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How Do Active Firms Implementing Corporate Environmental Responsibility Take Technological Approaches to Environmental Issues? A Resource-Allocation Perspective

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Abstract: In this study, we acknowledge that corporate environmental responsibility (CER) can be implemented in a strategic sense. Given that firms cope with their resource constraints to pursue competitive advantages, firms tend to consider CER activities as a cost they expend rather than a value they invest. This tendency determines the level of investments to develop specific technologies to deal with environmental issues. Accordingly, we conjecture that the level of CER activities (i.e., the extent to which firms engage in various environmental issues) is negatively related to environmental innovation (i.e., the extent to which firms develop environmentally-sound technologies). To test this counterintuitive idea, we sample 623 U.S. public firms between 1996 and 2010 and figure out the relationship between CER and environmental innovation. As a result, we find a trade-off between CER and environmental innovation. In addition, to elaborate the resource-enabling mechanism between CER and environmental innovation, we examine the moderation effects of slack resources (instantiated by current ratios and debt–equity ratio) and find that the moderators show a positive impact on the relationship between CER and environmental innovation. These results suggest that environmental innovation is a dedicated action firms can take for environmental issues and is not automatically derived from their prior CER activities.

Keywords: corporate environmental responsibility; technological innovation for environment; resource constraint; slack resources

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1. Introduction

The corporate environmental responsibility (CER), which refers to the process where firms take actions for environmental protection and sustainable development, has been understood as a strategic response of the firm to the social demands from the stakeholders [1–3]. This notion indicates that CER can be implemented to just comply with the institutional pressures rather than to voluntarily tackle environmental issues around the firm [4]. The superficially-made environmental compliance oftentimes leads to deviant behaviors, such as greenwashing [4,5], which entail additional social costs, impairing achieving the goals for sustainable development [6].

In this study, we postulate that greenwashing is not a pathological outcome, but a motivational one. In fact, as the foremost source of such environmental issue is greenhouse gases (GHGs) [7–10], technological breakthroughs to resolve the climate inconsistency have been increasingly expected [11,12], and thus environmental policies have been formed to make firms actively engaged in developing advanced technologies to effectively deal with environmental issues [13–15]. In other words, implementing CER can be fostered in a more fundamental sense by motivating firms to take technological approaches, called environmental innovation (EI hereafter). Then, when can firms consider technological intervention to achieve EI? In fact, scholars have largely investigated the drivers of EI in terms of external institutional pressures, such as environmental policies [15], pollution

regulations [16], or international environmental standards (i.e., ISO 14000) [17,18]; or stakeholder engagement [19,20]. From these studies, we can understand that given that CER implementation of a firm is determined through ongoing interactions between the firm and its external stakeholders [19,21], the social demands from the external stakeholders can enable firms to pay attention to developing new technologies, leading to corporate innovation [19,20]. Thereupon, we may conjecture a positive relationship between CER and EI: firms which want to implement corporate environmental responsibility will tend to take technological approaches to tackle environmental issues.

However, the reality is not so straightforward [22]. According to Lee and Kim [22], corporate innovation does not linearly lead to environmental sustainability because there is a resource-allocation conflict between innovation activities and CER activities. Even though both activities jointly construct a capability to deal with environmental issues, firms cannot fully invest their resources to both activities simultaneously [22]. As such, firms are required to consider a strategic position between CER activities and innovation activities, presenting a trade-off relationship.

In prior literature, the trade-off between CER activities and environmental innovation has not been well discussed. Positing that innovative capabilities can help take actions for environmental sustainability, Lee and Kim [22] also illuminated the trade-off between CER and overall innovative activities of the firm due to resource constraints. In fact, many studies either have focused on environmental performances driven by environmental innovation [14] or have considered these activities separately [23–25]. While many studies found positive relationships between environmental performance and environmental innovation [2,19,20], we cannot totally ignore the possibilities that CER activities demotivate firms to develop new technologies that can resolve environmental issues.

Then, where does this research gap come from? First, the prior studies rarely disentangle environment-specific technologies from the technologies which can possibly touch upon environmental issues regardless of whether the technologies are particularly developed to address environmental issues; or they have paid attention to overall implementation of "green" innovation [20] or overall technological development [19]. That is, in prior literature, the notion of innovation is outcome-based rather than action-based. Second, the drivers for EI have been investigated from external sources. Such externality logic assumes that CER is achieved in a responsive way: once external stakeholders demand sustainability-related actions, firms consider CER. Yet, when taking a resource allocation perspective, CER can be understood as being achieved in a voluntary way: considering the internal conflict between financial valuation and environmental valuation, firms make decisions on how they implement CER and how they embody the values of sustainable development (e.g., [26]).

In this study, acknowledging that resource allocation processes are essential in effectively navigating the sustainability options between externally-driven responsibility (i.e., CER) and internally-developed capabilities (i.e., EI), we figure out how EI can be demotivated by CER. In particular, we examine the role of CER implementation by figuring out whether CER implementation can lead to environmental innovation. In addition, to examine the aspect in which resource allocation processes between responding external pressures (i.e., CER) and developing internal technological capabilities (i.e., EI) are involved, we consider a moderator which represents resource constraints: slack resources, which refer to firm resources which are possessed for its future actions [27,28]. As many studies consider, slack resources are a way to capture resource constraints or resource abundance of the firm in investigating corporate social responsibility [28–30]. Since slack resources can play a buffer role in environmental uncertainty [31], any risks from the CSR activities can be alleviated with slack resources. When this logic of resource allocation to the CER–EI linkage is considered, slack resources can enable firms to have more room to invest in CER and EI activities simultaneously. As a result, the trade-off between CER and EI can be weakened.

This idea is examined with a sample of 623 U.S. public firms between 1996 and 2010 by using multiple databases, such as KLD, Compustat, and the USPTO database. We define CER as firm activities to deal with any environment-related issues (such as pollution, recycling, clean energy, etc.) and capture these activities using the KLD database. EI is captured using the patent classifications of environmentally-sound technologies (EST), provided by USPTO. Then, we figure out the empirical relationship between these variables and validate the hypothetical mechanisms (i.e., resource allocation) we propose with the moderators of current ratios and debt–equity ratios.

This study can provide theoretical contributions to the literature on sustainability and environment management. First, this study specifies the relationship between CER and EI. Acknowledging that developing environmentally sound technologies calls for serious environmental commitment, we argue that what firms previously did for environment can impair the further engagement in corporate environmental responsibility through technological development. In this sense, second, this study illuminates the (de-)motivational aspects of EI by taking a resource-allocation perspective. While prior studies focus on the roles of external pressures, this study focuses on internal process in which firms are likely to engage in developing new technologies to address environmental issues. This internal aspect suggests that developing technologies can be costly under the limited resources and the social demands from the external stakeholders. If firms perceive that their CER implementation satisfies the demands from external stakeholders, they might not be likely to further engage in developing new technologies to embody the sustainability values. Third, this study empirically defines EI. While in prior studies, EI is not specified in terms of environmental concerns, this study attempts to capture technologies particularly developed to address environmental issues rather than overall technologies developed for corporate innovation. This new measure may help clearly figure out the causality between CER and EI.

This paper is organized as follows. In the next section, based on the understanding of resource allocation processes, we develop hypotheses on the relationship between CER and EI. Then, our empirical approaches to examine our hypotheses are introduced, including research settings, data, measures, and estimation models. Then, we present the research findings and discuss what we find from the empirical analyses. In the final section, we further discuss our results to provide theoretical and practical implications.

2. Theory and Hypotheses

2.1. Resource Allocation Process

Resource allocation processes have been understood as capital investments to competing opportunities [32–34]. As Bower [33] contended, resource allocation processes can be facilitated with decision-makers' commitment to business projects which are defined toward funding (We interpret the term of commitment as equivalent to attention in that both represent a "feeling that guides action, not a legal obligation" [33] (p. 68)). Gilbert [34] illustrated that decision-makers' attention to digital publishing technology lets traditional newspaper companies allocate their resources to developing the new publishing method. This suggests that what decision-makers pay attention to eventually induces fungible investments. In other words, firms' resources are allocated by the attentional structure of the decision-makers [35,36].

Yet, because of the cognitive limitations of human beings [37,38], decision-makers cannot treat all the alternatives in their cognitive processes. This limits what decision-makers conceive as alternatives in their mind. As such, decision-makers are likely to simplify the alternatives to make the choice efficient and viable even though they can identify various alternatives [39]. Then, given such cognitively identified and simplified alternatives (or cognitive representations), they select some targets to particularly focus on among the alternatives [40,41]. To the selected targets, decision-makers commit with capital investments. As a result, firm resources are allocated according to how the decision-makers evaluate for the future values.

2.2. Corporate Environmental Responsibility and Environmental Innovation

The concept of resource allocation implies that the targets for resource allocations are pluralistic. By pluralistic, we mean that the targets can be sought simultaneously and independently. In strategizing environmental performances, there are two competing cognitive representations which can be typically found in the resource allocation processes as the pluralistic targets: technology vs. market [42]. Technological focus for the environmental performance indicates that firms allocate their resources to the activities to create new knowledge or develop their technology [43–47]. This leads firms to implement environmental innovation [48]. On the other hand, firms can focus on markets in which firms consider brand equity, customer relations, and market status by responding to environmental issues, or corporate environmental responsibility [49–52]. In this sense, corporate environmental responsibility includes any strategies making eco-friendly products, addressing environmental issues in the supply chains, and minimizing consuming natural resources [53–57].

While both environmental innovation and corporate environmental responsibility are, respectively, specialized and usually departmentalized within the firm [2,19,20], because of the limited resources, firms cannot make full investments as each alternative requires attention. Given that there is a trade-off between the targets, the resource constraints allow decision-makers to cognitively determine the allocation scheme, based on how decision-makers evaluate each target for the firm's overall future value [22]. Environmental innovation is expected to bring competitive advantages by making firms' operations efficient and eco-friendly [58–61]. This expectation will make decision-makers further engage in technological development for environmental issues when the developed technologies provide economic benefits, and the commitment to environmental innovation is escalated. However, ironically, as this self-reinforcing process require more firm resources, the activities for market are to be less pursued [62,63].

This indicates that environmental innovation has a limit to growth in a firm because of resource constraints. Furthermore, as CER is continuously called for by the society [19,20,64,65], firms pay more attention to find ways to enhance environmental performance in the short run. Since technological development process is costly as firms should invest abundant resources to develop a technology, they cannot ensure the efficacy of the technology once developed, and firms should endure the time the technology is fully developed to effectively tackle environmental issues [66]. Given such risky aspects of environmental innovation, firms tend to pursue market-based resource allocation rather than technology-based resource allocation.

Moreover, cognitively, decision-makers may stop pursuing environmental innovation when they satisfy their firms' market reputations in terms of environmental performance [67]. With the satisfaction coming from the reputation, decision-makers do not have any incentives to further develop technologies to tackle environmental issues, as such firms invest less resources to environmental innovation and pursue non-technological actions satisfying their stakeholders. Therefore, we hypothesize:

Hypothesis 1 (H1). *Firms well-implementing corporate environmental responsibility are less likely to develop environmentally-sound technologies.*

2.3. Slack Resources as a Facilitator of the Environmental Innovation

After we consider the trade-off effect between corporate environmental responsibility and environmental innovation in the perspective of resource allocation, the remaining question is whether resource abundance can affect environmental innovation. More specifically, we focus on the question of whether resource abundance can alleviate the demotivation of environmental innovation driven by corporate environmental responsibility. We predict that this effect will be more pronounced when firms have a higher level of resource abundance. Specifically, we argue that the firm's (1) slack resources and (2) free cash flows signal

resource abundance of the firm and thus moderate the proposed negative relationship between corporate environmental responsibility and environmental innovation.

First, firms that have slack resources have more leeway to take long-term actions, such as technological development, while satisfying their corporate environmental responsibility. It has been understood that slack resources play a cushion role in managing resource constraints [27,28] as well as environmental uncertainty [31]. When firms have sufficient resources, they can better defend their market position and bear the costs for technological development [68,69].

Second, in a finance aspect, free cash flow endows a space for navigating between corporate environmental responsibility and environmental innovation. Free cash flow is defined to be the cash available for distribution to investors after meeting required investments in firms' operation. Therefore, the growth in the free cash flow implies that a firm is capable of investing in various corporate activities that can potentially add value to the current intrinsic value of the firm. In this sense, a corporation's value is known to be determined by the shape of expected future cash flow and its growth rate. We conjecture that larger free cash flow can allow firms to better navigate the limited path of environmental performance to environmental innovation, caused by resource constraints, because greater level of free cash flow reflects firms' status of resource abundance.

Last, debt is understood as an external financing means and thus firms tend to prioritize debt financing when they consider external financing [70–73]. Given this, as a financial source, debt can provide a pool for firm growth [72,73]. For technological innovation, however, it has been understood that debt financing is not beneficial due to the uncertainty from any efforts for innovation (i.e., R&D investments) [74,75]. This indicates that debt financing itself cannot bring any motivation for environmental innovation. While we acknowledge such negative relations between debt financing and technological innovation, we posit that firms can strategically use the debt financing method to make competitive advantages of the market. According to Thakor and Lo [76], firms are likely to increase their investments for innovations to mitigate the systematic risk when they face intense industrial competition. Na [77] examined how innovative firms tend to consider debt financing in competitive environments. From these studies, we contend that debt financing, by increasing cash holdings [78], can be used to facilitate the implementation of corporate environmental responsibility through environmental innovation.

Based on our discussion, we predict that resource abundance has an environmental-innovation-improving moderation effect. Hence, we predict:

Hypothesis 2 (H2). *Resource abundance positively moderates the negative relationship between corporate environmental responsibility and environmental innovation.*

3. Methods

3.1. Data Collection and The Sample

To examine our hypotheses, we employ multiple databases, such as Compustat, KLD, and USPTO patent database. First, we started sampling from the MSCI ESG database for variables to assess corporate environmental responsibility. That is, we identified all public firms whose corporate environmental responsibility were evaluated by MSCI ESG. Second, we collected patent data of each firm from the USPTO database to operationally define the intellectual capital, more specifically, environment-friendly patents. Then, to consider other firm-specific characteristics, we added the sample firms' financial and accounting information which was extracted from Standard & Poor's Compustat database. This sampling procedure yielded 5047 firm-year observations with 623 firms spanning from 1996 to 2010 after integrating all the databases and considering the data availability across such diverse databases.

3.2. Measures

3.2.1. Dependent Variable

To capture environmental innovation, we considered how firms created and developed their intellectual capital regarding environment over time [79]. In particular, we consider environmentally-friendly patents as the artifact of environmental innovation. As USPTO defines the Environmentally Sound Technology (EST) in terms of technological classifications (http://www.uspto.gov/web/patents/classification/international/est_concordance.htm, accessed on 10 June 2022), we identified ESTs among the patents our sample firms had filed to the USPTO. Specifically, the USPTO discerns the ESTs in the areas of (a) alternative energy production, (b) energy conservation, (c) environmentally friendly farming, (d) environmental purification, protection, or remediation, and (e) regulation, design, or education. Using the patent classifications in these areas, we extracted the information of the patents. Then, we computed the proportions of EST classifications in the whole list of patent classifications in the patents of the given firm at each year and then employed a five-year time window to aggregate the EST proportions. Since the variable has a skewed distribution, we considered the log-transformed variable as our focal dependent variable.

3.2.2. Independent Variable

The independent variable is corporate environmental responsibility, which is understood as "the degree to which a firm ensures that environmental concerns that arise either out of its business operations or otherwise are addressed" [80] (p. 1256). This indicates how much firms are aware of environmental issues around them and deal with them [81]. In this study, corporate environmental responsibility is measured using the MSCI ESG database. According to the MSCI ESG guidelines, the environmental strength refers to the extent to which a firm takes an action addressing environmental issues in a given year. Out of seven categories, we chose five of them which clearly represent pollution-control activities, such as (1) environmentally beneficial products and services, (2) pollution prevention, (3) recycling, (4) clean energy, and (5) property, plant, and equipment, all of which were coded as dichotomous variables. We summed up the 0/1 variables across the categories to construct positive environmental performance of the given firm at each year. The environmental concern is defined as the extent to which a firm is involved in the activities which can exacerbate environmental issues. From the MSCI data, we chose the following five aspects to evaluate each firm's negative activities, such as (1) hazardous waste, (2) ozone depleting chemicals, (3) substantial emissions, (4) agricultural chemicals, and (5) climate change. We also summed up the binary codes of the given firm by year to measure negative environmental performance. To capture corporate environmental responsibility as a firm's orientation toward environmental issues, we cumulated these two continuous measures of environmental strength and environmental concerns, respectively, in a five-year window. Then, we subtracted the environmental concerns from the environmental strengths to measure corporate environmental responsibility.

3.2.3. Moderators

The moderators for this study are slack resources, free cash flow, and financial leverage. The variable of slack resources was measured using current ratio and financial leverage [27,31]. Current ratio was measured by separating current assets with current liabilities. Financial leverage was measured by the addition of long-term debt and short-term debt, and then dividing the total assets of the firm. Free cash flow of a firm was measured by subtracting the changes in working capital and capital expenditures from net incomes adjusted by depreciation and amortization [82].

3.2.4. Control Variables

To deal with unobserved heterogeneity with respect to environmental innovation, we considered various control variables, such as industry-adjusted ROA, firm size, marketing intensity, R&D intensity, corporate social responsibility, and technological competency [2,19,20].

For industry-adjusted ROA, we first measured the ratio of net incomes to total assets in each firm and aggregated the ROA values by the three-digit SIC codes, which yielded the industry-level ROA. Then, we subtracted the industry-level ROA from the firm-level ROA to compute industry-adjusted ROA. Firm's size was measured with the dollar amount of total assets of the firm. Marketing intensity was measured with the ratio of selling, general, and administrative expenditures (i.e., SG&A) to sales. R&D intensity was measured by R&D expenditures divided by total assets. Corporate social responsibility was considered as a control variable to capture the overall level of the given firm's engagement in the corporate social responsibility. By using the scores of MSCI ESG, we summed up all the scores of strengths and concerns across the categories except the category of Environment, respectively, in a five-year time window. Then, we computed corporate social responsibility as the value difference between the strengths and the concerns. Technological competency was measured with the number of patents which had been filed to the USPTO. To deal with the skewness of the variable, we took a logarithm of the variable.

Table 1 presents the descriptive statistics of the focal variables we used in this study.

Table 1. Descriptive statistics.

Variables (N = 5047)	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Environmental Innovation	0.35	0.75										
2. Corporate Environmental Responsibility	0.29	2.21	0.01									
3. Slack Resources	65.69	203.94	0.38	−0.01								
4. Free Cash Flow	0.22	0.18	−0.06	0.09	−0.16							
5. Financial Leverage	0.04	0.06	0.10	−0.05	−0.10	0.28						
6. Industry-adjusted ROA	−0.32	2.28	0.08	0.00	−0.05	0.21	0.10					
7. Firm size	2.03	1.88	0.54	−0.04	0.19	0.06	0.30	0.19				
8. Marketing intensity	2.26	1.93	−0.12	−0.06	−0.18	0.04	0.30	0.01	0.02			
9. R&D intensity	−0.05	3.15	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00		
10. Corporate Social Responsibility	2.77	11.30	0.28	0.01	0.51	−0.02	−0.01	0.04	0.21	−0.10	0.00	
11. Technological competency	−0.84	4.27	−0.18	−0.01	−0.27	0.24	0.15	0.34	−0.02	0.14	0.00	−0.15

3.3. Estimation Model

From the results of the Hausman test [83], we used a firm and year fixed-effect model to test our hypotheses proposing the relationships between corporate environmental responsibility and environmental innovation (χ^2 = 69.21; $p < 0.000$). The independent variables, moderators, and control variables were introduced into the estimation models as one-year lagged variables.

4. Result

4.1. Hypothesis Tests

Table 2 presents the estimations of environmental performance with respect to control variables and our hypothesized variables. In Table 2, Model 1 included only control variables. In Model 2, the independent variable, corporate environmental responsibility, was added to Model 1 to estimate environmental innovation. Models 3 through 5 include the three moderators, i.e., slack resources, free cash flow, and financial leverage in the estimation model, respectively.

Model 2 shows that corporate environmental responsibility has a significant and negative effect on environmental innovation (β = −0.009, p = 0.000, Model 2), implying that a firm with active involvement in corporate environmental responsibility has a lower level of commitment to environmental innovation. This support Hypothesis 1.

Meanwhile, Models 3 through 5 show that the interaction effects of slack resources (β = 0.006, p = 0.001, Model 3), free cash flow (β = 0.0001, p = 0.077, Model 4), and financial leverage (β = 0.093, p = 0.033, Model 5) turn out positive. All these positive interaction effects reveal that the trade-off between corporate environmental responsibility and environmental innovation can be alleviated when firms are recourse-wise abundant. Thus, Hypothesis 2 is also supported.

Table 2. Fixed-effects estimations of environmental innovation with respect to corporate environmental responsibility.

	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	−0.1146 **	−0.1072 **	−0.1066 **	−0.1072 **	−0.1091 **
	(0.0358)	(0.0358)	(0.0357)	(0.0358)	(0.0358)
Adjusted ROA	0.0009	0.0009	0.0009	0.0009	0.0009
	(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Firm size	0.0005 ***	0.0004 ***	0.0004 ***	0.0004 ***	0.0004 ***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Marketing Intensity	0.2171 **	0.2108 **	0.2108 **	0.2109 **	0.2105 **
	(0.0815)	(0.0814)	(0.0813)	(0.0813)	(0.0813)
R&D intensity	−0.0903	−0.1066	−0.1210	−0.0961	−0.1124
	(0.1991)	(0.1988)	(0.1986)	(0.1988)	(0.1987)
Corporate social responsibility	0.0006	0.0051	0.0044	0.0048	0.0051
	(0.0033)	(0.0035)	(0.0035)	(0.0035)	(0.0035)
Technological competency	0.1185 ***	0.1144 ***	0.1144 ***	0.1139 ***	0.1146 ***
	(0.0066)	(0.0066)	(0.0066)	(0.0067)	(0.0066)
Slack resources	−0.0108 *	−0.0106 *	−0.0104 *	−0.0105 *	−0.0105 *
	(0.0047)	(0.0047)	(0.0047)	(0.0047)	(0.0047)
Free cash flow	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Financial leverage	−0.0006	−0.0006	−0.0006	−0.0001	−0.0007
	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0006)
Corporate environmental responsibility		−0.0087 ***	−0.0179 ***	−0.0094 ***	−0.0081 ***
		(0.0020)	(0.0034)	(0.0020)	(0.0020)
Corporate environmental responsibility * Slack resources			0.0064 ***		
			(0.0019)		
Corporate environmental responsibility * Free cash flow				0.0001 +	
				(0.0001)	
Corporate environmental responsibility * Financial leverage					0.0930 *
					(0.0435)
Firm dummies	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES
Adj. R^2	0.859	0.860	0.860	0.860	0.860

The number of firm-year: 5047. The number of firms: 623. + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

