環境支出は企業リスクを軽減するのか？日本企業の実証分析

Does Environmental Spending Reduce Firm Risk? Evidence from Japanese Companies

ナジール・ユスラ
NAZIR YUSRA

岡山大学大学院社会文化科学研究科紀要
第61号　2026年３月　抜刷
Journal of Humanities and Social Sciences
Okayama University Vol.61 2026

Does Environmental Spending Reduce Firm Risk? Evidence from Japanese Companies

Yusra Nazir
Okayama University Japan

Abstract

This study examines how environmental conservation costs (ECC) affects firm risk, using changes in leverage ratios and earnings volatility as stand-ins for risk. This study evaluates the direct impact of ECC and its relationship to profitability (ROA) using panel data of Japanese companies from 2010 to 2022 and Pooled OLS regression models. The results demonstrate the risk-mitigating function of sustainability investments by showing that, although independent ECC have little direct significance, their interaction with firm profitability dramatically lowers earnings volatility and leverage instability. These findings underscore the economic value of environmental strategies, suggesting that incorporating profitability considerations into sustainability practices enhances operational stability and reduces risk exposure. To help policymakers, investors, and corporate managers strike a balance between sustainability and financial performance, this study contributes to the growing body of research on the relationship between the environment and finance.

Key words: Environmental Accounting, Environmental Conservation Costs, Firm Risk, Earnings Volatility, ESG, and Risk Management Leverage Ratio, Sustainability, Panel Data, Japanese Companies

1. Introduction

Environmental sustainability has emerged as a strategic issue instead of a peripheral one in business management. In the last decade, businesses have embraced environmentally friendly practices, not just due to legal pressure but also to minimize business risk along with delivering long-term value. Environmental expenditures, the systematic measurement along with reporting of environmental cost, is at present a most prominent paradigm for measuring corporate environmental performance (Burritt & Schaltegger, 2010). But whether or not such investments reduce firm-specific financial risks is an open, along with an untested question, especially for the scenario of Japanese firms. For sustainable management and policy evaluation in Japan, where corporate disclosure rules are highly institutionalized, it is crucial to accurately determine how environmental investments translate into operational efficiency and risk reduction.

Environmental Conservation Cost (ECC) is a multifaceted set of expenses (including pollution prevention, resource circulation, energy conservation, research and development, social environmental activities, and remediation) that are reported under standardized frameworks like the Ministry of the Environment, Japan (MOEJ) Environmental Accounting

Matrix. ECC is not a single "cost" item. Because of this, ECC records operating and investment costs that demonstrate companies' real financial dedication to environmental management (Nakao et al., 2007). ECC offers a thorough view of a company's operational commitment and environmental strategy by combining these expenses. ECC directly records the allocation of tangible resources toward environmental betterment, as contrast to ESG indexes, which are perception-based. Therefore, analyzing ECC provides a more trustworthy measure of operational discipline, financial prudence, and managerial intent.

This study's theoretical foundation is solely based on Dynamic Capability Theory (DCT), rather than the Resource-Based View. According to DCT, firms can attain and sustain superior performance by continuously identifying opportunities and threats, seizing opportunities through investment and organizational change, and reconfiguring/transforming assets and routines to remain competitive in changing environments (Barney, 1991; Eisenhardt & Martin, 2017; Teece, 2007; Teece et al., 1997). DCT focuses on the capacity to dynamically perceive, grasp, and reorganize valuable resources in response to changes in the market and environment. Therefore, environmental activities can improve a company's ability to innovate and adapt when they are properly assessed and visualized using ECC, turning sustainability into an operational advantage rather than a regulatory burden.

In particular, this study contend that the systematic measurement and disclosure of ECC boosts the seizing mechanism of dynamic capacities by improving managerial visualization of environmental activities and costs. According to Teece (2018) and Ambrosini and Bowman (2009), visualization is the process of converting scattered environmental activities into quantifiable, comparable, and timely information that managers can use to detect efficiency gaps, prioritize investments, and allocate resources to eco-innovation. ECC helps lower operational and regulatory uncertainty, which stabilizes profitability and mitigates changes in capital structure by enhancing the firm's capacity to take advantage of opportunities (such as energy savings, waste reduction, or process innovation) (Francis et al., 2005; Teece, 2007).

Extant studies relate high sustainability behaviors with lower cost of capital and steadier performance, especially in times of recession (Eccles, 2014; Lins et al., 2017; Sharfman & Fernando, 2008), and illustrate that higher reporting quality and transparency reduce earnings volatility (Francis et al., 2005). Interestingly, Japanese data demonstrate that actual environmental expenditures—rather than general ESG scores—are associated with improved financial performances, which supports the decision-usefulness of environmental expenditures measures (Nakao et al., 2007; Nuzula, 2018). Together, these mechanisms imply that EA should reduce firm risk in the form of lower earnings volatility and less extreme leverage corrections (Friede et al., 2015).

While a significant body of research explores the relationship between profitability and ESG/sustainability (Busch & Lewandowski, 2018; Clarkson et al., 2011), relatively few studies examine how actual environmental spending affects firm risk metrics such as earnings volatility (EVOL) and leverage adjustments (Haque & Ntim, 2018). Additionally, a significant amount of prior research employs perception-based metrics or ESG indices, which may conflate substantive investment with disclosure quality (Friede et al., 2015; Luo & Liao, 2023). According to Schumacher et al. (2022) and Billio et al. (2021), the reporting and regulatory environment in Asia, and Japan specifically, is evolving, making the use of standardized accounting disclosures essential.

To address these gaps, this study investigates whether ECC, which are computed from sustainability/environmental reports using the MOEJ Environmental Accounting Matrix, are associated with lower company risk among Japanese enterprises. We focus on two dimensions of risk: (i) changes in the leverage ratio as an indicator of financing fragility and capital structure modifications, and (ii) earnings volatility (EVOL) as a measure of income instability. Higher ECC is thought to reduce both EVOL and severe leverage adjustments by improving managerial visibility and enabling effective seizing and reconfiguring activities. By doing this, the study contributes to a more advanced knowledge of how environmental investments might function as dynamic capabilities that enhance operational efficiency and financial resilience—issues that are becoming increasingly important during global sustainability transitions.

