Corporate Environmental Performance: Determinants and Real Effects*

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Abstract

This study mainly addresses two questions. The first question is: what determine the "greenness" of a company? The second question is: what are the impacts of a company's green policies on its investment decisions and financial performance? Using the green score published by Newsweek in 2009, 2010 and 2011, we find that firms are more likely to adopt good practices in their environmental policies if they have more top women executives and have more operations overseas. Furthermore, we document that more environmentally responsible companies invest less, but their investments contribute more to firm performance, suggesting that good environmental policies help companies reduce agency problems by avoiding over-investments.

KEY WORDS: Newsweek, green score, corporate social responsibilities, environmental performance, financial impacts, investment policies

JEL classifications: G34, M14

1. **Introduction**

There is a long history of debates on the goal of corporation. People question about to what extent a corporation should care about objectives other than firm-value maximization. Lougee and Wallace (2008) offer an excellent review of those arguments. At one extreme, the value maximization theory argues that firm/shareholder value maximization should be the overwhelming objective of the corporation. Managers should keep investing as long as the marginal return on investment exceeds the cost of capital. At the other extreme, the stakeholder theory argues that corporate performance should be evaluated in terms of the firm's ability to satisfy not only its shareholders, but also other stakeholders such as customers, employees, communities, government, and so on. Therefore, managers are asked to balance the interests of all stakeholders to the point that the aggregate welfare is maximized. The middle-of-the-road argument suggests that while corporations should take social responsibilities into account, economic profit performance is the base without which corporations cannot fulfill their responsibilities to society. In other words, conducting business without considering economic profit is socially irresponsible. At the same time, value maximization cannot be achieved without the support of all corporate stakeholders.

Corporate social responsibilities (CSR) refer to the duties corporations owe to other stakeholders in society. They have become major issues in corporate management in recent years. For example, in addition to financial reports, many large corporations, such as Intel Corporation, also issue social responsibility reports nowadays. Although skeptics argue that those reports are no more than lip services, their increasing popularity reflects investors' increasing awareness of non-financial impacts of corporate policies. Besides, there is growing importance of socially responsible investment (SRI) funds that screen their investments according to ethical, social, and environmental criteria. The assets of SRI funds in the United States increased by more than ten times to $2.3 trillion between 1995 and 2005 (Renneboog, Horst, and Zhang (2008a, b)), and were about $3.1 trillion as of 2010 according to *2010 Report on Socially Responsible Investing Trends in the United States*.

Compared with other issues of CSR, such as human rights and diversity in employment, environmental issues have been gaining even more people's attention worldwide, for their global impacts and economic significance. Many countries around the world are implementing environmental policies to limit the emission of pollutants. For example, government officials met in Copenhagen in December 2009 aiming to reduce the emission of carbon dioxide, a gas that results in the so-called "green-house" effect. At corporate level, Intel Corporation has recently implemented a compensation policy that links its employees' bonuses to certain sustainability goals. The oil spill event in Gulf of Mexican by British Petroleum in 2010 also arouses people's attention to the environmental impacts of corporate activities.

However, not all people share the same concerns and support less pollution. Investors, for example, tend to accept corporate environmental policies as a tool to achieve better financial performance, the paramount goal of financial management. They generally have two main questions/concerns about corporate environmental policies. First, do good corporate environmental policies promote corporate financial performance, and how? Second, if the answer for the first question is "yes", how can investors identify environmentally responsible companies or motivate corporate managers to adhere to good environmental practices?

Numerous studies on corporate environmental performance have addressed the above two questions to some extent and a majority of them documents a positive but relatively weak relation between corporate environmental performance and corporate financial performance.[1] A

limitation of prior studies is that most of them rely on databases that cover certain specific aspects of environmental performance only, such as Toxics Release Inventory (TRI) by Environmental Protection Agency (EPA), which covers only a specific set of toxic chemicals, or use measures of environmental performance that are binary in nature, such as those provided by Kinder, Lydenberg and Domini (KLD) Research & Analytics. In addition, the impact of environmental performance on capital expenditure decisions, which should have pronounced environmental consequences by nature, is underexplored in the literature. Although previous theoretical studies predict that greener companies may invest more because they face a lower cost of capital (Heinkel, Kraus, and Zechner, 2001; Barnea, Heinkel, and Kraus, 2005) or managers may over-invest in CSR for private benefits (Tirole, 2001), we argue that the opposite will be true if good environmental policies can alleviate the free-cash-flow problems (Jensen, 1986) in corporate investment decisions. We fill the gaps in the literature by empirically examining the impact of environmental performance on investment decisions using a comprehensive measure of environmental performance.

We use a new index of environmental performance first published in 2009 by Newsweek that works together with several environmental agencies, namely Trucost, KLD Research & Analytics, and CorporateRegister.com. Since 2009, Newsweek has been evaluating top 500 US companies every year according to their environmental performance, policies, reputation, and disclosure, and summarized the evaluation using a composite "green score" that captures various aspects of environmental performance.[2]

To the best of our knowledge, this is the first study to relate Newsweek's green score to corporate investment policies and financial performance. Although the green score is new, the three agencies preparing it are all well-established in assessing environmental impacts and potential damages of corporate operating activities, evaluating corporate environmental reporting, policies, programs, leadership, and regulatory issues, and surveying opinions of CSR professionals and academics, and environmental experts. Therefore, by construction, the Newsweek's environmental performance measures are correlated with the environmental variables from established databases such as KLD STAT, but at the same time, it provides a more comprehensive picture about corporate environmental performance.

Our empirical analysis consists of two parts. First, we examine the determinants of corporate environmental performance and policies. Motivated by previous studies on CSR and corporate environmental performance, we identify three variables that may explain corporate environmental performance. They are top executive compensation, women representation in top management, and the percentage of revenues coming from foreign countries (i.e. outside the United States). Second, we examine the real effects of environmental performance by testing if more environmentally responsible companies are more or less conservative in making investments. Then, we examine if more environmentally responsible companies invest more efficiently by comparing the effects of investments on financial performance between more responsible companies and less responsible companies.

We examine the green score published by Newsweek's Green Rankings in 2009, 2010, and 2011, and perform regression analysis to relate corporate environmental performance and corporate financial performance. We have three major findings. First, women participation in top management and foreign sales are all positively associated with environmental performance. Second, more environmentally responsible companies invest less in fixed assets and research and development (R&D) after controlling for cash flow and growth opportunities that are found to explain corporate investments by previous studies (e.g. Fazzari, Hubbard, and Petersen, 1988).

We confirm the robustness of our finding by running a three-stage-least-squares (3SLS) model for environmental performance and corporate investments. Third, although green firms invest less, their investments contribute more to financial performance. The latter two findings collectively are inconsistent with the predictions in previous studies that more environmentally responsible companies invest more, but consistent with the alternative hypothesis that good environmental policies can reduce agency problems in corporate investment decisions.

This study sheds light on the literature of corporate environmental performance in several ways. First, it introduces and evaluates a new environmental performance measure. Second, relatively few studies have examined the impacts of corporate governance and foreign operations on corporate environmental performance. Our results suggest that they do have impacts on corporate environmental policies. Shareholders and directors should take these factors into account when they select top managers. