Corporate Environmental Responsibility and Credit Ratings

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While prior literature focuses on the shareholder's perspective, this study investigates the benefits of corporate environmental responsibility (CER) activities from the debtholder's perspective. We find a strong positive relationship between CER activities and credit ratings. Specifically, the positive relationship is mainly driven by the strategy and performance factors of CER activities. Also, we find that the positive relationship is more pronounced in firms with higher agency costs. The results indicate that CER activities in emerging countries have the effect of reducing default risk and meet creditors' interests. Additionally, it suggests that CER activities have the effectiveness of the corporate strategic perspective on corporate financing and disclosure.

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Ⅰ. Introduction

Global, multifaceted efforts, such as the Rio Summit or the adoption of the Kyoto Protocol, to expand the sustainability of humanity and society through environmental conservation are continuing to expand. The importance of corporate environmental responsibility (CER) activities is on the rise (Cai, Cui, and Jo 2016; El Ghoul, Guedhami, Kim and Park 2018). CER activities are strategic investment decisions that incur a substantial amount of initial outlay. Therefore, firms have incentives to be actively engaged in the activities only if they guarantee sufficient benefits. Prior literature investigates whether the benefits of CER activities increase shareholder wealth under shareholder theory (Friedman 1970; El Ghoul, Guedhami, Kim and Park 2018).[1] However, CER activities are the devices for meeting various stakeholders' interests under the stakeholder theory (Freeman 1984). Therefore, shareholder theory alone cannot fully explain the benefits of CER activities. Specifically, it increases the importance of understanding the stakeholder theory given the conflict of interest between shareholders and other stakeholders (Jensen and Meckling 1976).

This study empirically investigates the relationship between CER activities and credit ratings from the perspective of debtholders, as one of the stakeholders. Credit rating is the key information to determine the interest rate based on the default risk, so it reflects the debtholder's expectation of and analysis of a firm. Credit rating is important in terms of a corporate strategy because a firm facilitates the outside financing and effectively pursue investment opportunity by improving its credit rating through active risk

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1) The literature provides empirical evidence that CER activities are positive factors from the shareholder's perspective. Further discussions followed in the literature review and hypothesis sections in this study.

management. Generally, both quantitative (e.g. profitability, growth potential, or efficiency) and qualitative financial information (e.g., corporate structure or strategy) can affect the credit rating (Dillenburg, Greene, and Erekson 2003). Therefore, we can expect CER activities can be a factor in the determination of credit rating.

This study focuses on debtholders because they have a conflict of interest with shareholders in understanding CER activity. As residual claimants, shareholders have an incentive to maximize stock price by bearing the risk of investing in risky projects. On the other hand, as fixed claimants, debtholders have an incentive to avoid excessive risks to decrease the default risk. These differences in the risk-taking incentives between two stakeholders will lead to the difference in evaluating CER activities. Generally, CER activities involve substantial uncertainty as investment means. Shareholders will prefer CER activities with high risks due to this uncertainty. In contrast, debtholders will allow CER activities only if these activities are effective in controlling default risks. Therefore, it is important to analyze the benefits of CER activities from the debtholder's perspective.

Comparing with prior literature, this study is unique because it resolves the academic gap and strengthens practical implications through the independent evaluation of CER activities. In global financial markets, there is an increasing interest in non-financial information, ESG (Environmental, Social, Governance), among market participants. However, it is rare to find a study focusing on the systematic and detailed analysis of CER activities (Montiel and Delgado-Ceballos 2014). Specifically, social debates on CER activities, such as GHG emission control, fossil fuel reduction, and hazardous chemical emission management, are expanding the necessity of independent analysis on CER activities. However, prior literature only considers CER activities as one

category of corporate social responsibility (CSR) activities. While the expected effect of CSR activities is rather vague, CER activities can be used as an important measure for investor evaluation due to their clear objective and effect. For this reason, a recent study focuses on the unique expected effect of CER activities apart from CSR activities (Montiel and Delgado-Ceballos 2014; Cai, Cui and Jo 2016; El Ghoul, Guedhami, Kim and Park 2018).

This study conducts further analysis considering corporate characteristics as constraints to more precisely determine the causes of the effect of CER activities on credit ratings. Based on the theoretical discussion, the benefits of CER activities contribute to risk management, growth opportunities expansion, management efficiency improvement, and resolving agency problems. CER activities have the effect of reducing the potential business risk such as the environmental pollution accident and a lawsuit from various stakeholders (Godfrey, Merrill and Hansen 2009). We can consider CER activities as a growth strategy to preempt the competitive advantage by introducing new technology and product differentiation. Also, these activities can lead to improving management efficiency by reducing production costs through production process efficiency (Nehrt 1996; Miles and Covin 2000). Finally, CER activities mitigate information asymmetry, which is the main cause of agency problems (Cui, Jo and Na 2016). Therefore, we can infer the relationship between CER activity and credit rating based on these associations. By analyzing the relationship, we can evaluate the expected benefits of CER activities from the creditor's perspective.

We perform an empirical study using a sample of Korean listed companies. The reason is as follows. First, CER activities in Korea are more important than those in developed countries such as the United States or the United Kingdom. Due to the rapid economic growth in a short period, the

establishment and implementation of a strategy that minimizes the environmental impact of management activities were insufficient in Korea. Recently, the environmental pollution problem has been an issue in Korea for these reasons. More people are interested in CER activities. Typical examples include measures to reduce fine dust and the introduction of a carbon credits market. Second, the stock market development level is lower than that of developed countries in Korea due to the low level of investor protection. Naturally, there is a high proportion of external financing through debt, such as bank loans and corporate bonds, and the analysis of credit ratings, which are essential for the pricing of such financial instruments, is more actively required. In other words, analyzing the creditor perspective (stakeholder theory) rather than the shareholder perspective (shareholder theory) is expected to provide better information in judging the practical value of CER activities.

There are some implications in this study. First, it can provide evidence for judging the benefits of CER activities in emerging economies. Previous studies conducted empirical analysis on developed countries such as the United States and the United Kingdom. It is difficult to anticipate that these results will still hold in emerging economies because regulatory environments and capital market conditions are different. Second, this study will review the function of CER activities as a strategic means. If the active implementation of CER activities improves credit rating, it suggests that these activities are a tool to mitigate bankruptcy risk. The result implies that CER activities may be an alternative to reducing external financing costs for companies.

The main results of this study are as follows. We perform regression analysis using the fixed effect models in this study. The CER activities (or changes in CER activities) have a significant positive effect on the credit rating. This

result suggests that CER activities can improve debtholders' wealth as stakeholders by reducing the bankruptcy risk. This result is confirmed when we use the 2SLS (two-stage least squares) to control the endogeneity problem based on reverse causality. Also, the strategy and performance factors of CER activities drive the main result. It means that a systematic strategy and performance of CER activities that investors can easily visualize will improve credit ratings. Also, CER activities improve credit ratings more in firms with high agency costs after considering firm characteristics in the analysis. The result suggests that CER activities effectively reduce the possibility of incentives for managers' pursuit of private interests.

