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ESG, corporate social responsibility and business effectiveness in Taiwan's banking industry: Cost and risk perspectives

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ABSTRACT

Whether the additional costs and risks derived from investing in ESG and corporate social responsibility will have a positive or negative impact on corporate operations is an issue worthy of further study. Past works have discussed the impact of ESG and corporate social responsibility (CSR) on corporate operations, but mostly from the perspective of operating performance. The empirical results are also inconsistent, and even in the same study, there are ambiguities. Different from previous literature, this study attempts to explore this topic from the perspectives of cost and risk. Therefore, this paper constructs empirical data of Taiwan's financial industry from 2007 to 2022 to explore the impact of ESG and CSR on capital costs and business risks. In this paper, the panel data model is used to carry out an empirical estimation of the full sample and sub-sample and further verify the differences between the influencing factors. The results show that in terms of business risk, when ESG performance is good, it can alleviate the financial distress of banks and enhance the stability of business operations. It further verifies the practical application of ESG disclosure, which can effectively reduce the debt and capital cost of the banking industry.

Contribution/Originality: This study is one of very few which have investigated this issue in newly industrialized economies from the cost and risk points of view. The results based on Taiwan's experience could serve as a valuable reference for other developing countries.

1. INTRODUCTION

In recent years, extreme weather, COVID-19, and other infectious diseases have threatened the health, life, and social and economic development of mankind, and has prompted policy makers and regulatory agencies around the world to pay more attention to the implementation of corporate and environmental governance. In addition, the concept of social responsibility and sustainable development is increasingly welcomed and valued by governments and enterprises. In 2015, the United Nations formulated 17 sustainable development goals (SDGs), covering the three major aspects of environment, economy and society, as an international benchmark for promoting sustainable development. SDGs are the ultimate goal, and ESG (environmental, social, and governance) is the process and means to achieve the goal. It should also combine the environmental, social, corporate governance and business model to reflect the actual internal and external values of enterprises. In August 2020, Taiwan's Financial Supervisory Commission (FSC), the highest authority governing Taiwan's financial industry, released the Green Finance Action Plan 2.0, which aims to encourage financial institutions, state-owned enterprises and investors to pay attention to

sustainable finance and help guide financial institutions to improve the quality of ESG transparency and information disclosure. When the relationship between enterprises and stakeholders is stronger, they will more actively participate in social responsibility activities. Similarly, when the degree of environmental information disclosure is higher, the performance of corporate social responsibility (CSR) is better (Hong, Chen, & Fu, 2013). In order to address the gap in investors' evaluation of corporate value, the Sustainability Accounting Standards Board (SASB) has formulated more comprehensive, complete, qualitative, and quantitative sustainability information disclosure standards and combined them with ESG indicators to meet investors' demand for information. Strengthening the ESG information disclosure of listed companies will also help companies demonstrate more complete long-term performance and value.

The Bank for International Settlements pointed out in the Green Swan report that climate change will become an important source of risk to global financial stability and may trigger the next systemic financial crisis. Extreme weather has triggered a series of chain effects, such as food crises, rising energy prices, inflation, and a series of sharp interest rate hikes by the Federal Reserve. The above-mentioned reality has brought severe challenges to the survival and development of humanity. BlackRock, the world's largest investment institution, is also aware of the seriousness of this problem, emphasizing that climate change not only endangers the world, but also has an impact on the financial system that cannot be underestimated.

BlackRock will begin divesting from high-carbon-emitting companies and shifting investments toward ESG-sustainable companies. The financial industry is the most important supplier of funds in various other industries and is facing the challenges of the "green swan effect", "entity risk" and "transition risk". These not only increase the operating costs of the financial industry, but also increase the operating costs and carbon tariffs of industries with high carbon emissions, which may bring default risks to the financial industry in the future. Therefore, the FSC has called on Taiwan's financial industry to commit to becoming an advocate and practitioner of ESG, not only considering operating results, but also helping customers focus on strengthening ESG-related information disclosure to improve corporate profitability and sustainability and maintain continuous development.

In order to effectively leverage the influence of the financial industry on CSR, as of October 2022, 18 banks and one financial holding company in Taiwan have signed the Equator Principles, which is regarded as a positive sign of ESG implementation. From the perspective of the benefits of introducing the Equator Principles, corporate borrowers with higher environmental management index scores have lower financing costs and fewer financial constraints. Moreover, banks provide financing for green enterprises, or lend on relatively favorable terms, because they comply with the principle of bank credit review, and bank claims are relatively secure (Huang, 2021). The above-mentioned environmental and social risk management mechanism is used to assist financial institutions in identifying the risk level of credit granting and reduce the impact of large-scale project financing and loan cases involving environmental and social risks. It not only strengthens risk prevention and control and improves the bank's reputation, it also performs well in the international sustainable development evaluation indicators, which is of great help in enhancing competitiveness. Taking from society and using it for society, the implementation of ESG and CSR is indispensable for enterprises to achieve the goal of sustainable operation. However, the implementation of sustainable development policies is costly. Although it is beneficial for the environment and society, the benefits for company operating performance are limited, and in addition to increasing input costs, it may even bring uncertain risks.

In view of the fact that most of the previous literature on the impact of ESG and CSR on corporate operations adopts the perspective of corporate performance, the actual results are inconsistent, and there are even ambiguities within the same studies. For example, Zhou, Liu, and Luo (2022) found that the improved ESG performance of listed companies is conducive to the improvement of operational capabilities, but it has no significant impact on the company's profitability and growth capabilities. Other scholars, such as Ammar Zahid, Khan, Anwar, and Maqsood (2022) and Yuen, Ngo, Le, and Ho (2022), showed that banks' ESG engagement will reduce their profitability and

increase operating costs. In the existing literature, in-depth analysis on the negative impact of ESG investment in the financial industry on its operations, such as costs and risks, is rare.

