

ESG activities and financial stability: The case of Korean financial firms

Highlights

- ESG activities potentially enhance the financial stability of financial institutions in Korea.
- Financial stability might be improved by managing overall ESG activities, particularly the environmental pillar.
- Positive associations between ESG activities and stability remain for nonbank financial institutions.

Abstract

This study explores the relationship between financial firms' ESG activities and their financial stability measured by Altman's Z-score. Based on a dataset of listed financial institutions in Korea, our results indicate a positive association between stability and ESG activities. Overall ESG scores and environmental, social, and governance pillars potentially enhance financial stability. The environmental pillar has a significant role in improving the stability of financial firms. The positive association between ESG activities and financial firms' stability remains for the non-banking sectors.

Keywords: ESG; Emerging market; Financial institution; Financial stability; Z-score

JEL Classification: G10, G19, G21

1. Introduction

Recent studies shed light on firm value, investments, and capital markets from the perspective of CER (corporate environmental responsibility), CSR (corporate social responsibility), and more broadly, ESG (environmental, social, and governance) frameworks (Dhaliwal, Tsang, Yang, 2011; Surroca, Tribó, and Waddock, 2010). They have shown that these ESG frameworks are linked to firm value (Bang, Ryu, and Yu, 2023; Cheng, Kim, and Ryu, 2024; Deng, Kang, and Low, 2013; Mishra, 2017; Nam, Bilgin, and Ryu, 2024), risk reduction (Albuquerque, Koskinen, and Zhang, 2019, 2020; Boubaker, Cellier, Manita, and Saeed, 2020), and asset-pricing risk factors (Bang, Kang, and Ryu, 2024; Bang, Ryu, and Webb, 2023). Also, previous studies suggest that engaging in ESG activities can positively impact a company's financial performance. They highlight the potential value of integrating ESG into corporate strategies (Friede, Busch, and Bassen, 2015; Husted, 2005; Malik, 2015) and the mitigation of financial risk in ESG activities (Boubaker, Cellier, Manita, and Saeed, 2020; Sassen, Hinze, and Hardeck, 2016). However, the relationship between ESG activities and financial performance remains a contentious issue (Bae, El Ghouli, Gong, and Guedhami, 2021; Demers, Hendrikse, Joos, and Lev, 2021). We, therefore, reexamine the effect of ESG on financial stability.

Existing research on ESG activities has focused on non-financial companies, leaving the

financial sector's ESG activities largely unaddressed. Noting that the characteristics of financial firms somewhat differ from those of non-financial firms, Brogi and Lagasio (2019) suggest the importance of establishing socially responsible standards and principles to provide regulatory support, particularly in the banking sector. Our study tries to fill the empirical research gap on ESG activities in the financial industry by analyzing the effects of financial firms' ESG activities. We explore the effects of overall ESG performance and three ESG pillars (i.e., environmental, social, and governance pillars) on the financial stability of listed financial firms in Korea, which is a leading and representative emerging market.

We have several reasons for focusing on Korea and its financial institutions to address ESG-related issues. First, currently, Korea is planning to transition from a carbon-centered economy to a decarbonization of the economy. To achieve this, there is an increasing demand for green finance. Following this, the environmental pillar has gained significant importance in the Korean market. As Korea moves towards shifting its economy away from carbon dependency and towards decarbonization, there's a growing understanding of how important environmental factors are in shaping financial plans and investment decisions. This increased awareness is leading to a strong demand for green finance options that support sustainable projects, lower carbon emissions, and encourage environmentally friendly practices in different industries. Financial institutions and investors are increasingly prioritizing environmental criteria in their decision-making processes, reflecting a broader shift towards sustainability within Korea's economic landscape. Second, Korea's rapid economic growth has resulted in social conflicts, recently emphasizing the need for inclusive finance to address these issues. Third, governance in Korea's financial industry has been also identified as an important issue due to its bureaucracy-controlled financial system. Since 2000, there has been a continuous effort to improve the governance of financial institutions, making them more competitive in global financial markets. In sum, Korea has urgent ESG issues that need addressing in the financial sector.

Our research focuses on financial firms listed on the Korea Exchange that have published ESG scores from Refinitiv. The study period is from 2013 to 2022 considering that ESG ratings were scarce before 2013. We employ fixed-effects regression models as a baseline analysis and conduct generalized method of moments (GMM) analyses with lagged instrumental variables to mitigate endogeneity issues. We also check the panel Granger causality test results to consider potential reverse causality relationships (Berger, Molyneux, and Wilson, 2020; Blundell and Bond, 1998). Our overall results suggest that ESG activities might enhance the financial stability of Korean financial institutions. Our baseline regression analyses imply that each of the environmental (Kim, Park, and Ryu, 2017; Yang, Bae, and Ryu, 2022, 2024), social (Park and Ryu, 2022; Ryu, Ryu, and Hwang, 2016), and governance (Kang, Bang, and Ryu, 2024; Ryu, Ryu, and Hwang, 2017) frameworks are somewhat positively related to financial stability. Especially, the environmental pillar seems to play the most significant role in enhancing financial stability in the Korean financial industry. Our results remain similar for non-bank

financial institutions.

