INDIVIDUAL VERSUS INDEXED MEASURES OF ENVIRONMENTAL PERFORMANCE AND THEIR IMPACT ON CUMULATIVE STOCK RETURNS

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ABSTRACT

This study investigates the relationship between environmental performance and firms' cumulative annual stock returns from three main perspectives. First, this study starts by considering individual environmental measures that are sorted as six strength variables and seven concern variables that are then individually regressed on cumulative stock returns to identify the relationship between individual environmental performance measures and firms' annual stock returns. Results of this regression indicate that none of the individual environmental strength or concern variables is significantly related to firms' cumulative annual returns. Second, to have an overview on the relationship between overall environmental measures and cumulative stock returns, three environmental indices are constructed which are: Total Strength Rating, Total Concern Rating and Overall Environmental Rating Score and the relationship between cumulative stock returns and each of these indices is investigated. The regression results show that the environmental strength rating variable and overall environmental rating variable have a significant negative effect on firms' stock market performance. The evidence presented supports the perspective that investors perceive that environmental activities represent additional costs on firms that negatively affect financial performance. However, the relationship between cumulative stock returns and environmental concern rating variable turns to be insignificant which indicates that firms that attempt to disregard the environment do not witness any significant changes in their financial performance.

Keywords: Environmental Performance, Cumulative Stock Returns, Strength Variables, Concern Variables.

INTRODUCTION

In recent years, environmental problems and challenges attracted the attention of academics, practitioners and society as a whole. This, in return, forces firms and organizations that engage in environmentally harmful activities to start to care more about the environment and be more environmentally friendly. Shen et al. (2019) argue that, in recent years, the critical role that firms play in preventing environmental crises is one of the main issues in management research agendas. Specifically, researchers are divided into two main schools; a school that view environmental issues as an opportunity and a school that view them as a threat. This, in turn, creates an increased interest in testing the relationship between environmental performance and financial performance.

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The environmental crisis that results from either firm's malfunctioning operations or byproducts from the firms' production process has contributed to a more environmentally conscious society. The Deepwater Horizon oil spill is the largest accidental marine oil spill in the history of the petroleum industry. The Deepwater Horizon oil rig drilled on the BP-operated Macondo Prospect in the Gulf of Mexico. On April 20th, 2010, an explosion led to the release of approximately 5 million barrels of crude oil in open waters, which was contained by capping the gushing wellhead. The spill caused extensive damage to marine and wildlife habitats and the Gulf's fishing and tourism industries. BP admitted that it had made mistakes leading to the Gulf of Mexico oil spill. In June 2010, BP set up a $20 billion fund to compensate the victims of the oil spill. In January 2011, the White House oil spill commission released its final report on the causes of the oil spill. They blamed BP and its partners for making a series of cost-cutting decisions and the lack of a system to ensure well safety. They also concluded that the spill was not an isolated incident caused by "*rogue industry or government officials*", but that "*The root causes are systemic and, absent significant reform in both industry practices and government policies, might well recur*".

In response to increased environmental awareness, firms are now engaging in several environmental activities to redefine their products as more environmentally friendly. For example, in the automotive industry, there has been a major shift, partly induced by governments mandated fuel efficiency standards, to produce more vehicles that produce fewer carbon emissions and use less gas. The redefinition of products also refers to a firm's inclusion of environmental factors in its overall strategies and policies. These may result from the need to comply with the regulatory authorities' rules and regulations or from a desire to serve the new emerging market segment interested in environmentally friendly products. Also, companies are diligently working to build and maintain the image of being good corporate citizens that protect the environment and remediate the effects of the firms' operations.

The nature of the industry and the severity of the impact of the firms' operations on the environment are two of the essential factors that should be considered when analyzing the relationship between firms' environmental and financial performance. With regards to the nature of the industry, giving credit to firms for not polluting the environment when these firms operate in nonpolluting industries seems disingenuous. Practically, these firms make minimal or maybe no effort at all to avoid pollution since the industry is nonpolluting by nature, yet they may be rewarded. On the other hand, firms operating in polluting industries are blamed for polluting the environment just because the nature of their operations results in polluting byproducts. These firms may be involved in considerable efforts to control and/or reduce the polluting byproducts. In determining the severity of the impact of the firms' operations on the environment, researchers tend to differentiate between environmental activities undertaken by the firm based on whether they are positive actions that are considered as strength or negative actions that are considered as a concern and then determine how these strengths and concern scores affect the firm's financial performance.

In this study, we intend to provide evidence on the market response towards environmental activities. Given the above argument that the nature of the industry and severity of the impact of the firm's operations on the industry, the sample used in this study consists only of firms that have an impact on the environment as indicated by their environmental score. Then, these environmental scoring variables are used to highlight the extent of the environmental activities whether positive, which is considered as a strength, or negative, which is considered as a concern and analyze how strength and concern variables independently and jointly affect the financial performance of the firms as measured by cumulative stock returns.

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The rest of the paper is organized as follows: Section 2 presents the literature review and Section 3 addresses the hypotheses of this study and the research methodology employed in testing these hypotheses. The results are reported in Section 4, while Section 5 presents a discussion of the findings and concludes.

LITERATURE REVIEW

The literature on the relationship between environmental performance and financial performance is controversial. Corporations choose to deal with their environmental obligations in a number of ways. Some firms support a sustainability agenda and are willing to go beyond complying with environmental regulations. Other firms are exclusively concerned with short-term profitability and maintaining a competitive advantage in the market and would not spend on environmental activities unless they are obliged to do so. A third group considers the costs of improving environmental performance as a way to reduce other costs, such as environmental liability costs, and/or increases the firm's long-term profitability by making more sales based on a better social image. A final group would not consider corporate environmental and financial performance associated at all.