Therefore, this study explores the impact of ESG and CSR investment on business performance-related variables from the perspectives of cost and risk and constructs empirical data of Taiwan's financial industry from 2007 to 2022. This paper uses the ESG score database to construct the ESG score for Taiwan's banking industry and analyzes and discusses the four indicators and total CSR scores of companies listed in CommonWealth magazine's Top 100 Sustainable Citizens II. Secondly, in addition to verifying the panel data on the impact of ESG and CSR on operating costs and business risks, this study also considers multiple related variables such as company size, information disclosure, corporate governance, and credit. Finally, the sample is divided into sub-samples of financial and non-financial holding companies and further examines the differences in influencing factors between the two. It is also hoped that the empirical results of this study can provide a reference for government policy formulation, corporate decision making, public investment strategies, and future research.

The structure of this article is as follows: Section 2 contains the literature review, which mainly discuss the research related to ESG and corporate performance; Section 3 explains the data sources, variable definitions, empirical model and research method; Section 4 provides the empirical results and analysis; and Section 5 comprises the conclusion and recommendations.

2. LITERATURE REVIEW ON ESG RELATED ISSUES

Most of the literature on the impact of corporate ESG investment on performance, except for Ammar Zahid et al. (2022) and Yuen et al. (2022), holds a positive view on the issue. Ammar Zahid et al. (2022) pointed out that the adverse impact of ESG on corporate social performance is more pronounced in companies certified by the Big Four accounting firms. They stated that ESG has a negative impact on a company's financial performance due to spending on environmental, social, and sustainable activities, which increases costs and reduces profitability.

However, Xie, Nozawa, Yagi, Fujii, and Managi (2019), Alsayegh, Abdul Rahman, and Homayoun (2020), Ellili (2020), Ahmad, Mobarek, and Roni (2021), Chiaramonte, Dreassi, Girardone, and Piserà (2021), Adeneye, Kammoun, and Ab Wahab (2022), Feng and Zhang (2022), Naeem, Cankaya, and Bildik (2022), and Rahi, Akter, and Johansson (2022) all show that the investment in ESG is conducive to the development and improvement of performance.

For instance, Feng and Zhang (2022) discussed the impact of ESG performance on corporate financial risk. They found that improving ESG performance can reduce corporate financial risk, and the green governance investment of listed companies can enhance risk management, control capabilities, and further achieve sustainable development. In addition, improving ESG can alleviate financing constraints, improve corporate information transparency, increase institutional investors' shareholding ratio, continuously improve internal and external corporate governance systems, and reduce risks faced by companies. A study by Naeem et al. (2022) explored whether ESG performance affects the financial performance of environmentally sensitive industries. Their results show that the overall ESG performance of sensitive companies is significantly positively correlated with return on equity and the Tobin's Q value. It also has an impact on profitability, which helps to increase market value. The ESG performance of environmentally sensitive companies in developed countries has a relatively stronger impact on financial performance. However, ESG performance has a positive impact on the financial performance of environmentally sensitive companies, implying that ESG investment will expand.

Based on the above-mentioned literature, it can be seen that compared with domestic and foreign literature resources, domestic ESG academic research is not rich enough, and most of the research only discusses ESG-related issues. The existing literature doesn't contain an in-depth analysis on the negative impact of ESG investment in the financial industry. Therefore, this study not only refers to relevant ESG input variables adopted by foreign scholars, it also includes diversified and relevant financial and environmental variables and discusses from the perspective of operating costs and risks.

3. METHODOLOGY

This section divides into four parts. The first section is the selection of the sample and data sources, the second defines the variables, the third describes the methods, and the fourth section is the empirical model.

3.1. Sample Selection and Sources

Based on the Taiwan Economic Journal (TEJ) database, this paper includes 14 financial holding companies and 10 domestic general banks, making a total of 24 banks. The research period is from the first quarter of 2007 to the fourth quarter of 2022, a total of 64 quarters. The main sources of data for this paper are the numerical database disclosed in the financial statements of TEJ, the World Sustainable Citizen Award evaluation system, the S&P Global ESG, and Thomson Reuters' Refinitiv ESG database.

3.2. Definition of Variables

In order to discuss the impact of ESG and CSR on corporate risk and cost, the variables selected in this paper are divided into six aspects: risk, cost, corporate governance, finance, corporate fundamentals, and the macroeconomy.

3.2.1. Risky Variable

Z-score: Altman, Iwanicz-Drozdowska, Laitinen, and Suvas (2017) believe that the Z-score model is mainly used to predict the degree of bankruptcy and diagnose the financial distress of other types of enterprises. Because this model can effectively judge the credit risk of enterprises, it is a credit risk model that is often used. The general Z-score model works fairly well for most countries (with a prediction accuracy of around 75%) and can be further estimated by including additional country-specific variables to improve classification accuracy (above 90%), especially banking companies whose operations are international and need to assess the risk of failure. The estimated formula is given in Equation 1.

$$Z = \frac{WC}{TA} + \frac{retEARNINGS}{TA} + \frac{EBIT}{TA} + \frac{REV}{TA} + \frac{MV}{TL} \qquad (1)$$

Where WC is expressed as working capital, TA is total assets, retEARNINGS is retained earnings, EBIT is earnings before interest and taxes, MV is the market value of the company, TL is total liabilities, and REV is revenue. This study uses the Z-score model proposed by Altman (1968), with five financial ratio variables that are independent of each other and have the most common predictive power. Different multipliers were assigned to these five financial ratios to construct a discrimination function that approximates the regression equation. This can be used to distinguish whether a company is in financial crisis. The Z-score model is expressed in Equation 2.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5 \qquad (2)$$

The above variables are defined as follows: Z = difference fraction, X1 = capital/total assets, X2 = retained earnings/total assets, X3 = EBIT/total assets), X4 = shareholders' equity (preferred and common market value of shares)/book value of total liabilities (market value of equity/book value of total debt), X5: sales/total assets. To obtain the Z-score of a company at a certain point in time, the values of X1 to X5 of the company at that point in time need to be substituted into Equation 2, then the formula value is based on the Altman (1968) classification test, with a Z-score of 2.675 as a demarcation point for judging whether it is a financial crisis company. When $Z > 2.675$, it is classified as a normal company; otherwise, if $Z \leq 2.675$, it is classified as a financial crisis company, which means that the company is experiencing a financial crisis.