The rest of the paper is organized as follows. In section II, we set up a research hypothesis based on theoretical discussions surrounding CER activities. In section III, we explain the sample and variable construction process for empirical analysis. In section IV, we discuss empirical analysis results. In section V, we provide the conclusion of this study.

II. Prior literature and hypothesis development

The academic evaluation of CER activities mainly utilizes stock price-oriented variables based on shareholder theory. In companies with the ultimate goal of profit maximization, there will be incentives to actively implement CER activities only if its benefits exceed the costs (Friedman 1970). As a result, there are two categories in the perception of CER activities. One view is that if companies reject the social trend for CER activities, it will hurt the production and sales of goods and services in the long run. Another view is that the company's profit will deteriorate due to the cost accompanied by CER

activities. Existing studies suggest that CER activities generally have a positive effect on firm value considering two views. There is a study using emerging market data. Jiang, Xue, and Xue (2018) verify the effect of CER activities on corporate performance in China's energy industry. They argue that CER activities improve corporate performance and that this effect is mainly strong in privately-owned companies.

Several studies explain the benefits of CER activities on financial decision-making. Ambec and Lanoie (2008) systematize the economic and financial benefits of CER activities and support them through case studies. Through CER activities, firms in case studies enjoy the benefits of access to specific markets, product differentiation, pollution control technology sales, the stakeholder understanding of risk management, and reduction in production costs (raw materials, energy, capital raising, and labor). They argue that the costs associated with these activities can be sufficiently offset. Schneider (2011) argues that active CER activities can improve the ability to pay creditors by reducing clean-up costs for environmental pollution and compliance costs. Herbohn, Gao, and Clarkson (2019) empirically verify the informational effect of a company's carbon emissions risk on bank loan disclosures. They confirm positive stock returns for companies with high carbon emission risks when renewing loans. Jung, Herbohn, and Clarkson (2018) empirically examine the relationship between carbon-related risks and debt financing costs. They find a positive relationship between carbon-related risk and debt financing costs in companies with low levels of carbon-related risk awareness (not responding to the Carbon Disclosure Project survey).

Recently, the seriousness of the environmental pollution problem has been raised mainly in emerging countries, and the countries actively search for alternatives to solve this problem. In response to this demand, academic

research is also increasing. Li, Cao, Zhang, Chen, Ren, and Zhao (2017) report that a positive relationship exists between CER activities and Return on Assets (ROA) for Chinese companies. However, they find a negative (-) relationship between the two in companies with high organizational slack due to large working capital. The finding raises the possibility that the management will abuse CER activities using the excessive expansion of its discretion. It shows the case of the agency problem. Du, Weng, Zeng, Chang, and Pei (2017) empirically verify the relationship between CER activities and debt raising costs for Chinese companies. They suggest that firms can significantly reduce the interest rate on debt through active CER activities. Kang and Byun (2020) report that CER activities for Korean companies can increase investment inefficiencies. The result implies that firms can exploit CER activities to satisfy managers' incentives for overinvestment. The results of recent studies on emerging countries are mixed. So, it is a meaningful task to verify the benefits of CER activities empirically.

Existing studies attempt only a comprehensive approach based on CSR activities, not an independent analysis of CER activities, to verify the stakeholder theory. Attig, El Ghoul, and Guedhami, and Suh (2013) find that the active implementation of CSR activities leads to higher credit ratings. Also, they argue that these activities can contribute to improving the creditworthiness of the company by stakeholders. However, they only recognize the CER activities as subcategories of CSR activities and do not attempt specific and detailed analysis.

1. Risk mitigation view

In general, bankruptcy risk increases when the repayment possibility of

principal and interest increases due to difficulties in obtaining external financing and poor profitability. CER activities can lead to better access to external financing by mitigating the information asymmetry, which is the main cause of risk premium. CER activities can reduce information asymmetry because the activities force managers to disclose relevant non-financial information to stakeholders and facilitate the dialogue between managers and stakeholders (Cui, Jo and Na 2016). Further, companies can be more aggressive in supplying relevant information on these activities to signal their ethics in capital markets. More directly, CER activities can reduce potential business risk by mitigating the probability and impact of adverse events such as strikes, product recalls, and environmental scandals (El Ghoul, Guedhami, Kim and Park 2018).

On the other hand, CER activities can contribute to increasing companies' profitability. The skills and knowledge acquired through the development of new technologies in CER activities can serve as a source of competitive advantage (Nehrt 1996). Sáez-Martínez, Díaz-García, and González-Moreno (2016) confirm that, for SMEs in 38 European countries, there is a positive relationship between CER activities and financial performance measured by sales growth. Based on this, they argue that CER activities can be a Win-Win strategy that reduces environmental pollution while inducing corporate innovation. Li, Liao and Albitar (2020) suggest that active CER activities for Chinese companies improve Tobin's Q. It also confirms that CER activities promote innovation activities that represent the number of patent applications by companies. So, they argue that innovation activities explain the relationship between CER activities and Tobin's Q.

New technologies related to CER activities can improve corporate profitability by reducing production costs. CER activities can improve

corporate performance by improving corporate reputation (Miles and Covin 2000). In competitive product markets, CER activities could contribute to the construction of mobility barriers. They construct them by satisfying consumer's needs for environmental conservation and thereby increasing sales. Jiang, Xue and Xue (2018) confirm a significantly positive (+) relationship between CER activities and ROA. Also, the relationship between the two is strong in privately-owned companies. These companies have good incentives to respond to the public needs and the government. Thus, it suggests that CER activities can be considered alternatives that meet these incentives.

Meanwhile, Merton (1974) and Vassalou and Xing (2004) show that bankruptcy risk is closely related to the volatility of asset values. An increase in asset value leads to a reduction in bankruptcy risk, and an increase in volatility leads to an increase in bankruptcy risk. Since we estimate the asset value by discounting the value of future cash flow, asset value is directly related to the firm's expected future income and expenses. Naturally, changes in revenues and costs resulting from CER activities can affect the risk of bankruptcy (credit rating). As mentioned above, CER activities contribute to profit expansion by (1) product differentiation through reputation expansion. Pathways contributing to cost reduction are (1) improved productivity through the introduction of new technologies, (2) reduced capital costs through reduced information asymmetry, and (3) avoided potential litigation and regulatory costs. Eventually, the effect of these CER activities reduces bankruptcy risk by raising the asset value or by reducing volatility.

Hypothesis 1: Companies that are active implementation of CER activities have a high credit rating.

2. Overinvestment view

According to the agency theory, managers can create an overinvestment problem by adopting an unprofitable investment. Managers increase reputation and discretion by adopting an unprofitable investment. Also, reputation and discretion increase with the size of a company (Jensen and Meckling 1976; Jensen 1986). This incentive can also be linked to CER activities because they are part of the investment decisions (Barnea and Rubin 2010). Managers are likely to decide excessive investment in CER activities to signal their ethics by exploiting the growing social demand for these activities (Aupperle, Carroll and Hatfield 1985). It is difficult to quantitatively visualize the performance of CER activities in the short term. Thus, incumbent managers are less likely to be responsible for the failure to invest in CER activities, which may increase the likelihood of agency problems exploiting them.