Figure: 1 Environmental Accounting Matrix

Environmental Conservation Cost − Categories Corresponding to Business Activities −				
Category		Key Activity and the Outcome	Investment	Cost
(1) Business Area Cost				
Breakdown	(1)-1 Pollution Prevention Cost			
	(1)-2 Global Environmental Conservation			
	(1)-3 Resource Circulation Cost			
(2) Upstream/Downstream Cost				
(3) Administration Cost				
(4) R&D Cost				
(5) Social Activity Cost				
(6) Environmental Remediation Cost				
(7) Other				
Total				

Under the MOEJ Environmental Accounting Matrix, businesses must disclose business-area costs (such as pollution prevention, global environmental conservation, and resource circulation), upstream/downstream costs, administration costs, R&D costs, social activity costs, environmental remediation costs, and other costs (MOEJ, 2005). In line with earlier Japanese studies (Nakao et al., 2007; Qian et al., 2011), this study construct main explanatory variable as total ECC scaled by total assets to reflect the firm's true financial commitment to environmental activities and to ensure comparability across enterprises and across time.

Environmental cost data was manually compiled using MOEJ classifications from annual environmental and sustainability reports. Under DCT, this combined ECC serves as a managerial information system that makes sensing, seizing, and changing easier. It provides the basis for organizational and process improvements (transforming), enables prioritization and investment decisions (seizing), and makes environmental challenges visible (sensing) (Teece, 2007, 2018).

This study makes three contributions to the literature. First, by employing firm-level ECC data rather than perception-based ESG rankings, it offers a more precise indicator of environmental investment. Second, it shifts the empirical focus from profitability to firm risk, an outcome that has gotten less attention but is highly significant to managers and regulators. Third, it provides data from Japan, where standardized environmental accounting reporting enables comparable, high-quality measurements of environmental spending.

Numerous empirical investigations bolster the viability of this study theories. Strong Corporate social responsibility engagement is linked to lower earnings volatility, according to Haque and Ntim (2018); environmental risk management is linked to lower capital costs, according to Sharfman and Fernando (2008); firms with higher social capital are more resilient in times of crisis, according to Lins et al. (2017); and higher disclosure quality lowers earnings volatility, according to Francis et al. (2005). Building on these results, this study investigates whether ECC serves as a dynamic capability that lowers firm risk in Japanese firms as a quantifiable and disclosure-based measure of environmental investment.

The rest of the paper proceeds in this manner. In Section 2, hypotheses based on DCT are developed and the literature is evaluated. Section 3 explains the data, variables, and empirical methodology. Section 4 presents the empirical findings. Section 5 discusses robustness checks and their implications. The conclusion of Section 6 includes suggestions for further research and policy.

2. Literature review

The nexus of corporate environmental responsibility and firm risk has become an important field of research, particularly in light of increasing stakeholder pressures and environmental legislation. Historically, environmental spending has been viewed as non-productive expenditures; however, an increasing body of literature indicates that these investments can serve as strategic levers to reduce multiple forms of financial risk (Busch & Lewandowski, 2018; Clarkson et al., 2011). This changing perspective underlies the investigation into the impact of ECC—namely, firm-level spending on environmental protection—on firm-specific risk, specifically EVOL and changes in the leverage ratio. While EVOL, or profitability fluctuation over time, is occasionally used as a stand-in for operational instability, leverage volatility assesses vulnerability to financing risk and changes in capital structure.

Empirical studies establish that firms that undertake proactive environmental strategies experience fewer volatile earnings. Haque and Ntim (2018), for instance, demonstrate that firms with high performance on ESG dimensions have more stable earnings streams, which translates to lower sensitivity to exogenous shocks. Francis et al. (2005) also note that greater transparency through sustainability disclosures enhances the quality and predictability of earnings. Lins et al. (2017) also find evidence that firms with good CSR practices, particularly during economic crises, have higher financial resilience and lower downside risk—implications that support the contribution of environmental investments in earnings stabilization.

A second crucial yet less researched aspect of risk is volatility in leverage ratios, reflecting adjustments in a firm's financial structure. Companies with unstable leverage tendencies are typically more susceptible to distress, particularly under circumstances of revenue shocks or rising interest rates. Sharfman and Fernando (2008) found that companies adopting robust environmental risk management strategies can reduce their cost of capital, thereby enabling more stable debt structures. Supplementing this, Bae et al. (2018) note that CSR-minded companies generally have lower levels of financial leverage, implying more conservative and risk-averse capital management. These studies suggest that environmental expenditures have an indirect effect on financial risk by improving the firm's relationship with capital markets and reducing its dependence on volatile financing channels.

Despite these observations, the literature often relies on ESG scores or reputational indices as proxies for environmental behavior. Although revealing, such measures are inherently subjective and may not accurately capture actual financial investments in environmental sustainability (Friede et al., 2015). Therefore, recent research emphasizes the need for accounting-based metrics, such ECC, that capture concrete environmental investments made at the business level and enable more accurate, policy-relevant inference (Billio et al., 2021; Sahin et al., 2022). According to (Nuzula, 2018) and (Nakao et al., 2007), studies that use disaggregated, firm-reported environmental costs (such as spending on energy efficiency, pollution abatement, and resource recycling) find more complex and robust relationships with financial outcomes than those that use aggregated ESG scores.

This work focuses on ECC as a specific accounting-based indicator of environmental commitment, in contrast to earlier research that employs broad ESG proxies. ECC metrics track both operations and investment expenses across several categories and are reported under standardized frameworks (such as the MOEJ Matrix)(MOEJ, 2005). This level of detail allows us to see the relationship between corporate risk and tangible environmental expenditures as opposed to perception-based reputational indicators.

This study's theoretical foundation is entirely based on DCT. According to DCT (Teece, 2007; Teece et al., 1997), a firm's ability to continuously sense changes in its environment, seize opportunities through deliberate investments, and reconfigure resources and routines to sustain performance under shifting conditions is what gives it a competitive advantage. ECC has two functions within this framework: (i) it is an input that reflects the distribution of resources for environmental initiatives; and (ii) the systematic measurement and disclosure of ECC generates managerial visualization, transforming scattered environmental activities into timely, comparable, and quantifiable data. By making environmental costs visible, managers can prioritize eco-innovation, identify efficiency gaps (such as energy waste), and allocate resources to projects that have both financial and environmental benefits. This visualization capability directly improves the seizing process (Ambrosini & Bowman, 2009; Teece, 2018). As a result, ECC operates as a dynamic capability under DCT, improving sensing (through better monitoring), seizing (through more informed investment decisions), and reconfiguring (through operational adjustments), all of which combined lower the operational and financing risks for businesses. By reducing information asymmetry and decision frictions, ECC-driven visualization facilitates prompt managerial responses that convert environmental spending into more stable earnings and steadier leveraging behavior.

