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Proactive versus Reactive Corporate Environmental Practices and Environmental Performance

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Abstract: This study investigates how different types of corporate environmental practices affect environmental performance. This paper is theoretically anchored in the natural resource-based view and, methodologically, it applies the recently recommended disaggregated approach in a new effort to deepen our understanding of how environmental performance is associated with different types of corporate environmental practices. The results partially affirm the argument of the natural resource-based view that proactive corporate environmental practice leads to better environmental performance, whereas reactive corporate environmental practice is associated with worse environmental performance. However, the relationship between corporate environmental practices and environmental performance should be carefully interpreted, because the findings differ depending on how Kinder Lydenberg Domini (KLD) strength and concern rating scores are measured. The results further demonstrate that the disaggregate KLD environmental rating scores can be better alternative measures for corporate environmental practices than the commonly used composite and aggregate KLD rating scores, given that disaggregate KLD concern and strength scores represent independent rather than similar constructs. The findings are expected to help both theorists and practitioners achieve a more nuanced understanding of the measurement of environmental practices.

Keywords: environmental practices; environmental performance; Kinder Lydenberg Domini; toxic releases

1. Introduction

The 2011 Gesellschaft für Konsumforschung (GfK) [1] Roper Consulting Green Gauge survey indicates that while the concerns of investors and consumers regarding environmental issues have increased in the U.S. over the 20 years between 1991 and 2010, firms have been acting as both pollution preventers and pollution generators. That is, firms have not only reduced pollution by developing environmentally friendly technologies and processes, but have also emitted considerable amounts of pollution into the natural environment. Considering that the natural environment is likely to affect the design of corporate strategy [2], organizational theorists have modified previous strategy models to incorporate the natural environment's pressures and the corporate responses to such pressures [3]. Over the past 20 observation years, corporations have attempted to incorporate the effect of corporate environmental practices on environmental performance into their main strategies in pursuit of sustainable growth [4]. Investors have also increasingly paid more attention to corporate environmental practices and environmental performance, as corporate responses to the natural environment necessarily affect corporate economic performance [5].

Corporate responses to the natural environment's pressures are likely to depend on corporate environmental practices in place to cope with environmental risks and to take advantage of newly created opportunities. Numerous studies on environmental sustainability management have emphasized the effect of corporate environmental practices on environmental performance [6–11] with the underlying premise that corporate environmental practices are directed at improving both

environmental and economic performance [12]. Indeed, establishing a link between corporate environmental practices and environmental performance has been a primary concern in the environmental sustainability literature. Because of both weak theory [11] and the limits to the measurement of environmental practices presently in use [13], however, few studies have investigated how distinct proactive and reactive environmental practices influence the corporate environmental performance in different ways, although the literature agrees that environmental practices are the precursor of environmental performance.

The natural resource-based view (NRBV) posits that the connection between strategic environmental management practices and competitive advantage depends on the improvement of environmental performance [14]. The strategic approach to corporate environmental management is likely to exist on a continuum ranging from reactive to proactive corporate environmental practices [15–17]. Reactive corporate environmental practices emphasize complying with environmental regulations and implementing environmental activities, such as end-of-pipe solutions, at a minimum level [11,16]. By contrast, proactive corporate environmental practices go beyond compliance by emphasizing corporate pollution-prevention activities, higher-order learning, and redesign of existing processes [18]. Endrikat et al. [19] acknowledge that reactive environmental practices with respect to the natural environment do not need expertise or skill in dealing with new environmental technologies or processes, whereas proactive environmental practices with respect to the natural environment are closely related to the development of organizational capabilities and resources that may be "potential sources of competitive advantage and that affect a firm's ability to gain financial benefits from improved corporate environmental performance" (p. 740). The NRBV provides reasoning for why proactive environmental management practices can systematically examine the subsequent effect on the natural environment. Nonetheless, few studies have investigated how both proactive and reactive environmental practices may influence environmental performance in different ways, although the sustainability literature agrees that environmental practices are the precursor of environmental performance. Accordingly, it is worth asking how such reactive and proactive corporate environmental practices are associated with environmental performance in different ways [6,20]; specifically, how do environmentally proactive firms differ in environmental performance from their counterparts?

To address the relationship between environmental practice and environmental performance, it is critical to have an appropriate measure for environmental practices. However, the existing prevalent measures are not consistent across studies, and are thus unsatisfactory. Hence, it is necessary to further explore the measurement issue in order to provide better understanding. Firms often use voluntary disclosures such as environmental performance ratings to present their proactive environmental performance while suppressing bad news [21], and such ratings have been used as proxy variables to measure corporate environmental management and environmental performance [6]. Since 1991, the voluntary data of Kinder Lydenberg Domini (KLD) ratings has been the de facto standard in environmental sustainability and corporate social performance research [22]. However, the KLD ratings have been employed in similar ways to evaluate corporate environmental management and performance [13,20]. Chen and Delmas [23], for example, indicate that almost 80 percent of corporate social performance research between 1997 and 2009 relied on aggregate measures of KLD 'strengths' and 'concerns' rating scores without ensuring content validity. Namely, the KLD ratings have primarily been used as one of the total (i.e., aggregate) strength scores, total concern scores, and total strengths-total concerns (i.e., composite scores). However, Mattingly and Berman [13] warned that simply aggregating or combining KLD strength and concern scores for empirical research could mask the countervailing effects of each KLD rating; rather, they suggest that aggregate or composite measures of KLD ratings be regarded as independent constructs. Given that the validity of any conclusions employing aggregate or composite KLD rating scores may lead to misinterpreting the latent meanings of KLD ratings, this study employs disaggregate KLD environmental rating scores, as recommended as an alternative method by Mattingly and Berman [13], to measure corporate environmental practices. In turn, rather than enumerating the well-argued criticisms provided by

both Chatterji et al. [20] and Mattingly and Berman [13] for the existing composite and aggregate KLD score methods, this study attempts to qualify whether the disaggregate score method can be a promising alternative measure to help enhancing researchers' and practitioners' understanding of the measurement of environmental practices.

The next section addresses the theoretical connection between corporate environmental practices and environmental performance to develop and test some hypotheses. Data and methods section presents details of the sample and methodology, and results section explains the regression models and their results. The discussion, conclusion, and possible future research directions are presented in the final section.