3.2.2. Variable of Cost

Here, the weighted average cost of capital (WACC) is used as the cost variable. In order to measure the capital cost of a company's financial activities, Ellili (2020) pointed out that capital structure is a mixture of the debt and

equity held by a company and reflects the level of debt balanced between debt financing benefits and bankruptcy costs. This is represented by Equation 3.

$$WACC = \frac{D}{E+D} \times R_d \times (1-t) + \frac{E}{E+D} \times R_e \quad (3)$$

The structure of Equation 3 is defined as follows: D = total liabilities, E = total shareholders' equity, Rd = cost of debt, that is, interest expense × (1-corporate tax rate)/total liabilities, Re = the cost of equity, that is, the risk-free rate plus (the market rate of return minus the risk-free rate), where the risk-free rate is based on the Bank of Taiwan's β one-year time deposit rate as the benchmark, and the market rate of return is calculated using the average rate of return.

Taiwan's weighted stock price index (the beta value of individual stocks) uses the estimated value of the stock price data β during the five-year period, and finally, t is the corporate tax rate.

3.2.3. Variable of Corporate Governance

3.2.3.1. ESG Score (ESG)

This paper constructs the overall ESG score of the banking industry and a separate score that encompasses the environmental score (ENV), social score (SOC) and corporate governance score (GOV). Finally, this paper uses the scores from 2017 to 2022 as the reference data for the research.

3.2.3.2. ESG (ESGDV)

This is a dummy variable with a score of 1 for disclosed ESG scores and 0 for undisclosed ESG scores.

3.2.3.3. Corporate Social Responsibility Score (CSRDI)

This variable uses the scores of the World Sustainable Citizen Award published by CommonWealth magazine and chooses the banking industry as the research target.

3.2.3.4. CSR (CSRDV)

This is also a dummy variable, set to 1 if the firm has ever received a score and 0 if it has not. For empirical research on corporate social responsibility, please see Badayi, Matemilola, An, and Wei Theng (2021); Farah, Li, Li, and Shamsuddin (2021) and Lee (2016) for details.

3.2.3.5. Board Size (BODSIZE)

The size of the board of directors is the sum of the number of independent directors and the number of supervisors.

This paper refers to the variables selected by Feng and Zhang (2022). The results of their research show that the larger the board size, the greater the power to promote corporate social responsibility, which implies greater responsibility for supervision and management.

3.2.3.6. Concentration of Ownership (TOP1)

This variable is measured by the ratio of the largest shareholder to the company's total share capital, that is, the number of shares held by the largest shareholder divided by the total number of shares and multiplied by 100. A major shareholder is one who holds more than 10% of the shares but does not serve as a director or supervisor. Ellili (2020) shows that internal shareholders and major shareholders are the most powerful and effective regulators of an enterprise, and their existence helps to minimize the cost of capital in banks with a high concentration of ownership. See also Sarhan and Al-Najjar (2022) for a study on ownership structures.

3.2.4. Company Attribute Variables

3.2.4.1. The Size of the Company (SIZE)

The natural logarithm (LN) of the total assets of an enterprise is used as the standard to measure the size of the enterprise. Ellili (2020) pointed out that company size is regarded as a positive signal of a company's financial stability and strength in the financial market, and the larger a company is, the easier it is to raise the required financial resources.

3.2.4.2. Year of Establishment (AGE)

The current year minus the year of incorporation of the company.

3.2.5. Financial Variables

3.2.5.1. Return on Assets (ROA)

The return on assets is used to measure the operating efficiency of the enterprise's use of assets, and the higher the utilization efficiency of the enterprise's assets, the higher the operating level, which means the stronger the profitability of the entire enterprise. This financial ratio variable is an important indicator for evaluating the profitability of a company.

3.2.5.2. Financial Leverage (LEV)

This variable reflects the importance of debt financing to a company, and the asset–liability ratio is directly related to financial risk. When a company's asset–liability ratio is higher, its financial risk is higher. Ellili (2020) shows that a low level of financial leverage is a key determinant of lowering a firm's cost of capital.

3.2.5.3. Shareholder Equity Ratio (ROE)

This is total shareholders' equity divided by total assets. The higher the proportion of equity provided by the enterprise, the greater the protection for creditors, which means that the company has less debt, the stronger the ability to repay debt, and the smaller the financial risk borne by shareholders. However, if the cost of funds obtained through borrowing is greater than the cost of borrowing, shareholders will tend to increase borrowing to reduce the proportion of equity to serve their own interests.

3.2.6. Macroeconomic Variables

3.2.6.1. Real GDP Growth Rate (GDPG)

When the GDP growth rate is positive, it indicates that the region's economy is in a period of expansion, and it also means that the country's productivity and economic activity is higher, and the degree of prosperity is better. Conversely, a negative GDP growth rate indicates that the region's economy has entered a recession. Chiaramonte et al. (2021) stated that in regions with a higher level of economic development, enterprises are more sensitive to sustainable development.