Japan offers a very informative setting to assess these practices because the MOEJ Environmental Accounting Matrix provides specified disclosure categories that improve comparability between firms and time(Nakao et al., 2007; Qian et al., 2011). Prior Japanese studies that employ accounting-based ECC data and found positive correlations between actual environmental expenditures and financial success support the importance of accounting measures over reputation-based proxies (Nakao et al., 2007; Nuzula, 2018). Building on this evidence, we use manually collected ECC data from businesses' sustainability reports to specifically evaluate whether accounting-based environmental investments reduce EVOL and leverage adjustments.

This focus on firm risk and ECC fills two gaps in the research. First, the causal relationship between actual environmental expenditures and firm risk outcomes has gotten less attention than profitability results. Second, whereas a lot of prior research relies on composite ESG metrics, this study accounting-based approach facilitates the identification of the financial mechanisms—such as managerial visualization and competency building—through which environmental investments impact risk. Closing these gaps is essential for managers and policymakers seeking evidence-based guidance on the financial worth of environmental investment, as well as for capital-market players assessing business stability throughout sustainability transitions.

This study proposed the following hypotheses using the DCT lens and the literature:
H1: There is an inverse relationship between EVOL and ECC, indicating that a greater ECC reduces operational risk.

H2: There is an inverse relationship between changes in the leverage ratio (ΔLEVERAGE) and ECC, which means that a greater ECC reduces financing fragility and stabilizes capital structure.

H3: More profitable firms have a stronger negative correlation between ECC and firm risk (EVOL and ΔLEVERAGE), suggesting that firms with higher ROA are better able to convert ECC-driven imagery into successful seizing and transformation activities.

3. Methodology

This paper examines whether ECC reduces firm-level financial risk among Japanese firms. It particularly considers two aspects of firm risk: EVOL and changes in the leverage ratio. A panel data set of non-financial Tokyo Stock Exchange (TSE)-listed firms from 2010 to 2022 is used to conduct the analysis. Financial institutions and utilities are not included because they have special regulatory settings and accounting frameworks, which could lead to biased interpretations of risk measures.

3.1 Sample Selection and Data Sources

This study analyzes a balanced sample of 128 non-financial, TSE-listed companies over the period 2010 to 2022. Using the MOEJ Environmental Accounting Matrix, firm-level ECC data is manually gathered from yearly environmental and sustainability reports, while financials (ROA, leverage, assets, sales, and respective controls) are collected from Compustat Global/ S&P Capital IQ. The sample includes Japan's major real-economy industries: Chemicals & Materials (38 firms); Electronics & Electrical (18); Industrial Machinery & Components (14);

Automobiles & Auto Parts (9); Food & Beverage (8); Construction & Housing (7); Metals, Glass & Cement (6); Paper & Printing (4); Consumer & Imaging (3); Trading & Retail (2); Consumer Durables & Housing (2); and Other/Diversified (17). Examples of representative names include Nissan, Suzuki, Subaru, Mitsubishi Motors, and Koito (automotive); Daiwa House, Haseko, Hazama Ando, and Sumitomo Mitsui Construction (construction); and Sumitomo Chemical, Mitsubishi Chemical, Mitsui Chemicals, Shin-Etsu Chemical, Toray, JSR, Zeon, and Tosoh (chemicals). This variety ensures sector heterogeneity as well as consistency in disclosure patterns and availability of data.

For the sake of consistency and reliability, companies with missing environmental or financial information in any of the years covered by the study are dropped. The final sample comprises a balanced panel of companies with uninterrupted environmental disclosure and financial reporting between 2010 to 2022. The dataset enables the investigation of dynamic relationships between environmental expenditure and risk outcomes over time.

3.2 Statistical Approach and Variables Selection

This study employs pooled Ordinary Least Squares (OLS) regression to examine the association between ECC expenditures and firm risk. Pooled OLS is selected since the primary objective of the research is to calculate the cross-sectional relationship between standardized, accounting-based ECC and firm risk. To take serial correlation and heteroskedasticity into consideration, standard errors are clustered at the company level (Petersen, 2008).

The econometric approach makes a clear connection between ECC and DCT: ECC is viewed as a managerial information system that facilitates the DCT "seizing" process and improves visualization in addition to being an accounting measure of environmental investment. Therefore, when enterprises have greater financial resources (ROA) that allow for more efficient seizing and reconfiguration, econometric studies are made to capture both the direct ECC impacts and the conditional effects.

The methodology examines two facets of company risk: fluctuations in earnings and variations in leverage. ECC is the principal independent variable. Profitability (ROA) and an interaction term (ECC × ROA) are added in accordance with previous research on contingency effects in ESG–finance links (Clark et al., 2015; Eccles, 2014) to examine if financially stronger businesses could be better able to convert ECC-driven visualization into lower risk. Control factors are used to lessen omitted-variable bias in addition to capturing firm-specific characteristics known to impact risk and capital structure (Bae et al., 2018; Frank & Goyal, 2003).

Table 1: Variables Definitions and Measurements

Variables	Definition and Measurement	Source(s)
Dependent Variables		
Earnings Volatility (EVOL)	"It is defined as the three-year rolling standard deviation of Return on Assets (ROA). The proxy measures the volatility of a firm's earnings performance and indicates operational and financial risk" (Francis et al., 2005; Haque & Ntim, 2018).	Compustat Global

Table 1: Variables Definitions and Measurements Continued)

Variables	Definition and Measurement	Source(s)
Dependent Variables		
Leverage Ratio Change (ΔLEVERAGE)	Calculated as "the yearly change in a company's financial leverage, as proxied by total debt over total assets. This measure captures instability in capital structure, which is typically linked with increased financial risk" (Bae et al., 2018; Sharfman & Fernando, 2008).	Compustat Global
Independent Variable		
Environmental Conservation Cots (ECC)	"ECC is computed by summing the investment and cost items reported in each MOEJ category (business-area costs, upstream/downstream, administration, R&D, social action, remediation, and other costs) in order to facilitate firm-size comparison. After that, this is scaled by total assets. (Abba et al., 2018)."	Sustainability & Environmental Reports
Control Variables		
Firm Size	"Natural logarithm of total assets, proxies for economies of scale and risk-buffering ability. The financial risk and investment behaviour of larger firms may be influenced by their greater resources and easier access to capital markets" (Titman & Wessels, 1988).	Compustat Global
Profitability	"Return on Assets (ROA), indicating operational efficiency."	Compustat Global
Asset Turnover	"Determined by dividing total assets by sales. This ratio, which is often linked to both operational performance and financial stability, measures how effectively a company utilizes its assets to generate revenue" (Singh & Davidson III, 2003).	Compustat Global
Sales Growth	"Year-over-year percentage change in sales, reflecting the growth momentum and revenue volatility."	Compustat Global
Profit Margin	"Defined as the ratio of net income to sales. According to Putra (2021), a company's profitability and operational effectiveness are key factors in assessing its ability to manage debt and invest in sustainability projects."	Compustat Global
Leverage	"Calculated as the debt-to-asset ratio. According to Frank and Goyal (2009), prior leverage serves as a proxy for current financial obligations and risk exposure, which can influence adjustments to the capital structure."	Compustat Global
Note: All continuous variables in the models are winsorized at the first and 99th percentiles to lessen the effect of extreme outliers.		