We can interpret that ESG activities can play a crucial role in fostering risk management and sustainable growth within financial institutions. Evaluating and improving ESG practices become essential for financial institutions to pursue long-term value creation and sustainable management (Broadstock, Chan, Cheng, and Wang, 2021; Zhou, Liu, and Luo, 2022). Among these aspects, the environmental component has emerged as particularly significant. Environmentally-focused ESG activities can assist companies in mitigating future risks associated with the natural environment and transitioning towards more sustainable business models. Environment-related ESG activities can enhance a company's reputation while emphasizing its social responsibility. Consequently, financial institutions are increasingly focusing on environmental aspects of ESG activities to contribute to the long-term success and stability of companies.

The remainder of this paper is organized as follows. In Section 2, we offer an overview of the relevant literature, and in Section 3, we describe the materials and methodologies used in this study. Section 4 presents our analysis results. Section 5 concludes the paper.

2. Literature review and research background

Previous research indicates a positive association between a firm's ESG (including CER and CSR) activity and its sustainable value. Jo, Kim, and Park (2015) argue that CER enhances operational performance by reducing a company's environmental costs. They suggest that pursuing environment-centered industrial policies will yield positive effects not only in the manufacturing sector but also in the financial services sector. Friede, Busch, and Bassen (2015) assert that firms that give precedence to ESG considerations and incorporate them into their business operations are more likely to realize superior financial performance in the long run, suggesting that augmenting CSR can be advantageous for firms. El Ghoul, Guedhami, Kwok, and Mishra (2011) also reveal that companies prioritizing CSR initiatives often achieve higher profitability and market valuation. In a study on ESG activities and the financial performance of the banking sector, Buallay (2019) explores the correlation between ESG factors and banks' operational, financial, and market performance, as measured by the ROA (Return on Asset), the ROE (Return on Equity), and Tobin's Q, respectively. It finds a significant positive correlation between ESG activities and overall performance.

Some studies analyze the indirect effects of ESG. Deng, Kang, and Low (2013) show that firms that prioritize ESG activities are less prone to financial distress compared to other firms. They suggest that ESG can build a positive social reputation, enhance customer loyalty, boost investor confidence, and improve access to financing. They highlight that ESG can elevate employee morale and productivity, resulting in improved operational performance and financial stability. Malik (2015) shows a positive association between CSR and financial performance, attributing this to enhanced reputation and stakeholder attraction. Ferrell, Liang, and Renneboog (2016) argue that firms with strong

CSR performance experience reduced managerial entrenchment, which positively affects firm value. They suggest, therefore, that CSR not only maximizes shareholder wealth but also meets important societal expectations. The study of Mishra (2017) posits that engaging in CSR activities can bolster a firm's reputation and brand image, thereby fostering customer loyalty and trust. It asserts that CSR initiatives can lead to cost savings, enhanced employee productivity, and improved risk management, all of which contribute to superior financial performance.

Recent studies have established a positive correlation between sustainability and firm stability. Sassen, Hinze, and Hardeck (2016) explore the impact of sustainability on a firm's financial performance, showing that an increase in sustainability is inversely related to both total and unsystematic risk. They find that the environmental and social frameworks predominantly decrease three types of risk (i.e., total, systematic, and unsystematic), especially in environmentally vulnerable firms (Curcio, Gianfrancesco, and Vioto, 2023). They further propose that emphasizing a firm's social performance can reduce overall risk. Chiamonte, Dreassi, Girardone, and Piserà (2022) examine ESG scores in the European banking industry and find that higher overall ESG scores and individual pillar scores contribute to greater bank stability during financial risks. They argue that a heightened commitment to ESG practices in the banking sector has positive effects on both the environment and society, while also bolstering the industry's resilience during financial crises. This viewpoint is consistent with the findings of Gillan, Koch, and Stark (2021) and Sassen, Hinze, and Hardeck (2016). Meanwhile, Di Tommaso and Thornton (2020) debate the influence of governance structure on the relationship between ESG scores and risk-taking in banks.

In summarizing the existing literature, we are motivated to reexamine the potential link between the ESG framework and financial performance, providing empirical evidence for the role of ESG in establishing stability and sustainability, especially in emerging economies.

3. Data and Methodology

Our sample encompasses representative 15 financial firms¹ listed on the Korea Composite Stock Price Index (KOSPI) with available ESG scores in the Refinitiv database from 2013 to 2022. We measure financial stability using Altman's *Z*-score (*Zscore*) and use it as the dependent variable. We calculate the *Z*-score, a measure of a firm's financial stability, which previous studies have used to assess the risk in the financial sector, especially in emerging markets (Altman, Iwanicz-Drozdowska, Laitinen, and Suvas, 2017; Pradhan, 2014). Altman's *Z*-score model considers several financial ratios and variables,

¹ These financial firms are 1) BNK Financial Group Inc.; 2) DB Insurance Co., Ltd.; 3) DGB Financial Group; 4) Hanwha Life Corp.; 5) Hana Financial Group Inc.; 6) Hyundai Marine & Fire Insurance Group; 7) Industrial Bank of Korea; 8) KB Financial Group Inc.; 9) Korea Investment Holdings Co.; 10) Mirae Asset Securities Co., Ltd.; 11) NH Investment & Securities Co., Ltd.; 12) Samsung Life Insurance Co., Ltd.; 13) Samsung Fire & Marine Insurance; 14) Samsung Securities Co., Ltd.; 15) Shinhan Financial Group Co., Ltd.

such as profitability, liquidity, leverage, solvency, and activity, and is expressed as follows (Beltrame, Velliscig, Zorzi, and Polato, 2022):