3.2.6.2. Industrial Market Concentration: Herfindahl–Hirschman Index (HHI)

This is the market share of all manufacturers in an industry, which is the sum of the squares of the market shares of all banks in the country (calculated on the basis of net operating income), that is, HHI=, $\Sigma_{i=1}^{n}\left(\frac{x_i}{x}\right)^2 = \Sigma_{i=1}^{n} s_i^2$, where n is the total number of entrepreneurs in the market and Si is the market share of the *i*th enterprise. The higher the estimated value of the HHI, the more concentrated the market is. If the value is smaller and closer to 0, it means that the market tends to be more dispersed and the competition in the industry is more intense. Boubaker, Cellier, Manita, and Saeed (2020) believe that when companies face high external governance pressure, the role of CSR in reducing the risk of financial distress is more important. In addition, Feng and Zhang (2022) pointed out that the mitigation

effect of ESG performance improvement on corporate financial risk is more significant in highly competitive industries.

3.3. Description of Research Methods

3.3.1. Panel Data Model

The study is based on longitudinal and horizontal data analysis, as well as pooled regression using time series and cross-sectional analyses. For empirical demonstrations of panel data models, see Chih, Miao, and Chuang (2014); Tasnia, Syed-Jaafar, and Rosman (2021) and Lins, Servaes, and Tamayo (2017). The original basic regression is written in Equation 4 as:

$$Y_{i,t} = \beta X_{i,t} + u_{i,t}, \quad i = 1, \dots, N \; ; \; t = 1, \dots, T \qquad (4)$$

Where $Y_{i,t}$ is the ith influencing variable, which is the dependent variable in period t, $X_{i,t}$ represents the explanatory variable, $u_{i,t}$ is the error term, and β is the regression coefficient. We then change Equation 4 into Equation 5:

$$Y_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{k,i,t} + e_{i,t} \qquad (5)$$

β_k are the regression coefficients, which have fixed constant values for each other in a long period of time, and α_i is the intercept of the regression and is fixed in the long run. Choosing the estimation technique of Equation 5 depends on further assumptions about the value of the α_i coefficient, which can be divided into fixed effects and random effects models.

3.3.2. Fixed Effects Model

When using the panel data method for empirical analysis, a fixed intercept term α_i is usually assumed, and dummy variables are added to measure the impact of unobserved variables on the model. Thus, differences between samples can be found and the covariance of the model can be reduced, so the fixed effects model is also known as the least squares dummy variable (LSDV) model. If it is assumed that the value of α_i is a fixed parameter, Equation 6 is a fixed effects model:

$$Y_{i,t} = \sum_{j=1}^{N} \alpha_i D_{j,t} + \sum_{k=1}^{K} \beta_k X_{k,i,t} + e_{i,t} \qquad (6)$$

$$D_{j,t} = \begin{cases} 1, \text{when } j = 1 \\ 0, \text{when} j \neq 1 \end{cases}$$

Where α_i represents the coefficient of the intercept term, $D_{i,t}$ is a dummy variable, and if $j = i$, then $D_{i,t} = 1$; otherwise, $j \neq i$ and $D_{i,t} = 0$.

3.3.3. Random Effects Model

The random effects model, also known as the error component model, emphasizes the overall relationship of the data, while the fixed effects model only checks whether the estimated coefficients are equal, not the residual item. This model assumes that the differences caused by unit structure or time changes are randomly generated, and their manifestations are in the residual term. Assuming that α_i is a random coefficient, it can be rewritten as Equation 7:

$$\alpha_{it} = \lambda + \mu_i \qquad (7)$$

λ is a fixed unknown parameter, which represents the average number of individual effects on the variables. μ_i is an independent random variable with the same probability distribution. Therefore, the above model can be rewritten as Equation 8:

$$Y_{i,t} = \lambda + \alpha_i D_{j,t} + \beta' X_{i,t} + e_{i,t} \qquad (8)$$

3.3.4. Empirical Models

Model 1 is a panel data model that affects the determinants of the Z-score, and it is for the discussion of enterprise risk, written in Equation 9 as:

$$Z-Score_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 AGE_{it} + \alpha_3 ESG_{it} + \alpha_4 ESGDV_{it} + \alpha_5 CSRDI_{it} + \alpha_6 TOP1_{it} + \alpha_7 BODSIZE_{it} + \alpha_8 ROA_{it} + \alpha_9 LEV_{it} + \alpha_{10} ROE_{it} + \alpha_{11} GDPG_{it} + \alpha_{12} HHI_{it} + \varepsilon_{it} \quad (9)$$

Model 2 is a panel data model that affects the determinants of the WACC, and it is an exploration from the perspective of corporate capital costs, written in Equation 10 as:

$$WACC_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 AGE_{it} + \beta_3 ESG_{it} + \beta_4 ESGDV_{it} + \beta_5 CSRDI_{it} + \beta_6 TOP1_{it} + \beta_7 BODSIZE_{it} + \beta_8 ROA_{it} + \beta_9 LEV_{it} + \beta_{10} ROE_{it} + \beta_{11} GDPG_{it} + \beta_{12} HHI_{it} + \mu_{it} \quad (10)$$

4. EMPIRICAL RESULTS

4.1. Descriptive Statistical Analysis

The sample period of this study runs from the first quarter of 2007 to the fourth quarter of 2022, a total of 64 quarters. In addition to general financial variables, it also includes corporate governance variables, company fundamental variables and general economic variables as the basis for the estimation analysis. The basic statistics of the full-sample panel data model in this section include the mean, standard deviation, minimum value, and maximum value. In order to avoid excessive numerical differences between enterprises, the natural logarithm (LN) of the variables with excessive standard deviations was used to reduce possible deviations in the final estimation results. See Table 1 for the descriptive statistics.