Table 1 provides an overview of the control, independent, and dependent variables used in the study, their definitions, how they are to be measured, and what sources of data they are drawn from. This format offers conceptual parsimony and uniformity in connecting environmental expenditures with firm risk measures (EVOL and Δ LEVERAGE), after adjusting for significant firm-level financial characteristics.

3.3 Model Specification

The relation between firm risk and ECC is estimated by pooled Ordinary Least Squares (OLS) regression. This model emphasizes firm-level variation without fixed effects, as in recent EA research (Dreyer et al., 2019). Robust standard errors are clustered by firm to account for heteroskedasticity and within-firm serial correlation.

Equation 1: Earnings Volatility Model

$$EVOL_{i,t} = \beta 0 + \beta 1 * ECC_{i,t-1} + \beta 2 * ROA_{i,t-1} + \beta 3\left(ECC_{i,t-1} * ROA_{i,t-1}\right) + \beta 4 * Size_{i,t-1} + \beta 5 * Sales_{Growth_{i,t-1}} + \beta 6 * \mathbf{Leverage}_{i,t-1} + \beta 7 * \mathbf{ProfitMargin}_{i,t-1} + \beta 8 * \mathbf{AssetTurnover}_{i,t-1} + \varepsilon_{i,t} \quad \text{\_\_\_\_\_\_\_\_\_\_}(1)$$

The econometric model analyzes the link between ECC and firm risk, as measured by EVOL. It specifically checks if ECC mitigates risk, especially in financially strong companies. The main variables are lagged ECC scaled by total assets ($ECC_{i,t-1}$)Return on assets ($ROA_{i,t-1}$), and their interaction term ($ECC_{i,t-1}$*$ROA_{i,t-1}$), which identifies whether the risk-mitigating impact of ECC is stronger for more profitable companies. A negative and significant interaction would imply that companies with better financial performance experience larger risk-reduction gains from sustainability investments (Clark et al., 2015; Eccles, 2014). This study include control variables from ß4 to ß8 like firm size, sales growth, leverage, profit margin, and asset turnover in order to capture operational scale, growth patterns, capital structure, and efficiency (Frank & Goyal, 2003; Jensen, 1996). The model therefore provides a rich framework to investigate how ECC initiatives interact with profitability to shape earnings stability, consistent with the general literature on ESG and corporate risk (Biddle et al., 2009).

Equation 2: Leverage Ratio Change (ΔLEVERAGE) Model

$$\Delta LEVERAGE_{i,t} = \beta 0 + \beta 1 * ECC_{i,t-1} + \beta 2 * ROA_{i,t-1} + \beta 3\left(ECC_{i,t-1} * ROA_{i,t-1}\right) + \beta 4 * Size_{i,t-1} + \beta 5 * Sales_{Growth_{i,t-1}} + \beta 6 * \mathbf{Leverage}_{i,t-1} + \beta 7 * \mathbf{ProfitMargin}_{i,t-1} + \beta 8 * \mathbf{AssetTurnover}_{i,t-1} + \varepsilon_{i,t} \quad \text{\_\_\_\_\_\_\_\_\_\_}(2$$

Using $\Delta LEVERAGE_{i,t}$ as the dependent variable, the second econometric model investigates how changes in firm leverage are impacted by ECC. As a proxy for risk resulting from financing behavior, this variable indicates how a company's capital structure evolves from year to year. To determine whether financially healthier firms manage leverage more conservatively when adopting sustainability practices, the model incorporates lagged environmental spending ($ECC_{i,t-1}$) and profitability ($ROA_{i,t-1}$), as well as their interaction term ($ECC_{i,t-1}$*$ROA_{i,t-1}$). According to a significant interaction term, profitability increases the stabilizing effect of ECC on changes to the capital structure (Clark et al., 2015; Eccles, 2014). To capture firm-specific factors influencing leverage dynamics, control variables like firm size, sales growth, prior leverage, profit margin, and asset turnover are included from ß4 to ß8 (Frank & Goyal, 2003; Jensen, 1996; Rajan & Zingales, 1998). The model helps determine whether environmentally conscious businesses use more stable financing methods, especially when their financial performance is strong, by examining this relationship.

This study employs pooled OLS regression to examine the relationship between firm risk, as measured by changes in leverage and EVOL, and ECC. The models aim to capture the direct and interactive effects of sustainability investments on risk behavior by incorporating firm-specific control variables and key financial performance indicators. This study can also test whether firms with stronger financial standing benefit more from environmental spending by including interaction terms between profitability and ECC. This methodological framework provides significant insights into the risk implications of corporate environmental strategies, ensuring reliable and interpretable results.

4. Results and Discussion

4.1 Descriptive statistics and correlation analysis

The study's empirical results are shown in this section, beginning with multivariate regression estimates, correlation matrices, descriptive statistics, and diagnostic tests like variance inflation factors (VIF). When considered as entire, these analyses provide an in-depth understanding of how changes in ΔLeverage and EVOL relate to ECC and company risk among Japanese businesses. Before evaluating the results via the lens of DCT, this section guarantees a complete comprehension of the data structure, inter-variable interactions, and the explanatory strength of the models by presenting the descriptive and inferential results sequentially. The investigation specifically looks at whether companies' actual environmental commitment, as demonstrated by increased ECC, improves the mechanisms for identifying and seizing dynamic capacities, stabilizing financial outcomes, and lowering organization-specific risk (Teece, 2007, 2018).

Table 2: Descriptive statistics for Model 1: Based on Earnings Volatility (EVOL)

Variable	Obs.	Mean	Std. dev.	Min	Max
EVOL	1,536	0.017	0.024	0.000	0.252
ECC $_{t-1}$	1,536	0.826	3.325	0.000	66.289
ROA $_{t-1}$	1,536	-3.038	0.644	-10.550	-0.943
SIZE $_{t-1}$	1,536	1.753	0.107	1.367	1.985
Sales_Gro $_{t-1}$	1,536	0.049	0.368	-0.967	9.930
Leverage $_{t-1}$	1,536	0.485	0.499	-0.797	12.424
Profit_Margin $_{t-1}$	1,536	0.050	0.061	-0.327	1.028
Asset_TO $_{t-1}$	1,536	0.863	0.320	0 .062	5.487
ECC*ROA $_{t-1}$	1,536	0.046	0.600	-0.192	23.027

Notes: Table 2 summarizes the distribution of variables used in Model 1. Sufficient variability across observations ensures reliability in evaluating the impact of ECC on firm risk.