2. Literature Review and Hypotheses

2.1. Corporate Environmental Practices and Environmental Performance

Firms usually disclose good news while suppressing bad news because they don't want to be involved in environmental risks, which is why investors may interpret these disclosures as a positive signal concerning the firm's exposure [24,25]. Managers have used environmental disclosure to maintain or increase the legitimacy of their firms, in order to reassure stakeholders and their approval of the firm's activities, since stock market reactions seem to be positively linked to this kind of disclosure [21,24,25]. As a result, firms often use voluntary disclosure to present a proactive environmental image by providing "green washing" information about their environmental performance. For this reason, it is worth exploring to what extent environmental management practices are really implemented by companies [26] and are associated with environmental performance [16,20].

Environmental issues such as pollution prevention and climate change, on the one hand, have rapidly grown in importance as social matters [27,28], and they, on the other hand, have changed the competitive environment [29]. The natural resource-based view insists that corporate competitive advantage cannot be maintained without taking into account the interaction between the organization and its natural environment [29,30]. As corporate responses to the natural environment necessarily affect the economy in general and corporations in particular [5], how firms adopting proactive environmental practices differ from their counterparts in environmental performance has become a fundamental research question in the organizational management and natural environment literature [3]. Corporate environmental practices are likely to depend on management's response to environmental risks and opportunities, on organizational capabilities to deal with environmental challenges, and on environmental regulatory pressure, consumer pressure, and other stakeholder pressure [31,32]. Corporate environmental practices can be defined as a set of initiatives that contribute to the natural environment [11] or a set of actions taken by firms to achieve their environmental objectives [18,29,33]. Lee and Rhee [34] also define corporate environmental practices as the choice of environmental initiatives, which in turn lead a firm to shape distinctive environmental capabilities.

According to the natural resource-based view [14,29], environmental practices can be specifically dichotomized, where minimal legislative compliance is labeled as "Reactive" practices and voluntary actions as "Proactive" practices. Reactive environmental practices can be achieved by end-of-pipe methods [12,29] and require little involvement from top management and no company-wide employee training or education [32]. Reactive corporate environmental practices emphasize compliance with environmental regulations and implement environmental activities, such as end-of-pipe solutions, to a minimum level [11,16]. Companies merely complying with regulation deliberately commit minimal resources towards environmental issues, and they primarily focus on "low-hanging fruit", i.e., short-term actions, such as improved waste management or better energy efficiency that can be easily implemented [33]. Generally, companies advocating minimal environmental actions give environmental issues low priority and assume that minimal investments will pay off. For this reason, they accept lower environmental performance (e.g., more toxic releases) and increased risk of environmental failure.

In contrast, proactive corporate environmental practices go beyond compliance by emphasizing corporate-pollution prevention activities, higher-order learning, and redesign of existing processes [18]. Proactive environmental practices include serious efforts to increase resource productivity, material substitutions, innovative manufacturing process (e.g., to conserve energy) and new products (e.g., 100% recyclable products), technological innovations and substitutions, which often require the collaboration and involvement of many stakeholders [18,29]. Firms adopting these environmental practices expect significant enhancement in environmental performance (e.g., smaller volumes of toxic materials released into the natural environment) and assume that implementing such practices will yield better and more sustainable economic performance. Indeed, according to the proponents of NRBV [14,29], environmental performance is determined by the ability of a firm to reduce its environmental impact by committing to optimal environmental practices.

Environmental rating databases appear as the only existing sources for standardized and longitudinal data on the topic, although their relevance for research as well as the nature of activity and behavior they are actually capturing is still under debate. While meeting the increasing demands among diverse stakeholders for environmental sustainability reporting, socially responsible investment organizations have reported social and environmental performance indicators, such as the Dow Jones Sustainability Indices, Calvert, Innovest, and KLD ratings, to help evaluate corporate environmental practices and performance. Of the existing environmental ratings, KLD has become "the de facto research standard" [22], and has been widely used to evaluate corporate environmental management [13,20]. It is simply noted that few have deeply examined the structure and information content of the KLD data.

The KLD records voluntarily disclosed longitudinal data of environmental concern and strength rating scores, and such scores indicate the outcomes of the distinct corporate environmental initiatives. The KLD concerns are the consequences of actions taken ex post, and are evidence of a reactive strategy. For example, KLD concern scores such as 'Regulatory Problem' and 'Hazardous Waste' indicate outcomes resulting from the implementation of corporate environmental actions or practices not taken ex ante, i.e., the results of actions taken to control pollution, rather than prevent pollution. In contrast, The KLD strengths are the outcomes of deliberate action taken ex ante; a proactive strategy. For example, 'Pollution Prevention' and 'Beneficial Products & Services' represent the outcomes of corporate environmental practices taken ex ante, i.e., long-term oriented proactive actions. Proactive environmental practices emphasize prevention of problems rather than cleaning up of messes such as those created in the Gulf of Mexico by BP and its contractors (i.e., Transocean and Halliburton) in April 2010. According to the definition of environmental practices mentioned previously, some firms may adopt and implement dimensions of reactive environmental concerns in the KLD environmental ratings, whereas others may execute proactive environmental strengths. Depending on the selection of the different KLD environmental dimensions, firms are likely to form different types of environmental capabilities over time, in turn leading to distinct environmental performance.

Klassen and Whybark [35] argue that corporate environmental performance can be understood as the output of strategic corporate environmental practices and indicates the effects of corporate activities and products on the natural environment. Environmental performance refers to the impact of corporate environmental practices on the natural environment (ISO 14031:1999 definition 3.7). Thus, implementing corporate environmental practices should lessen the effects on the natural environment. Indeed, according to the proponents of the NRBV [14,29], environmental performance is determined by the ability of a firm to reduce its environmental impact by committing to optimal environmental practices. Most firms tend to adopt environmental practices and activities to reduce their environmental effects or minimize their impact on the natural environment [6].

Pollution control, such as for toxic emissions, is a good example of examining corporate environmental performance with regard to a specific phenomenon [20]. Färe et al. [36] acknowledge that environmental performance can be measured by aggregate data such as toxic release inventory (TRI) data. According to the 1986 Environmental Protection and Community Right-to-Know Act

in USA, facilities are required to voluntarily disclose their toxic release inventory data to the Environmental Protection Agency (EPA). Färe et al. [36] also showed that the disclosure of TRI voluntary data report allows the public to monitor self-regulatory activities by business, in turn contributing to the reduction of toxic emissions by firms within pollution-generating industries such as coal-fired power plants. Some studies insist that voluntary self-regulatory programs such as EPA TRI are a very effective mechanism for evaluating corporate environmental performance (i.e., decrease or increase in a firm's toxic emissions) [37,38].

