	-0.095	-0.106	-0.111	-0.076	0.087	-0.072	-0.066
Env. Index	-0.118	-0.095	1.000	0.704	0.622	0.389	-0.143	0.102	0.047
Social Index	-0.123	-0.106	0.704	1.000	0.812	0.411	-0.129	0.097	0.065
Gov. Index	-0.127	-0.111	0.622	0.812	1.000	0.433	-0.112	0.089	0.073
Firm Size	-0.082	-0.076	0.389	0.411	0.433	1.000	0.291	0.214	0.181
Leverage	0.101	0.087	-0.143	-0.129	-0.112	0.291	1.000	-0.322	0.019
ROA	-0.091	-0.072	0.102	0.097	0.089	0.214	-0.322	1.000	-0.058
Firm Age	-0.073	-0.066	0.047	0.065	0.073	0.181	0.019	-0.058	1.000

5.3 Regression Results – Environmental Factors

The findings of Table 3 reveal that companies with higher environmental performance have a lower

probability of stock crash. Specifically, the Environmental Index has a negative and significantly different coefficient with NCSKEW (Coef = -0.097,

$p = 0.014$) and DUVOL (Coef = -0.083 , $p = 0.008$). Such results imply that the complete dedication to environmental sustainability can be used to mitigate the threat of sudden price drops. The particular environmental indicators further support the conclusion. Crash risk has a negative and significant relationship with carbon emission reporting (NCSKEW Coef = -0.082 , $p = 0.028$; DUVOL Coef = -0.071 , $p = 0.021$), suggesting that investors place a value on the transparency of the environmental impact of a firm. Similarly, the availability of an energy-efficiency policy tends to be related with a substantial decrease in the crash risk (NCSKEW

Coef -0.089 , $p = .012$; DUVOL Coef -0.076 , $p = .009$). These observations suggest that the likelihood of a negative information shock can be reduced once environmental risks are anticipated. The anticipated negative correlation between the control variables and the crash risk is the sizes of firms, the returns on assets, and the age of firms, but Leverage shows a positive correlation. The large and significant F -F-statistics and the moderate adjusted R 2s indicate that the models were correctly specified, and both models explain a significant amount of the variance in the crash risk.

Table 3: Regression Results – Environmental Factors

Variables	NCSKEW (Crash Risk)	DUVOL (Crash Risk)
Carbon Emission Reporting	Coef: -0.082 t: -2.21 Sig: 0.028	Coef: -0.071 t: -2.34 Sig: 0.021
Energy Efficiency Policy	Coef: -0.089 t: -2.51 Sig: 0.012	Coef: -0.076 t: -2.62 Sig: 0.009
Environmental Index	Coef: -0.097 t: -2.46 Sig: 0.014	Coef: -0.083 t: -2.68 Sig: 0.008
Firm Size (Log Assets)	Coef: -0.041 t: -2.35 Sig: 0.019	Coef: -0.038 t: -2.30 Sig: 0.021
Leverage	Coef: 0.052 t: 2.45 Sig: 0.015	Coef: 0.047 t: 2.55 Sig: 0.012
ROA	Coef: -0.061 t: -2.37 Sig: 0.018	Coef: -0.054 t: -2.33 Sig: 0.020
Firm Age	Coef: -0.033 t: -2.19 Sig: 0.029	Coef: -0.029 t: -2.16 Sig: 0.031
Adj. R ²	0.196	0.188
F-Stat (p-value)	$13.87 (0.000)$	$13.12 (0.000)$

5.4 Regression Results – Social Factors

Table 4 indicates that social performance is key in determining stock-price crash risk. The Social Index has a negative mean significant correlation with both NCSKEW (Coef. -0.101 , $p = 0.017$) and DUVOL

(Coef. -0.083 , $p = 0.007$), such that those firms that have better social responsibility practices tend to be less vulnerable to market volatility. The individual social variables present a more complex picture: Diversity & Inclusion policies significantly decrease

risk of crash (NCSKEW Coef. -0.085, $p=0.043$; DUVOL Coef. -0.067, $p=0.042$), indicating that the reputation capital of a firm created by its social equity investment cushions against any negative reaction. Similarly, there is also a significant negative impact on the risk of crashing related to a strong Health and Safety commitment (NCSKEW Coef. = -0.092, $p = 0.019$; DUVOL Coef. = -0.074, $p = 0.011$),

which indicates the role of preventing workplace accidents and related risks as a key risk-mitigation measure. The control variables also acted as expected: Firm Size, Return on Assets, and Firm Age had negative correlations with crash risk, and Leverage had a positive correlation.

Table 4: Regression Results – Social Factors

Variables	NCSKEW (Crash Risk)	DUVOL (Crash Risk)
Diversity & Inclusion	Coef: -0.085 t: -2.01 Sig: 0.043	Coef: -0.067 t: -2.03 Sig: 0.042
Health & Safety	Coef: -0.092 t: -2.36 Sig: 0.019	Coef: -0.074 t: -2.59 Sig: 0.011
Social Index	Coef: -0.101 t: -2.39 Sig: 0.017	Coef: -0.083 t: -2.71 Sig: 0.007
Firm Size (Log Assets)	Coef: -0.039 t: -2.27 Sig: 0.025	Coef: -0.034 t: -2.25 Sig: 0.026
Leverage	Coef: 0.048 t: 2.49 Sig: 0.013	Coef: 0.044 t: 2.58 Sig: 0.010
ROA	Coef: -0.057 t: -2.47 Sig: 0.014	Coef: -0.052 t: -2.40 Sig: 0.017
Firm Age	Coef: -0.031 t: -2.23 Sig: 0.027	Coef: -0.028 t: -2.20 Sig: 0.030
Adj. R ²	0.207	0.198
F-Stat (p-value)	14.32 (0.000)	13.67 (0.000)

5.5 Regression Results – Governance Factors

The associations observed in Table 5 that explore the governance aspect are the strongest, indicating the critical role of governance in reducing the crash risk. The Governance Index is also important, with negative correlations with NCSKEW (Coef. = -0.096, SE=0.014) and DUVOL (Coef. -0.079, SE=0.005). Upon further analysis of specific governance mechanisms, it becomes clear that Board Independence has a statistically significant negative impact on crash risk (NCSKEW Coef. = -0.077, p=0.032; DUVOL Coef.= -0.061, p=0.024), thus proving the independence of directors to be a vital tool in mitigating crash risk. Additionally, crash risk

is also dampened by the Anti-Corruption Policy (NCSKEW Coef.= -0.084, p=0.045; DUVOL Coef.= -0.069, p=0.018), suggesting that transparency and ethical behavior can be effective in preventing the financial scandals that often trigger the crash in the stock price. Control variables used in such models are not only statistically significant, but they also make sense. Collectively, the results in the three tables have proven strong arguments that strong ESG activities in the three areas of environmental, social, and governance are key factors that reduce the share-price crash risk of firms.

Table 5: Regression Results – Governance Factors

Variables	NCSKEW (Crash Risk)	DUVOL (Crash Risk)
Board Independence	Coef: -0.077 t: -2.15 Sig: 0.032	Coef: -0.061 t: -2.28 Sig: 0.024
Anti-Corruption Policy	Coef: -0.084 t: -2.03 Sig: 0.045	Coef: -0.069 t: -2.41 Sig: 0.018
Governance Index	Coef: -0.096 t: -2.52 Sig: 0.014	Coef: -0.079 t: -2.82 Sig: 0.005
Firm Size (Log Assets)	Coef: -0.042 t: -2.41 Sig: 0.017	Coef: -0.037 t: -2.35 Sig: 0.020
Leverage	Coef: 0.051 t: 2.56 Sig: 0.012	Coef: 0.046 t: 2.50 Sig: 0.014
ROA	Coef: -0.059 t: -2.51 Sig: 0.015	Coef: -0.053 t: -2.37 Sig: 0.018
Firm Age	Coef: -0.032 t: -2.20 Sig: 0.028	Coef: -0.027 t: -2.14 Sig: 0.033
Adj. R ²	0.214	0.205
F-Stat (p-value)	15.02 (0.000)	14.55 (0.000)

5.6 Regression Results – ESG Factors and Stock Price Crash Risk

The regression analysis results in Table 6 infer a detailed understanding of the ESG factors in the

crash of stock price mitigation as measured through both NCSKEW and DUVOL. Their findings also consistently show that firms with higher ESG performance are much less likely to undergo severe stock price drops, and even after controlling for firm-level control factors (size, Leverage, profitability, and age), a firm with higher ESG performance loses much less value. Crash risk is strongly negatively and statistically significantly associated with environmental performance indicators. In particular, the disclosure of carbon emissions (Coef = -0.082 in NCSKEW, -0.071 in DUVOL) and positive energy efficiency policy (Coef = -0.089 in NCSKEW, -0.076 in DUVOL) decreases the risk of a crash, implying that investor confidence is enhanced by transparent reporting of carbon emissions and the pursuit of sustainable energy measures. In addition, the Environmental Index (Coef = -0.097 and -0.083 in the case of NCSKEW and DUVOL) shows that firms with a holistic and integrated environmental approach are better insulated in extreme stock price decline. This shows how significant it is to use a range of environmental initiatives instead of the segmented ones. The social aspect findings also underline the stakeholder-oriented practices' barrier effect. Diversity & inclusion initiatives (Coef = -0.085 NCSKEW, -0.067 DUVOL) as well as health & safety policies (Coef = -0.092 NCSKEW, -0.074 DUVOL) are also significantly related to reduced crash risk. This indicates that workplace equity and employee well-being help firms establish more resiliency, and it is less likely that a set of emergent negative information will unexpectedly arise. The Social Index (Coef = -0.101 for NCSKEW, -0.083 for DUVOL) yields more resounding coefficients than all the other social-based variables, which supports the notion that a far-reaching social responsibility approach is more effective than a single-specific initiative. Variables that have to do with governance also exercise decisive influence. Monitoring and having less managerial opportunism through Board independence (Coef = -0.077 for NCSKEW, -0.061 for DUVOL) causes a decrease in crash risk. Likewise, anti-corruption policy also has a negative effect on the crash risk (Coef = -0.084 for NCSKEW,

-0.069 for DUVOL), meaning that the presence of a more rigorous internal control and ethical regulations in the firm reduces its exposure to the unexpected disclosure of the dirty secret. Most significant coefficients are found in Governance Index (Coef = -0.096 in NCSKEW, -0.079 in DUVOL), which indicates that the quality of governance is more important than the specifics of governance mechanisms. This only reiterates the importance of institutional structures and accountability mechanisms in firm-level crash risk. The control variables perform much as we would like to see them do Firm size (Coef = -0.041 (NCSKEW), -0.038 (DUVOL)), which is based on an industry standard firm size (NCSKEW) or the standardised number of analysts covering the firm (DUVOL) is negatively related to crash risk, indicating that more diversified and well-covered firm size is less likely to experience sharp price decreases. Leverage (Coef = 0.052 and 0.047 on NCSKEW and DUVOL, respectively) is found to be positively and significantly related to crash risk, as expected, since firms with an extensively leveraged position are most vulnerable to adverse shocks. Profitability (ROA) (Coef = -0.061 NCSKEW, -0.054 DUVOL) is found to have a significant negative effect on crash probability, which implies that more profitable companies have steady cash flows and are less likely to be hit by a collapse. Lastly, crash risk is positively correlated with firm age (Coef = -0.033 and -0.029, in NCSKEW and DUVOL, respectively), but this association holds only in the value-weighted sample, indicating that stronger established firms, i.e., the older ones, are less vulnerable to a stock price crash. The diagnostic statistics further reinforce the validity of these findings. Adjusted R² values of 0.226 (NCSKEW) and 0.215 (DUVOL) are acceptable for firm-level crash risk research. This implies that a combination of ESG factors and controls is associated with an overall ability to explain about 22 percent of the stock price crash risk variation. Additionally, the F- F-statistic values (15.92 for NCSKEW and 15.11 for DUVOL; both significant at $p < 0.01$) support the overall strength of the models.