Overinvestment is more likely to undermine the debtholders' wealth than shareholders. Jensen and Meckling (1976) propose a wealth transfer problem from debtholders to shareholders. They argue that there is a possibility of seeking excessive risk by shareholders to increase the value of their ownership, and this behavior can increase bankruptcy risk and undermine the wealth of debtholders, who are guaranteed only fixed returns. In emerging countries, this concern can increase due to controlling shareholders who have considerable control power in the corporate decision-making as owner-manager. Excessive CER activities to meet the incentive to pursue private benefits by an owner-manager are more likely to undermine debtholder's value rather than shareholder's value. If managers invest in CER activities for excessive risk-seeking or incentives for overinvestment, the

debtholder's wealth may decrease. In this case, debtholders will negatively evaluate companies with the active implementation of CER activities and give them a low credit rating.

Hypothesis 2: Companies that are active implementation in CER activities have a low credit rating.

III. Sample and variables

1. Sample

This study conducts the empirical analysis using listed companies on the Korea Exchange. The sample period is from 2010 to 2014.[2] The sample excludes financial and capital encroachment companies to ensure the comparability of financial statements. A final sample contains a total of 773 firm-year observations (240 firms) for empirical analysis. This paper uses the CER activity index from the Korean Corporate Governance Service. This study uses credit rating, stock price, and financial statement data from FN-Guide. Winsorization between top and bottom one percent has been performed for financial ratios to control for outlier effect.

2. Variables

1) CER activity index

CER activities utilize the results of the Korea Corporate Governance

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[2] The sample period starts from 2010 because CER activity information has been released since 2010.

Service's evaluation of environmental management by the company.3) There are five categories of listed companies from the evaluation since 2010: environmental strategy, environmental organization, environmental management, environmental performance, and stakeholder response. The total score is 300 points. The environmental strategy (45 points) includes items based on the company's internal environmental strategies and policies establishment and the planning and implementation of environmental investment plans. The environmental organization (30 points) includes items based on the holding company-wide decision-making and working organizations for environmental management and regular environmental education. Environmental management (115 points) includes items based on GHG emission management and green purchasing policies and systems. Environmental performance (85 points) is evaluated based on GHG emissions, energy consumption, water consumption, and stakeholder response (25 points) includes items based on disclosure and external verification of environmental information, support for environmental preservation activities, and cooperation of local communities.4) This evaluation is objective because it is conducted on the entire listed company by a credible institution. Also, it is relatively free from a sample selection bias that can occur when KCGS establishes the sample within a specific industry or business group. The

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3) The CER activity index is the internal data of the KCGS, and the evaluation score is not open outside. KCGS only discloses the list of companies with a B grade or higher, and this is also limited to the evaluation results of the recent business year. The current analysis data are limited to past data at the beginning of the study. We obtained the data with the permission of the KCGS. Since the current analysis period does not include any events (e.g. financial crisis, etc.) that may cause structural changes in CER activities or credit ratings, we believe that there will be no major difficulties in generalizing the analysis results.

4) For more information on the corporate environmental responsibility activities evaluation by the Korean Corporate Governance Service, see ⟨Appendix Table 2⟩.

evaluation results for the detailed categories will be available in addition to the individual evaluation of CER activities. Thus, we expect the analysis based on detailed categories.

This study uses the CER activity index by converting firms' environmental management evaluation results to one point (CER_{Total}). Finally, the evaluation results of the detailed categories, $CER_{Strategy}$, $CER_{Organization}$, $CER_{Management}$, $CER_{Performance}$, and $CER_{Response}$, are indexed out of one point. The fact that the indexes have high values means that companies are active in CER activities.

2) Credit rating

The credit rating uses the corporate bond rating. There are three credit rating agencies (Korea Credit Rating, Korea Enterprise Rating, and NICE Credit Rating) in Korea. If there are duplicated credit ratings in the same fiscal year among the credit ratings given by these credit rating agencies, we use the lowest rating. We select the lowest rating to set up the most conservative perspective in evaluating bankruptcy risk to meet the risk management purpose. Credit rating agencies often release ratings from AAA+ to D grades. High-rated companies mean superior debt repayment ability. Low-rated companies are the companies with bankruptcy risk. Generally, firms with BBB or higher ratings mean investment-grade firms, and firms below BBB ratings mean speculative-grade firms. This study assigns a value of 1 to 22 to each grade to facilitate the empirical analysis (Credit rating). The AAA+ rating has a value of 22, and the D rating has a value of 1, and the high credit rating index means that the risk of bankruptcy in a firm is low.

3) Other variables

This study refers to existing studies and includes various controlling variables to control endogenous problems based on the omitted variable bias. (Jiraporn, Jiraporn, Boeprasert and Chang, 2014). To control for the firm size effect, the natural log of the total asset is used (Size) and the total debt to total assets ratio is used (Leverage) to control for the difference of the bankruptcy risk caused by the capital structure or the financing capacity in advance. Firms with high profitability have an internal funding ability to buffer unexpected risk factors. Therefore, Earnings Before Interest and Tax (EBIT) to total assets should be considered in the empirical analysis (EBIT). A high market value relative to the book value of the assets means that firms have a high growth potential in the future. Therefore, the market value to book value ratio is controlled in the empirical analysis. We calculate the market value by multiplying the number of shares outstanding by the end-of-year closing price of the stock (MTB).

High investment spending has a positive impact on debtholders' wealth as it contributes to securing future growth engines. Thus, we include a growth potential, calculated by the sum of capital expenditure and research & development expense divided by total assets (Investment expenditure), in the model. Increasing managerial risk can inevitably increase bankruptcy risk. The debtholder's evaluation of the firm reflects this information. So, the information will have a significant impact on credit ratings. Therefore, we include the standard deviation of ROA (return on assets) for the past five years as a control variable in the model (Business risk). The level of growth of a firm can influence the creditor's valuation. The valuation will reflect the changes in future cash flows. Therefore, we consider the average sales growth over the past five years as a control variable (Sales growth). Increasing the firm's

internal financing capacity can contribute to the crisis management's ability to respond to external shock. Naturally, it can contribute to reducing bankruptcy risk. Under this discussion, we include cash and cash equivalents relative to total assets as a control variable in the model (Cash). Longer firm age means the sustainability of the business activity is relatively high. Thus, we control for the natural log of (current year-establishment year+1) (Age).

The controlling family has a significant stake within Korean firms. So, the controlling family has a significant influence on management decision-making in Korea. This behavior affects the evaluation of the capital market. In general, if the controlling shareholder has a high stake, the alignment of interests with minority shareholders lowers the possibility of agency problems. On the other hand, securing an excessively high stake can lead to managerial slack. We use the sum of ownership of the controlling shareholder and their relatives as a control variable. The purpose is to control the effect of agency problems based on this ownership structure (Ownership).