2.2. Hypotheses

Given that not every environmental practice is likely to result in the same environmental performance, this study assumes that corporate proactive and reactive environmental practices developed from distinct capabilities influence the natural environment in different ways. Proactivity refers to the tendency for a company to take action in expectation of emerging social and environmental issues [39,40]. As mentioned earlier, firms tend to intentionally disclose "good news" and suppress "bad news" about their exposure to environmental risks, which is why investors may interpret these disclosures as a positive signal concerning the firm's exposure. For example, corporations intend to employ voluntary disclosure to present a proactive environmental image by providing "green washing" information about their environmental performance [24]. The KLD strength ratings point to the outcomes of corporate environmental initiatives ex ante. Accordingly, proactive environmental practices indicate actions taken ex ante to prevent such emerging environmental issues. Proactive environmental practices go beyond regulatory compliance and symbolic behavior to increase resource productivity, material substitutions, innovative manufacturing processes, new products, and technology innovations and substitutions, all of which presumably require the collaboration of many stakeholders [18,29]. Proactive environmental practices emphasize prevention rather than cleaning up messes.

Proponents suggest that proactive environmental practices actually help firms better utilize inputs, reduce costs, remove unnecessary processes, develop differentiating competitive advantages, and enhance their legitimacy while improving the environment [18,29,30]. Proactive environment-friendly innovations allow firms to use resources more productively and design them to actually reduce their environmental footprint, leading to economic benefits through increased sales, and product and process offsets, which in turn enable further investment in more proactive environmental practices [12]. Companies investing in the natural environment through eco-friendly innovations or designs regard proactive environmental practices as a key market commitment [9]. The NRBV contends that improved environmental performance is more often associated with proactive environmental practices than with reactive pollution control practices [30]. Strategy scholars also regard proactive environmental practices as value-creating actions because such practices may facilitate firms' competitive advantage [10,17,35,41]. Firms adopting proactive environmental practices expect fewer toxic releases into the natural environment and significant environmental performance enhancements. Firms adopting these proactive environmental practices expect significant environmental performance enhancements and a more sustainable economic performance. Thus, proactive environmental practices are likely to lead to better environmental performance (e.g., fewer toxic releases into the natural environment).

Hypothesis 1. *Proactive environmental practices will lead to better environmental performance.*

Reactive environmental practices emphasize ex post actions. KLD concern ratings point to corporate environmental initiative outcomes not taken ex ante. Reactive environmental practices can be achieved by end-of-pipe methods [12] and require little involvement from top management or company-wide employee training and education [32]. Companies that merely comply with regulations commit minimal resources to environmental issues, focusing instead on short-term, easily implemented actions such as improved waste management or better energy efficiency [33].

Firms that implement reactive environmental practices respond to changing environmental regulations by managing their physical equipment or employing their waste removal facilities more effectively [16]. They may also limit their spending to improving "communications", decoupled from actual involvement. They usually respond to environmental challenges only after pollution occurs [29]. For example, BP's Texas City refinery faced around a $10 billion lawsuit in August 2010 after the company had illegally emitted 538,000 pounds of toxic chemicals into the air. Companies advocating minimal environmental practices tend to give environmental issues low priority and assume that minimal investment will pay off. For this reason, they accept lower environmental performance and the increased risk of environmental failure. This study regards reactive environmental practices as a symbolic behavior rather than substantial ex-ante environmental initiatives. Thus, reactive environmental practices are likely to lead to worse environmental performance (e.g., greater toxic releases into the natural environment).

Hypothesis 2. *Reactive environmental practices will lead to worse environmental performance.*

3. Data and Methods

3.1. Sample

This study uses two primary longitudinal databases: the Environmental Protection Agency's toxic releases inventory for environmental performance and the KLD concern and strength ratings for corporate environmental practices. This study also employs COMPUSTAT for other control variables related to corporate financial data. The sample consists of publicly traded U.S. firms operating in heavily polluting industries in which environmental issues are among the most hotly debated [42,43]. The North American Industry Classification System (NAICS) indicates that the sample can be classified as six heavily polluting industries at the two digit codes: NAICS 21 includes Coal Mining and Metal Mining; NAICS 22 consists of Electric Utilities, NAICS 31 comprises Food/Beverage/Tobacco, Textiles, Apparel, and Leather; NAICS 32 includes Paper, Printing and Publishing, Petroleum, Chemical, Plastics and Rubber, and Stone/Clay/Glass/Cement; NAICS 33 is made up of Primary Metals, Fabricated Metals, Machinery, Computers and Electronic Products, Electric Equipment, Transportation Equipment, Furniture, and Miscellaneous Manufacturing; and, NAICS 42 is composed of Chemical Wholesalers and Petroleum Bulk Terminals. Health-impairing pollution problems and the costs of pollution have enormously increased over time. According to EPA, pollution-generating industry sectors are greatest contributors to a health-impairing environment, although firms across all industries pollute to a greater or lesser degree. These pollution-generating industries have paid more attention to environmental issues because they are more likely to be under environmental regulation control [44]. These industry sectors have often been singled out because the industry has a high environmental effect via toxic emissions on the natural environment [45,46].

Since 1988, the EPA TRI has provided "detailed information on approximately 650 chemicals and chemical categories that over 23,000 industrial and other facilities manage through disposal or other releases, recycling, energy recovery, or treatment". Since 1991, the KLD has annually reviewed company public documents and generated approximately 80 binary "concern" and "strength" ratings of environmental, social, governance, and controversial business issues. Considering the primary research question, this study only uses environmental concern and strength ratings.

The year 1991 is the beginning of the observation period, the so-called "left-censoring" [47], as KLD data have been available since 1991. This study set the year 2010 as the end of the observation (so-called "right-censoring") because this study aims at qualifying how firms have responded to the increased environmental concerns of investors and consumers in the U.S. over the past 20 years, as the 2011 GfK survey indicates that the concerns of investors and consumers regarding environmental issues increased from 1991 to 2010.

In integrating the two data sets, this study used the KLD as the primary reference because it covers a smaller number of firms and its data are available for a few years longer than the TRI data. First, the toxic releases were totaled from all facilities in a given year to compute the aggregate releases at the firm level. Second, since the two databases are compiled in different ways, the author verified whether the same company appeared in both datasets, and then carefully matched the two datasets to create an integrated database. Finally, the author randomly checked several firms for accuracy. The final sample consists of 3613 firm year cases for 490 firms during the observation period between 1991 and 2010.