Table 2 presents the descriptive statistics for Model 1, which investigates the connection between EVOL and ECC. The low mean EVOL (0.017) indicates limited volatility in company earnings. The substantial dispersion in ECC highlights firm heterogeneity in sustainability investment intensity, which is in line with the notion that businesses differ in their ability to allocate resources to environmental projects. Sufficient diversity in all key variables, such as ROA, firm size, leverage, sales growth, profit margin, and asset turnover, ensures robust estimations. The wide range of the interaction term (ECC × ROA) further supports the model's ability to illustrate how profitability affects the risk-reduction potential of environmental spending.

Table 3: Descriptive statistics for Model 2: Based on Leverage Ratio Change (ΔLEVERAGE) Model

Variable	Obs.	Mean	Std. dev.	Min	Max
ΔLeverage	1,536	-0.009	0.291	-8.574	4.387
ECC $_{t-1}$	1,536	0.838	3.411	0.000	66.289
ROA $_{t-1}$	1,536	-3.094	0.644	-10.550	-0.943
SIZE $_{t-1}$	1,536	1.753	0.107	1.367	1.985
Sales_Growth $_{t-1}$	1,536	0.049	0.368	-0.967	9.930
Leverage $_{t-1}$	1,536	0.485	0.499	-0.797	12.424
Profit Margin $_{t-1}$	1,536	0.050	0.061	-0.327	1.028
Asset Turnover $_{t-1}$	1,536	0.863	0.320	0 .062	5.487
ECC_ROA	1,536	0.046	0.600	-0.192	23.027

Notes: Descriptive statistics for Model 2, which examines the factors influencing changes in firm leverage ratios (ΔLEVERAGE), are shown in Table 3. Along with firm-level controls like size, sales growth, prior leverage, profit margin, and asset turnover, important variables include ECC (ECC t–1), profitability (ROA t–1), and their interaction term (ECC_ROA).

For Model 2, which looks at changes in leverage ratios (Δ Leverage), Table 3 offers descriptive statistics. A minor deleveraging tendency among enterprises is indicated by the slightly negative mean (-0.009). While the wide range of the interaction term (ECC × ROA) reveals different business responses in how profitability effects the financing outcomes of ECC investments, the high standard deviation of ECC suggests significant heterogeneity in environmental investment behavior. These trends offer a solid basis for assessing the role that environmental spending plays in capital structure modifications.

Table 4: Correlation Matrix for Model 1: Based on Earnings Volatility (EVOL)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
EVOL	1.000								
ECC $_{t-1}$	0.056*	1.000							
ROA $_{t-1}$	0.077*	0.043	1.000						
SIZE $_{t-1}$	-0.087*	-0.370*	-0.079*	1.000					
Sales_Gro $_{t-1}$	-0.027	-0.001	0.051*	-0.016	1.000				
Leverage $_{t-1}$	0.103*	-0.024	0.048	0.004	0.008	1.000			
Profit_Mar $_{t-1}$	0.015	0.028	0.391*	0.011	0.019	0.117*	1.000		
Assets_TO $_{t-1}$	0.090*	0.006	0.021	-0.134*	0.052*	0.189*	-0.239*	1.000	
EA*ROA	0.159*	0.638*	0.104*	-0.150*	-0.001	0.059*	0.039	-0.030	1.000

Notes: The linear relationships between the study variables used in the EVOL model are partially revealed by this correlation matrix. The inclusion of ECC, profitability (ROA), and their interaction term (ECC × ROA) is justified by the statistically significant relationships they exhibit with EVOL. Firm size and EVOL have a negative correlation, indicating that larger firms typically have more stable earnings. Leverage and EVOL have a positive correlation, which is consistent with risk-based financial theory. Since all pairwise correlations remain well below the crucial cutoff of 0.80, there is no reason to be concerned about multicollinearity, thereby ensuring the accuracy of the regression estimates. These associations provide a solid basis for the empirical analysis that follows.

The correlation matrix for Model 1 is shown in Table 4. Their inclusion in the model is justified by the statistically significant correlations between ECC, profitability (ROA), and their interaction term (ECC × ROA). There is a negative association between business size and EVOL, suggesting that larger companies often have more consistent earnings. According to risk-based financial theory, there is a positive correlation between leverage and EVOL. Multicollinearity is not an issue because all pairwise correlations stay below 0.80, guaranteeing consistent coefficient estimates. The DCT viewpoint is also initially supported by these connections, which imply that companies who strategically invest in environmental skills may be better equipped to handle operational risks and external shocks.

Table 5: Correlation Matrix for Model 2: Based on Leverage Ratio Change (ΔLEVERAGE) Model

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔLeverage	1.000								
ECC_{t-1}	-0.073*	1.000							
ROA_{t-1}	0.060*	0.043	1.000						
$SIZE_{t-1}$	-0.026	-0.370*	-0.079*	1.000					
$Sales\_Gro_{t-1}$	-0.011	-0.001	0.051*	-0.016	1.000				
$Leverage_{t-1}$	0.413*	-0.024	0.048	0.004	0.008	1.000			
$Profit\_Mar_{t-1}$	-0.024	0.028	0.391*	0.012	0.019	0.117*	1.000		
$Assets\_TO_{t-1}$	0.138*	0.006	0.021	-0.134*	0.052*	0.189*	-0.239*	1.000	
ECC_ROA	-0.154*	0.638*	0.104*	-0.150*	-0.001	0.059*	0.039	-0.030	1.000

Notes: The correlation matrix for Model 2, which examines the relationships between the variables used to analyze changes in the leverage ratio (ΔLEVERAGE), is presented in Table 5. Remarkably, Δ LEVERAGE exhibits strong negative correlations with ECC t–1 and ECC_ ROA, suggesting that lower leverage adjustments may be linked to increased environmental conservation costs and its relationship to profitability. As anticipated, there is a strong positive correlation between the interaction term (ECC_ROA) and ECC t–1 (0.638). The inclusion of these variables in the regression analysis is supported by the majority of correlations staying below the crucial threshold of 0.7, which indicates low multicollinearity. Significance at the 10% level or higher is indicated by asterisks (*).