4.2. Further Analyses

We explore whether our main finding is influenced by contingencies. First, we considered economic recessions. As the financial resources in the capital market rest on the macroeconomic situations, we remove any data points which describe economic recessions of the dot-com bubbles (2000–2001) and the subprime mortgage crises (2008–2009) and re-run our estimation models. The results show consistency if we removed all the recession-embedded data. Second, we also consider the institutional pressure to affect the motivation of corporate environmental responsibility. Considering our data's timeframe (1996 and 2010), we consider the Kyoto Protocol, which is an international treaty to cope with any environmental risk from greenhouse gas emissions. The Kyoto Protocol, which was adopted in 1997, was globally enforced in 2005. Thus, we test whether such institutional pressures influence the trade-off relationship between corporate environmental responsibility and environmental innovation. For this, we create a dummy variable discerning two groups of strong and weak corporate environmental responsibility considering the above and below median levels of corporate environmental responsibility. Additionally, we create a dummy variable discerning the data of post-2005 and prior to 2005. Then, we figure out whether the difference-in-difference of these two categorical variables (which is equivalent to the interaction term between the two) turns out significant in our estimation model of environmental innovation. A statistically significant difference-in-difference shows that the relationship between corporate environmental responsibility and environmental innovation can be

influenced by the institutional pressure and thus out findings might be biased. Yet, our tests on difference-in-difference show nonsignificant effects of the difference-in-difference ($\beta = 0.025$, $p = 0.330$), which attests that the institutional pressure cannot affect the trade-off between corporate environmental responsibility and environmental innovation.

Third, while we consider the conventional duration from ideation to filing a patent as 5 years, we need to acknowledge that the time window of 5 years in measuring the variables can be arbitrary. To avoid such possible measurement biases derived from the time window, we remeasured CER and EI in 3- and 4-year time windows, respectively, and re-ran our estimation models. The results were found to be consistent with our original ones.

5. Discussion

This study attempts to demonstrate that CER and EI are separate, independent, but interrelated through a resource-allocation mechanism. Specifically, our findings present a negative relationship between CER and environmental innovation. The findings from our study support the literature of firm's investment decision-making under resource-based view with its attention to the focal area of businesses [62,63]. Consistent with the literature, when deciding where to allocate its resources, firms choose to focus on one area over another. Specifically, we could confirm that a firm decides whether to invest in innovative technological advances or to better position itself with a market-relevant view of environmental performance. The empirical results of this study on the moderating effect of proxy variables that capture the level of resource abundance also support the existing literature that firms' capital allocation decision can be better dealt with under the financial condition that guarantees the availability of cash for firms' investment purposes [68,69].

In addition, this study further contributes to the literature by testing resource allocation perspective and the impact of resource abundance under the novel context of corporate approaches to issues. When focal areas share a common basis, such as firm's environment-concerning decisions, how firms' resources are allocated could be directly examined since decisions to allocate its resources belong to the same corporate investment criteria, corporate environmental contribution. In addition, we could also confirm that the firm may sacrifice long-term value-creation that can be achieved through technological innovation in pursuit of the immediate improvement of feedback that can be derived from market-based environmental engagement.

Finally, this study adds value to the extant literature on the antecedents of corporate social responsibility. We could identify CSR-based corporate investments as the potential factor that could determine the level of CSR engagements by the firm. If a firm is pursuing enhancement of long-term CSR standing, intensive investments into R&D would be made and this might deteriorate the level of concurrent investments into CSR activities, hurting the short-term performance of CSR. This suggests that CSR-related long-term corporate investments could reinforce its CSR policy as to how it plans and executes CSR initiatives.

6. Conclusions

This study examines that corporate environmental responsibility impairs environmental innovation due to resource constraints. This trade-off can be reconciled if firms have little difficulties in attaining resources. By using the resource allocation mechanisms, we show that slack resources, free cash flow, and financial leverage can facilitate the commitment to technological development for environmental issues vis-à-vis corporate environmental responsibility. With these findings, this study presents two theoretical implications. First, this study specifies two distinctive ways to embody the value of sustainability: CER and EI. CER is a response to social demands from various stakeholders. CER, accordingly, is understood as externally-driven environmental actions. In contrast, environmental innovation is a firm action to address environmental concerns in its internal processes through technological breakthroughs. As such, EI is internally motivated. Given this distinction, second, this study maintains that the different motivations of CER and EI can be conflicting under the resource constraints within the firm, which shows a trade-off relationship be-

tween them. While technological breakthroughs are required for corporate environmental responsibility, developing technologies for environmental concerns should be internally incentivized. Without serious commitment from abundant resources, firms are not likely to engage in environmental innovation.

Along with these theoretical contributions, the findings from this study provide managerial and social implications. With respect to the managerial implication, this study can suggest guidelines to strategic resource allocation. If the managerial goal is to serve shareholders by maximizing the share value in a sustainable manner, then managers might have to strategically allocate its capital into improving environmental innovation and market perception to preserve higher long-term valuation while maintaining competitive short-term valuation implied by the CSR–CFP link. On the other hand, when managers act and make short-sighted decisions such as focusing heavily on market-wide perception, stakeholders might perform better due diligence and prevent potential harm to long-term firm value by examining its capital allocation decisions.

This study also provides significant social implication for policy-makers. Ever-increasing attention to ESG has led to enactment of regulations such as the ones that target low-carbon emissions as the path to net-zero or disclosure of corporate sustainability actions in their reporting. In this sense, firms will have to pursue not only financial gains but also social gains. Policies that encourage firms to contribute to the social gains could be designed and proposed. Such policies could emphasize and value firms' efforts toward long-term technological innovation that can preserve environmental condition and benefit the society.

Our findings motivate further future research. First, decision-makers' attention between two competing targets should be investigated. In particular, as the board of directors governs the decision-making process of the firm, the navigation between corporate environmental responsibility and environmental innovation should be further discussed in the future. The composition of directors or any other governance-related characteristics of the firm can be a factor to elaborate the underlying mechanism of the trade-off between corporate environmental responsibility and environmental innovation. This way, future study could further extend the literature on firms' strategic decision-making.