Table 1. Descriptive statistics of the full sample.

Variable	Symbol	Mean	Standard deviation	Minimum	Maximum
Z-score	*Z-score*	6.019	5.270	1.73	51.36
Weighted average cost of capital	*WACC*	0.018	0.012	0.004	0.22
ESG score	*ESG*	15.925	29.280	0	89
ESG dummy	*ESGDV*	0.312	0.464	0	1
CSR score	*CSR*	2.267	3.724	0	9.50
CSR dummy	*CSRDV*	0.267	0.442	0	1
Board size	*BODSIZE*	4.036	1.509	0	9
Equity concentration	*TOP1*	3.346	8.932	0	36.73
Company size (LN)	*SIZE*	20.878	1.073	18.49	23.20
Number of years	*AGE*	32.814	20.430	11	73
Return on assets (%)	*ROA*	0.399	0.447	-5.55	2.77
Financial leverage (%)	*LEV*	0.915	0.053	0.54	0.97
Return on equity (%)	*ROE*	0.085	0.053	0.03	0.46
GDP growth rate (%)	*GDPG*	3.900	3.995	-8.51	12.46
Market concentration	*HHI*	1405.449	188.244	887.84	1722.35

4.2. Selection of Optimal Panel Data Empirical Model

The optimal model selection results in this paper are shown in Table 2. First, the models are divided into two categories: business risk and operating cost, which are the determinant models affecting the Z-score and the WACC, respectively.

Table 2. Results of optimal model for each sample.

Z-score model	Full sample	Financial holding company	Non-financial holding companies
F-test	59.78*** (0.000)	55.00*** (0.000)	10.68*** (0.000)
LM test	5498.44*** (0.000)	2534.08*** (0.000)	29.74*** (0.000)
Hausman test	18.57 (0.291)	372.59*** (0.000)	81.08*** (0.000)
Model	Random effects	Fixed effects	Fixed effects
WACC model	Full sample	Financial holding company	Non-financial holding companies
F-test	8.35*** (0.000)	9.33*** (0.000)	2.71*** (0.004)
LM test	362.18*** (0.000)	124.05*** (0.000)	2.60 (0.107)
Hausman test	10.67 (0.776)	135.16*** (0.000)	----------
Model	Random effects	Fixed effects	OLS

Note: The values in parentheses represent the p-values. *** represents statistical significance at the 10% level.

The F-test, LM test and Hausman test were used for further detection. Finally, based on the above results, the most suitable empirical models for the full sample, the financial holding companies sample and the non-financial holding companies sample are determined. After testing, the full sample adopts the random effects model, and the financial holding companies use the fixed effects model. The non-financial holding companies use the fixed effects model in the Z-score model, but in the WACC model, they need to use the ordinary least squares (OLS) model for empirical estimation.

4.3. Empirical Results of the Z-Score Model

Table 3 shows the empirical panel data results of ESG and CSR performance and the other control variables on the Z-score. For the full sample, the results show that ESG disclosure has a significant negative impact on the Z-score, reaching the 1% significance level. It can be inferred that the Z-score will decrease for the companies that have implemented ESG, which means that these companies will increase their financial risk due to ESG information disclosure, which implies that participation in ESG activities may affect profitability. This result is consistent with the findings of Yuen et al. (2022).

The environmental sustainability and corporate commitment scores in the CSR score have a negative impact on the Z-score, reaching a significance level of 10%, which means that the higher the score of the above two corporate scores, the higher its business risk (Z-score is smaller). With increased operating costs, the risk will also increase with the increase of CSR, and the research of Nieh, Lin, and Chi (2017) reached the same conclusion. The size of the board of directors reaches a positive significance level of 1%, which implies that the board of directors can assist enterprises in assessing and disclosing risks and improving corporate supervision duties to reduce the risk of losses.

Table 3. Empirical results of the Z-Score model for the full sample.

Variable	Symbol	Coefficient	P-value
ESG score	ESG	0.002	0.238
ESG dummy variables	ESGDV	-0.465	0.000***
• Environmental	ENV	-0.007	0.207
• Social	SOC	-0.000	0.990
• Corporate governance	GOV	0.009	0.262
• CSR score	CSR	1.326	0.192
• CSR dummy variables	CSRDV	0.357	0.140
• Corporate governance	CG	-0.276	0.264
• Corporate commitment	CC	-0.402	0.097*
• Social participation	SP	-0.168	0.547
• Environmental sustainability	ES	-0.515	0.068*
Board size	BODSIZE	0.126	0.000***
Equity concentration	TOP1	-0.030	0.000***
Company size	SIZE	0.633	0.000***
Number of years	AGE	0.012	0.051*
Return on assets	ROA	-0.090	0.043**
Financial leverage	LEV	-110.191	0.000***
Return on equity	ROE	111.049	0.000***
GDP growth rate	GDP_GRW	-0.015	0.001***
Market concentration	HHI	-0.001	0.000***
Constant	CONS	93.676	0.000***
R-squared = 0.969			

Note: ***, ** and * represent statistical significance levels of 1%, 5% and 10%, respectively. ESG is the ESG score, ESGDV is a dummy variable with a score of 1 for disclosed ESG scores and 0 for undisclosed ESG scores, ENV is the environmental score, SOC is the score for social responsibility, GOV is the score for governance, CSRDI is the corporate social responsibility score, CSRDV is a dummy variable set to 1 if the firm has ever received a score and 0 if it has not, CG is the score for corporate governance, CC is the score for corporate commitment, SP is the score for social participation, ES is the score for environmental sustainability, BODSIZE is the size of the board of directors, TOP1 is measured by the ratio of the largest shareholder to the company's total share capital, SIZE is the natural logarithm of the total assets, AGE is the number of years since the establishment of the enterprise, ROA is return on assets, LEV is the level of financial leverage by using the asset–liability ratio, ROE is return on equity, GDPG is real GDP growth rate, and HHI represents the industrial market concentration by applying the Herfindahl–Hirschman Index.