McGuire et al. (1988) investigate the extent to which social responsibility predicts financial performance and whether financial performance predicts social responsibility. The study provides a summary of three theoretical relationships between corporate social responsibility (CSR) and financial performance: negative association since high social responsibility results in additional costs that put the firm at an economic disadvantage when compared to other less socially responsible firms; positive association since improved employee and customer goodwill is considered an important outcome of social responsibility; no association since the costs of improving environmental performance, while it can be significant, will be offset by other costs that will be reduced and/or revenues that may increase. The results indicated that firms' prior performance, assessed by both stock market returns and accounting-based measures, is more closely related to corporate social responsibility than subsequent performance.

Blaconniere & Patten (1994) examine the market reaction to chemical firms after the Bhopal incident.[1] Results show a significant negative market reaction within the chemical industry following the Bhopal environmental incident. The results of the cross-sectional analysis indicate a significant positive relationship between segment involvement and the severity of the market reaction while a significant negative relationship is found between environmental disclosure and market reaction.

Klassen & McLaughlin (1996) examine the association between environmental management and firms' financial performance. The environmental performance is measured by firms' winning an environmental award announced by third parties. The financial performance is measured using the stock prices as reflected in the equity value of the firm, based on which the authors sought the firms' abnormal returns. The results show significant positive abnormal stock returns following positive environmental events.

Cohen (1997) explores the relationship between environmental performance and financial performance. They categorized companies into low polluter and high polluter groups to compare their accounting and market returns. The main hypothesis is whether firms that perform well in the environmental arena also perform well financially. The results show that green investors (Low polluters) don't need to pay a premium for their convictions. Cohen

[1] Bhopal, Madhya Pradesh, India 1984, A pesticide facility release tons of toxic methyl isocyanate gases that led to a huge death toll in the surrounding area. The Bhopal incident is frequently cited as the world's worst environmental disaster because the death toll was 8,000 -

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10,000 within the first 72 hours of toxic gas emission.

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finds that investors who choose the environmental leaders in an industry-balanced portfolio do better than choosing the environmental laggards in each industry.

Lanoie et al. (1998) investigate the role that capital markets are playing in creating an incentive or applying pressure on firms to improve their environmental performance. As of July 1990, the Ministry of Environment of British Columbia published a list of polluters classified into two categories: firms out of compliance regarding environmental standards or permits and firms of concern to the Ministry because their environmental performance is near the regulatory threshold, or because their level of pollution is abnormally high in a sector of activity which is not regulated. The authors investigate how investors react to firms that appear successively on more than one environmental pollution list. The results indicate that investors do not respond to firms appearing on either or both lists. Abnormal losses occur for firms appearing more than once on the lists only when the sample is classified by the successive appearance in each list. Thus, the results show that investors only respond negatively to firms that appear successively on the out of compliance list.

Lorraine, Collison, & Power (2004) examine the relationship between environmental performance information and stock prices. The study investigates the impact resulting from pollution activities as well as commendations on the share prices in the UK stock market. The results show that 13 out of 32 companies are negatively affected by environmental news. They divide the sample into the good newsgroup and bad news group to measure the individual effect of good and bad events where t-test is carried out. They analyze the good-news events and find little evidence that the stock market utilizes this information as none of the mean abnormal returns were significant at the 5% level. The bad-news event analysis is more consistent with the overall findings from the 32 events with a significant negative return on day t + 7.

Ziegler et al. (2007) explore the effect of the sustainability performance of European firms on their stock performance. The study indicates that the average environmental performance of the industry in which a corporation operates has a significant positive impact on the average monthly stock return from 1996 to 2001. On the contrary, the average social performance of the industry has a significantly negative influenceon the stock performance.

Yamaguchi (2008) assesses the effect of the environmental performance on the ranked firms' stock prices using the event study methodology. He uses the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) and compared the results to those of the OLS (Ordinary Least Squares) for a period of eight years and for each year. The stock prices data is collected from stock prices listed in the first and second sections of the Tokyo Stock Exchange and Tokyo Stock Price Index (TOPIX). The results indicate that the corporate environmental performance of a firm positively affects its stock price as its frequency of ranking increases. Also, firms with a low frequency of ranking are affected considerably by noise. Thus, the researcher compares the financial impact of the lower frequency of ranking with the higher frequency of ranking, finding that the negative effect increases in the low frequency of ranking and the positive effect increases in the higher frequency of ranking. The market may take the firms with the lower frequency of ranking as being unfriendly towards the environment and their environmental performance is not linked to their financial performance in the short term. On the other hand, firms with a higher frequency of ranking may be regarded as being friendly towards the environment and their environmental performance is linked to their profits in the long term.

Anderson-Weir (2010) investigates the relationship between environmental decisions and the stock market reaction. He assesses the 2009 NewsWeek Green Rankings effect on the firm's financial performance using stock market returns. The results indicate that investors place a negative value for firms that are environmentally friendly.

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Cortez (2011) explores the relationship between social and environmental performance and financial performance in the Japanese top listed companies. The researcher shows that there is a significant positive relation between environmental innovations costs and market performance. The other direction of the relation is not rejected where market performance affects investments in environmental innovations costs of the TSE manufacturing companies. The researcher suggests that although environmental innovation is positively related to firm size, revenues (sales), and liquidity, short term and long-term liabilities, it is not significantly related to intangible assets and profitability.

McPeak & Demi Dai (2011) examine environmental issues as a part of corporate social responsibility and how these environmental issues are related to stock market performance. The study uses the KLD data and investigates each company's positive and negative issues. The authors assess the relationship between the environmental ratings and financial performance by using the CAPM beta to evaluate the risk-return relationship. The authors argue that companies that have betas higher than 1 (growth beta) tend to grow higher than the market in bull markets and tend to face sharp declines compared to the market in bear markets. On the contrary, companies that have betas lower than 1 (defensive beta) tend to perform better than the market in bear markets. The results of this paper show that environmentally friendly companies tend to have high betas and thus investors should consider these companies in bull markets to benefits from the gains that these companies achieve. On the contrary, companies that have negative environmental ratings should be considered in bear markets as these companies tend to have low betas and thus they don't face sharp declines in bear markets.