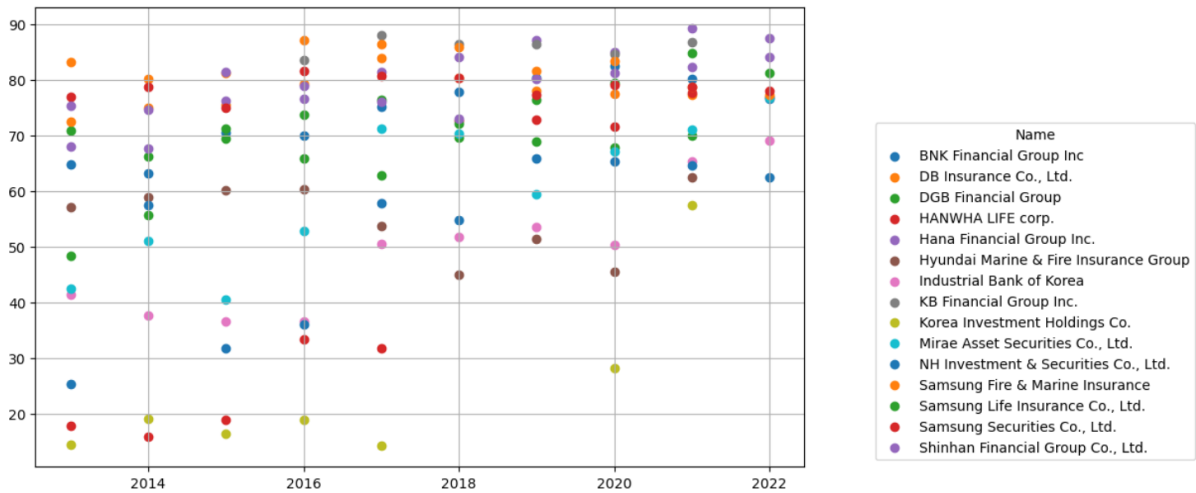
$$Zscore = 0.717 \cdot X_1 + 0.847 \cdot X_2 + 3.107 \cdot X_3 + 0.420 \cdot X_4 + 0.998 \cdot X_5, \quad (1)$$

where *Zscore* denotes the Z-score value; X_1 is defined as the ratio between cash and total assets; X_2 is equal to the retained earnings divided by total assets; X_3 is calculated as the ratio of earnings before interest and tax (EBIT) to total assets; X_4 is the ratio of total equity to total liabilities; and X_5 is the ratio of sales to total assets. We calculate the *Zscore* of each financial firm, which serves as a predictive tool to assess the firm's financial soundness and default probability. A higher *Zscore* value indicates a lower likelihood of bankruptcy, whereas a lower score suggests a greater risk of financial difficulty.

Our explanatory variables of interest are the scores for overall ESG (*ESG*) and individual ESG pillars (*E*, *S*, and *G*). *ESG*, *E*, *S*, and *G* denote the natural logarithm of the ESG, environmental, social, and governance scores. The ESG score is a composite of the ESG pillars. Firms disclose ESG scores for the previous year's performance in the current year. The environmental pillar is subdivided into emissions, innovation, and resource usage. The social pillar includes community involvement, human rights, good product stewardship, and human resource advancement.² The governance pillar encompasses management, shareholders, and firm structure. Figure 1 displays the trends of ESG scores for 15 financial firms by year. There is an upward trend in ESG scores. In the early stages, ESG scores exhibited a wider distribution, but over time, the distribution has narrowed, and the variability has decreased. This could be interpreted as financial firms increasing their ESG initiatives in response to the growing interest in ESG recently.

Figure 1. ESG trends

² The social issues can also include ethical (Ko, Lee, Park, and Ryu, 2023), educational (Kim and Ryu, 2023), and inequality (Nam, Frijns, and Ryu, 2024; Nam and Ryu, 2024) issues.



Note. This figure shows the trends of ESG scores for the 15 financial firms.

Considering that firms with lower risk, higher performance, and larger assets tend to get higher ESG scores (Drempetic, Klein, and Zwergel, 2020), we use financial and accounting variables (*Debt*, *Cash*, *Oper*, *Size*, and *Cap*) to control the potential effects of financial profitability, size, and other firm-specific characteristics (Kim, Ryu, and Yang, 2021; Kim, Ryu, and Yu, 2021, 2024). We reference Laeven, Ratnovski, and Tong (2016) in employing firm size and debt level as firm-level control variables. Debt level can be a measure of risk and financial insolvency. *Debt* means the logarithm of the debt ratio, which is a financial metric measuring the proportion of a company's total assets financed by debt. It is calculated by dividing total debt by total assets. *Cash* means the logarithm of the cash and cash equivalents composition ratio, which is a metric indicating the proportion of a company's assets held in cash and cash equivalents relative to its total asset base. *Oper* means the operating profit margin, which represents the percentage of revenue that translates into operating profit. It is calculated by dividing operating profit by revenue. *Size* means the market capitalization which refers to the total value of a company's shares of stock. Firm size typically shows an inverse relationship with risk and a positive correlation with performance. *Cap* means the capital ratio which is a measure of a bank's financial strength, representing the proportion of a bank's capital to its risk-weighted assets. These controlled variable data are sourced from DataGuide.

We conduct unit root tests on the variables to check stationarity. The augmented Dickey-Fuller test results support the stationarity. We winsorize variables at 10% and 90% levels to remove extreme values that can potentially skew the result and lead to a false conclusion. Table 1 presents the descriptive statistics for the variables used. The average ESG score of our sample is 4.144. The mean scores for the environmental, social, and governance pillars are 4.151, 4.152, and 4.160, respectively. Among the different pillars, the governance pillar's highest mean may be attributed to the regulation of governance structures for financial institutions. Table 2 shows the correlation coefficients of the variables.

Table 1. Summary statistics

	Min	10 th	Mean	Med	90 th	Max	Std	Skew	Kurt	ADF
<i>Dependent variables</i>										
Zscore	0.086	0.120	0.217	0.165	0.466	0.564	0.132	1.413	3.355	0.000
<i>Explanatory variables</i>										
ESG	2.885	3.601	4.144	4.280	4.430	4.463	0.366	-1.949	6.424	0.000
E	2.880	3.438	4.151	4.337	4.456	4.507	0.421	-1.847	5.448	0.000
S	2.571	3.689	4.152	4.272	4.484	4.527	0.404	-2.129	7.272	0.000
G	3.089	3.656	4.160	4.282	4.451	4.564	0.348	-1.429	4.329	0.001
<i>Control variables</i>										
Debt	3.040	3.331	5.516	6.530	7.216	7.554	1.614	-0.486	1.352	0.010
Cash	-4.605	-1.171	0.095	0.351	1.384	1.944	1.250	-2.004	8.335	0.001
Oper	-1.43	2.745	7.573	6.16	19.57	20.76	4.814	0.734	2.799	0.000
Size	9.81e+08	2.21e+09	7.84e+09	4.87e+09	1.98e+10	2.36e+10	6.48e+09	1.090	2.888	0.000
Cap	4.97	6.99	9.486	8.62	13.13	17.58	2.646	1.233	4.007	0.000

Note. This table presents the summary statistics of research variables. *Min*, *10th*, *Mean*, *Med*, *90th*, *Max*, *Std*, *Skew*, and *Kurt* indicate minimum, 10th percentile, mean, median, 90th percentile, maximum, standard deviation, skewness, and kurtosis, respectively. *ADF* shows the *p*-values based on augmented Dickey-Fuller tests.

Table 2. Pearson correlation

	Zscore	ESG	E	S	G	Debt	Cash	Oper	Size
Zscore	1								
ESG	0.124	1							
E	0.157*	0.876***	1						
S	0.129	0.955***	0.843***	1					
G	0.110	0.869***	0.668***	0.721***	1				
Debt	0.404***	-0.148*	-0.067	-0.059	-0.268***	1			
Cash	0.382***	0.212**	0.257***	0.160	0.245**	0.328***	1		
Oper	-0.396***	0.164*	0.109	0.119	0.204**	-0.557***	-0.367***	1	
Size	-0.094	0.299***	0.279***	0.317***	0.215**	-0.185**	0.077	0.213**	1
Cap	0.481***	0.057	0.141*	0.107	-0.058	0.349***	0.311***	-0.412***	0.026

Note. This table presents Pearson's pairwise correlations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

We employ a panel method with two-way fixed effects to identify the unique traits of each firm and their changes over time, serving as a baseline model. We also apply the panel Granger causality test and the difference GMM estimator, which alleviate problems with reverse causality and endogeneity. Equation (2) shows the baseline panel regression model evaluating the correlation between ESG activities and risk.

$$Zscore_{it} = \alpha + \beta \cdot ESG_{it} (or E_{it}, S_{it}, G_{it}) + \gamma \cdot X_{it} + \theta_t + \tau_i + \epsilon_{it}, \quad (2)$$

where the dependent variable measures the risk ($Zscore$) of firm i at time t . Our key estimate of the regression is β capturing the effect of the ESG score for firm i at time t (ESG_{it}). The explanatory variable can be E_{it} , S_{it} , or G_{it} , which represents the environmental, social, or governance pillar for firm i at time t , respectively. The vector X_{it} represents a set of firm-level control variables. We control for the firm-fixed effect (τ_i) and time-fixed effect (θ_t). We estimate the coefficients by employing the standard error estimation method proposed by Petersen (2008). We also carry out subsample analyses of non-bank financial intermediaries (NBFIs), such as securities and insurance firms.

We also employ the difference GMM estimation, following the approach of Arellano and Bond (1991), to address potential endogeneity issues in our findings. These problems could stem from inaccuracies in measuring explanatory variables, the omission of certain variables, or reverse causality (Al-Malkawi and Javaid, 2018; Bénabou and Tirole, 2010; Liu and Hsu, 2006; Ullah, Akhtar, and Zaefarian, 2018). The dynamic panel model is as follows:

$$Zscore_{it} = \alpha + \gamma_1 \cdot Zscore_{it-1} + \gamma_2 \cdot Zscore_{it-2} + \beta_1 \cdot ESG_{it}(or E_{it}, S_{it}, G_{it}) + \delta \cdot X_{it} + \theta_t + \tau_i + \varepsilon_{it}, \quad t = 3, \dots, T, \quad (3)$$

where θ_t and τ_i capture time-fixed and firm-fixed effects, respectively. The dependent variable is the $Zscore$ for firm i at time t . We assume that the ESG variables and ε_{it} are not correlated. The key variables include $ESG_{it}(or E_{it}, S_{it}, G_{it})$, the firm-level ESG scores. To examine the dynamic relationship between stability and ESG activities, we use the dynamic panel model of Arellano and Bond (1991), which uses lags of the dependent variables as instruments. We also perform an autocorrelation test to check the serial correlation structure in the error term.