The degree of ownership concentration has a significant negative impact on the Z-score, indicating that the higher the proportion of equity pledges by major shareholders and directors, the higher the degree of ownership concentration and the higher the risk. When the stock pledge ratio between major shareholders and directors and supervisors is too high or increases, it is necessary to pay attention to whether major shareholders will hollow out the company's funds, thereby causing operational risks, which is consistent with the research results of Feng and Zhang (2022).

The real GDP growth rate has a significant negative impact on the Z-score, presumably due to a series of factors in recent years, such as persistent high inflation, high interest rates, slow economic growth, and heavy debt. These can dent investment and trigger corporate defaults, and when combined with climate change and low-carbon transition plans to slow economies, it could force banks to take on more operational risk. See Table 3 for the detailed full-sample empirical results of the Z-score model.

As shown in Table 4, among the sample of financial holding companies, the ESG scores have a positive and significant impact on the Z-score. The results indicate that the better the ESG performance, the higher the Z-score, which can reduce the financial distress of banks and enhance their stability, which is consistent with the research results of Chiaramonte et al. (2021). The environmental item scores in the ESG scores are negatively significant. This paper speculates that the indirect risks faced by banks mainly come from their value chain, especially the client. When customers fail to respond to rapidly changing and stringent environmental regulations and policies, it will cause a rapid increase in costs, affect their financial structure, and affect the operations of related companies, thereby bringing unforeseen risks.

In addition, the statistics show that corporate governance has a significant and positive relationship with the Z-score, which means that good corporate governance can improve business performance and reduce risks. Both the size of the board of directors and the size of the company have a significant positive impact on the Z-score, and both reach the 1% significance level.

Table 4. Empirical results of the Z-score model of financial holding companies.

Variable	Symbol	Coefficient	P-value
ESG score	ESG	0.005	0.011**
ESG dummy variables	ESGDV	-0.134	0.274
• Environmental	ENV	-0.017	0.013**
• Social	SOC	-0.018	0.170
• Corporate governance	GOV	0.033	0.001***
• CSR score	CSR	0.974	0.419
• CSR dummy variables	CSRDV	1.370	0.106
• Corporate governance	CG	-0.066	0.834
• Corporate commitment	CC	-0.498	0.083*
• Social participation	SP	0.003	0.993
• Environmental sustainability	ES	-0.575	0.075*
Board size	BODSIZE	0.182	0.000***
Equity concentration	TOP1	-0.031	0.001***
Company size	SIZE	1.420	0.000***
Number of years	AGE	-0.069	0.000***
Return on assets	ROA	-0.036	0.615
Financial leverage	LEV	(Dropped)	(Dropped)
Return on equity	ROE	118.819	0.000***
GDP growth rate	GDP_GRW	-0.028	0.000***
Market concentration	HHI	-0.001	0.000***
Constant	CONS	-34.375	0.000***
R-squared = 0.979			

Note: ***, ** and * represent statistical significance levels of 1%, 5% and 10%, respectively.

This implies that if the size of the board of directors is larger, it can help the company in its business decisions, and when the company is larger, its operation is relatively stable, so the risk of bankruptcy is smaller. Market concentration is negatively correlated with the Z-score. A possible reason is that Taiwan currently has a large number of bankers and there is excessive competition, resulting in interest rate spreads that are too small, which reduces the reasonable profit margin of banks and is also one of its operating risks.

As shown in Table 5, the ESG and CSR performance of non-financial holding companies have no significant impact on the Z-Score, so this paper infers that the ESG and CSR performance of non-financial holding companies is lower than that of financial holding companies. Return on total assets has a significant positive impact on the Z-score, indicating that the company is highly efficient at utilizing assets to make a profit. Excellent corporate management can help reduce operational risks, which is consistent with the research results of Feng and Zhang (2022).

Table 5. Empirical results of the Z-Score model of non-financial holding companies.

Variable	Symbol	Coefficient	P-value
ESG score	ESG	0.002	0.276
ESG dummy variables	ESGDV	-0.044	0.439
• Environmental	ENV	-0.000	0.941
• Social	SOC	0.001	0.880
• Corporate governance	GOV	-0.001	0.906
• CSR score	CSR	6.274	0.794
• CSR dummy variables	CSRDV	-0.069	0.844
• Corporate governance	CG	-1.636	0.791
• Corporate commitment	CC	-1.490	0.799
• Social participation	SP	-1.602	0.795
Environmental sustainability	ES	-1.543	0.793
Board size	BODSIZE	0.024	0.012**
Equity concentration	TOP1	-0.008	0.000***
Company size	SIZE	-0.217	0.000***
Number of years	AGE	-0.000	0.742
Return on assets	ROA	0.073	0.006***
Financial leverage	LEV	(Dropped)	(Dropped)
Return on equity	ROE	81.312	0.000***
GDP growth rate	GDP_GRW	-0.000	0.881
Market concentration	HHI	-0.000	0.000***
Constant	CONS	3.684	0.002***
R-squared = 0.973			

Note: *** and ** represent statistical significance levels of 1% and 5%, respectively.

Based on the research results of the above three samples for the entire banking industry, companies that implement and disclose ESG information will have increased business risk. The key point is that in order to implement ESG and improve the quality of the disclosed data, the company's financial and management costs may increase significantly. With regard to the sub-samples' operational risks, non-financial holding companies did not achieve significant results in terms of the impact of ESG and CSR on risks, which shows that non-financial holding banks have not invested enough in ESG and CSR. Furthermore, this paper empirically finds that banking operations are more stable when firms are large and have good corporate governance. The higher the proportion of shareholders' equity in non-financial holding companies, the lower the company's debts and the stronger its solvency, which can reduce financial risks and reduce the probability of default.