Flammer (2012) examines the relationship between Environmental CSR (corporate social responsibility) and stock prices. The results indicate that the stock market reacts positively to the announcement of eco-friendly initiatives, and negatively to the announcement of eco-harmful behavior. This result is consistent with the argument that environmental CSR generates new and competitive resources for firms as mentioned in instrumental stakeholder theory (Jones, 1995) and the natural resource-based view of the firm (Hart, 1995). The stock price reaction is measured by the average cumulative abnormal return (CAR). The results indicate that the mean CAR is positive (negative) for the announcement of eco-friendly (harmful) events, consistent with the view that shareholders reward companies for eco-friendly initiatives and punish them for eco-harmful behavior. Further, the correlation between CAR and the time trend is negative for both eco-friendly and harmful events, suggesting that the reward for eco-friendly initiatives has decreased over time while the punishment for eco-harmful behavior has increased. Finally, the correlations between the CAR and the KLD indices of environmental strengths and concerns are consistent with the decreasing marginal return argument.

Shen et al. (2019) examine the impact of environmental performance on financial performance in the Chinese market. The results show a concave-down quadratic relationship between variables. Specifically, the results show that the quadratic relation between the variables of interest gets weaker over time as more environmental disclosure regualtions on heavily polluting industries are undertaken. Additionally, it is found that the quadratic relationship between variables is more obvious in privately owned firms when compared to state-owned firms.

Zuoming (2020) studies the relationship between environmental performance and financial return and explains the inconsistent results proposed in prior studies. The overall test results suggest a positive association between the variables of interest (financial and environmental performance). However, the author finds that the relationship between variables differs among indutstries which is consistent with the argument that the nature of

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the industry is one of the most important factors that should be considered when assessing the

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relationship between environmental performance and financial performance. Furthermore, the results show that, even within an industry, the relationship between environmental performance and financial performance differs from one firm to another. Thus, these results may justify the inconclusive results in the literature concerning the relationship between environemtal and financial performance. The study also addresses the causal relationship between environmental and financial performance. While good environmental performance could trigger good financial performance, it is necessary in the first place to have sufficient financial resources to invest in the environmental programs. Thus, there appears to be a two-directional relationship between both variables which help in understanding the endogeneity problem concerned by some researchers (Garcia–Castro et al., 2010; Ghoul et al., 2011; Goss & Roberts, 2011).

Abban & Hasan (2021) investigate the bi-directional causation between environmental and financial performance in the Australian mining industry and utilize the instrumental variable technique to assess endogeneity issues in the model. The results indicate the presence of bi-directional causality between the variables of interest. After addressing the issue of endogeneity, the researchers propose that improved environmental performance leads to better financial performance. It appears that the marginal cost of environmental efforts is higher for more productive firms and thus financial stability of the mining companies is deemed necessary to achieve a more significant amount of emissions reduction.

METHODOLOGY

Previous studies as shown in Section 2 focus mainly on how capital markets respond to environmental events, environmental disclosures, and environmental performance measures such as Blaconniere & Patten (1994), Walden & Schwartz (1997), Klassen & McLaughlin (1996), and Lorraine et al., (2004). Economic performance for these studies is concerned with market responses limited to the particular time horizon around the event date or the environmental information announcement.

Furthermore, in assessing environmental performance, previous research either utilizes a single variable (see, Lorraine et al., 2004; Patten 2002; Al-Tuwaijri et al., 2004) or combine a number of variables to construct an index (see, Ingram & Frazier 1980; Wiseman 1982; Fryxell & Wang 1994). The results of these investigations are, however, inconclusive with respect to the impact of environmental performance on firm valuation. This may be due to the single variable's inability to proxy for overall environmental performance. On the other hand, the use of multiple variables to construct an index may lead to misleading results since some variables may outweigh or offset the effect of other variables.

In an attempt to overcome some of the aforementioned drawbacks, this study investigates whether stock market valuation, measured in terms of annual stock returns, is associated with environmental performance on an ongoing basis rather than in response to unique environmental events. Specifically, to achieve this aim, this study tests whether individual environmental performance variables and comprehensive environmental performance ratings are cross-sectionally related with stock returns. The relationship between firm value with both individual and comprehensive measures provides a unique depiction of how environmental variables combine to influence investor perceptions.

In this study six "*environmental strength*" [ES] measures and seven "*environmental concerns*" [EC] are employed to test the relationship between market valuation and environmental performance. Each ES measure (ES_i, where "i" ranges from 0 to 6) is regressed against annual stock returns and then combined into a total strength rating variable (TES) which, in turn, is regressed against annual stock returns. Likewise, each environmental

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concern measure (EC_i, where "i" ranges from 0 to 7) is regressed against the annual stock and then, similar to TES, combined into a total concern rating (TEC). This variable is then regressed against annual stock returns.

Finally, a company profile is created by combining the total strength rating variable (TES) and total concern rating variable (TEC) into an overall environmental rating variable (OER). This rating is used to test the relationship between firms' overall environmental position and firms' annual stock returns.

Combining individual variables into a rating variable is a process that depends essentially on the nature of the variables that will be combined; two main characteristics of these variables, namely weights and independence, are of interest in the current context. All environmental rating variables are assumed independent and equally weighted. Thus, the combination process is performed by simply adding the scores of both individual environmental strength variables and environmental concern variables in to total environmental strength rating and total environmental concern rating variables and then adding the scores of both total rating variables into one overall environmental rating variable.

Previous studies investigating corporate social sponsibility/environmental performance have used different approaches to assess this construct. These approaches include McGuire et al. (1988) use of Fortune magazine's ratings which is an index comprised of financial soundness, long-term investment value, use of corporate assets, quality of management, innovativeness, quality of products or services, use of corporate talent, and community and environmental responsibility. These attributes are rated on a scale of 0 to 10. Ratings of 0 represent poor environmental performance while a rating of 10 represents excellent environmental performance. Other studies such as Hamilton (1995) employ the use of the Toxics Release Inventory which is a quantitative measure regarding more than 650 toxic chemicals and compounds that are used, manufactured, treated, transported, or released by certain industry groups as well as federal facilities. The CEP index is also used as a measure of environmental performance in studies such as (Ingram & Frazier, 1980). The CEP index is based on a series of industry studies, published by the Council on Economic Priorities and it examines the pollution control records regarding 50 firms in four different industries: petroleum refining; steel; pulp and paper; and electric utility industries.