Meanwhile, this study performs a two-stage least squares approach using an instrumental variable to control for the endogeneity problem based on reverse causality. We use the industry CER activity index as an instrumental variable from the previous study (Jiraporn, Jiraporn, Boeprasert and Chang 2014). Individual companies consider a comparative advantage or reputation over competitors within the same industry in determining CER activity level. However, it is difficult to find the causal relationship between the CER activity of the industry and the value of individual companies. So, it is appropriate to use industry CER as an instrumental variable (Industry CER).

Also, the latter part of the study examines how the CER activity and credit rating differ based on firm characteristics. As a related variable, first, we use sales over total assets as a proxy for management efficiency (Efficiency). This

index means how firms generate high sales based on assets held, so existing studies use it as a proxy for asset efficiency (Ang, Cole and Lin 2000). Managers can discretionally adjust profits to avoid losses from poor performance. This discretion can be a representative agency problem that can arise due to information asymmetry between corporate insiders and external investors. Following Almeida, Park, Subrahmanyam and Wolfenzon (2011), this study uses discretionary accruals as a proxy for agency problems. The discretionary accruals are the absolute value of the difference between operating cash flow over total assets and net income over total assets (Accruals).

IV. Empirical results

1. Descriptive statistics

〈Table 1〉 presents the descriptive statistics of the variables used in the empirical analysis. The average CER activity index (CER$_{Total}$) was observed at 0.4550. The result suggests that there is still room for improvement in CER activities for firms from emerging economies like Korean-listed companies. But, the standard deviation of CER activities was 0.2434. It means there is a sufficient difference among Korean-listed companies. We can interpret the result as an index for debtholder's evaluation on firms. The average value of CER activity subcategory indices is 0.5548 for CER$_{Strategy}$, 0.5335 for CER$_{Organization}$, 0.5238 for CER$_{Management}$, 0.2101 for CER$_{Performance}$, and 0.4199 for CER$_{Response}$, respectively. In comparison, the ex-post performance on CER activities is still insufficient. The average credit rating (Credit rating) was 14.4114, with a median of 15.000. The similarity between the two figures suggests that credit ratings are unlikely to be skewed over certain intervals.

⟨Table 1⟩ Summary Statistics

Variables	N	Mean	Median	STD.DEV	Max	Min
CER$_{Total}$	773	0.4550	0.4650	0.2434	0.9257	0.0000
CER$_{Strategy}$	773	0.5548	0.6154	0.2760	1.0000	0.0000
CER$_{Organization}$	773	0.5335	0.6000	0.3149	1.0000	0.0000
CER$_{Management}$	773	0.5238	0.5818	0.2932	1.0000	0.0000
CER$_{Performance}$	773	0.2101	0.1846	0.1405	0.7615	0.0000
CER$_{Response}$	773	0.4199	0.3200	0.3768	1.0000	0.0000
Credit rating	773	14.4114	15.0000	3.7677	21.0000	1.0000
Size	773	21.2390	21.2188	1.4516	24.0674	17.0070
Leverage	773	0.5380	0.5547	0.1900	0.9210	0.0194
EBIT	773	0.0297	0.0297	0.0581	0.2225	-0.1835
MTB	773	1.2796	0.9517	1.1804	6.7155	0.1930
Investment expenditure	773	0.0465	0.0289	0.0482	0.2332	0.0000
Business risk	732	0.0422	0.0304	0.0455	0.3328	0.0041
Sales growth	739	0.1002	0.0798	0.1639	1.2026	-0.2609
Cash	773	0.0460	0.0320	0.0454	0.2857	0.0001
Age	773	3.4586	3.7136	0.7420	4.4427	1.0986
Ownership	757	0.2326	0.1972	0.2267	0.8465	0.0000
Efficiency	771	0.9151	0.8459	0.5223	3.1289	0.0012
Accruals	773	0.0644	0.0384	0.0916	0.9424	0.0000
Industry CER	773	0.3700	0.4083	0.1652	0.8410	0.0000

Note: This table provides summary statistics for variables used in the empirical analysis.
      Variable definitions are in ⟨Appendix Table 1⟩.

There are no noticeable outliers of other control variables. The average ownership of controlling shareholders and relatives (Ownership) is 0.2326. It suggests there is a characteristic of relatively concentrated ownership structures within emerging countries in the analysis sample of this study. We note that the management decision is likely to reflect the opinions of controlling shareholders with high ownership concentration. Conversely, it suggests that the debtholders' concerns about their decrease in wealth are relatively high. That is why this study analyzed the relationship between CER activities and credit rating in emerging countries.

〈Table 2〉 sets up 10 groups by dividing the CER activity index by 0.1 units, and presents the sample size and average credit rating of each group. The second column gives the sample size by the overall CER activity index (CER_{Total}). The sample is distributed relatively evenly over the entire group. This result suggests that the empirical analysis can fully reflect the differences in CER activities. The third column gives the average of each group's credit rating index (Credit rating). Overall, the credit rating index is higher in the group with a higher CER activity index. We observed a difference of about 4 units between the group with the lowest CER activity index and the highest group. This result suggests that companies with active CER activities receive a credit rating of about 4 grades higher than those that are not. The result supports the risk mitigation view (Hypothesis 1) that CER activities can contribute to credit rating improvement by reducing bankruptcy risk. In particular, companies with a CER activity index of more than 0.5 have a positive relationship with the credit rating.

〈Table 3〉 shows the correlation of variables to be used in the empirical analysis. There is a significant positive correlation between CER_{Total} and Credit Rating. These statistics also support the risk mitigation view (Hypothesis 1). We observe a significant positive correlation between the CER activity index and the market value to book value ratio (MTB). The market value to book value ratio measures a firm's market value. The results confirm that CER activity in emerging countries has the same effect of improving shareholder value as in developed countries. There is a significantly high positive correlation between Industry CER and individual firm's CER activity index. On the other hand, there is no statistically significant correlation between industry CER and credit ratings. It means that the industry CER, as suggested in the previous study, is adequate for an instrumental variable in the empirical analysis.