To investigate the possible causality, we perform the panel Granger causality test with two lags (Wooldridge, 2010).

$$Zscore_{it} = \alpha_t + \alpha_{11} \cdot Zscore_{it-1} + \alpha_{12} \cdot Zscore_{it-2} + \alpha_{21} \cdot ESG_{it-1}(or E_{it-1}, S_{it-1}, G_{it-1}) + \alpha_{22} \cdot ESG_{it-2}(or E_{it-2}, S_{it-2}, G_{it-2}) + u_{1i} + \varepsilon_{1it}, \quad (4)$$

$$ESG_{it}(or E_{it}, S_{it}, G_{it}) = \beta_t + \beta_{11} \cdot ESG_{it-1}(or E_{it-1}, S_{it-1}, G_{it-1}) + \beta_{12} \cdot ESG_{it-2}(or E_{it-2}, S_{it-2}, G_{it-2}) + \beta_{21} \cdot Zscore_{it-1} + \beta_{22} \cdot Zscore_{it-2} + u_{2i} + \varepsilon_{2it}. \quad (5)$$

4. Empirical Results

We empirically examine the connection between ESG activities (measured by the Refinitiv ESG scores) and financial stability (measured by Z-score) in financial firms, using the two-way fixed effects panel regression analysis. The dynamic panel model adheres to the method outlined by Arellano and Bond (1991) to address problems of endogeneity (Berger, Molyneux, and Wilson, 2020). We also

verify if the data exhibit an autoregressive process, which is crucial for detecting serial correlation in the error terms in the models. Granger causality Wald tests investigate whether previous values of one variable provide a causality for predicting the behavior of another variable over time. Our models use robust standard errors (Semykina and Wooldridge, 2010).

Table 3 presents the results of the fixed-effects panel regression analysis, where the dependent variable represents financial risk, as in Equation (2). The number of firm-year observations becomes 105 after excluding null observations. In column [1], the ESG score is aggregated, and the ESG coefficient shows positive statistical significance at the 1% level. Similarly, in columns [5] and [6], our results show that the environmental pillar score has a positive and significant impact at the 1% statistical level. The social pillar score has a positive and significant impact at the 1% statistical level in columns [4] and [7]. In columns [5] and [8], the governance pillar score also has a positive and significant relationship with financial stability.

Table 3. Impacts of ESG and its pillar scores on financial stability for listed financial firms

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
ESG	0.056^{***} (4.84)							
E		0.021 (1.51)	0.024* (1.72)		0.032^{***} (3.11)	0.040^{***} (4.30)		
S		0.018 (1.13)	0.023 (1.53)	0.034^{***} (2.92)			0.043^{***} (4.21)	
G		0.018 (1.41)		0.021 (1.63)	0.022* (1.75)			0.040^{***} (3.34)
Debt	0.047 (1.35)	0.038 (1.03)	0.023 (0.64)	0.044 (1.19)	0.044 (3.11)	0.026 (0.73)	0.027 (0.75)	0.075^{**} (2.01)
Cash	0.013^{***} (4.26)	0.012^{***} (3.78)	0.013^{***} (4.06)	0.013^{***} (3.99)	0.011^{***} (3.60)	0.012^{***} (3.75)	0.014^{***} (4.36)	0.010^{***} (3.12)
Oper	0.005^{***} (3.69)	0.005^{***} (3.50)	0.005^{***} (3.45)	0.005^{***} (3.55)	0.005^{***} (3.40)	0.005^{***} (3.28)	0.005^{***} (3.50)	0.005^{***} (3.14)
Size	3.76e-12^{**} (2.00)	3.50e-12* (1.82)	3.28e-12* (1.71)	3.87e-12^{**} (2.02)	3.14e-12 (1.66)	2.72e-12 (1.43)	3.67e-12* (1.90)	3.28e-12 (1.64)
Cap	0.011^{***} (3.52)	0.010^{***} (3.10)	0.009^{***} (2.77)	0.010^{***} (3.10)	0.011^{***} (3.33)	0.009^{***} (2.89)	0.008^{***} (2.68)	0.013^{***} (3.76)
<i>F-stat</i>	232.54	219.36	227.19	216.79	219.45	228.81	221.73	197.01
<i>p-value</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note. This table presents the impacts of ESG and its pillar scores on stability (*Zscore*). Intercept terms are excluded to simplify and clarify the table. *F-stat* denotes the F-statistic to test the overall fitness of each model. *p-value* denotes the statistical significance of the *F*-statistic. *t*-statistics are shown in parentheses. ^{***}, ^{**}, and ^{*} denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Our findings indicate that environmental factors exert a comparatively greater impact on

financial stability. Korea has many export-oriented companies, resulting in well-established environmental standards. With a multitude of companies focusing on global markets, strict compliance with environmental standards has become deeply embedded within the corporate landscape. Financial institutions are not only closely linked to export-oriented businesses through policies like green finance, which are intertwined with environmental politics, but they are also backing the Korean manufacturing industry. Therefore, the environmental pillar can potentially exert a significant influence on companies in Korea. In Korea, there exists a unique chaebol culture not observed in other countries. Baek, Kang, and Park (2004) note that during the Asian Financial Crisis (Seo, Kim, and Ryu, 2019), a higher concentration of ownership among owner-managers or their affiliates within chaebols led to a greater decline in stock value. Due to these unique characteristics in Korea, concentrated governance issues have consistently been addressed in Korea, particularly since 2008 when Korea became a full member of the G20. This period also saw sustainability emerge as a more significant concern (Choi, Park, and Yoo, 2007). Given these points, the governance pillar can also have an impact. Also, after achieving rapid industrialization, Korea has seen a growing interest in various social issues such as labor rights, human rights, employment, and community development. There is an increasing emphasis on social responsibility to enhance international competitiveness. Considering these factors, the social pillar can influence the stability of businesses.