However, this study employs the environmental performance measures from the KLD database. The KLD database is a dataset that provides an annual snapshot of the environmental, social, and governance performance as assessed by KLD Research & Analytics, Inc. KLD covers approximately 80 indicators in seven major qualitative issue areas including community, corporate governance, diversity, employee relations, environment, human rights and product. The data is gathered from several research processes, which results in a full profile of companies' performance. Based on the criteria used for environmental performance measurement, the data is classified either as "*strength*" or as a "*concern*." Whenever the firm performs a strength activity it is coded "*1*," otherwise "*0*." Similarly, whenever a concerning activity is performed by the firm it is coded "*1*," otherwise will be coded "*0*." The firm's overall environmental performance is assessed by using both the strengths score and concerns score and then by using the overall combined scores of both strengths and concerns.

HYPOTHESIS DEVELOPMENT

This study aims to investigate the general capital market response to firms' environmental performance apart from any particular event or incidence. The market response is measured using firms' annual stock market returns from the CRSP database and

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the environmental performance is measured at both the individual and the index levels. The study is conducted in two stages.

Stage I involves testing the relationship between the individual environmental performance measures and the firms' annual stock returns. Since the efficient markets hypothesis suggests that all information regarding a firm is impounded into the price, the individual environmental variables (ES_i and EC_i) should be significantly related to stock prices if they are viewed by market participants as impacting future cash flows. Thus, the initial hypotheses are:

H1: *There is a significant relationship between individual environmental strength variables (ES_i) and firms' annual stock returns.*

H2: *There is a significant relationship between individual environmental concern variables (EC_i) and firms' annual stock returns.*

Stage II involves investigating the relationship between the environmental rating variables and the firms' annual stock returns. Three tests are conducted; the relationship between the total strength rating variable (TES) and firms' annual stock returns, and the relationship between the total concern rating variable (TEC) and firms' annual stock returns, and finally the relationship between the overall environmental rating variable (OER) and firms' annual stock returns.

TES represents the accumulation of all environmental strength variables. Since these variables are dichotomous in nature, TES will range from 0 (in the case where a firm does not perform any strength activities), to 6 (in the case where a firm performs all of the identified strength activities). TEC represents the accumulation of all environmental concern variables. As with the ES measures, these variables are dichotomous in nature. TEC will thus range from 0 (in the case where a firm does not have any environmental concerns), to 7 (in the case where a firm is deemed to have all of the identified environmental concerns). The firm's overall environmental rating is the sum of the total strength rating score (TES) and total concern rating score (TEC) where $OER = TES - TEC$. The OER scores should technically range from +6 to -7. A +6 OER score will be achieved if the firm performs all strength activities while imposing no environmental concerns. A -7 OER score will result if the firm does not perform any environmental strength activities while its operations evidence all 7 environmental concerns. The overall environmental profile score is regressed against firms' annual stock returns. Afterwards, we consider the results of individual variables compared to the results of the index variables to decide which measures were capable of evaluating the relationship between environmental and financial performance.

We hypothesize that each of these constructs is significantly related to stock returns.
Thus, the third and fourth hypotheses are:

H3: *There is a significant relationship between the total strength rating (TES) and firms' annual stock Returns.*

H4: *There is a significant relationship between the total concern rating (TEC) and firms' annual stock returns.*

If environmental concerns are seen as evidence of increased future costs then it is possible to predict the direction of the association between stock returns and OER. When OER is negative (concerns outweigh strengths), or positive (strengths outweigh concerns), the relationship between stock returns and OER should be positive. Our fifth hypothesis, in an alternative form, is thus:

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H5: *There is a significant positive relationship between overall environmental rating (OER) and firms' annual stock returns.*

Variables

Environmental Performance Variables

The KLD database is used to identify the environmental performance measures employed in this study. The measure assesses environmental performance based on 6 environmental strength variables and 7 environmental concern variables. The environmental strength variables are: *beneficial products and services*, which will be considered an environmental strength only if the company derives substantial revenues from innovative remediation products, environmental services, or products that promote the efficient use of energy, or it has developed innovative products with environmental benefits; *pollution prevention*, which will be considered an environmental strength only if the company has notable strong pollution prevention programs including both emissions reductions and toxics-use reduction programs; *recycling*, which will be considered an environmental strength only if the company is either a substantial user of recycled materials as raw materials in its manufacturing processes, or a major factor in the recycling industry; *clean energy*, which will be considered an environmental strength only if the company has taken significant measures to reduce its impact on climate change and air pollution through the use of renewable energy and clean fuel or through energy efficiency; *management systems strength*, which will be considered an environmental strength only if the company includes environmental objectives as part of the firm's overall plans; *other strengths*, which will be considered an environmental strength only if the company has demonstrated a superior commitment to management systems, voluntary programs, or other environmentally proactive activities.

The environmental concern variables are: *hazardous wastes*, which will be considered an environmental concern only if the company's liabilities for hazardous waste sites exceed $50 million, or the company has recently paid substantial fines or civil penalties for waste management violations; *regulatory problems*, which will be considered an environmental concern only if the company has recently paid substantial fines or civil penalties for violations of air, water, or other environmental regulations, or it has a pattern of regulatory controversies under the clean air act, Clean Water Act or other major environmental regulations; *ozone depletion chemicals*, which will be considered an environmental concern only if the company is among the top manufacturers of ozone pollution chemicals such as HCFCs, Methyl chloroform, methylene chloride, or bromines; *substantial emissions*, which will be considered as environmental concern only if the company's legal emissions of toxic chemicals from individual plants into the air and water are among the highest of the companies within the KLD database; *agricultural chemicals*, which will be considered an environmental concern only if the company is a substantial producer of other cultural chemicals such as pesticides or chemical fertilizers; *climate change*, which will be considered an environmental concern only if the company derives substantial revenues from the sale of coal or oil and its derivative products, or the company derives substantial revenues indirectly from the combustion of coal or oil and its derivative fuel products; *other concerns*, which will be considered an environmental concern only if the company has been involved in any environmental controversy that is not covered by the other EC variables. It should be mentioned that the final sample has no firms with ozone depletion concern activities. Thus, even though the KLD database offers 7 concern variables only 6 contributes to the analysis of this study.