Second, the interplay among the categories constituting corporate social responsibility should be further considered to specify the trade-off between corporate environmental responsibility and environmental innovation. In particular, by exploring underlying mechanisms between corporate environmental responsibility and environmental innovation, we can figure out various types of interplay between the two, which will expand our knowledge on environmental innovation as well as corporate environmental responsibility. Similarly, we could further investigate the impact of other categories such as community contribution or diversity policy and if there exist any trade-off between corporate decisions within each category of CSR activities. Such future study could contribute to extend the literature on determinants of CSR actions by the firm.

Last, we should consider the change in capital market toward environmental issues. By actively attending to the environmental issues in the capital markets, firms' responses to environmental sustainability have intensified around 2021. For instance, EU's Sustainable Finance Development Regulation (SFDR) has changed how investment managers view and evaluate their holding firms. Since they have to consider ESG risks regarding their investment decisions, respective firms are encouraged to cope with such investment rules. This capital-market-driven movement toward environmental sustainability may influence the resource-allocation perspective in dealing with environmental innovation. That is, as firms might be forced to actively react to the environmental issues in this ESG regime, environmental innovation may be considered beyond the resource constraints. Firms may prioritize technological development and transform themselves to achieve the goals of corporate environmental responsibility. Firms may not separate environmental innovation from corporate environmental responsibility. Such embedded conception of corporate environmental responsibility will be considered as future research. This study may be used

for a reference frame to figure out the evolution of the landscape constituting corporate environmental responsibility in between the capital markets and the industries.

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References

1. Phiri, O.; Mantzari, E.; Gleadle, P. Stakeholder interactions and corporate social responsibility (CSR) practices: Evidence from the Zambian copper mining sector. *Account. Audit. Account. J.* **2019**, *32*, 26–54.
2. Li, Z.; Liao, G.; Albitar, K. Does corporate environmental responsibility engagement affect firm value? The mediating role of corporate innovation. *Bus. Strategy Environ.* **2020**, *29*, 1045–1055. [CrossRef]
3. Reyes-Rodríguez, J.F.; Ulhøi, J.P.; Madsen, H. Corporate environmental sustainability in Danish SMEs: A longitudinal study of motivators, initiatives, and strategic effects. *Corp. Soc. Res. Environ. Manag.* **2016**, *23*, 193–212. [CrossRef]
4. Berrone, P.; Fosfuri, A.; Gelabert, L. Does greenwashing pay off? Understanding the relationship between environmental actions and environmental legitimacy. *J. Bus. Ethics* **2017**, *144*, 363–379. [CrossRef]
5. Ramus, C.A.; Montiel, I. When are corporate environmental policies a form of greenwashing? *Bus. Soc.* **2005**, *44*, 377–414. [CrossRef]
6. Zhang, D. Environmental regulation and firm product quality improvement: How does the greenwashing response? *Int. Rev. Financ. Anal.* **2022**, *80*, 102058. [CrossRef]
7. Mitchell, J.F. The "greenhouse" effect and climate change. *Rev. Geophys.* **1989**, *27*, 115–139. [CrossRef]
8. Mikhaylov, A.; Moiseev, N.; Aleshin, K.; Burkhardt, T. Global climate change and greenhouse effect. *Entrep. Sustain. Issues* **2020**, *7*, 2897. [CrossRef]
9. Herndon, J.M.; Whiteside, M. Further evidence that particulate pollution is the principal cause of global warming: Humanitarian considerations. *J. Geogr. Environ. Earth Sci. Int.* **2019**, *21*, 1–11. [CrossRef]
10. Nwankwo, W.; Ukhurebor, K.E. An X-ray of connectivity between climate change and particulate pollutions. *J. Adv. Res. Dyn. Control Syst.* **2019**, *11*, 3002–3011.
11. Mikler, J.; Harrison, N.E. Varieties of capitalism and technological innovation for climate change adaptation. *New Political Econ.* **2012**, *17*, 179–208. [CrossRef]
12. Raiser, K.; Naims, H.; Bruhn, T. Corporatization of the climate? Innovation, intellectual property rights, and patents for climate change mitigation. *Energy Res. Soc. Sci.* **2017**, *27*, 1–8. [CrossRef]
13. Heal, G. Corporate social responsibility: An economic and financial framework. *Geneva. Pap. Risk Insur.-Issues Pract.* **2005**, *30*, 387–409. [CrossRef]
14. Carrión-Flores, C.E.; Innes, R. Environmental innovation and environmental performance. *J. Environ. Econ. Manag.* **2010**, *59*, 27–42. [CrossRef]
15. Berrone, P.; Fosfuri, A.; Gelabert, L.; Gomez-Mejia, L.R. Necessity as the mother of 'green' inventions: Institutional pressures and environmental innovations. *Strateg. Manag. J.* **2013**, *34*, 891–909. [CrossRef]
16. Wagner, M.; Van Phu, N.; Azomahou, T.; Wehrmeyer, W. The relationship between the environmental and economic performance of firms: An empirical analysis of the European paper industry. *Corp. Soc. Res. Environ. Manag.* **2002**, *9*, 133–146. [CrossRef]
17. Gimenez, L.G.; Casadeus, F.M.; Valls, P.J. Using environmental management systems to increase firms' competitiveness. *Corp. Soc. Res. Environ. Manag.* **2003**, *10*, 101–110. [CrossRef]
18. Wahba, H. Does the market value corporate environmental responsibility? An empirical examination. *Corp. Soc. Res. Environ. Manag.* **2008**, *15*, 89–99. [CrossRef]
19. Wu, W.; Liang, Z.; Zhang, Q. Effects of corporate environmental responsibility strength and concern on innovation performance: The moderating role of firm visibility. *Corp. Soc. Res. Environ. Manag.* **2020**, *27*, 1487–1497. [CrossRef]
20. Kawai, N.; Strange, R.; Zucchella, A. Stakeholder pressures, EMS implementation, and green innovation in MNC overseas subsidiaries. *Int. Bus. Rev.* **2018**, *27*, 933–946. [CrossRef]
21. Buysse, K.; Verbeke, A. Proactive environmental strategies: A stakeholder management perspective. *Strateg. Manag.* **2003**, *24*, 453–470. [CrossRef]