Bank and bank holding company is regulated in terms of governance elements by the Bank of Korea, the Financial Supervisory Service (FSS), and the Bank for International Settlements (BIS). Korean banks adhere to these regulations. However, NBFIs are subject to less regulation, primarily because they are somewhat exempt from central bank regulations. In this situation, a more detailed study on NBFIs is needed. Considering the distinct properties of NBFIs, we conduct a further subsample analysis using the baseline regression model. Table 4 presents the results of companies that are not banks or do not have a banking component within their companies, from the entire dataset (Ryu and Yu, 2020, 2021; Ryu, Webb, and Yu, 2020; Yu and Ryu, 2021). The number of firm-year observations is 78. The ESG coefficient shows positive statistical significance at the 1% level in column [1]. The environmental pillar score has a positive and significant impact at the 5% and 1% statistical level respectively in columns [5] and [6]. The social pillar score has a significantly positive relationship with financial stability at the 5% and 1% statistical level respectively in columns [4] and [7]. In column [8], the governance pillar score has a positively significant impact at a 1% statistical level.

Table 4. Impacts of ESG and its pillar scores on financial stability for listed NBFIs

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
ESG	0.041^{***} (4.19)							
E		0.015 (0.85)	0.021 (1.26)		0.029^{**} (2.33)	0.037^{***} (4.06)		

S	0.016 (0.98)	0.018 (1.11)	0.026** (2.38)				0.036*** (4.00)	
G	0.012 (0.95)		0.016 (1.33)	0.014 (1.08)				0.033*** (3.37)
<i>F</i> -stat	485.78	452.01	482.71	459.63	453.35	448.44	480.06	424.31
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note. This table presents the impacts of ESG and its pillar scores on stability (*Zscore*). Intercept terms are excluded to simplify and clarify the table. *F*-stat denotes the *F*-statistic value to test the overall fitness of each model. *p*-value denotes the statistical significance of the *F*-statistic. *t*-statistics are shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Although NBFIs operate within a regulatory framework that is comparatively less stringent than that of traditional banking institutions, it is evident that NBFIs remain markedly susceptible to the influence of environmental, social, and governance (ESG) considerations. This underscores the importance of conducting thorough assessments and implementing robust ESG strategies within the NBFIs sector to effectively manage risks and capitalize on emerging opportunities in alignment with sustainable principles.

Table 5 presents the results of the dynamic panel estimation from Equation (3) using the difference GMM. There is a statistically significant positive correlation between enhancements in the environment dimension and betterment in financial stability, as shown in columns [2], [3], [5], and [6]. Our findings indicate that environmental factors demonstrate a significant relationship with stability.

Table 5. Results of dynamic GMM for the impact of ESG and its pillars on stability

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
ESG	0.007 (0.84)							
E		0.018*** (3.32)	0.019*** (3.66)		0.011*** (2.56)	0.013*** (2.81)		
S		-0.011* (-1.68)	-0.009 (-1.49)	-0.000 (-0.02)			0.004 (0.60)	
G		0.006 (0.83)		0.009 (1.22)	0.004 (0.48)			0.008 (1.20)
<i>Chi</i> ²	718.59	5399.99	1046.26	768.52	620.15	612.80	786.13	690.24
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note. Using the dynamic panel GMM regression results, this table presents the impact of ESG and its pillars on financial stability (*Zscore*). Intercept terms are excluded to simplify and clarify the table. *Chi*² denotes Chi-squared statistic. *p*-value denotes the statistical significance of the Chi-squared statistic. *** and * denote statistical significance at the 1% and 10% levels, respectively.

We conduct panel Granger causality tests to check a potentially causal link and investigate the lead-lag relationship between ESG scores and financial stability. Table 6 shows the results of the panel Granger causality test, which follows Equations (4) and (5). It reveals the results for listed financial firms on stability. If the null hypothesis “Excluded variable does not Granger-cause equation variable” is rejected, it can be interpreted that the excluded variable Granger-causes the equation variable

(Granger, 1969). The ESG score Granger-causes *Zscore*. The environmental score Granger-causes the *Zscore*. The social score Granger-causes the *Zscore*. This means that incorporating overall ESG scores, environmental scores, and social scores when predicting *Zscore* provides more information than solely relying on *Zscore* values.

Table 6. Granger causality tests for the impact of ESG and its pillars on stability

Null hypothesis	Chi ²	<i>p</i> -value
ESG score does not Granger-cause <i>Zscore</i> .	5.832*	0.054
<i>Zscore</i> does not Granger-cause ESG score.	0.239	0.888
Environmental score does not Granger-cause <i>Zscore</i> .	4.857*	0.088
<i>Zscore</i> does not Granger-cause Environmental score.	1.533	0.465
Social score does not Granger-cause <i>Zscore</i> .	4.943*	0.084
<i>Zscore</i> does not Granger-cause social score.	0.241	0.887
Governance score does not Granger-cause <i>Zscore</i> .	4.452	0.108
<i>Zscore</i> does not Granger-cause governance score.	0.435	0.804

Note. Chi² denotes Chi-squared statistic. *p*-value denotes the statistical significance of the Chi-squared statistic. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5. Conclusion

This study explores the effects of ESG and individual ESG pillar scores on the stability of financial firms in the Korean market. We use firm-year observations from 2013 to 2022 for listed financial institutions with Refinitiv's ESG scores and analyze a panel regression with two-way fixed effects. We apply the panel Granger causality test and difference GMM technique to address endogeneity and reverse causality concerns. Our results show that ESG activities can potentially enhance the financial stability of financial firms and the environmental pillar could exert the most significant impact in the Korean financial sector.