The KLD database is considered to be among the best systems for evaluating

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environmental performance. It has been used extensively in the literature such as the

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following studies: A concurrent validity study of the KLD social performance rating data (Sharfman, 1996); Environmental risk management and the cost of capital (Sharfman & Fernando, 2008); Voluntary corporate environmental initiatives and shareholder wealth (Fisher-Vanden & Thorburn, 2008); How well do social ratings measure corporate social responsibility? (Chatterji, Levine, & Toffel, 2008); The language of US corporate environmental disclosure (Cho, Roberts, & Patten, 2009); Green governance: Board of director composition and environmental corporate social responsibility (Post, Rahman, & Rubow, 2011); Do actions speaker louder than words? (Cho, Guidy, Hageman, & Patten, 2012).

Annual Stock Returns

Monthly stock returns for the sample companies are obtained from the CRSP database then transformed into annual [Cum_Ret] returns in the following fashion:

$$Cumret_{\mathrm{i}} = [1 * (1 + Ret_{\mathrm{i}1}) * (1 + Ret_{\mathrm{i}2}) * (1 + Ret_{\mathrm{i}3}) * (1 + Ret_{\mathrm{i}4}) * (1 + Ret_{\mathrm{i}5}) * (1 + Ret_{\mathrm{i}6}) * (1 + Ret_{\mathrm{i}7}) * (1 + Ret_{\mathrm{i}8}) * (1 + Ret_{\mathrm{i}9}) * (1 + Ret_{\mathrm{i}10}) * (1 + Ret_{\mathrm{i}11}) * (1 + Ret_{\mathrm{i}12})] - 1$$

The cumulative annual returns are thus calculated by compounding the monthly returns where the initial base is 100% or 1, which corresponds to $Cumret$ at T=0. After one month, Cumret will take the value $1 * (1 + Ret_1)$, which is the accumulation of the initial base 100% and Ret_1. After the second month, $Cumret$ will take the value $1 * (1 + Ret_1) * (1 + Ret_2)$. This process is repeated until the twelve months are compounded.

Control Variables

Prior research shows that a number of firm-specific factors appear to be related to environmental performance. In order to more carefully investigate the relationship between firms' environmental performance and stock returns, firm size, environmentally sensitive industry membership, profitability, financial leverage, capital intensity, and return on assets are used as control variables.

Firm Size ($LnAs$)

Blacconiere & Patten (1994) and Cho et al. (2009) among others show that there is a significant relationship between firm size and environmental performance. Specifically, they argue that with respect to environmental performance, larger companies tend to perform better than smaller ones. In these studies, firm size is normally measured using the natural logarithm of total assets.

Capital Intensity (Cap_Int), Return on Assets (ROA), and Profit Margin (Prf_Mrgn)

Capital intensity and profitability are also found to be significantly related to firm's environmental performance (Aerts & Cormier 2009; Clarkson et al., 2008; Reitenga, 2000; Bewley & Li, 2000; Magness, 2006; Al-Tuwaihri et al., 2004). However, capital intensity and profitability are not significant determinants of firm's environmental performance as firm size and industry. Capital intensity is measured as the ratio of total assets to total revenues. Profitability is measured using return on assets (net income divided by total assets), and profit margin (net income divided by sales revenue).

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Financial Leverage (Fin_Lev)

Several studies have also employed financial leverage as one of the financial position control variables (Cormier & Megnan, 1999). Financial leverage indicates the extent to which the business relies on debt financing and is measured by dividing long-term debt by stockholders' equity.

Models

Inclusion of the control variables yields the following empirical test models. All variables are illustrated in Exhibit 1 (See Appendix A for definitions of symbols). The models used to test hypotheses 1 and 2 are:

$$Cumret = a_0 + a_1\,\mathrm{ES_i} + a_2\mathrm{LnAs} + a_3\mathrm{SIC} + a_4\,\mathrm{ROA} + a_5\,\mathrm{Fin\_Lev} + a_6\,\mathrm{Prf\_Mrgn} + a_7\,\mathrm{Cap\_Int} + \mathrm{e} \quad \text{(M1)}$$

$$Cumret = a_0 + a_1\,\mathrm{EC_i} + a_2\mathrm{LnAs} + a_3\mathrm{SIC} + a_4\,\mathrm{ROA} + a_5\,\mathrm{Fin\_Lev} + a_6\,\mathrm{Prf\_Mrgn} + a_7\,\mathrm{Cap\_Int} + \mathrm{e} \quad \text{(M2)}$$

The tests of total environmental Strengths and Concerns (hypotheses 3 and 4) employ the following empirical models:

$$Cumret = a_0 + a_1\,\mathrm{TES} + a_2\,\mathrm{LnAs} + a_3\,\mathrm{SIC} + a_4\,\mathrm{ROA} + a_5\,\mathrm{Fin\_Lev} + a_6\,\mathrm{Prf\_Mrgn} + a_7\,\mathrm{Cap\_Int} + \mathrm{e} \quad \text{(M3)}$$

$$Cumret = a_0 + a_1\,\mathrm{TEC} + a_2\,\mathrm{LnAs} + a_3\,\mathrm{SIC} + a_4\,\mathrm{ROA} + a_5\,\mathrm{Fin\_Lev} + a_6\,\mathrm{Prf\_Mrgn} + a_7\,\mathrm{Cap\_Int} + \mathrm{e} \quad \text{(M4)}$$

The test model for the Overall Environmental Profile variables (hypothesis 5) is:

$$Cumret = a_0 + a_1\,\mathrm{OER} + a_2\,\mathrm{LnAs} + a_3\,\mathrm{SIC} + a_4\,\mathrm{ROA} + a_5\,\mathrm{Fin\_Lev} + a_6\,\mathrm{Prf\_Mrgn} + a_7\,\mathrm{Cap\_Inv} + \mathrm{e} \quad \text{(M5)}$$

RESULTS AND DISCUSSION

To be included in the study, the sample firms have to meet the following criteria:

1. They must be listed in the ratings of corporate social and environmental performance compiled by KLD Research and Analytics, Inc.
2. They must have the required financial accounting information available in the Standard & Poors' COMPUSTAT database.
3. They must have stock prices data available on the CRSP Monthly Returns database.