4. 4. Empirical Results of the Weighted Average Cost of Capital (WACC) Models

As shown in Table 6, in the full sample, the ESG dummy variable has a negative and significant impact on the weighted average cost of capital, indicating that disclosing ESG can not only improve the transparency of corporate

information and reduce the problem of information asymmetry, it will also help to alleviate capital costs. The same phenomenon was also observed by Ellili (2020) and Adeneye et al. (2022). Among the financial variables, the return on total assets has a positive and significant impact on the weighted average cost of capital. When a company borrows, its debt will increase, which will increase the cost of debt.

From a macroeconomic aspect, the real GDP growth rate has a negative and significant impact on the weighted average cost of capital. A high economic growth rate represents a good economic situation, which can effectively improve a company's operating costs. However, when the economy is in recession, once a related company defaults, the asset value of the bank's loan will be affected. Therefore, the bank must set aside more economic capital to cope with the unexpected losses that come with a poor economic environment. Finally, industry concentration is negatively significant to the weighted average cost of capital. This infers that the higher the degree of concentration of the industry, the higher the degree of monopoly, and larger-scale manufacturers can enjoy cost advantages.

Table 6. Empirical results of the full-sample WACC model.

Variable	Symbol	Coefficient	P-value
ESG score	ESG	0.000	0.118
ESG dummy variables	ESGDV	-0.006	0.000***
• Environmental	ENV	0.000	0.515
• Social	SOC	-0.000	0.886
• Corporate governance	GOV	-0.000	0.522
• CSR score	CSR	0.009	0.539
• CSR dummy variables	CSRDV	0.001	0.843
• Corporate governance	CG	-0.002	0.542
• Corporate commitment	CC	-0.002	0.682
• Social participation	SP	-0.002	0.638
• Environmental sustainability	ES	-0.004	0.376
Board size	BODSIZE	-0.000	0.279
Equity concentration	TOP1	-0.000	0.225
Company size	SIZE	-0.001	0.229
Number of years	AGE	-0.000	0.727
Return on assets	ROA	0.008	0.000***
Return on equity	ROE	0.054	0.000***
GDP growth rate	GDP_GRW	-0.000	0.000***
Market concentration	HHI	-0.000	0.000***
Constant	CONS	0.059	0.000***
R-squared = 0.270			

Note: *** represents a statistical significance level of 10%.

The results of the WACC model for financial holding companies are shown in Table 7. In the sample of financial holding companies, the ESG dummy variable has a significant negative impact on the weighted average cost of capital. The implementation of ESG disclosure by financial holding companies can effectively reduce corporate debt and capital costs, and the empirical results are the same as the full sample. The CSR dummy variable has a significant positive impact on the weighted average cost of capital. Statistics show that CSR-oriented enterprises will generate external costs and expenditures due to their CSR activities, which will lead to increased operating costs. This is consistent with the results of Shen and Chang (2008), who found that corporate social responsibility behavior is negatively related to financial performance.

There is a significant negative correlation between equity concentration and the weighted average cost of capital, indicating that the higher the equity concentration, the greater the motivation of shareholders to supervise the agency, which can not only reduce agency costs, but also effectively reduce capital costs. Chen, Wang, and Hung (2017) pointed out that a corporate governance mechanism can effectively supervise the operation of corporate social responsibility, alleviate agency problems, and improve business performance and corporate value. The size of the

company has a significant negative impact on the weighted average cost of capital, which means that when the company has a large scale, a certain asset size, and enjoys economies of scale, it can then have a lower cost of capital advantage.

Table 7. Empirical results of the WACC model of financial holding company.

Variable	Symbol	Coefficient	P-value
ESG score	ESG	0.000	0.297
ESG dummy variables	ESGDV	-0.004	0.002***
• Environmental	ENV	0.000	0.407
• Social	SOC	-0.000	0.919
• Corporate governance	GOV	-0.000	0.433
• CSR score	CSR	0.007	0.594
• CSR dummy variables	CSRDV	0.003	0.077*
• Corporate governance	CG	-0.002	0.525
• Corporate commitment	CC	-0.000	0.904
• Social participation	SP	-0.002	0.683
• Environmental sustainability	ES	-0.003	0.378
Board size	BODSIZE	-0.000	0.579
Equity concentration	TOP1	-0.000	0.000***
Company size	SIZE	-0.003	0.030**
Number of years	AGE	0.000	0.097*
Return on assets	ROA	0.010	0.000***
Financial leverage	LEV	(Dropped)	(Dropped)
Return on equity	ROE	0.052	0.000***
GDP growth rate	GDP_GRW	-0.001	0.000***
Market concentration	HHI	-0.000	0.000***
Constant	CONS	0.099	0.001***
R-squared = 0.4281			

Note: ***, ** and * represent statistical significance levels of 1%, 5% and 10%, respectively.

As shown in Table 8, in the sample of non-financial holding companies, ESG dummy variables have a negative and significant impact on the weighted average cost of capital, which is exactly the same as the results of the full sample and financial holding companies. The size of the company has a negative and significant impact on the weighted average cost of capital. When the asset size is larger, it can bring economies of scale and cost advantages to the bank. Among the financial variables, the return on assets has a positive and significant impact on the weighted average cost of capital, as per the full sample and the empirical evidence of the financial holding companies. Financial leverage also has a significant impact in the same direction, and the results are consistent with the conclusion reached by Ellili (2020), who argues that a low level of leverage is a relevant determinant of lowering a firm's cost of capital.