3.2. Dependent Variable: Toxic Releases

As mentioned earlier, pollution-generating industry sectors in the sample are greatest contributors to a health-impairing environment. Pollution control in these industries is a good example of examining corporate environmental performance [20]. As mentioned earlier, environmental performance delivers the impact of corporate environmental practices on the natural environment. Thus, implementing corporate environmental practices should lessen the effect of corporate environmental practices on the natural environment. This study uses the EPA's TRI data, which are publicly accessible and measurable, providing objective comparisons in environmental performance over the years [20]. As mentioned earlier, pollution-generating industry sectors in the sample are the greatest contributors to a health-impairing environment. Blacconiere and Patten [48] acknowledged that firms in the so-called pollution-generating industries could be more responsible for environmental disasters such as toxic emissions or chemical leaks. Pogutz and Russo [49] also argued that TRI data effectively represent environmental performance because they are characterized by "relevance", "accuracy", "comparability", "availability", and "measurability". Specifically, this study uses firm log-transformed annual total toxic releases to control for outliers as the sample consists of small to large firms in diverse industries.

3.3. Independent Variables: Corporate Environmental Practices

This study uses the KLD environmental ratings as proxies for corporate environmental practices because the KLD, unlike other environmental ratings, includes more comprehensive samples, provides ratings on multiple attributes, and employs objective measures. The KLD employs independent and trained research staff to annually read, review, and evaluate public corporate documents (e.g., annual reports, company websites, firms' social performance reporting) and other data sources. The KLD became the research standard for environmental sustainability research [22], and it has been commonly used for independent analysis [13,20,50]. The KLD environment indicators encompass seven "strength" and seven "concern" dichotomous variables. The seven strengths are Beneficial Products and Services, Pollution Prevention, Recycling, Clean Energy, Communities, Property, Plant, and Equipment, and Other Strengths; all of which reflect ex ante actions directed towards better environmental performance. The seven concerns are Hazardous Waste, Regulatory Problems, Ozone-depleting Chemicals, Substantial Emissions, Agricultural Chemicals, Climate Change, and Other Concerns; all of which reflect the consequences of actions not taken ex ante. This study does not consider the indicators marked "not available" or "not related". Substantial Emissions was also not included in the analysis due to a high correlation with toxic releases used as a proxy for environmental performance. Thus, a firm may have up to four total concern scores and four total strength scores (see Table 1).

The existing studies have employed the KLD ratings in two ways [12,51]: the respective sums of the KLD strengths and concerns (i.e., total concern and strength scores) [20,52–54] and the differences between total strengths and total concerns (i.e., composite scores) [55,56]. These methods, however, are likely to mask the underlying meanings of the disaggregated ratings because these methods simply aggregate and subtract statistically unrelated disaggregate KLD rating scores [13,50]. Alternatively, some recent studies have called for fine-grained disaggregate measures, given that the KLD ratings have low internal reliability and external validity, and thus represent different constructs [13,50].

For the main research question, this study uses *disaggregate concern* and *strength rating scores* to reflect the most recent measurement recommendations. For further comparisons with existing studies, this study also employs *composite scores* by subtracting the sum of environmental concerns from the sum of environmental strengths. From this, a positive score indicates proactive environmental practices, whereas a negative score indicates reactive environmental practices. Separate *total concern scores* and *total strength scores* are also used as proxies for reactive and proactive environmental practices, respectively.

3.4. Control Variables

This study controls for firm size, capital expenditures, and economic conditions, which are correlated with corporate environmental performance at firm level and industry level, respectively. *Firm size*, represented by log-transformed sales, is likely to matter in the relationship with environmental performance [54,56,57]. Hart and Ahuja [14] note that American manufacturers spent about 20% of their capital budgets on emissions compliance, and they assume that *capital expenditures/sales* negatively correlated with toxic releases across time. The last control factor is the economic environment, reflected by the *Misery Index* (unemployment rate + inflation rate).

3.5. Analysis

The sample consists of time-series unbalanced panel data. Fundamental to the analysis of panel data is the choice of a coefficient estimator: fixed versus random effects [58,59]. The Hausman test, a commonly recommended post-estimation test in STATA, shows that the fixed effects model is more appropriate. To investigate whether corporate environmental practices indeed matter in explaining corporate environmental performance, this study applies the following ordinary least-square regression estimation. As is often recommended in a serial longitudinal data analysis, this study double-checked for the so-called heteroskedasticity problem by applying the Breusch-Pagan post-estimation technique [58,59]. This Breusch-Pagan test indicated that we could soundly reject the null hypothesis ('H0: No heteroskedasticity is satisfied') with chi2 distribution (chi2 = 115.64) at a significant level (Prob > chi2 = 0.0000). Thus, this study employed the white robust standard error to correct the heteroskedasticity [59]. Considering these analytic procedures, this study embodied the final ordinary least-square regression estimation method with STATA command option (i.e., 'xtreg, fe vce (robust)') to obtain the robust standard errors in the unbalanced panel data column.

$$TR_{i,t} = F\left(\beta_1 \text{Corporate environmental practices}_{i,t} + \beta_2 \text{Control variables}_{i,t} + \mu_{i,t}\right)$$

where TR = Log-transformed total toxic releases (unit: pounds) of a firm in year t; corporate environmental practices = KLD disaggregate concern and strength score, KLD total concern scores, KLD total strength scores, KLD composite scores.

4. Results

Table 1 summarizes the basic statistics, including means, standard deviations, and ranges. In Table 2, the correlation matrix shows that each environmental concern is positively correlated, whereas the environmental strength correlations are sometimes positive and sometimes negative. The correlation between disaggregate concern and strength scores are positively and negatively associated, but the positive relationship is more frequently observed. The correlation results also indicate that 'Total Concerns' is positively correlated (r = 0.246) with 'Total Strengths' at a significant level. That is, the results of the correlation analysis from the full sample consisting of 3613 firm-year cases indicate that the total concerns (i.e., negative KLD rating scores) and total strengths (i.e., positive KLD rating scores) may denote a similar meaning. However, two randomly selected sub-samples for the robust analyses show different results. The total concerns in a sample consisting of 1272 firm-year cases between 1991 and 2005 are negatively correlated (r = −0.08) with the total strength scores

at a significant level. This study further completed a robustness test using another sub-sample of 607 firm-year cases between 2000 and 2005. In the smaller sample, total concerns and total strengths are negatively correlated ($r = -0.07$) at a significant level. The results of the correlation analysis from two sub-samples indicate that the total concerns and total strengths are orthogonal, meaning that they represent different constructs [11,13] rather than similar constructs, as shown in the full sample. The results from the sub-samples indicate that simply aggregating KLD concern and strength areas is likely to mask the true meaning of the data [13]. The regression results may demonstrate that, although scholars can take advantage of the overall scores the existing measurement methods provide, they are likely to repeat an unnoticed analytic fallacy with the continuing unsound empirical practice of subtracting total concerns from total strengths [50].