⟨Table 2⟩ Credit Rating Score by the Level of CER

Level of CER	CER_{Total}		$CER_{Strategy}$		$CER_{Organization}$		$CER_{Management}$		$CER_{Performance}$		$CER_{Response}$	
	N	MEAN	N	MEAN	N	MEAN	N	MEAN	N	MEAN	N	MEAN
0≤ CER≤0.1	75	13.2533	53	13.4151	122	13.8689	95	13.4105	144	13.4028	166	12.6627
0.1⟨ CER ≤0.2	80	14.1375	43	12.9767	46	14.1522	66	14.8788	290	13.4828	137	12.8978
0.2⟨ CER ≤0.3	65	13.7692	97	13.5876	19	15.8947	42	13.9762	169	14.4438	82	14.6707
0.3⟨ CER ≤0.4	68	13.4559	38	14.1316	32	12.9375	50	12.9000	89	16.4944	76	14.6579
0.4⟨ CER ≤0.5	143	12.7622	44	14.1136	102	12.6863	65	14.2000	51	16.9412	24	14.6250
0.5⟨ CER ≤0.6	104	14.1538	94	13.9149	125	13.2160	92	12.8043	19	17.2105	49	15.1224
0.6⟨ CER ≤0.7	93	15.4301	154	13.2208	21	15.4762	117	13.2308	8	18.6250	21	12.7619
0.7⟨ CER ≤0.8	82	16.7683	86	15.0814	118	14.5678	88	15.0000	3	17.0000	30	14.9000
0.8⟨ CER ≤0.9	57	17.4211	90	16.5333	132	15.9848	91	16.8571	-	-	36	15.5556
0.9⟨ CER ≤1.0	6	17.5000	74	17.1081	56	17.5179	67	17.1493	-	-	152	17.0197

Note: This table provides the average credit rating for each of the ten subgroups divided by the level of CER activities. Variable definitions are in ⟨Appendix Table 1⟩.

〈Table 3〉 Correlation Analysis

Variables	CER$_{Total}$	Credit rating	Size	Leverage	EBIT	MTB	Investment expenditure	Business risk
Credit rating	0.2967*							
Size	0.5191*	0.6468*						
Leverage	0.0282	-0.4898*	-0.0243					
EBIT	0.0187	0.4384*	0.1572*	-0.3966*				
MTB	0.0972*	0.1225*	0.0025	-0.0486	0.3457*			
Investment expenditure	0.1951*	0.2614*	0.1337*	-0.1267*	0.2473*	0.2614*		
Business risk	-0.0225	-0.2898*	-0.1491*	0.0852*	-0.1645*	0.1247*	-0.0507	
Sales growth	-0.0951*	0.0411	0.0127	0.0181	0.0715	0.1117*	0.0751*	0.0540
Cash	-0.0904*	0.0656	-0.0708*	-0.0465	0.1017*	0.1093*	0.0086	-0.0032
Age	0.0325	-0.0788*	0.0258	0.0022	-0.1243*	-0.1403*	-0.1274*	0.0338
Ownership	-0.1687*	-0.0033	-0.1632*	-0.1345*	0.0676	-0.0685	0.0257	-0.0719
Efficiency	-0.0178	0.0313	-0.0922*	0.1744*	0.1397*	0.1032*	0.0661	-0.0479
Accruals	-0.0697	-0.3512*	-0.1295*	0.2998*	-0.3026*	0.1690*	0.0362	0.1251*
Industry CER	0.6593*	0.0031	0.1617*	0.1374*	-0.1444*	0.0557	0.0474	-0.0097

Variables	Sales growth	Cash	Age	Ownership	Efficiency	Accruals
Cash	0.0130					
Age	-0.1656*	-0.0496				
Ownership	-0.0326	-0.0735*	-0.1638*			
Efficiency	0.1504*	0.2366*	-0.0668	-0.1018*		
Accruals	-0.0197	0.0061	0.0230	-0.1189*	0.0020	
Industry CER	-0.1236*	-0.0788*	0.0085	-0.1134*	0.0030	0.0299

Note: This table provides correlation coefficients among variables used in the empirical analysis. Variable definitions are in 〈Appendix Table 1〉.
* means at least five percent significance level.

2. Regression results

1) Main result

This study analyzes whether the hypothesis is supported through multivariate regression analysis by controlling for firm characteristics. We use the fixed-effect model as an analysis considering the panel data sample. In particular, this model has the advantage of pre-controlling unobserved time-varying firm characteristics through firm fixed effects (λ_i), which alleviates endogenous problems based on the convenience of missing variables. As another panel data analysis method, unlike the fixed effect model, the random effect model reflects unobservable firm characteristics in the error term. We perform the Hausman test to choose between the fixed-effect model and the random-effect model. In our model, the statistics for this test was 96.06. We can reject the null hypothesis that there is no correlation between the independent variable and the random effect. It supports the use of the fixed-effect model. Petersen (2009) argued that the fixed effect model could be an alternative to optimizing the sample characteristics in empirical analysis in corporate finance. The paper also argued that the fixed-effect model could proactively control various statistical errors. Also, the analysis results using this model have the advantage of reflecting the dynamic effect by capturing the change in credit rating according to the change in CER activity in a specific company. Further, we added the year fixed-effect (η_t) to the model. The year fixed-effect controls the effects of the changes in the credit rating due to the changes in the economic environment and market conditions. Finally, we use the company-level clustered standard error to verify statistical significance. The purpose is to mitigate potential heteroscedasticity and autocorrelation

problems. The empirical analysis model is in Equation (1) below.

$$\text{Credit rating}_{it} = \beta_0 + \beta_1 * \text{CER}_{it}(\text{or } \Delta \text{CER}_{it}) + \beta_2 * \text{Size}_{it} + \beta_3 * \text{Leverage}_{it} + \beta_4 * \text{EBIT}_{it}$$
$$+ \beta_5 * \text{MTB}_{it} + \beta_6 * \text{Investment expenditure}_{it} + \beta_7 * \text{Business risk}_{it}$$
$$+ \beta_8 * \text{Sales growth}_{it} + \beta_9 * \text{Cash}_{it} + \beta_{10} * \text{Age}_{it} + \beta_{11} * \text{Ownership}_{it}$$
$$+ \lambda_i + \eta_t + \varepsilon_{it} \qquad\qquad\qquad \text{Equation (1)}$$

Model (1) of 〈Table 4〉 presents the results from the fixed-effect model. We will verify our main null hypothesis through the results. The coefficient of the CER activity index ($\text{CER}_{\text{Total}}$) is significantly positive within one percent level. These results indicate that the more active companies are in CER activities, the higher the credit rating. The result suggests that CER activities have a significant effect on satisfying debtholders' interests by reducing bankruptcy risk. Also, it means that CER activities can be an effective management strategy. The CER activities not only contribute to the sustainability of management activities but also facilitates external financing. Therefore, the empirical analysis results of this study support hypothesis 1 (risk mitigation view). Furthermore, there is little concern that CER activities may be abused by managers or controlling shareholders for the overinvestment problem. Recent studies have identified the positive effects of CER activity from the shareholders' point of view. So, the empirical analysis results show that the CER activity can be a means of satisfying both debtholder's and shareholder's interests. Also, the theory suggests that CER activities can meet both shareholder and stakeholder theories at the same time by bringing them together. As a control variable, the size of a company (Size) has a positive effect and the leverage (Leverage) has a negative effect. Market recognize large corporations for their sufficient sales competitiveness. Also, we can interpret

the expansion of debt as a result of reducing the default distance and increasing bankruptcy risk.