Table 6 Regression Results – ESG Factors and Stock Price Crash Risk

Variables	NCSKEW (Model1)	DUVOL (Model2)
Environmental Factors		
Carbon Emission Reporting	Coef: -0.082	Coef: -0.071
	t: -2.21	t: -2.34
	Sig: 0.028	Sig: 0.021
Energy Efficiency Policy	Coef: -0.089	Coef: -0.076
	t: -2.51	t: -2.62
	Sig: 0.012	Sig: 0.009
Environmental Index	Coef: -0.097	Coef: -0.083
	t: -2.46	t: -2.68
	Sig: 0.014	Sig: 0.008
Social Factors		
Diversity & Inclusion	Coef: -0.085	Coef: -0.067
	t: -2.01	t: -2.03
	Sig: 0.043	Sig: 0.042
Health & Safety	Coef: -0.092	Coef: -0.074
	t: -2.36	t: -2.59
	Sig: 0.019	Sig: 0.011
Social Index	Coef: -0.101	Coef: -0.083
	t: -2.39	t: -2.71
	Sig: 0.017	Sig: 0.007
Governance Factors		
Board Independence	Coef: -0.077	Coef: -0.061
	t: -2.15	t: -2.28
	Sig: 0.032	Sig: 0.024
Anti-Corruption Policy	Coef: -0.084	Coef: -0.069
	t: -2.03	t: -2.41
	Sig: 0.045	Sig: 0.018
Governance Index	Coef: -0.096	Coef: -0.079
	t: -2.52	t: -2.82
	Sig: 0.014	Sig: 0.005
Control Variables		
Firm Size (Log Assets)	Coef: -0.041	Coef: -0.038
	t: -2.35	t: -2.30
	Sig: 0.019	Sig: 0.021
Leverage	Coef: 0.052	Coef: 0.047
	t: 2.45	t: 2.55
	Sig: 0.015	Sig: 0.012
ROA (Profitability)	Coef: -0.061	Coef: -0.054
	t: -2.37	t: -2.33
	Sig: 0.018	Sig: 0.020

Firm Age	Coef: -0.033 t: -2.19 Sig: 0.029	Coef: -0.029 t: -2.16 Sig: 0.031
Model Diagnostics		
Adj. R ²	0.226	0.215
F-Stat (p-value)	15.92 (0.000)	15.11 (0.000)

6. Conclusion and Implications

It is to be concluded with a summary of the main conclusions, reiterating the main points without any new information. The main research question in this study is whether there is a significant negative relation between the risk of a stock-price crash and superior performance in ESG (environmental, social, and governance) dimensions. The hypothesised connection is that the greater the ESG score, the lower the crash risk. The hypothesis is supported by regression analysis showing that ESG performance and stock-price crash risk negatively correlate statistically.

6.1 For Managers and Corporations

The empirical evidence provides an attractive business case for ESG investment to managers and corporations. Instead of considering ESG efforts as discretionary costs, companies need to view them as essential risk-management tools, financial stability boosters, and shareholder value protectors.

6.2 For Investors

To investors, the findings highlight the usefulness of ESG as a non-financial screening tool in the portfolio's construction. Companies with strong ESG ratings will offer a side form of downside insurance, appealing to risk-averse investors.

6.3 For Regulators and Policymakers

The need to establish ESG disclosure and transparency is urgent for regulators and policymakers. The study proposes that increased ESG reporting may help establish a more stable and transparent financial market, which will help avert systemic risk.

Limitations to the study are a relatively small sample size, one data source, and a particular national setting. The relationship between the ESG and the crash risk in various economic settings should be

analyzed in future studies, more moderating variables should be explored, and other measures of ESG can be used to add more to the academic discussion and offer future projections.

7. Future Recommendations

7.1 Geographical and Economic Context

The present study involved a small sample of the firms in one country. Additional research must assess the ESG-crash risk nexus in diverse geographic environments, such as emerging markets. The ESG implementation and financial performance might be influenced by institutional, regulatory, and cultural factors specific to each jurisdiction, and a larger economic sample would clarify how governance/market maturity affects the connection between the two.

7.2 Industry-Specific Analysis

ESG variables have a different impact in different sectors. An example would be that environmental performance would be more salient in high-polluting industries like manufacturing or energy, with social and governance elements being more relevant in technologies or service industries. Sector-specific studies would identify whether the strength or direction of the ESG crash risk relationship is firm-specific.

7.3 Alternative ESG Measures

This paper used binary variables and composite indices. Future research may apply different or more granular ESG measures, e.g., textual analysis of corporate reporting or sentiment-based media analysis to measure qualitative aspects of the ESG that affect investor perception and risk.

7.4 Moderating and Mediating Factors

The association between ESG and crash risk must not be linear. Further research must examine the

moderating effect of ownership structure (e.g., state or private ownership), executive compensation plan, or presence of specialized risk committees. The explanation of these mechanisms would remove the confusion of causal pathways.

7.5 Causality and Longitudinal Studies

Regression analysis can indicate a significant relationship, but does not establish causality. More sophisticated econometrics methods like instrumental variable models or difference-in-differences methods can be utilized in future research to prove causation. Extended longitudinal studies would enable analysis of how variation in temporal changes in ESG policies impacts future crash risk variations.

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