Table 1 provides the data set collection and the filtering process. Data is collected for years 2006, 2007, and 2008. The initial sample consists of 8822 observations, however, the final dataset consists of 211 observations after excluding: firms with no annual returns, firms

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missing some or all of the accounting data, and Firms with Zero score in TES or TEC or OER.

Table 1
THE OVERALL CROSS-SECTIONAL SAMPLE SET

	2006	2007	2008	Total
Environmental data	2,962	2,937	2,923	8,822
(-) firms with no annual returns	236	218	44	498
Environmental data and annual returns	2,726	2,719	2,879	8,324
(-) firms missing some or all of the accounting data	544	477	623	1,644
All industries sample set	2,182	2,242	2,256	6,680
(-) Firms with Zero score in TES or TEC or OER	2124	2176	2169	6469
(=) Final sample set	58	66	87	211

Table 2 presents the descriptive statistics for the sample firms, more specifically, the minimum, the maximum, the mean, and the standard deviation. On average firms reported -0.064 annual returns during the sample period. The maximum and the mean of the TES rating variable are 4 and 1.770, respectively. These results indicate that the total environmental performance rating score is low during the sample period. The maximum and the mean of the TEC rating variable are 5 and 2.270, respectively. This also indicate that the total environmental concern rating score is low during the sample period. However, the results show that the TEC appears to be higher than the TES which is consistent with the mean of the overall environmental rating score of -0.5.

Table 2
DESCRIPTIVE STATISTICS

	N	Minimum	Maximum	Mean	Std. Deviation
lnAs	211	5.954	13.590	9.886	1.189
SIC_01	211	0.000	1.000	0.370	0.485
Fin_lev	211	-291.258	29.945	-0.515	20.590
Prf_Mrgn	211	-0.201	0.884	0.086	0.097
Cap_Int	211	0.216	4.686	1.526	0.872
ROA	211	-0.222	0.551	0.095	0.099
Cumret	211	-0.859	1.529	-0.064	0.358
Beneficial products & services strength	211	0	1	0.180	0.381
Pollution prevention	211	0	1	0.140	0.345
Recycling	211	0	1	0.150	0.360
Clean energy strength	211	0	1	0.600	0.491
Management systems strength	211	0	1	0.630	0.484
Other strengths	211	0	1	0.070	0.258
TES	211	1	4	1.770	0.955
Hazardous waste	211	0	1	0.510	0.501
Regulatory problems	211	0	1	0.670	0.472
Ozone depleting chemicals	211	0	0	0.000	0.000
Substantial emissions	211	0	1	0.610	0.490
Agricultural chemicals	211	0	1	0.040	0.203
Climate change	211	0	1	0.250	0.432
Other concerns	211	0	1	0.190	0.397
TEC	211	1	5	2.270	1.103
OER	211	-4	2	-0.500	1.465

Strength Variables: (H1)

The models' goodness of fit and the adjusted R-square for each environmental

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strength model as well as the analysis of variance results are presented in Table 3. The

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adjusted R-square for the 6 models ranges from 20.8% to 21.8% which indicates that, on average, approximately 21% of the variability in annual stock returns can be explained by the models that include individual strength variables along with control variables. Furthermore, the F-statistics for all models is significant, p-value = 0.000, which indicates that the independent variables significantly explain the variation in the dependent variable.

Table 3
DEPENDENT VARIABLE

		Model Summary		ANOVA		
Model #	Environmental strength variable	R Square	AdjustedR Square	Regression sum of squares	Residual sum of squares	Model significance
Model 1_1	Beneficial products & services strength (ES_1)	0.235	0.209	6.341	20.588	0.000
Model 1_2	Pollution prevention (ES2)	0.234	0.208	6.314	20.615	0.000
Model 1_3	Recycling (ES3)	0.235	0.208	6.323	20.606	0.000
Model 1_4	Clean energy strength (ES_4)	0.237	0.211	6.388	20.541	0.000
Model 1_5	Management systems strength (ES_5)	0.239	0.213	6.447	20.482	0.000
Model 1_6	Other strengths (ES6)	0.244	0.218	6.582	20.347	0.000

Table 4 presents the coefficients of the environmental strength along with the significance of each strength variable. The results indicate that, across the 6 strength models, return on assets, profit margin, and capital intensity variables are significantly related with the sample firms' cumulative annual returns. Both return on assets and capital intensity are positively related while profit margin is negatively related to the sample firms' cumulative annual returns. None of the environmental strength variables is significantly associated with the firms' cumulative annual returns except other strength variable that is marginally significant at the 10% level. Thus, H1 is rejected for all environmental strength variables.