Table 1. Descriptive Statistics.

Category	Variables	Observations	Mean	Std. Dev.	Min	Max
Disaggregate Concern Scores	Hazardous Waste	3613	0.141	0.348	0	1
	Regulatory Problems	3613	0.183	0.387	0	1
	Ozone Depleting Chemicals	3613	0.011	0.103	0	1
	Agricultural Chemicals	3613	0.029	0.168	0	1
Disaggregate Strength Scores	Beneficial Products/Services	3613	0.085	0.279	0	1
	Pollution Prevention	3613	0.071	0.257	0	1
	Recycling	3613	0.038	0.191	0	1
	Clean Energy	3613	0.069	0.253	0	1
Total Concerns	Aggregation of Concern Scores	3613	0.678	1.097	0	4
Total Strengths	Aggregation of Strength Scores	3613	0.358	0.668	0	4
Composite Scores	Total Concerns + Total Strengths	3613	−0.320	1.136	−4	4
Environment Performance	Toxic Releases (Unit: lbs)	3613	3,996,290	2,054,653	0.0000375	453,157,385
Control Variables	Firm Size (Unit: million dollars)	3613	7838	20,368	31	425,071
	Capital Expenditures/Sales	3613	0.064	0.068	0.000	1.135
	Misery Index (Economic Environment)	3613	8.213	1.027	6.05	11.01

Note: We report only five Concern ratings and four Strength ratings, owing to the availability of data, as explained in the paper.

Before executing the nested regression models, the study executed a multicollinearity test by using the variance inflation factor (VIF) [58,60]. The values of VIF for all primary variables are less than four, indicating that there is no serious multicollinearity problem. Concerning confounding effects, the results reported in Table 3 show that firm size has a consistent negative effect on toxic releases at a significant level across both concurrent (Model 4) and time-lagged (Models 5 and 6) models. The results imply that large firms perform better because they are more visible to the public and are likely to be more susceptible to public scrutiny [61]. Large firms are often asked to act as industry leaders, and are more concerned about their external reputations [62]. Decreases or increases in toxic releases of a firm may allow the public to self-monitor corporate environmental performance. Capital expenditures/sales, unlike Hart and Ahuja's [14] observation, is not significant, implying that spending capital on emissions compliance may not allow companies to take advantage of advanced technologies with improved environmental capabilities. Maltz et al. [63] argue that there might be tradeoffs between financial performance such as increase in profitability and environmental performance such as reduction in carbon emissions because performance indicators are measured in different ways or scales. Thus, how capital investment works on environmental performance needs to be further studied by focusing on a single industry, rather than on multiple industries, as in this sample. The macro-economic environment behaved at a significant level only in the one-year disaggregate model as Hart and Ahuja [14] observed. Tough times (i.e., years with a high Misery Index) are expected to add to people's woes, although this is not consistent over all models, thus producing

greater pollution. That is, corporations under unfavorable economic situations or a recession in the U.S. are likely to place greater priority on economic performance rather than environmental performance, as indicated in the 2011 GfK survey. A recent study insists that managers are asked to meet the perceived value of changing social values over time: "If the economy is in recession, then outcomes that lead to higher employment may become more prominent. If an ecological disaster has recently occurred, then perceived societal value of environmental preservation often increases" [63].

To assess how environmental performance is distinctly influenced by different types of corporate environmental practices, this study ran a number of regressions. In concurrent Models 2, 3, and 4 of Table 3, this study regressed current toxic releases on current proactive and reactive environmental practices. Model 2 included only 'Composite Scores', whereas Model 3 included only 'Total Concerns' and 'Total Strengths'. As observed in the existing studies [23,64], 'Composite Scores' in Model 2 has a negative effect on toxic releases at a weakly significant level ($p < 0.1$), and only 'Total Strengths' in Model 3 has a negative effect on current toxic releases at a weakly significant level. The results may imply that composite scores are more influenced by total strengths scores than total concern scores. The negative relationship between toxic releases and both composite and total strength scores, however, should be carefully interpreted. This is because the correlation between total concerns and total strengths from two sub-samples and the full sample demonstrates that total concerns and total strengths are orthogonal and positively associated, respectively, representing different constructs or addressing similar constructs, in turn. Accordingly, the simply summated scores may deliver either lopsided KLD rating scores (here, KLD strength ratings) or countervail both positive strength and negative concern KLD rating scores.

To compare the disaggregate score model with total and composite score models, Model 4 included only the *disaggregate concern and strength ratings* and other control variables. The results of Model 4 are quite different from those of Models 2 and 3. Only a few disaggregate concern and strength ratings in Model 4 have a statistically significant relationship with toxic releases. That is, only 'Regulatory Problems' and 'Ozone Depleting Chemicals' among the four disaggregate concern scores have a positive impact on toxic releases (i.e., worse environmental performance) at a significant level. Similarly, only one strength indicator, 'Pollution Prevention', out of the four strength ratings has a negative effect on toxic releases at a weakly significant level (i.e., better environmental performance). The results from the analysis of the concurrent disaggregate model support Hypotheses 1 and 2.

This study additionally assessed the oft-posed question: *Is the effect of environmental practice on environmental performance time lagged?* [65]. The natural resource-based view argues that environmental practice, particularly proactive environmental practice, requires the ongoing development of specific capabilities over time. This study tested the one-year lagged effects in Model 5 of disaggregate concern and strength ratings on current toxic releases and the two-year lagged effects in Model 6. The results of the time-lagged models show that both 'Regulatory Problems' and 'Ozone Depleting Chemicals' still have an expected positive effect on current toxic releases at a strong significant level. The time-lagged models also demonstrate that both 'Pollution Prevention' and 'Beneficial Products and Services' out of the four strength factors have the expected negative effect on current toxic releases at a strong significant level. The results of the lagged models firmly suggest that current environmental performance is influenced by past corporate environmental practices, as the natural resource-based view insists, although not all disaggregate scores have the expected significant effect on toxic releases. Moreover, the results from the time-lagged models support the argument of the NRBV that corporate environmental capabilities are likely to develop over time.