22. Lee, J.; Kim, S.J. Curvilinear relationship between corporate innovation and environmental sustainability. *Sustainability* **2017**, *9*, 1267. [CrossRef]
23. Friedman, M.A. Friedman doctrine: The social responsibility of business is to increase its profits. *New York Times*, 13 September 1970; Volume 13, 32–33.
24. Berkhout, F.; Green, K. Managing innovation for sustainability: The challenge of integration and scale. *Int. J. Innov. Manag.* **2002**, *6*, 227–232. [CrossRef]
25. Stafford, E.R.; Hartman, C.L.; Liang, Y. Forces driving environmental innovation diffusion in China: The case of Greenfreeze. *Bus. Horiz.* **2003**, *46*, 47–56. [CrossRef]
26. Li, Z.; Wang, Y.; Tan, Y.; Huang, Z. Does corporate financialization affect corporate environmental responsibility? an empirical study of China. *Sustainability* **2020**, *12*, 3696. [CrossRef]
27. George, G. Slack resources and the performance of privately held firms. *Acad. Manag. J.* **2005**, *48*, 661–676. [CrossRef]
28. Islam, S.M.T.; Ghosh, R.; Khatun, A. Slack resources, free cash flow and corporate social responsibility expenditure: Evidence from an emerging economy. *J. Acc. Emerg. Econ.* **2021**, *11*, 533–551. [CrossRef]
29. Waddock, S.A.; Graves, S.B. The corporate social performance–financial performance link. *Strateg. Manag. J.* **1997**, *18*, 303–319. [CrossRef]
30. McWilliams, A.; Siegel, D. Corporate social responsibility and financial performance: Correlation or misspecification? *Strateg. Manag. J.* **2000**, *21*, 603–609. [CrossRef]
31. Bourgeois, L.J., III. On the measurement of organizational slack. *Acad. Manag. Rev.* **1981**, *6*, 29–39. [CrossRef]
32. Arrfelt, M.; Wiseman, R.M.; Hult, G.T.M. Looking backward instead of forward: Aspiration-driven influences on the efficiency of the capital allocation process. *Acad. Manag. J.* **2013**, *56*, 1081–1103. [CrossRef]
33. Bower, J.L. *Managing the Resource Allocation Process: A Study of Corporate Planning and Investment*; Harvard Business School Press: Boston, MA, USA, 1970.
34. Gilbert, C.G. Unbundling the structure of inertia: Resource versus routine rigidity. *Acad. Manag. J.* **2005**, *48*, 741–763. [CrossRef]
35. Ocasio, W. Towards an attention-based view of the firm. *Strateg. Manag. J.* **1997**, *18* (Suppl. S1), 187–206. [CrossRef]
36. Ocasio, W. Attention to attention. *Organ. Sci.* **2011**, *22*, 1286–1296. [CrossRef]
37. Cyert, R.M.; March, J.G. *A Behavioral Theory of the Firm*; Prentice Hall: Englewood Cliffs, NJ, USA, 1963.
38. March, J.G.; Simon, H.A. *Organizations*; Wiley: New York, NY, USA, 1958.
39. Gavetti, G.; Levinthal, D. Looking forward and looking backward: Cognitive and experiential search. *Admin. Sci. Q.* **2000**, *45*, 113–137. [CrossRef]
40. Sullivan, B.N. Competition and beyond: Problems and attention allocation in the organizational rulemaking process. *Organ. Sci.* **2010**, *21*, 432–450. [CrossRef]
41. Maula, M.V.; Keil, T.; Zahra, S.A. Top management's attention to discontinuous technological change: Corporate venture capital as an alert mechanism. *Organ. Sci.* **2013**, *24*, 926–947. [CrossRef]
42. Gavetti, G.; Rivkin, J.W. On the origin of strategy: Action and cognition over time. *Organ. Sci.* **2007**, *18*, 420–439. [CrossRef]
43. James, P. The sustainability cycle: A new tool for product development and design. *J. Sustain. Prod. Des.* **1997**, *2*, 52–57.
44. Kemp, R.; Oltra, V. Research insights and challenges on eco-innovation dynamics. *Ind. Innov.* **2011**, *18*, 249–253.
45. Kemp, R. Technology and environmental policy—Innovation effects of past policies and suggestions for improvement. *Innov. Environ.* **2000**, *1*, 35–61.
46. Chen, Y.S.; Lai, S.B.; Wen, C.T. The influence of green innovation performance on corporate advantage in Taiwan. *J. Bus. Ethics* **2006**, *67*, 331–339. [CrossRef]
47. Burgelman, R.; Maidique, M.A.; Wheelwright, S.C. *Strategic Management of Technology and Innovation*; McGraw Hill: New York, NY, USA, 2004.
48. Huber, J. *New Technologies and Environmental Innovation*; Edward Elgar Publishing: Cheltenham, UK, 2004.
49. Klassen, R.D.; McLaughlin, C.P. The impact of environmental management on firm performance. *Manag. Sci.* **1996**, *42*, 1199–1214. [CrossRef]
50. Greeno, J.L. Rethinking corporate environmental-management. *Columbia J. World Bus.* **1992**, *27*, 222–232.
51. Holtbrügge, D.; Dögl, C. How international is corporate environmental responsibility? A literature review. *J. Int. Manag.* **2012**, *18*, 180–195. [CrossRef]
52. Lyon, T.P.; Maxwell, J.W. Corporate social responsibility and the environment: A theoretical perspective. *Rev. Environ. Econ. Policy* **2008**, *2*, 240–260. [CrossRef]
53. Rayman-Bacchus, L.; Husser, J.; André, J.M.; Barbat, G.; Lespinet-Najib, V. CSR and sustainable development: Are the concepts compatible? *Manag. Environ. Qual. Int. J.* **2012**, *23*, 658–672. [CrossRef]
54. Mazurkiewicz, P. Corporate environmental responsibility: Is a common CSR framework possible. *World Bank* **2004**, *2*, 1–18.
55. Azzone, G.; Manzini, R. Measuring strategic environmental performance. *Bus. Strateg. Environ.* **1994**, *3*, 1–14. [CrossRef]
56. Claver, E.; Lopez, M.D.; Molina, J.F.; Tari, J.J. Environmental management and firm performance: A case study. *J. Environ. Manag.* **2007**, *84*, 606–619. [CrossRef]
57. Rasche, A.; Morsing, M.; Moon, J. The changing role of business in global society: CSR and beyond. In *Corporate Social Responsibility: Strategy, Communication, Governance*; Rasche, A., Morsing, M., Moon, J., Eds.; Cambridge University Press: Cambridge, UK, 2017; pp. 1–28.