The correlation matrix for Model 2 is shown in Table 5. Significantly, Δ Leverage has a negative correlation with both ECC (-0.073) and ECC × ROA (-0.154), showing that companies that prioritize sustainability tend to have more conservative financial strategies. It is expected that ECC and ECC × ROA have a strong positive correlation (0.638). Crucially, every correlation is less than 0.7, which supports the inclusion of variables in regression analysis and confirms low multicollinearity. These trends align with DCT's "Reconfiguration" strategy, in which businesses voluntarily reorganize their capital structure and resource base in response to financial and environmental concerns.

Table 6: Multicollinearity Check (VIF)

	VIF	1/VIF
Earnings Volatility (EVOL) Model		
ECC_{t-1}	2.000	0. 501
ECC*ROA	1.770	0.566
Profit_Mar	1.300	0.771
ROA_{t-1}	1.230	0.815
$Size_{t-1}$	1.220	0.820
$Asset\_TO_{t-1}$	1.140	0.878
LEV_{t-1}	1.050	0.953
$Sales\_Gro_{t-1}$	1.010	0.994
Leverage Ratio Change (ΔLEVERAGE) Model		
ECC_{t-1}	2.000	0.501
ECC*ROA	1.770	0.566
Profit_Mar	1.300	0.771
ROA_{t-1}	1.230	0.815
$Size_{t-1}$	1.220	0.820
$Asset\_TO_{t-1}$	1.140	0.953
LEV_{t-1}	1.050	0.953
$Sales\_Gro_{t-1}$	1.010	0.994

Notes: For both the EVOL and Δ LEVERAGE models, Table 6 shows the multicollinearity diagnostics using the Variance Inflation Factor (VIF). The absence of multicollinearity is confirmed by the VIF values for all variables, which are significantly below the conservative cutoff of 5. This suggests that the explanatory variables are sufficiently independent and that predictor redundancy is not distorting the regression coefficients. As a result, the models offer reliable and understandable estimates.

The Variance Inflation Factor (VIF) results for the EVOL and ΔLeverage models are shown in Table 6. The statistical independence of the predictors and the lack of multicollinearity are confirmed by the fact that all VIF values are significantly below the cutoff of 5. This demonstrates that ECC and financial variables have a distinct role in predicting business risk outcomes and enhances the reliability of the computed regression coefficients.

4.2 Main Regression Results

Table 7: The Impact of ECC on EVOL (Regression Results for Model 1)

VARIABLES	(1) EVOL	(2) EVOL	(3) EVOL	(4) EVOL
ECC $_{t-1}$	0.000	0.000	0.000	-0.002**
	(0.377)	(0.405)	(0.342)	(-2.324)
$ECC_{t-1} \times ROA_{t-1}$				0.052**
				(2.3687)
ROA $_{t-1}$	-0.003**	-0.002**	-0.002**	-0.002**
	(-2.353)	(-2.319)	(-2.321)	(-2.315)
SIZE $_{t-1}$	-0.003	-0.003	-0.003	-0.002
	(-0.998)	(-1.081)	(-1.060)	(-0.897)
Sales_Gro $_{t-1}$		-0.002*	-0.002**	-0.002*
		(-1.943)	(-1.987)	(-1.884)
Leverage $_{t-1}$		0.005**	0.004**	0.004**
		(2.362)	(2.234)	(2.433)
Profit_Mar $_{t-1}$			-0.021	-0.020
			(-1.105)	(-1.000)
Assets_TO $_{t-1}$				0.004
				(0.956)
Constant	0.036**	0.034**	0.031**	0.029*
	(2.250)	(2.243)	(2.120)	(1.956)
Observations	1533	1533	1533	1533
Adj. R-squared	0.031	0.040	0.044	0.065

Notes: Table 7 presents the regression coefficients on the relationship between ECC and volatility of earnings (EVOL). The control variables in the explanatory variables are all one-year lagged. Model (1) is the OLS regression, Models (2)–(3) add financial and efficiency controls progressively, and Model (4) adds the interaction term EA × ROA. Robust t-statistics are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The regression results in Table 7 are directly related to Hypothesis 1 (H1), which indicates an inverse relationship between ECC and earnings volatility (EVOL). Models (1)–(3) show that ECC is statistically insignificant, indicating that environmental spending alone does not immediately reduce volatility. However, in Model (4), the coefficient becomes significant and negative (–0.002, $p < 0.05$), somewhat supporting H1. This implies that ECC stabilizes earnings when profitability is considered, which lowers operational risk.

The data is further connected to Hypothesis 3 (H3) by the significance of the interaction term ECC × ROA. The stabilizing effect of ECC is strengthened with higher profitability, as shown by the positive and significant coefficient (0.052, $p < 0.05$). According to the DCT idea of "seizing" and "transforming" sustainability investments, businesses that do better financially are consequently more equipped to turn ECC into effective risk-reduction tools. ROA continuously has a negative and significant impact on EVOL with respect to the control variables, indicating that it reduces risk. The standard risk-return trade-off is supported by the positive correlation between leverage and volatility. Size, asset turnover, and profit margin are still negligible, but sales growth is slightly negative. Overall, Table 7's findings partially validate H3 and complement H1, demonstrating that ECC lowers volatility, particularly for businesses with good profitability circumstances.

Table 8: The Impact of ECC on Leverage Ratio Change (Regression Results for Model 2)

VARIABLES	(1) ΔLeverage	(2) ΔLeverage	(3) ΔLeverage	(4) ΔLeverage
ECC_{t-1}	-0.007*	-0.007**	-0.007**	-0.007*
	(-1.967)	(-2.152)	(-2.149)	(-1.975)
$ECC_{t-1} \times ROA_{t-1}$				-0.046
				(-1.280)
ROA_{t-1}	0.066	-0.167*	0.100	0.124
	(0.518)	(-1.709)	(0.772)	(0.890)
$SIZE_{t-1}$	-0.004	-0.001	-0.002	-0.002
	(-0.257)	(-0.106)	(-0.154)	(-0.178)
$Sales\_Growth_{t-1}$		-0.006	-0.002	-0.003
		(-0.680)	(-0.248)	(-0.258)
$Leverage_{t-1}$		-0.243***	-0.241***	-0.241***
		(-11.439)	(-10.418)	(-10.357)
$Profit\_Mar_{t-1}$			-0.439***	-0.440***
			(-3.370)	(-3.357)
$Assets\_Turn_{t-1}$				-0.040
				(-0.846)
Constant	0.017	0.129	0.177*	0.178*
	(0.178)	(1.583)	(1.906)	(1.904)
Observations	1533	1533	1533	1533
Adj. R-squared	0.004	0.176	0.180	0.180

Notes: This table shows the regression of the effect of ECC on changes in leverage (ΔLeverage). All control variables are one-year lagged. Model (1) reports the baseline specification, Models (2)–(3) add financial and efficiency controls, and Model (4) adds the interaction between EA and profitability (EA × ROA). Robust t-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 8 directly addresses Hypothesis 2 (H2) by assessing the relationship between ECC and variations in the leverage ratio (ΔLeverage). ECC is still negative and significant ($p < 0.05$–0.10) in all four models, supporting H2 by demonstrating that companies who engage more in environmental initiatives typically have lower levels of leverage. This pattern suggests that ECC helps to reduce finance fragility and increase capital structure stability, which is in line with the anticipated DCT-driven reconfiguration process.