〈Table 4〉 Impact of CER Activities on Credit Rating

Variables/Models	Model (1)	Model (2)
Constant	-54.2233*** [-3.13]	-40.8694* [-1.96]
CER_{Total}	1.1658*** [3.02]	
$\Delta\ CER_{Total}$		1.0859** [2.32]
Size	3.3792*** [4.16]	3.0470*** [3.10]
Leverage	-6.0156*** [-4.38]	-5.7557*** [-3.65]
EBIT	-0.8261 [-0.45]	-0.8344 [-0.33]
MTB	0.0965 [0.72]	0.1362 [0.94]
Investment expenditure	2.0422 [1.60]	0.3867 [0.36]
Business risk	-2.7297 [-1.40]	-0.2360 [-0.08]
Sales growth	0.2123 [0.55]	-0.1184 [-0.29]
Cash	0.7202 [0.62]	0.0219 [0.02]
Age	0.0130 [0.01]	-1.8399* [-1.71]
Ownership	-0.4920 [-1.02]	-0.3211 [-0.68]
Year fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
N	716	537
R^2	0.2866	0.3122

Note: The table provides the results of the effect of CER activity on the credit rating from the fixed effect model of panel data analysis. Variable definitions are in 〈Appendix Table 1〉. Z-statistic is in the bracket based on firm-level clustered standard error. ***, **, * represents one, five, and ten percent significance level, respectively.

In addition to the level of CER activity, change of it can also have an impact on credit rating decisions. In particular, the analysis considering changes in

CER activity implies a dynamic effect, as it contains information on whether the determination of credit rating immediately reflects short-term improvements in CER activity. This discussion raises the need to analyze the effects of improved CER activity levels on the credit rating index. Models (2) present the results of this analysis.

The coefficient of change of the CER activity index (ΔCER$_{Total}$) has a significantly positive effect on the credit rating index. This result suggests that credit rating decisions reflect the dynamic changes in CER activity. Also, it means that CER activity matters both static and dynamic in determining a credit rating.

2) Endogeneity test: 2SLS approach

Concerns about endogeneity issues based on reverse causality may arise between CER activity and the credit ratings. Companies with high credit ratings can afford CER activities costs (Jiraporn, Jiraporn, Boeprasert and Chang 2014; Cai, Cui and Jo 2016). Therefore, the two-stage least squares approach is used as an alternative to alleviate this endogeneity problem. Model (1) of ⟨Table 5⟩ presents the results of the first stage model. We use the industry average CER activity index as the instrumental variable. The coefficient of the industry average CER activity index (Industry CER) appears to have a significant positive value at the one percent level.[1] This result means that it has sufficient explanatory power as an instrumental variable. The coefficient of the CER activity index (CER$_{Total}$) of model (2) has a significantly positive value. These results suggest that the main results of this study are not based on the reverse

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1) We estimate the F-statistic of the first-stage model in this study to verify the adequacy of the instrumental variable. The F-statistic is 108.89. It is a strong instrumental variable because the statistic was greater than 10 (rule of thumb).

causality, but can be generalized with robustness.

〈Table 5〉 Endogeneity Test: 2SLS

Variables/Models	1 stage	2 stage
	Model (1)	Model (2)
Constant	1.5831*	−57.4030***
	[1.96]	[−7.14]
Industry CER	0.9429***	
	[8.87]	
CER_{Total} (predicted)		2.1287**
		[2.00]
Size	−0.0682*	3.4474***
	[−1.94]	[10.10]
Leverage	0.0608	−6.1043***
	[0.72]	[−7.59]
EBIT	−0.0181	−0.8231
	[−0.16]	[−0.76]
MTB	−0.0098	0.1070
	[−1.19]	[1.36]
Investment expenditure	−0.0640	2.0894
	[−0.44]	[1.50]
Business risk	0.0670	−2.7114*
	[0.40]	[−1.71]
Sales growth	0.0148	0.2017
	[0.29]	[0.42]
Cash	−0.0127	0.8692
	[−0.09]	[0.67]
Age	−0.0133	0.1388
	[−0.12]	[0.13]
Ownership	0.0592	−0.5680
	[1.38]	[−1.37]
Year fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
N	716	716
R^2	0.7617	0.2779

Note: This table provides 2SLS estimation results of CER activity on credit rating. Industry CER used in the first stage estimation is the instrumental variable of CER_{Total}. Variable definitions are in 〈Appendix Table 1〉. Z-statistic is in the bracket. ***, **, * represents one, five, and ten percent significance level, respectively.

3) Sub-indices of CER activities

We classified the CER activities index into various subindices. This study provides a detailed path of the main results by further analyzing which subindices have a significant impact on credit ratings. ⟨Table 6⟩ shows the effect of a variable that divides CER activity into five subindices on credit rating. The coefficients of subindices of CER activity in models (1), (2), (3), and (4) have a positive value. Specifically, the coefficients of $CER_{Strategy}$ in model (1) and $CER_{Performance}$ in model (4) have relatively high statistical significance and marginal effects. These findings suggest that debtholders consider the systematic strategy and management's commitment to the effective implementation of CER activities important. Also, it is important to derive performance that debtholders can visualize. These results were attributed to the characteristics of CER activities. Firms should pursue CER activities continuously as the long-term investment means rather than short-term investment means. We cannot recognize the results of these CER activities easily because we do not visualize them as quantitative information in the short term.

⟨Table 6⟩ Impact of Sub-categories of CER on Credit Rating

Variables/ Models	CER= $CER_{Strategy}$	CER= $CER_{Organization}$	CER= $CER_{Management}$	CER= $CER_{Performance}$	CER= $CER_{Response}$
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Constant	-53.9216***	-53.4227***	-53.0221***	-51.2010***	-52.3731***
	[-3.15]	[-3.02]	[-3.07]	[-3.00]	[-3.08]
CER	0.8596***	0.4036*	0.4745*	1.1725**	0.3131
	[3.12]	[1.66]	[1.71]	[2.39]	[1.51]
Size	3.3573***	3.3608***	3.3356***	3.2935***	3.3245***
	[4.19]	[4.04]	[4.10]	[4.08]	[4.14]
Leverage	-5.9012***	-5.9650***	-5.9525***	-5.9801***	-6.0206***
	[-4.30]	[-4.30]	[-4.29]	[-4.39]	[-4.31]
EBIT	-0.7770	-0.8870	-0.8738	-0.7364	-0.7429
	[-0.43]	[-0.48]	[-0.48]	[-0.40]	[-0.41]
MTB	0.0998	0.0791	0.0914	0.0810	0.0945
	[0.76]	[0.59]	[0.69]	[0.61]	[0.71]
Investment expenditure	2.1486*	1.9366	2.0426	1.8596	1.9867
	[1.66]	[1.54]	[1.60]	[1.52]	[1.57]
Business risk	-2.6219	-2.7012	-2.8229	-2.8211	-2.6035
	[-1.30]	[-1.38]	[-1.44]	[-1.49]	[-1.34]
Sales growth	0.1741	0.2079	0.2374	0.2785	0.1779
	[0.45]	[0.54]	[0.60]	[0.69]	[0.46]
Cash	0.6214	0.6974	0.6293	0.5167	0.6286
	[0.54]	[0.58]	[0.54]	[0.44]	[0.53]
Age	0.0234	-0.0494	-0.0263	-0.2821	-0.1294
	[0.02]	[-0.04]	[-0.02]	[-0.23]	[-0.11]
Ownership	-0.4889	-0.4730	-0.4317	-0.4080	-0.4357
	[-1.03]	[-0.97]	[-0.91]	[-0.82]	[-0.92]
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
N	716	716	716	716	716
R^2	0.2912	0.2780	0.2772	0.2824	0.2783

Note: The table provides the results of the effect of the sub-categories of CER activity on the credit rating from the fixed effect estimation of panel data analysis. Variable definitions are in ⟨Appendix Table 1⟩. Z-statistic is in the bracket based on firm-level clustered standard error. ***, **, * represents one, five, and ten percent significance level, respectively.