References

- Albuquerque, R., Koskinen, Y., & Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science*, 65(10), 4451–4469.
- Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C. (2020). Resiliency of environmental and social stocks: An analysis of the exogenous COVID-19 market crash. *Review of Corporate Finance Studies*, 9(3), 593–621.
- Altman, E.I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's z-score model. *Journal of International Financial Management & Accounting*, 28(2), 131–171.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58(2), 277–297.

- Al-Malkawi, H.A.N., & Javaid, S. (2018). Corporate social responsibility and financial performance in Saudi Arabia: Evidence from Zakat contribution. *Managerial Finance*, 44(6), 648-664.
- Bae, K., El Ghouli, S., Gong, Z.J., & Guedhami, O. (2021). Does CSR matter in times of crisis? Evidence from the COVID-19 pandemic. *Journal of Corporate Finance*, 67, 101876.
- Baek, J.S., Kang, J.K., & Park, K.S. (2004). Corporate governance and firm value: Evidence from the Korean financial crisis. *Journal of Financial Economics*, 71(2), 265-313.
- Bang, J., Kang, H., & Ryu, D. (2024). ESG, firm image, and explanatory power for stock returns. *Applied Economics Letters*, Forthcoming.
- Bang, J., Ryu, D., & Yu, J. (2023). ESG controversies and investor trading behavior in the Korean market. *Finance Research Letters*, 54, 103750.
- Bang, J., Ryu, D., & Webb, R.I. (2023). ESG controversy as a potential asset-pricing factor. *Finance Research Letters*, 58, 104315.
- Beltrame, F., Velliscig, G., Zorzi, G., & Polato, M. (2022). A revision of Altman's Z-Score for SMEs: suggestions from the Italian Bankruptcy Law and pandemic perspectives. *Università Ca'Foscari Venezia, SSRN Working Paper*.
- Bénabou, R., & Tirole, J. (2010). Individual and corporate social responsibility. *Economica*, 77(305), 1–19.
- Berger, A.N., Molyneux, P., & Wilson, J.O. (2020). Banks and the real economy: An assessment of the research. *Journal of Corporate Finance*, 62, 101513
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
- Boubaker, S., Cellier, A., Manita, R., & Saeed, A. (2020). Does corporate social responsibility reduce financial distress risk? *Economic Modelling*, 91, 835–851.
- Broadstock, D.C., Chan, K., Cheng, L.T., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, 38, 101716.
- Brogi, M., & Lagasio, V. (2019). Environmental, social, and governance and firm profitability: Are financial intermediaries different? *Corporate Social Responsibility and Environmental Management*, 26(3), 576–587.
- Buallay, A. (2019). Is sustainability reporting (ESG) associated with performance? Evidence from the European banking sector. *Management of Environmental Quality: An International Journal*, 30(1), 98–115.
- Cheng, R., Kim, H., & Ryu, D. (2024). ESG performance and firm value in the Chinese market. *Investment Analysts Journal*, In-press.

- Chiaramonte, L., Dreassi, A., Girardone, C., & Piserà, S. (2022). Do ESG strategies enhance bank stability during financial turmoil? Evidence from Europe. *European Journal of Finance*, 28(12), 1173–1211.
- Choi, J.J., Park, S.W., & Yoo, S.S. (2007). The value of outside directors: Evidence from corporate governance reform in Korea. *Journal of Financial and Quantitative Analysis*, 42(4), 941-962.
- Curcio, D., Gianfrancesco, I., & Viotto, D. (2023). Climate change and financial systemic risk: Evidence from US banks and insurers. *Journal of Financial Stability*, 66, 101132.
- Demers, E., Hendrikse, J., Joos, P., & Lev, B. (2021). ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. *Journal of Business Finance & Accounting*, 48(3–4), 433–462.
- Deng, X., Kang, J.K., & Low, B.S. (2013). Corporate social responsibility and stakeholder value maximization: Evidence from mergers. *Journal of Financial Economics*, 110(1), 87–109.
- 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. *Accounting Review*, 86(1), 59–100.
- Di Tommaso, C., & Thornton, J. (2020). Do ESG scores effect bank risk taking and value? Evidence from European banks. *Corporate Social Responsibility and Environmental Management*, 27(5), 2286–2298.
- Drempetic, S., Klein, C., & Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics*, 167, 333–360.
- El Ghouli, S., Guedhami, O., Kwok, C.C., & Mishra, D.R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*, 35(9), 2388–2406.
- Ferrell, A., Liang, H., & Renneboog, L. (2016). Socially responsible firms. *Journal of Financial Economics*, 122(3), 585–606.
- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
- Gillan, S.L., Koch, A., & Starks, L.T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889.
- Granger, C.W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, 424-438.
- Husted, B.W. (2005). Risk management, real options, corporate social responsibility. *Journal of Business Ethics*, 60, 175–183.
- Jo, H., Kim, H., & Park, K. (2015). Corporate environmental responsibility and firm performance in the financial services sector. *Journal of Business Ethics*, 131, 257-284.
- Kang, S., Bang, J., & Ryu, D. (2024). Female CEOs' risk management and earnings performance during the financial crisis. *Asian Business & Management*, 23(1), 110-138.