Table 2. Correlation Matrix (* $p < 0.05$).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)														
(2)	0.364 *													
(3)	0.199 *	−0.02 7 *												
(4)	−0.025 *	−0.073 *	−0.050 *											
(5)	0.467 *	0.510 *	0.154 *	−0.021										
(6)	0.141	0.335 *	0.047 *	−0.021	0.246 *									
(7)	−0.368 *	−0.295 *	−0.122 *	0.008	−0.821 *	0.351 *								
(8)	0.293 *	0.407 *	0.038 *	−0.033 *	0.685 *	0.222 *	−0.531 *							
(9)	0.347 *	0.385 *	0.080	0.005	0.736 *	0.198 *	−0.599 *	0.387 *						
(10)	0.144 *	0.135 *	−0.000	0.014	0.316 *	0.076 *	−0.261 *	0.196	0.117 *					
(11)	0.139 *	0.134 *	−0.015	0.011	0.375 *	0.090 *	−0.309 *	0.218	0.195 *	0.460 *				
(12)	0.013	0.034 *	0.012	−0.055	−0.041 *	0.474 *	0.319 *	0.001	−0.009	−0.013	−0.006			
(13)	0.039 *	0.230 *	−0.069 *	−0.060 *	0.136 *	0.511 *	0.169 *	0.195 *	0.111 *	0.044 *	0.087 *	0.055 *		
(14)	0.099 *	0.082 *	−0.005	0.033 *	0.041 *	0.314 *	0.145 *	0.019	0.067 *	−0.007	−0.026 *	−0.019	−0.015	
(15)	0.167 *	0.258 *	0.156 *	0.025	0.300 *	0.595	0.060 *	0.185 *	0.224 *	0.046 *	0.070	0.062 *	0.138 *	0.031

(1) Log Toxic Releases; (2) Log Sales; (3) Capital Expenditures/Sales; (4) Misery Index; (5) Total Concerns; (6) Total Strengths; (7) Composite Scores; (8) Hazardous Waste; (9) Regulatory Problems; (10) Ozone Depleting Chemicals; (11) Agriculture Chemicals; (12) Beneficial Products and Services; (13) Pollution Prevention; (14) Recycling; (15) Clean Energy.

Table 3. Effect of corporate environmental practices on Log Toxic Releases (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; † $p < 0.1$).

DV: Log Toxic Releases Ind. Variables		Model 1	Model 2 (Composite)	Model 3 (Total Score)	Model 4 (Disaggregate Scores)	Model 5 (L1) (Disaggregate Scores)	Model 6 (L2) (Disaggregate Scores)	Model 7 (L1) (Toxic Releases)	Model 8 (L2) (Toxic Releases)
Control	Firm Size (log Sales)	−0.462 *** (0.118)	−0.467 *** (0.117)	−0.428 *** (0.125)	−0.457 *** (0.117)	−0.455 *** (0.121)	−0.428 *** (0.131)	−0.262 ** (0.081)	−0.366 ** (0.120)
	Capital Expenditure/Sales	0.509 (0.737)	0.397 (0.732)	0.378 (0.732)	0.364 (0.720)	−0.547 (0.921)	−0.230 (0.899)	−0.553 (0.615)	−0.115 (0.776)
	Misery Index	0.106 (0.027)	0.042 (0.027)	0.044 (0.028)	0.036 (0.028)	0.062 * (0.039)	0.044 (0.037)	0.033 (0.022)	0.048 (0.032)
Aggregate Scores	Composite Scores (Total Concerns + Total Strengths)		−0.121 † (0.062)						
	Total Concerns			0.067 (0.051)					
	Total Strengths			−0.182 † (0.110)					
Disaggregate Strengths	Beneficial Products and Services				−0.140 (0.222)	−0.355 * (0.176)	−0.480 ** (0.144)		
	Pollution Prevention				−0.256 † (0.202)	−0.0243 † (0.185)	−0.385 * (0.171)		
	Recycling				−0.091 (0.513)	0.124 (0.417)	0.440 † (0.257)		
	Clean Energy				−0.159 (0.160)	−0.073 (0.171)	−0.099 (0.221)		
Disaggregate Concerns	Hazardous Waste				−0.014 (0.154)	−0.079 (0.160)	−0.045 (0.159)		
	Regulatory Problems				0.269 ** (0.097)	0.321 ** (0.099)	0.253 ** (0.094)		
	Ozone Depleting Chemicals				1.187 ** (0.508)	1.382 * (0.582)	1.626 * (0.804)		
	Agriculture Chemicals				0.449 (0.312)	0.247 (0.330)	0.097 (0.334)		
Lagged TR	Lagged Log Toxic Releases							0.557 *** (0.037)	0.267 *** (0.022)
Obs		3613	3613	3613	3613	3123	2668	3123	2668
R-Square		0.019	0.022	0.023	0.028	0.036	0.042	0.304	0.081
Model		6.46 ***	5.82 ***	4.70 ***	3.88 ***	5.42 ***	7.22 ***	74.74 ***	14.07 ***

Note: Numbers in parentheses indicate standard errors; a negative coefficient indicates that the factor is associated with smaller toxic releases.

The results of both concurrent and time-lagged disaggregate models strongly but partially support Hypotheses 1 and 2, suggesting that firms with more 'Regulatory Problems' and 'Ozone Depleting Chemicals' are expected to have higher toxic releases, whereas firms with more 'Pollution Prevention' and 'Beneficial Products and Services' are likely to have lower toxic releases. This result is consistent with the NRBV's argument. This study reveals that the relationship between corporate environmental practices and environmental performance sounds more convincing when the environmental practices are measured at the disaggregate level, given the results of the correlation analysis that total concerns and total strengths are orthogonal and that disaggregate concern and strength scores are not consistently associated.

This study further assessed another commonly asked question: *Are firms that perform better environmentally more likely to do better in successive years?* [64]. To evaluate whether environmentally better- (or worse-) performing firms are more likely to do better (or worse) in successive years, the author regressed current toxic releases on lagged toxic releases in Models 7 (one-year) and 8 (two-year). The results of Models 7 and 8 definitely show that current toxic releases (current environmental performance) are likely to be influenced by past toxic releases (past environmental performance), supporting the argument of the NRBV that either good or weak environmental performance tends to continue because firm capabilities develop over time.

5. Discussion

This study set out to assess a theoretical link between corporate environmental practice and environmental performance. The results provide supporting empirical evidence for the NRBV's argument that corporate environmental performance is likely to depend on the selection of proactive versus reactive environmental practice, given that independent corporate environmental practices do not equally lead to better environmental performance.