4) Path of the main result

This study determines whether the relationship between CER activity and the credit rating index is observed mainly in companies with certain firm characteristics, and determines which benefits of this activity lead to a reduction in bankruptcy risk. As mentioned earlier, according to existing studies, CER activities are associated with risk management, growth opportunities, management efficiency, and agency costs. This study separates the sample based on the median values of proxies for risk management (Business risk), growth opportunities (Sales growth), management efficiency (Efficiency), and agency costs (Accruals), and runs separate regressions to investigate the relationship between CER activity and credit rating in each sample. Based on this, we first confirm whether there is a difference in the relationship between the two depending on certain firm characteristics. Next, it will be possible to infer whether CER activity influences to reduce bankruptcy risk in some way based on whether the bilateral relationship is strongly observed in any sample separated according to the median values of Business risk, Sales growth, Efficiency, and Accruals.

Model (1) and (2) of 〈Table 7〉 are the results using the separated sample according to the median value of Business risk. The coefficient of the CER activity index has a significantly positive value in both models, and the difference between the two models is not large. Model (3) and (4) are the results using separated samples based on the median value of Sales growth. Similar to the analysis for Business risk, there is no big difference in the coefficient of the CER activity index. Model (5) and (6) present the results using separated samples based on the median value of Efficiency. This also does not show a large difference in the coefficient of the CER activity index

between the two models. Model (7) and (8) are the result of the analysis using separated samples based on the median value of Accruals. We use Accruals as the proxy for the agency cost. In model (7) using samples with large discretionary accruals, the coefficient of the CER activity index is significantly positive. On the other hand, in the sample with relatively small discretionary accruals (model (8)), the coefficient of the CER activity index does not have a significant effect on the credit rating. Based on these differences, we can infer that agency costs level can be a major factor in inducing the relationship between CER activities and credit ratings. The relationship between the two parties is observed strongly in companies with large information asymmetry. The result suggests that CER activities contribute to the bankruptcy risk reduction of the firms with serious agency problems. Based on this, we can conclude that CER activities are effective investment means to prevent agency problems in advance,[2] and as a result, they are improving credit rating through a reduction in bankruptcy risk.

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2) Further, this study conducted the additional analysis using whether or not a firm belonging to a chaebol business group and ownership-control disparity as proxies for the corporate governance structure. We confirm that our results are stronger in chaebol firms or firms with high ownership-control disparity. The results are consistent with our argument.

⟨Table 7⟩ Path of the Main Result

Variables/Models	Business risk>Median Model (1)	Business risk≤Median Model (2)	Sales growth >Median Model (3)	Sales growth ≤Median Model (4)	Efficiency >Median Model (5)	Efficiency ≤Median Model (6)	Accruals >Median Model (7)	Accruals ≤Median Model (8)
Constant	-71.8797**	-48.2104**	-58.5112***	-50.6574*	-50.3736	-55.5243***	-70.7727***	3.4212
	[-2.15]	[-2.20]	[-2.94]	[-1.74]	[-1.59]	[-3.74]	[-2.69]	[0.36]
CER_{Total}	1.1944*	1.0005**	1.1372*	1.3331**	1.3200**	0.9246**	1.5044***	-0.0480
	[1.73]	[2.15]	[1.97]	[2.07]	[2.22]	[2.14]	[2.61]	[-0.11]
Size	3.9070***	3.3789***	3.5820***	3.1030**	3.4300**	3.1558***	4.5729***	0.6283
	[2.67]	[3.10]	[3.71]	[2.41]	[2.24]	[4.74]	[3.62]	[1.46]
Leverage	-7.0415***	-9.3180***	-8.6199***	-4.7401**	-6.4030***	-6.6437***	-6.2980***	-2.7441***
	[-3.60]	[-3.66]	[-3.98]	[-2.38]	[-2.73]	[-3.61]	[-3.35]	[-2.80]
EBIT	-1.7171	-0.4089	-1.9504	4.0513	-0.7917	-0.3472	-1.3275	-5.5838***
	[-0.72]	[-0.12]	[-0.83]	[1.18]	[-0.24]	[-0.16]	[-0.53]	[-2.92]
MTB	0.0411	0.2369	0.0671	0.1515	0.0572	0.2954**	0.2325	0.0978
	[0.20]	[1.42]	[0.47]	[0.74]	[0.34]	[2.23]	[1.22]	[1.07]
Investment expenditure	0.2264	2.3338	1.8390	0.8034	4.7060*	-0.3119	1.5685	2.8208**
	[0.16]	[1.17]	[1.20]	[0.42]	[1.92]	[-0.23]	[0.73]	[2.15]
Business risk	-0.7965	-14.6837*	1.6982	-3.7843	-5.4521	-0.0931	-1.3208	-7.3184*
	[-0.21]	[-1.74]	[0.39]	[-1.52]	[-1.23]	[-0.06]	[-0.57]	[-1.89]
Sales growth	0.0009	1.0946	0.6638	1.6931	-0.3358	0.5666	-0.4982	0.7762*
	[0.00]	[0.97]	[1.59]	[0.85]	[-0.35]	[1.35]	[-0.67]	[1.84]

Cash	3.5571*	-2.3390*	-0.3987	0.0448	-0.1339	3.5363**	-2.0926	0.6294
	[1.79]	[-1.75]	[-0.25]	[0.02]	[-0.09]	[2.22]	[-0.97]	[0.48]
Age	2.0756	-1.3230	0.2694	0.2654	-1.2234	1.2935	-2.4742	-0.0078
	[0.90]	[-1.06]	[0.14]	[0.16]	[-0.50]	[1.13]	[-1.48]	[-0.01]
Ownership	-0.6444	-0.5580	-0.3525	-0.9484	-0.4432	-0.0798	-1.1922	-0.1496
	[-0.68]	[-0.71]	[-0.87]	[-1.31]	[-0.56]	[-0.21]	[-1.38]	[-0.62]
Firm&Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	339	377	358	358	367	349	374	342
R^2	0.2864	0.4038	0.3143	0.3323	0.2289	0.3991	0.4130	0.2758

Note: The table provides the results of the effect of CER activity on the credit rating from the fixed effect estimation of panel data analysis by dividing the sample by Business risk, Sales growth, Efficiency, and Accruals. Variable definitions are in ⟨Appendix Table 1⟩. Z-statistic is in the bracket based on firm-level clustered standard error. ***, **, * represents one, five, and ten percent significance level, respectively.