Table 4
COEFFICIENTS OF THE ENVIRONMENTAL STRENGTH

	Model 1_1		Model 1_2		Model 1_3		Model 1_4		Model 1_5		Model 1_6	
	Beneficial products and services (ES_1)		Pollution prevention (ES2)		Recycling(ES3)		Clean energy strength (ES4)		Management systems strength (ES5)		Other strengths (ES6)	
	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.
(Constant)	-0.238	0.214	-0.275	0.145	-0.265	0.159	-0.320	0.102	-0.265	0.158	-0.309	0.102
lnAs	-0.009	0.654	-0.006	0.779	-0.006	0.756	0.001	0.971	-0.002	0.933	0.000	0.994
SIC_01	-0.038	0.455	-0.035	0.491	-0.040	0.430	-0.035	0.489	-0.027	0.598	-0.042	0.396
Fin_lev	-0.001	0.589	-0.001	0.584	-0.001	0.591	0.000	0.675	-0.001	0.511	-0.001	0.611
Prf_Mrgn	-0.925	0.010	-0.955	0.007	-0.974	0.006	-0.987	0.005	-0.898	0.012	-0.979	0.006
Cap_Int	0.088	0.010	0.087	0.010	0.086	0.012	0.096	0.006	0.074	0.036	0.080	0.019
ROA	2.441	0.000	2.463	0.000	2.486	0.000	2.426	0.000	2.434	0.000	2.473	0.000
ESi	-0.043	0.471	-0.033	0.615	-0.038	0.558	-0.053	0.322	-0.064	0.211	-0.150	0.088

Concern Variables: (H2)

Table 5 and Table 6 present the regression results of the individual concern variables. The results of Table 5 show that the adjusted R-square for the 7 models ranges from 20.8% to 21.1%, which indicates that, on average, approximately 21% of the variability in the cumulative annual returns variable can be explained by the models that include individual concern variables along with control variables. Furthermore, the F-statistics for all models is significant, p-value = 0.000, which indicates that the independent variables can significantly explain the variation in the dependent variable.

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Table 5
REGRESSION RESULTS

		Model Summary		ANOVA		
Model #	Environmental strengthvariable	R Square	AdjustedR Square	Regression sum of squares	Residualsum of squares	Model significance
Model 2_1	Hazardous waste (EC1)	0.235	0.209	6.333	20.596	0.000
Model 2_2	Regulatory problems (EC2)	0.237	0.211	6.379	20.550	0.000
Model 2_4	Substantial emissions (EC4)	0.235	0.208	6.316	20.613	0.000
Model 2_5	Agricultural chemicals (EC5)	0.238	0.212	6.421	20.508	0.000
Model 2_6	Climate change (EC6)	0.235	0.208	6.322	20.607	0.000
Model 2_7	Other concerns (EC7)	0.234	0.208	6.301	20.628	0.000

Consistent with the results of Table 4, the results of Table 6 show that return on assets, profit margin, and capital intensity variables are significantly related to the sample firms' cumulative annual returns, where return on assets and capital intensity are positively related to cumulative annual returns, while profit margin is negatively related to cumulative annual returns. However, the results show that none of the concern variables is significantly related to cumulative annual returns. Thus, H2 is rejected for all environmental concern variables.

Table 6
REGRESSION RESULTS

	Model 1_1		Model 1_2		Model 1_4		Model 1_5		Model 1_6		Model 1_7	
	Hazardous waste (EC1)		Regulatory problems (EC2)		Substantial emissions (EC4)		Agricultural chemicals (EC5)		nate change(EC6)		ıer concerns(EC7)	
	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.
(Constant)	-0.255	0.177	-0.277	0.140	-0.273	0.148	-0.255	0.174	-0.254	0.178	-0.281	0.144
lnAs	-0.010	0.632	-0.009	0.665	-0.005	0.814	-0.009	0.653	-0.009	0.650	-0.005	0.801
SIC_01	-0.040	0.430	-0.041	0.417	-0.030	0.557	-0.042	0.407	-0.033	0.519	-0.034	0.501
Fin_lev	-0.001	0.545	-0.001	0.588	-0.001	0.613	-0.001	0.571	-0.001	0.552	-0.001	0.552
Prf_Mrgn	-0.940	0.008	-0.922	0.010	-0.967	0.006	-0.979	0.006	-0.933	0.009	-0.959	0.007
Cap_Int	0.089	0.009	0.084	0.014	0.087	0.010	0.092	0.007	0.088	0.010	0.088	0.009
ROA	2.455	0.000	2.474	0.000	2.458	0.000	2.471	0.000	2.459	0.000	2.456	0.000
ESi	0.031	0.506	0.047	0.345	-0.025	0.602	0.126	0.253	0.031	0.567	-0.021	0.724

Total Environmental strength variable (TES – H3), Total Environmental Concern variable (TEC – H 4), and Overall Environmental rating variable (OER – H5)

The models' goodness of fit and the adjusted R-square for the firms' three overall environmental indices are illustrated in Table 7. The adjusted R-square for TES, TEC, and OER are 22.4%, 22.8%, and 21.0%, respectively, which indicates that the models can explain around 21 % of the variability in cumulative annual returns. The overall regression models appear to be statistically significant with a p-value of 0.000. This indicates that the independent variables significantly explain the variation in the dependent variable.

Table 7
THREE OVERALL ENVIRONMENTAL INDICES ARE ILLUSTRATED

		Model Summary		**ANOVA**		
	ironmental Ratingvariable	R Square	Adjusted R Square	Regression sum of squares	Residual sum of squares	Model significance
Model 1_7	Total strengths (TES)	0.250	0.224	6.720	20.209	0.000
Model 2_7	Total concern (TEC)	0.254	0.228	6.831	20.098	0.000
Model 3	Overall Environmental Rating (OER)	0.236	0.210	6.367	20.562	0.000

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Table 8 presents the regression results for the rating variable models. The results of return on assets, profit margin, and capital intensity variables are consistent with the results in Tables 4 and 6. The results show that total environmental strength rating variable is significantly negatively related to firms' annual returns at the 5% level. From a comprehensive perspective, it appears that firms' activities that are deemed environmental strengths affect financial performance negatively. Thus, Hypothesis 3 is not rejected. However, the total environmental concern rating variable is insignificantly related to firms' cumulative annual returns (p = 0.38). Thus, H4 is rejected.