Concerning measurement when using the KLD rating scores, the results of this study indicate that the KLD assessment ratings should be employed carefully, in order to transfer the underlying true meanings of corporate environmental practices [13]. Specifically, the results of this study indicate that the correlation between total concerns and total strengths in the correlation analysis delivers confusion, depending on the sample composition. That is, in the full sample, which included 3613 firm-year cases from 1991 to 2010, total concerns are positively related to total strengths (r = 0.246) at a significant level. However, in two comparable smaller samples, which were randomly selected, they are essentially orthogonal, meaning that they represent different constructs [11,13]. If they are correlated at $r = -1.00$ or $r = +1.00$, aggregating concerns and strengths would be arithmetically sound. However, the correlation between them is -0.08 and -0.07 in the two sub-samples, respectively, meaning that they are essentially not additive. These mixed correlation results carefully suggest that simply summing independent concern and strength scores could be an unreliable method, as it is founded on the untenable assumption that these factors are highly correlated, and each strength and concern has equal importance. Therefore, the correlation between total concerns and strengths indicates that the simply summated composite scores may not deliver the true meaning of the underlying construct of the KLD ratings. Even worse, the important issue of counts in any research is attributing meaning to the sums of quite different categories. The composite and summated scores for concerns and strengths are difficult to interpret because the composition score is lost: what, for example, is the meaning of adding the annual observation of the strengths 'Beneficial Products and Services' and 'Recycling' activities?

This study attempted to carefully and deeply look at the existing methods used to analyze the KLD database; were the methods used appropriate? The correlation matrix of Chatterji et al. [20] serves as a good benchmark for this research. Although the correlation between total concerns and total strengths ($r_{TC,TS}$) has a positive correlation in Chatterji et al.'s study and the full sample of this study, and a negative correlation in the two sub-samples in this study, the important point is that the correlation between these two total scores is low in each study. Given the sample differences, the different $r_{TC,TS}$ in both studies is not a surprise. However, a closer examination of both Table 2 of

this study and Chatterji et al.'s correlation matrix (i.e., Table 4) reveals that, individually, the correlations between separate KLD concerns and separate strengths are themselves almost all low in both studies, varying from slightly positive to negative from one to the next almost randomly. The results from both studies support the conclusion that quite low correlations characterize the KLD data. Why do these low KLD concern and strength rating correlations matter? One reason they matter is that they preclude factor analysis as a data consolidation scheme. Namely, the low correlations of Table 2 would preclude Principal Components Analysis (PCA) and Exploratory Factor Analysis (EFA) as useful data consolidation schemes. Low correlations usually yield low loadings and make interpretation difficult. EFA only makes sense if there is a reasonable prima facie case that one or a few variables could explain our observations [66]. The low correlations of Table 2 are, therefore, a warning that the use of EFA in the KLD-anchored research is likely to be fraught with difficulty. Accordingly, it is unclear what composite and aggregate KLD variables used in the existing corporate social responsibility and sustainability literature and their significant parameter estimates might mean in studies relying on untested restrictions. Whenever the aggregate and composite variables are used in exploratory factor analysis, the untested assumption of equal weights for the constituent primary KLD observations holds. Tabachnick and Fidell [67] also state that simply summing different unrelated factors to make construct variables (i.e., total concerns, total strengths, and composite scores) should not be attempted unless the data being studied are generally correlated at 0.30 or above.

After reviewing the results of the correlation analysis, this study carefully investigated whether the measures of corporate environmental practices matter in explaining environmental performance and how a different type of corporate environmental practice is related to environmental performance. The results from both concurrent and time-lagged disaggregate models (i.e., Models 4, 5, and 6) provide partial evidence that reactive environmental practices are positively related to toxic releases, whereas proactive environmental practices are negatively related to toxic releases. However, the results suggest that researchers need to be more careful in attributing great weight to the effects of both the KLD composite scores and total scores on toxic releases. First, the concern-to-concern and strength-to-strength correlations were so low that attributing practical meaning to both composite and total scores may transfer unproven meanings to these. Evidence of this is clear in this study; for example, a few particular disaggregate strength and concern scores were significant across both concurrent and time-lagged models. Second, the composite scores and total scores may mask significant effects of specific ratings, given that only disaggregate scores can be readily and reliably interpreted, and that KLD concern and strength dimensions, as shown in the two sub-samples, are orthogonal.

As shown on both concurrent and time-lagged Models 4, 5, and 6 in Table 3, only two concern scores out of 4 and two strength scores among 4 were significant across all models, implying that attributing practical meaning to disaggregate scores need to be conservative. The results in the correlation matrix, Table 2, may provide evidence for the results from these models. Table 2 also shows that disaggregate strength and concern factors are not only weakly correlated one to another, but some pairs have signs quite at odds with common use; for example, the strength 'Pollution Prevention' is positively correlated with all of the separate concern factors, including 'Hazardous Waste', 'Regulatory Problems', 'Ozone Depleting Chemicals', and 'Agriculture Chemicals'. Moreover, the strength factor 'Recycling' is not correlated with other strength ratings. Accordingly, the results in Table 2 partially support the possibility that summing untested separate strength and concern factors is likely to be an error [68]. Caution is needed when studying the relationship between the KLD ratings as a proxy for corporate environmental practices, as Mattingly and Berman [13] argued.

In addition, the findings in disaggregate score Models 4, 5, and 6 show that not all environmental practices predict toxic emissions, but rather only two concern and two strength scores showed an expected effect on current toxic releases, suggesting that both practitioners and theorists need to be cautious in making simple conclusions. Partially supporting the hypotheses may be due to sample characteristics. This study sample includes 6 heavy pollution-generating industry sectors to increase the generalization of findings. However, some researchers argue that empirical studies applying single

industry sectors are likely to show significantly stronger results than using samples across diverse industry sectors [19,63,69].

Table 3 shows that the R-square values across the concurrent nested models are relatively low, although a slight improvement in the models was apparent for the time-lagged models. Given the small number of significant results reported in Table 3, we found no compelling evidence of a strong relationship between environmental performance and the disaggregate concern and strength scores. It may be that there is a weak causal relationship between environmental practices and environmental performance [64,65]. Regardless of the degree of R-square values, the marginal effect of primary coefficient is alternatively used in the econometric analysis to strengthen the suggested model significance [60]. To understand the marginal effect of disaggregate KLD ratings, this study held other variables in Model 4 as constants and calculated the marginal effect of both one concern rating ('Regulatory Problems') and one strength rating ('Pollution Prevention'). According the analysis, a firm with one Regulatory Problems is expected to emit about 30.8% (about a 0.85 pound increase in toxic releases from 2.754 to 3.604) more toxic releases into the natural environment than a firm without Regulatory Problems. By contrast, a firm with one Pollution Prevention is estimated to release about 22.98% (about a 0.64 pound decrease in toxic releases from 2.754 to 2.212) fewer toxic releases into the natural environment than a firm without Pollution Prevention. The size of their marginal effects is small, but this finding cannot be considered insignificant, because a small toxic emission of some chemicals can have huge effects on humans [70]. The findings partially confirm the NRBV's argument that environmental performance is likely to depend on the selection of a proactive versus a reactive environmental practice.