Regarding the operating costs of the banking industry, based on the research results of the above three samples in this section, the disclosure of non-financial performance can help reduce the cost of capital, while the empirical results of the financial and non-financial holding companies are consistent with those of the full sample of banks. The estimated results show that the implementation of ESG disclosure can effectively reduce the debt and capital cost of enterprises. Firm size also has a significant impact on operating costs.

When the scale of a company is larger, its stability and competitiveness can be maintained through economies of scale and scope. Therefore, the larger the scale of the holding company, the more it helps to reduce the cost of capital investment and further improve its operating efficiency. However, the equity concentration of both financial and non-financial holding companies has a negative and significant impact on the weighted average cost of capital, indicating that the high equity concentration increases its operating efficiency, and the operating cost or capital cost paid is relatively low.

Table 8. Empirical results of the WACC model of non-financial holding companies.

Variable	Symbol	Coefficient	P-value
ESG score	ESG	0.000	0.105
ESG dummy variables	ESGDV	-0.005	0.010***
• Environmental	ENV	0.000	0.774
• Social	SOC	-0.000	0.738
• Corporate governance	GOV	-0.000	0.873
• CSR score	CSR	0.314	0.763
• CSR dummy variables	CSRDV	-0.004	0.776
• Corporate governance	CG	-0.077	0.772
• Corporate commitment	CC	-0.080	0.752
• Social participation	SP	-0.084	0.753
• Environmental sustainability	ES	-0.073	0.774
Board size	BODSIZE	-0.000	0.371
Equity concentration	TOP1	-0.000	0.222
Company size	SIZE	-0.003	0.001***
Number of years	AGE	0.000	0.213
Return on assets	ROA	0.00	0.000***
Financial leverage	LEV	0.0521	0.004***
Return on equity	ROE	(Dropped)	(Dropped)
GDP growth rate	GDP_GRW	-0.000	0.001***
Market concentration	HHI	-0.0000	0.000***
Constant	CONS	0.059	0.004***
R-squared = 0.6702			

Note: *** represents a statistical significance level of 10%.

5. CONCLUSION

Among the three samples, only the financial holding companies' ESG score showed a significant positive contribution. When the ESG performance is better, it can alleviate the financial distress of the bank. When the environmental score is significantly negative, due to changes in relevant environmental policies, the increase in the input cost of related enterprises affects their financial structure, which prompts banks to bear financial risks without warning. When the corporate governance performance is better, the financial situation is more stable, and the risk is lower. For the full sample and financial holding companies, the environmental sustainability and corporate commitment scores in the CSR score have a negative and significant relationship, indicating that companies that pay more attention to CSR have higher financial risks. The variable of board size in the aspect of corporate governance is positive and significant in all three samples, indicating that when the number of directors and supervisors increases, it will help the company's operating decisions and reduce operational risks. The larger the company size (in the full sample and the financial holding company sample), the lower the operating risk, because the internal conditions are perfect, the operating ability is good, and the financial system is stable. The market concentration of the industry is significant in all three samples. Due to the large number of manufacturers in the banking industry and the high degree of competition, the interest rate spread is too small, which reduces the reasonable profit margin of the banks.

The results of the WACC empirical model show that the disclosure of non-financial performance in the three samples can help reduce capital costs, further verifying that the implementation of ESG disclosure can effectively reduce corporate debt and capital costs. Among the three samples, ownership concentration has a significant negative contribution to the WACC. When a company has a high degree of equity concentration, it helps to improve operating efficiency, thus lowering operating and capital costs. Both the real GDP growth rate and the industrial market concentration are negatively significant. This can be observed from the perspective of economic recession; the credit rating of banks in general is poor during a crisis and their financing costs rise. In addition, in the loan market, the weakening of bank liquidity and the loss of financial intermediary functions will lead to a reduction in bank credit and a consequent rise in loan interest rates.

6. RECOMMENDATIONS

The results of this paper show that the implementation and disclosure of ESG can improve the operating performance of enterprises and reduce financial risks. Therefore, the government should formulate and actively promote policies and measures related to the finance industry and encourage affiliated companies to independently disclose ESG and CSR information. To achieve these goals, relevant government agencies can hold relevant forums or create a platform that can be accessed by enterprises and the public that clearly displays the non-financial performance of each enterprise. A system such as this will be able to more effectively convey the information of social responsibility and environmental sustainability to the general public, and it will also enhance the awareness of ESG and CSR among all walks of life, which will definitely help Taiwan take a big step forward in sustainable development.

ESG and CSR have become a focus globally and in various industries. When a company voluntarily discloses its non-financial performance, has a high ESG score, and is financially transparent, it means that the company has a relatively stable constitution and low operational risk. At the same time, climate change and carbon emission policies will also become risks affecting the long-term profitability, growth, and sustainability of enterprises in the future. Therefore, investors can use relevant information on non-financial performance as a screening tool for investments to understand the significance of sustainable investment and further contribute to the sustainable development of society and the environment.

In this paper, the Z-score of the financial early warning indicator is integrated into an overall score, and it is suggested that future research could subdivide the indicator into five sub-indicators or use a revised Z-score model as a new research basis. In addition, ESG and CSR-related indicators can be considered for interaction and analysis with overall economic indicators, or the scope of research can be expanded to compare differences between industries, such as traditional industries, shipping industries or the electronics industry, and even foreign companies involved in ESG.

Finally, the main research limitation of this study is that, compared with China and advanced countries in Europe and America, it is not easy to obtain information on ESG-related index scores of Taiwanese companies. Therefore, in addition to the lack of reference data, there is also a lack of a rigorous standard calculation model for scoring various companies. This is also one of the topics that the relevant management agencies of Taiwan's government need to pay attention to in the future.

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