Table 8
REGRESSION RESULTS

	Model 1		**Model 2**		**Model 3**	
	otal strengths(TES)		**otal concern(TEC)**		**Overall Environmental Rating (OER)**	
	B	Sig.	B	Sig.	B	Sig.
(Constant)	-0.315	0.092	-0.234	0.22	-0.242	0.194
lnAs	0.01	0.643	-0.015	0.496	-0.01	0.603
SIC_01	-0.032	0.513	-0.046	0.368	-0.05	0.317
Fin_lev	-0.001	0.624	-0.001	0.551	-0.001	0.549
Prf_Mrgn	-0.897	0.011	-0.912	0.011	-0.846	0.017
Cap_Int	0.072	0.035	0.088	0.009	0.079	0.020
ROA	2.486	0.000	2.46	0.000	2.487	0.000
Rating Variable	-0.058	0.020	0.02	0.380	-0.033	0.039

The OER is calculated by subtracting TEC from TES to create a measure of overall environmental performance. The higher the TES score the better a firm performs environmentally, while the higher the TEC score, the worse a firm's environmental performance. Although the overall environmental rating (OER) could, theoretically, range from +6 to -7, the actual sample results ranged from +2 to -4. The regression results for the overall environmental rating model are presented in Table 8. The results show that the OER is significantly negatively related to firms' cumulative annual returns (p = 0.039). Thus, H5 is not rejected.

When considering the results of individual environmental variables on one side and the results of the rating or indexed variables on the other side, it seems like the index measures would be more reliable than individual variables in assessing the association between environmental and financial performance.

CONCLUSION

This study investigates the relationship between both individual environmental performance variables and comprehensive environmental performance ratings and firms' stock returns. The individual environmental performance variable and the rating variables are based on the KLD dataset. Firms' environmental activities are classified as either a "*strength*" or a "*concern.*" The analysis is conducted in two stages. In stage 1, the relationship between individual environmental performance measures, whether strengths or concerns, and firms' annual stock returns is investigated. Results indicate that none of the 6 environmental strength variables are significantly related to the firms' cumulative annual returns. Thus, H1 is rejected for all environmental strength variables. Also, all environmental concern regression models indicate no significant association with the cumulative annual returns. Thus, H2 is rejected for all environmental concern variables. In stage 2, the relationship between the environmental rating variables and the firms' annual stock returns is

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investigated. Results indicate that the environmental strength rating variable and overall environmental rating variable are significantly negatively related to the firms' financial performance, while there is no significant relationshoip between environemnatl concern rating variable and financial performance.

Collectively, the results indicate that rating variables are more capable of assessing the relationship between firms' environmental performance and annual stock returns than individual environmental variables. The negative association between the TES and the OER and annual stock returns indicates the environmental protection efforts are perceived by the investors negatively and thus reflected in the capital market as a reduction in the firms' annual returns which demonstrates the short-term profit orientation of the capital market. The evidence presented above supports the perspective that environmental activities impose costs on firms, which are perceived by investors to negatively impact financial performance. Market participants seemingly ignore potential long-run benefits. Furthermore, firms' attempts to operate by disregarding environmental consequences are not viewed as negative economic events.

The results presented in this paper contributes to the literature in the following sense. First, the negative association between the TES and the OER and cumulative stock returns indicate that the costs that firms incur to comply with environmental rules and regulations outweigh any benefits that they might gain from being environmentally friendly. However, given that the sample period employed in this study is from 2006 to 2008, it is recommended that to repeat this analysis on a more recent sample period as in recent years, environmental awareness increased and this may have an impact on investors' perception of environmental activities undertaken by firms. However, recent studies such as Shen et al. (2019) show that the win-win relationship between environmental performance and financial performance diminishes over time in a sample of Chinese firms. These results along with our results raise concerns regarding environmental rules and regulations. Policy makers should try to motivate firms to be environmentally friendly through either increasing penalties for environmental pollution or through increasing subsidies and benefits for firms that have good environmental performance.

Second, the insignificant relationship between the TEC and cumulative stock returns implies that the cost of environmental pollution penalties is lower than the cost of investing in green equipment, thus this, in turn, demotivates firms to engage in environmental activities as the penalties are not severe. Thus, this necessitates significant changes on environmental rules and regulations to ensure that all firms comply with these rules to protect the environment. Finally, given the increasing environmental challenges that the whole world is witnessing nowadays, the relationship between environmental performance and financial performance should be studied in different markets with different conditions. This, in turn, provides valuable information to policy makers and regulators that might help them in setting better environmental rules that can actually be implemented by firms and achieve a win-win situation.

APPENDIX

Exhibit 1		
Variables Definition		
Dependent Variable		
Cumret	=	Cumulative annual stock market returns, which represents the accumulationof monthly returns for each firm year. For model 6, Δ Cum_Ret = Annual return2008 – Annual return2006.
Control Variables		
LnAs	=	Natural logarithm of Total Assets;

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ROA	=	Net Income / Average Total Assets;
Fin_Lev	=	(Debt in current liabilities + Debt in long term Liabilities) / Total Shareholder's Equity;
Prf_Mrgn	=	Net income / Total sales;
Cap_Int		Total Assets / Total Revenues.
e	=	Error term

Exhibit 1 (continued)			
Variables of Interest in each Model			
M1	ESi	=	Different environmental strength measures. "i" ranges from 1 to 6 where, i = 1 refers to clean energy, i = 2 refers to beneficial (green) products and services, i = 3 pollution prevention, i = 4 refers to recycling, and i = 5 management systems, i = 6 is other strengths. These variables will be employed in dichotomous manner where If a firm performs any of these environmental activities, it be coded 1 otherwise 0;
M2	ECi	=	Different environmental concerns. "i" ranges from 1 to 7, i = 1 refers to climate changes concern, i = 2 refers to regulatory problems, i = 3 refers to substantial emissions, i = 4 refers to ozone depletion chemicals concern, i = 5 refers to hazardous waste, i = 6 refers to agricultural chemicals, and i = 7 refers to other concerns. These variables will be employed in dichotomous manner where If a firm activities impose any of these concerns on the environment, it be coded 1 otherwise 0;
M3	TES	=	Total environmental strength rating variable. It represents the simple addition of all environmental strength variables. TES = $\sum$ (ESi)
M4	TEC	=	Total environmental concern rating variable. It represents the simple addition of all environmental concern variables. TEC = $\sum$ (ECi)
M5	OER	=	Overall environmental rating variable. Total environmental strength rating - total environmental concern rating

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