V. Conclusion

While all-around efforts to expand the sustainability of the nation and society are being implemented through environmental preservation, academic reviews on the benefits of CER activities are insufficient. In particular, since conflicting claims for CER activities are being raised theoretically, we need active empirical review. Also, existing studies focus on the effect of CER activities on shareholders' wealth under shareholder theory, and it is hard to find a review of stakeholders. This study empirically examines the effects of CER activities on firms' credit ratings in Korea. Korea is one of the emerging countries.

From the empirical results, companies that actively implement CER activities receive a good credit rating. In particular, this effect was able to identify the main path that appears to be more prominent in the company's excellent pre-strategy and post-performance for CER activities. The results of this study mean that CER activities have the effect of reducing potential management risks, especially bankruptcy risks. Specifically, it suggests CER activities as a means of risk management to effectively control bankruptcy risk even from debtholder's perspective, who do not hold high-risk incentives like shareholders. Also, the main analysis results largely come from companies with large agency costs. These results suggest that CER activities are meeting the interests of debtholders as a way to reduce the likelihood of potential agency problems.

This study provides policy and practical implications. From a policy point of view, it will contribute to effectively promoting CER activities as an alternative to solving environmental problems. The results of this study imply that investors (especially creditors) consider CER activities when making

investment decisions. In other words, this suggests that CER activities in the capital market are being fully evaluated (or recognized). Therefore, we expect people to use CER activities as basic data to examine the possibility of creating the financial instrument market related to CER activities. The idea has recently received increasing interest in the capital markets of emerging countries. The results of this study also suggest that active implementation of CER activities can reduce the risk premium in financing by reducing bankruptcy risk. Therefore, policymakers will be able to secure the justification for introducing related regulations and systems by presenting the benefits of CER activities to companies, such as reducing financing costs.

From a company's practical point of view, the results of this study imply that we can use CER activities as a means to satisfy the interests of stakeholders. We can also use CER activities as an efficient management strategy. In particular, this suggests that CER activities have the effectiveness of the strategic perspective of corporate financing and disclosure. For example, in the case of companies with large external financing restrictions due to high information asymmetry, CER activities may be expanded as a strategy to resolve these restrictions.

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Appendices

⟨Appendix Table 1⟩ Definition of Variables

Variables	Definition
CER_{Total}	An index that converts the Korea Corporate Governance Service's environmental responsibility activity rating score by the company by one point
$\Delta\ CER_{Total}$	Changes in CERTotal compared to the previous year
$CER_{Strategy}$	An index that converts the strategy item of the Korea Corporate Governance Service's environmental responsibility activity rating score by the company by one point
$CER_{Organization}$	An index that converts the organization item of the Korea Corporate Governance Service's environmental responsibility activity rating score by the company by one point
$CER_{Management}$	An index that converts the management item of the Korea Corporate Governance Service's environmental responsibility activity rating score by the company by one point
$CER_{Performance}$	An index that converts the performance item of the Korea Corporate Governance Service's environmental responsibility activity rating score by the company by one point
$CER_{Response}$	An index that converts the stakeholder response item of the Korea Corporate Governance Service's environmental responsibility activity rating score by the company by one point
Credit rating	The index set based on the lowest grade of corporate bond credit rating announced by Korea Credit Rating, Korea Enterprise Rating, and NICE Credit Rating (AAA+=22, D=1)
Size	The value of natural log on total assets
Leverage	Total debt divided by total assets
EBIT	Operating income divided by total assets
MTB	The market value of equity divided by the book value of equity
Investment expenditure	R&D expense and capital expenditure divided by total assets
Business risk	The standard deviation of ROA for the past five years
Sales growth	The average sales growth rate for the past five years
Cash	Cash and cash equivalent divided by total assets
Age	The value of natural log on firm age
Ownership	The sum of ownership of controlling shareholders and relatives
Efficiency	Sales divided by total assets
Accruals	The absolute value of the difference between cash flow in business activities compared to total assets and net income compared to total assets
Industry CER	Industry average CERTotal based on the two-digit classification code from Korean Standard Industry Code

〈Appendix Table 2〉 Korea Corporate Governance Service's Environmental Responsibility Activity Rating Index

Classification	Points (%)	Main Content
Environmental Strategy	45(15.0)	- Establishment of environmental strategies and policies - Percentage of environmental investment planning and implementation, etc.
Environmental Organization	30(10.0)	- Review of environmental management activities within the board of directors - Company-wide decision-making and practical organizations for environmental management - Regular practice of environmental education, etc.
Environmental Management	115(38.4)	- Establishment of the environmental performance evaluation system and cooperation with employee compensation - Management of greenhouse gas emission activities - Chemical management - Supplier management (Review of environmental management situation, the establishment of the evaluation management system, and provision of education and support) - Green purchase policy and system - Investment in facilities in the last five years (Greenhouse gases, energy, water, waste), etc.
Environmental Performance	85(28.3)	- Reduction of greenhouse gas emissions, energy usage, water use, waste emissions and hazardous chemical emissions, etc.
Stakeholder Response	25(8.3)	- Communication programs with stakeholders - Disclosure of environmental information and external verification - Support and cooperation in environmental conservation activities of the community - Join a international initiative, etc.
Total	300(100)	-

요 약

본 연구는 기존 연구가 주목하는 주주의 관점이 아닌, 채권자의 관점에서 기업의 환경적 책임 활동의 편익을 파악한다. 이를 위해, 대표적 신흥국가인 한국의 상장기업을 대상으로 환경적 책임 활동이 신용등급에 미치는 효과를 실증적으로 확인한다. 분석결과, 적극적으로 환경적 책임 활동을 이행하는 기업은 높은 신용등급을 부여 받는 것으로 나타났다. 이러한 효과는 환경적 책임 활동을 구성하는 다양한 요인 중 전략과 성과 부문이 개선될 경우 주로 관찰되었다. 한편, 본 연구의 주요 결과는 대리인비용이 높은 기업에서 주로 관찰되었다. 이는 환경적 책임 활동이 사전적으로 경영자의 사적이익 추구 유인의 확대 가능성을 축소시키는 경로로 채권자의 이해를 충족시키고 있음을 시사한다. 이상의 결과들은 신흥국가에서 환경적 책임 활동이 기업의 잠재적 위험을 통제하는 수단으로 간주되어 채권자의 이해에 부합하는 효과를 가짐을 의미한다.

※ **국문 색인어:** 기업의 환경적 책임, 신용등급, 파산위험, 위험관리, 한국