Table 4 further corroborates the findings in Table 3. It lists the corporate environmental practice rating scores and toxic releases per dollar for six companies that appear to adopt either reactive or proactive environmental practices from 1991 to 2005. United States Steel, Du Pont, and Dow, all with more Regulatory Problems, report higher toxic releases per dollar than Calgon Carbon, Thermo Fischer Scientific, and Johnson Controls, which have more Beneficial Products and Services. Table 4 confirms, as Dentchev [40] suggested, the superior environmental performance of proactive companies is apparent.

Table 4. Mini Sample Firms—Impact of corporate environmental practices on Toxic Releases.

	Firms	Number of Regulatory Problems	Number of Beneficial Products and Services	(TR (kg)/ $ Sales) $\times 10^4$
Firms with reactive corporate environmental practices	US Steel	14	0	317
	DuPont	15	0	198
	Dow	15	7	49
Firms with proactive corporate environmental practices	Calgon Carbon	10	13	216
	Thermo Fischer Scientific	6	15	23
	Johnson Controls	3	8	161

This study has several theoretical and practical implications. First, the disaggregate KLD measures tend to partially support the NRBV's argument that proactive corporate environmental practices lead to better environmental performance, whereas reactive corporate environmental practices lead to worse environmental performance. Thus, if firms attempt to incorporate environmental performance into their core strategies in the pursuit of sustainable growth, they are more likely to achieve this goal by implementing the KLD strength ratings rather than the KLD concern ratings, in turn contributing to an improved natural environment. Second, aggregating and subtracting uncorrelated ratings seem to be a poor method for measuring corporate environmental practices, because the results inferred from such measures may be unintelligible. Accordingly, data aggregation methods, which mask the underlying meanings, are likely to confuse and potentially mislead researchers. Third, this study's disaggregate model provides statistical evidence for the recent argument [13] that not all KLD concern and strength

ratings are significantly related to environmental performance. This study can convince managers to more effectively allocate resources by paying attention to a few effective factors, rather than to all factors. Investors are also more likely to focus on demonstrably effective and transparent KLD ratings. Given that incorporating environmental sustainability into corporate core business practices is becoming a primary strategic issue [63], the results from Table 4 may provide an easy benchmarking guideline, allowing firms to quickly identify excellent corporations in with respect to environmental performance, and to benchmark appropriate environmental practices. Finally, the results of the lagged models support the argument that firms with good (or bad) environmental performance in the past are likely to continue to perform better (or worse) in later years [64]. These findings could provide investors with relevant reasons to pay greater attention to current corporate environmental practices and environmental performance for better investment screening.

This study has several limitations. First, this study employs 6 heavy pollution-generating industry sectors to increase the generalization of findings, given the underlying argument that they are more responsible for environmental disasters or hazardous pollution [48]. Given that applying a single industry sector is likely to show significantly stronger results than using samples across diverse industry sectors [19,63,69], this study employed 'Quantile Regression' analysis, a method that is well suited to exploring relationships that may vary with the level of the dependent variable [71], to additionally execute a robustness test for three industries NAICS 31 (i.e., Food/Beverage/Tobacco, Textiles, Apparel, and Leather), NAICS 32 (i.e., Paper, Printing and Publishing, Petroleum, Chemical, Plastics and Rubber, and Stone/Clay/Glass/Cement), and NAICS 33 (i.e., Primary Metals, Fabricated Metals, Machinery, Computers and Electronic Products, Electric Equipment, Transportation Equipment, Furniture, and Miscellaneous), which are commonly regarded as great contributors to environmental pollution; specifically, this study explored how the relationship between environmental performance and disaggregate concern and strength scores varies across different industry groups. The results show that, in industry 32, 'Hazardous Waste' and 'Recycling' are significant across a wide swathe of the environmental performance spectrum, but, in industry 33, 'Substantial Emissions' and 'Pollution Prevention' are compelling. Comparisons of the patterns of significance across three chosen industries make it clear that industry differences are important. These industry-specific results suggest that studies focusing on one to three disaggregate variables might be fruitful in a single carefully selected industry. Second, as the study used only toxic releases in pounds, it failed to consider the toxicity that represents the quality of environmental performance. This may miss the quality of environmental regulations, given that a small toxic emission of some chemicals can have huge effects on humans [70]. Toffel and Marshall [72] point out that toxic releases can be extended to include toxicity to humans (e.g., carcinogens) or to the ecosystem, persistence (e.g., biodegradable or accumulative), and concentrations into air, soil, or water. The quality of toxicity has yet to be studied. In addition, how environmental practices are associated with social performance such as litigation events and regulatory fines needs to be explained. Third, this study focused on the relationship between corporate environmental practices and environmental performance, as this was the purpose of the research, but future studies need to explain how strategic environmental practices influence financial performance, given that strategic environmental practices can directly improve financial performance due to pollution indicating incomplete, inefficient, or ineffective use of corporate resources [12]. Fourth, it should be noted that the sample consisting of panel data precludes the inclusion of what would otherwise be prudent controls such as GDP growth and energy prices. As mentioned in a recent study [63], researchers can expect that GDP growth would correlate strongly with environmental performance while rising energy prices might facilitate investments in pollution mitigation. Unfortunately, the very nature of the data would make these factors fixed effects, common to every firm. Lastly, the findings do not transfer enough meaning to environmental practices because the KLD binary ratings used to measure proactive and reactive environmental practices have their own intrinsic problems. So, recent studies suggest that simultaneously considering multiple dimensions of sustainability performance may be more reliable for measuring the consistence of sustainability

performance, as multiple dimensions are likely to be tradeoffs [63]. Alternative methodologies, such as content analysis [11] or combining the KLD ratings with other public data, might be a good surrogate measure. Nonetheless, using the combined data should be done carefully, given that little convergence was found across data sources regarding what each organization rates, the companies rated, and the differences between the definitions of corporate social performance [20].

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