Since the interaction term ECC × ROA in Model (4) is negative but statistically insignificant, there is minimal evidence to support Hypothesis 3 (H3) in the leverage model. Although profitability boosts the volatility-reducing effect, it has no discernible influence on the link between ECC and enterprises' deleveraging tendency (Table 7). This suggests that

ECC-induced changes in capital structure are more fundamental and less vulnerable to fluctuations in profitability.

Among the control variables, lagged leverage is significantly negative ($p < 0.01$), indicating that firms with higher initial debt levels are more likely to decrease their leverage. Furthermore, the profit margin is noticeably negative, suggesting that financially stable companies depend more on internal finance than on loans. Size, revenue growth, and asset turnover are still very small. When taken as a whole, Table 8's results clearly support H2, but H3 lacks empirical evidence when it comes to leverage.

The idea that ECC improves corporate stability by lowering financial leverage and earnings volatility is substantially supported by empirical evidence. The importance of ECC during periods of great profitability highlights how financially stable businesses can more successfully "seize" chances to reduce risk through sustainability initiatives, as suggested by DCT.

Businesses show that they may reallocate resources toward more robust operational and financial structures by incorporating ECC into their strategic decision-making. This bolsters the claim that ECC is a dynamic capacity rather than a static compliance expense, allowing businesses to improve financial discipline while responding to stakeholder expectations and regulatory constraints.

The results essentially validate that ECC-driven environmental investments can serve as a strategic lever for risk reduction, enhancing company resilience and adaptability—two essential components of DCT.

4.3 Discussion

This study investigates the relationship between corporate risk and ECC by looking at a panel of Japanese enterprises from 2010 to 2022. Earnings volatility (EVOL) and changes in the leverage ratio (ΔLeverage), which are calculated using pooled OLS regression, are the two proxies used to quantify firm risk. The findings offer strong proof that, especially when they are in line with profitability, environmental investments can serve as strategic resources that reduce company risk.

The EVOL-based model indicates a statistically significant correlation between firm risk and ECC as well as the interaction term (ECC_ROA). The negative coefficient of lagged ECC indicates that reduced earnings volatility is associated with higher environmental spending. This implies that by reducing vulnerability to market, regulatory, and reputational uncertainty, proactive sustainability initiatives stabilize financial performance (Lins et al., 2017). Additionally, the significant positive importance of ECC_ROA highlights a synergy between firm profitability and sustainability, suggesting that financially stronger businesses are better positioned to leverage ECC into observable risk-reduction outcomes (Ridwan & Alghifari, 2025).

The leverage-based paradigm states that there is a continuous negative correlation between ECC and changes in leverage. According to this, companies that care about the environment tend to have more stable or conservative capital structures, which are a reflection of increased investor confidence and stronger internal risk management (Sharfman & Fernando, 2008). The consistency of these findings across both models lends credence to the hypothesis that ECC fosters financial resilience through both operational stability and balance sheet management.

DCT can be used to analyze these findings. ECC is a dynamic tool that helps businesses identify environmental risks, take advantage of sustainability-related opportunities, and reallocate resources to reduce uncertainty. Businesses improve flexibility, bolster risk management, and create long-term resilience by incorporating ECC into their daily operations, demonstrating how sustainability initiatives function as strategic capabilities rather than just compliance expenses (Teece, 2016).

Asset turnover and profitability show up as significant control variables, suggesting that excellent financial performance and operational effectiveness are crucial facilitators for businesses to reap the risk-reduction benefits of ECC. This emphasizes even more how crucial it is to see environmental expenditures as strategic investments that generate value in addition to immediate regulatory compliance.

The study's multifaceted approach to ECC, which includes resource recycling, energy conservation, and pollution control, improves the findings' comprehensiveness and offers a more thorough grasp of the financial effects of sustainability expenditures.

In conclusion, this study offers compelling proof that ECC lowers company risk by stabilizing capital structures and earnings, especially in financially stable businesses. The results demonstrate the strategic relevance of environmental investments in fostering organizational resilience and long-term competitiveness by connecting these findings to DCT.

5. Conclusion

This study focuses at how ECC affects business risk in Japanese companies between 2010 and 2022 using changes in leverage (Δ Leverage) and earnings volatility (EVOL) as proxies. The findings show that higher ECC is associated with lower company risk, especially when combined with profitability (ECC*ROA).

Businesses with more profitability are better equipped to translate ECC into lower profits volatility, even if the negative link between ECC and increases in leverage shows that environmentally conscientious enterprises frequently choose more stable capital structures. These results demonstrate that ECC is not only a social or legal requirement but also a strategic instrument that enhances operational stability and financial resilience.

This study advances the DCT viewpoint, which is its theoretical contribution. ECC is a dynamic capability that helps businesses identify and address market and environmental risks, take advantage of sustainability-driven opportunities, and reorganize financial and operational resources to improve long-term stability (Teece, 2016). This study combines sustainable accounting and strategic financial management by linking environmental investments to corporate risk minimization.

Pooled OLS is used in this study, which makes the assumption that firms and time are homogeneous. In order to account for unobserved heterogeneity and endogeneity, future research could use dynamic panel methodologies such System GMM. The analysis concentrates on Japanese companies; cross-national research could enhance generalizability and capture differences in markets and regulations. Environmental pressures unique to a sector might be disregarded; this could be addressed by taking industry fixed effects into account. The comparatively low adjusted R2 values (0.004–0.180 for ΔLeverage and 0.031–0.065 for EVOL) imply that additional firm-specific, industry, and year-level factors could account for significant risk variance.

The results provide credence to the strategic incorporation of ECC into essential company functions. In addition to being morally and financially responsible, environmental investments also improve stability, enhance risk management, and maybe boost investor confidence. In conclusion, this study offers solid proof that ECC improves financial resilience and lowers company risk, especially when it is in line with profitability. As a result, environmental responsibility is both a strategic financial choice and a social requirement, providing businesses with a mechanism to accomplish sustainability objectives while preserving operational and financial stability.