- Kim, H., Park, K., & Ryu, D. (2017). Corporate environmental responsibility: A legal origins perspective. *Journal of Business Ethics*, 140, 381-402.
- Kim, Y.-C., & Ryu, D., (2023). Segregation, education cost, and group inequality. *Economics: The Open-Access, Open-Assessment Journal*, 17(1), 20220042.
- Kim, K., Ryu, D., & Yang, H. (2021). Information uncertainty, investor sentiment, and analyst reports. *International Review of Financial Analysis*, 77, 101835.
- Kim, K., Ryu, D., & Yu, J. (2021). Do sentiment trades explain investor overconfidence around analyst recommendation revisions?. *Research in International Business and Finance*, 56, 101376.
- Kim, K., Ryu, D., & Yu, J. (2024). Do changes in star selection criteria affect analyst behaviour?. *Investment Analysts Journal*. In-press.
- Ko, T., Lee, J., Park, D., Ryu, D. (2023). Supply chain transparency as a signal of ethical production. *Managerial and Decision Economics*, 44(3), 1565-1573.
- Laeven, L., Ratnovski, L., & Tong, H. (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking & Finance*, 69(S1), S25–S34.
- Liu, W.C., & Hsu, C.M. (2006). Financial structure, corporate finance and growth of Taiwan's manufacturing firms. *Review of Pacific Basin Financial Markets and Policies*, 9(01), 67-95.
- Malik, M. (2015). Value-enhancing capabilities of CSR: A brief review of contemporary literature. *Journal of Business Ethics*, 127, 419–438.
- Mishra, D.R. (2017). Post-innovation CSR performance and firm value. *Journal of Business Ethics*, 140, 285–306.
- Nam, H.-J., Bilgin, M.H., & Ryu, D. (2024). Firm value, ownership structure, and strategic approaches to ESG activities. *Eurasian Business Review*, Forthcoming.
- Nam, H.-J., Frijns, B., & Ryu, D., (2024). Trade openness and income inequality: The moderating role of institutional quality. *Global Finance Journal*, 60, 100959.
- Nam, H.-J., & Ryu, D., (2024). Impacts of gender inequality on international trade and innovation, *Finance Research Letters*, Revise & Resubmit.
- Park, D., & Ryu, D. (2022). Supply chain ethics and transparency: An agent-based model approach with Q-learning agents. *Managerial and Decision Economics*, 43(8), 3331–3337.
- Petersen, M.A. (2008). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, 22(1), 435-480.
- Pradhan, R. (2014). Z score estimation for Indian banking sector. *International Journal of Trade, Economics and Finance*, 5(6), 516-520.
- Ryu, D., Ryu, D., & Hwang, J.H. (2016). Corporate social responsibility, market competition, and shareholder wealth. *Investment Analysts Journal*, 45(1), 16-30.
- Ryu, D., Ryu, D., & Hwang, J. H. (2017). Corporate governance, product-market competition, and stock returns: Evidence from the Korean market. *Asian Business and Management*, 16(1-2), 50-91.

- Ryu, D., & Yu, J. (2020). Hybrid bond issuances by insurance firms. *Emerging Markets Review*, 45, 100722.
- Ryu, D., & Yu, J. (2021). Nonlinear effect of subordinated debt changes on bank performance. *Finance Research Letters*, 38, 101496.
- Ryu, D., Webb, R.I., & Yu, J. (2020). Bank sensitivity to international regulatory reform: The case of Korea. *Investment Analysts Journal*, 49(2), 149-162.
- Sassen, R., Hinze, A., & Hardeck, I. (2016). Impact of ESG factors on firm risk in Europe. *Journal of Business Economics*, 86, 867–904.
- Seo, S.W., Kim, J.S., Ryu, D. (2019). Effects of the Asian financial crisis on the relation between leverage and employee compensation. *Spanish Journal of Finance and Accounting*, 48(1), 1-20.
- Semykina, A., & Wooldridge, J.M. (2010). Estimating panel data models in the presence of endogeneity and selection. *Journal of Econometrics*, 157(2), 375–380.
- Surroca, J., Tribó, J.A., & Waddock, S. (2010). Corporate responsibility and financial performance: The role of intangible resources. *Strategic Management Journal*, 31(5), 463–490.
- Ullah, S., Akhtar, P., & Zaefarian, G. (2018). Dealing with endogeneity bias: The generalized method of moments (GMM) for panel data. *Industrial Marketing Management*, 71, 69–78.
- Wooldridge, J.M. (2010). *Econometric analysis of cross section and panel data*. MIT Press.
- Yang, E., Bae, H., & Ryu, D. (2022). What makes the level of particulate matter emissions worse in Korea?. *Romanian Journal of Economic Forecasting*, 25, 128–143.
- Yang, E., Bae, H., & Ryu, D. (2024). Air pollution and daily public transportation ridership: The case of Seoul city. *Energy & Environment*, forthcoming.
- Yu, J., Ryu, D. (2021). Effectiveness of the Basel III framework: Procyclicality in the banking sector and macroeconomic fluctuations. *Singapore Economic Review*, 66(3), 855-879.
- Zhou, G., Liu, L., & Luo, S. (2022). Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment*, 31(7), 3371-3387.