58. Sharma, S.; Vredenburg, H. Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strateg. Manag. J.* **1998**, *19*, 729–753. [CrossRef]
59. Jacoby, G.; Liu, M.; Wang, Y.; Wu, Z.; Zhang, Y. Corporate governance, external control, and environmental information transparency: Evidence from emerging markets. *J. Int. Financ. Mark. Inst. Money* **2019**, *58*, 269–283. [CrossRef]
60. Horbach, J. Determinants of environmental innovation—New evidence from German panel data sources. *Res. Policy* **2008**, *37*, 163–173. [CrossRef]
61. Chang, C.H. The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. *J. Bus. Ethics* **2011**, *104*, 361–370. [CrossRef]
62. Gallego-Álvarez, I.; Prado-Lorenzo, J.M.; García-Sánchez, I.M. Corporate social responsibility and innovation: A resource-based theory. *Manag. Decis.* **2011**, *49*, 1709–1727. [CrossRef]
63. O'Riordan, T.; Stoll-Kleemann, S. The challenges of changing dietary behavior toward more sustainable consumption. *Environ. Sci. Policy Sustain. Dev.* **2015**, *57*, 4–13. [CrossRef]
64. Gonzalez-Benito, J.; Gonzalez-Benito, O. The role of stakeholder pressure and managerial values in the implementation of environmental logistics practices. *Int. J. Prod. Res.* **2006**, *44*, 1353–1373. [CrossRef]
65. Sarkis, J.; Zhu, Q.; Lai, K.H. An organizational theoretic review of green supply chain management literature. *Int. J. Prod. Econ.* **2011**, *130*, 1–15. [CrossRef]
66. Li, Y. Environmental innovation practices and performance: Moderating effect of resource commitment. *J. Clean. Prod.* **2014**, *66*, 450–458. [CrossRef]
67. Hull, C.E.; Rothenberg, S. Firm performance: The interactions of corporate social performance with innovation and industry differentiation. *Strateg. Manag. J.* **2008**, *29*, 781–789. [CrossRef]
68. Dierickx, I.; Cool, K. Asset stock accumulation and sustainability of competitive advantage. *Manag. Sci.* **1989**, *35*, 1504–1511. [CrossRef]
69. Teece, D.J. Capturing value from knowledge assets: The new economy, markets for know-how, and intangible assets. *Calif. Manag. Rev.* **1998**, *40*, 55–79. [CrossRef]
70. Ross, S.A. The determination of financial structure: The incentive-signalling approach. *Bell J. Econ.* **1977**, *8*, 23–40. [CrossRef]
71. Rauh, J.D.; Sufi, A. Capital structure and debt structure. *Rev. Financ. Stud.* **2010**, *23*, 4242–4280. [CrossRef]
72. Bae, J.; Kim, S.J.; Oh, H. Taming polysemous signals: The role of marketing intensity on the relationship between financial leverage and firm performance. *Rev. Financ. Econ.* **2017**, *33*, 29–40. [CrossRef]
73. Kim, S.J.; Bae, J.; Oh, H. Financing strategically: The moderation effect of marketing activities on the bifurcated relationship between debt level and firm valuation of small and medium enterprises. *N. Am. J. Econ. Financ.* **2019**, *48*, 663–681. [CrossRef]
74. Hall, B.H. The financing of research and development. *Oxf. Rev. Econ. Policy* **2002**, *18*, 35–51. [CrossRef]
75. Czarnitzki, D.; Kraft, K. Capital control, debt financing and innovative activity. *J. Econ. Behav. Organ.* **2009**, *71*, 372–383. [CrossRef]
76. Thakor, R.T.; Lo, A.W. *Competition and R&D Financing Decisions: Theory and Evidence from the Biopharmaceutical Industry*; No. w20903; National Bureau of Economic Research: Cambridge, MA, USA, 2015.
77. Na, H. Innovation on the choice of debt financing source: Evidence from innovative firms. *Stud. Econ. Financ.* **2021**, *38*, 901–925. [CrossRef]
78. Guney, Y.; Ozkan, A.; Ozkan, N. International evidence on the non-linear impact of leverage on corporate cash holdings. *J. Multinatl. Financ. Manag.* **2007**, *17*, 45–60. [CrossRef]
79. Corrocher, N.; Ozman, M. Green technological diversification of European ICT firms: A patent-based analysis. *Econ. Innov. New Technol.* **2020**, *29*, 559–581. [CrossRef]
80. Jayachandran, S.; Kalaignanam, K.; Eilert, M. Product and environmental social performance: Varying effect on firm performance. *Strateg. Manag. J.* **2013**, *34*, 1255–1264. [CrossRef]
81. DesJardins, J. Corporate environmental responsibility. *J. Bus. Ethics* **1998**, *17*, 825–838. [CrossRef]
82. Novy-Marx, R. The other side of value: The gross profitability premium. *J. Financ. Econ.* **2013**, *108*, 1–28. [CrossRef]
83. Hausman, J.A. Specification tests in econometrics. *Econometrica* **1978**, *46*, 1251–1271. [CrossRef]