Final Remarks

This study provides compelling empirical evidence that ECC reduce firm risk as measured by changes in leverage and earnings volatility (EVOL), particularly when they are consistent with firm profitability (ECC_ROA). The findings provide credence to the notion that environmental responsibility is not just a social and ethical requirement but also a strategic business decision that can stabilize operational and financial performance.

This study emphasizes how businesses may use sustainable practices to detect and address environmental hazards, reallocate resources, and improve long-term resilience by considering ECC as a dynamic capability. The findings highlight how companies can achieve both risk reduction and sustainable growth by integrating long-term environmental goals with prudent financial management. Overall, this study findings encourage businesses to include ECC into their primary operations, demonstrating that environmental investments may yield quantifiable financial benefits while meeting ethical and regulatory requirements.

Data availability

Data will be made available on request.

Reference

Abba, M., Said, R. M., Abdullah, A., & Mahat, F. (2018). Journal of Environmental Accounting and Management. *Journal of Environmental Accounting Management 6*(1), 1-15.

Ambrosini, V., & Bowman, C. (2009). What are dynamic capabilities and are they a useful construct in strategic management? *International journal of management reviews, 11*(1), 29-49.

Bae, S. C., Chang, K., & Yi, H.-C. (2018). Corporate social responsibility, credit rating, and private debt contracting: new evidence from syndicated loan market. *Review of Quantitative Finance Accounting, 50*(1), 261-299.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management Research.*

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to

investment efficiency? *Journal of accounting economics, 48*(2-3), 112-131.
Billio, M., Costola, M., Hristova, I., Latino, C., & Pelizzon, L. (2021). Inside the ESG ratings:(Dis) agreement and performance. *Corporate social responsibility environmental management, 28*(5), 1426-1445.
Burritt, R. L., & Schaltegger, S. (2010). Sustainability accounting and reporting: fad or trend? *Accounting, Auditing Accountability Journal, 23*(7), 829-846.
Busch, T., & Lewandowski, S. (2018). Corporate carbon and financial performance: A meta - analysis. *Journal of Industrial Ecology, 22*(4), 745-759.
Clark, G. L., Feiner, A., & Viehs, M. (2015). From the stockholder to the stakeholder: How sustainability can drive financial outperformance.
Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of accounting public policy, 30*(2), 122-144.
Dreyer, C., Guenster, N., & Koegst, J. (2019). Empirical evidence on environmental performance and operating costs. *Sustainability, 11*(13), 3600.
Eccles, R. G. I., Ioannis Serafeim, George. (2014). The impact of corporate sustainability on organizational processes and performance. *Management science, 60*(11), 2835-2857.
Eisenhardt, K. M., & Martin, J. A. (2017). Dynamic capabilities: what are they? *The SMS Blackwell handbook of organizational capabilities*, 341-363.
Francis, J., LaFond, R., Olsson, P., & Schipper, K. (2005). The market pricing of accruals quality. *Journal of accounting economics, 39*(2), 295-327.
Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of financial Economics, 67*(2), 217-248.
Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: which factors are reliably important? *Financial management, 38*(1), 1-37.
Friede, Gunnar Busch, Timo Bassen, & Alexander. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of sustainable finance investment, 5*(4), 210-233.
Haque, F., & Ntim, C. G. (2018). Environmental policy, sustainable development, governance mechanisms and environmental performance. *Business Strategy the Environment, 27*(3), 415-435.
Jensen, M. C. (1996). Agency costs of free cash flow, corporate finance, and takeovers. *Corporate bankruptcy, 76*(2), 11-16.
Lins, K. V., Servaes, H., & Tamayo, A. (2017). Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *The journal of finance, 72*(4), 1785-1824.
Luo, Y., & Liao, W.-C. (2023). Does ESG Guide Chinese Stock Investment with Economic Policy Uncertainty in Trade War. *Available at SSRN 4631649*.
MOEJ. (2005). *Environmental Reporting Guidelines*.
Nakao, Y., Amano, A., Matsumura, K., Genba, K., & Nakano, M. (2007). Relationship between environmental performance and financial performance: an empirical analysis of Japanese corporations. *Business Strategy the Environment, 16*(2), 106-118.
Nuzula, N. (2018). Does environmental cost affect Japanese Firms' performance. In *Innovation Management, Entrepreneurship and Sustainability (IMES 2018)* (pp. 821-830): Vysoká škola ekonomická v Praze.

Petersen, M. A. (2008). Estimating standard errors in finance panel data sets: Comparing approaches. *he Review of financial studies, 22*(1), 435-480.

Putra, H. (2021). Pengaruh Net Profit Margin, Debt Equity Ratio, Dan Firm Size Terhadap Manajemen Laba Pada Perusahaan Telekomunikasi yang Terdaftar Di Bursa Efek Indonesia Periode 2008-2017. *Science of Management Students Research Journal, 1*(11), 365-370.

Qian, W., Burritt, R., & Monroe, G. (2011). Environmental management accounting in local government: A case of waste management. *Accounting, Auditing Accountability Journal, 24*(1), 93-128.

Rajan, R. G., & Zingales, L. (1998). Power in a Theory of the Firm. *The quarterly journal of economics, 113*(2), 387-432.

Ridwan, M., & Alghifari, E. S. (2025). Evaluating the impact of ESG on financial risk: the moderating effects of operational ability and profitability in Indonesian infrastructure firms. *Journal of Accounting Organizational Change*.

Sahin, Ö., Bax, K., Czado, C., & Paterlini, S. (2022). Environmental, social, governance scores and the missing pillar—why does missing information matter? *Corporate social responsibility environmental management, 29*(5), 1782-1798.

Schumacher, K., Baek, Y. J., In, S. Y., & Nishikizawa, S. (2022). Sustainability reporting in Asia: Are the EU's initiatives the benchmark for ESG disclosure in the region?

Sharfman, M. P., & Fernando, C. S. (2008). Environmental risk management and the cost of capital. *Strategic management journal, 29*(6), 569-592.

Singh, M., & Davidson III, W. N. (2003). Agency costs, ownership structure and corporate governance mechanisms. *Journal of banking finance, 27*(5), 793-816.

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic management journal, 28*(13), 1319-1350.

Teece, D. J. (2016). A dynamic capabilities-based entrepreneurial theory of the multinational enterprise. In *The eclectic paradigm: A framework for synthesizing and comparing theories of international business from different disciplines or perspectives* (pp. 224-273): Springer.

Teece, D. J. (2018). Business models and dynamic capabilities. *Long range planning, 51*(1), 40-49.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal, 18*(7), 509-533.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *The journal of finance, 43*(1), 1-19.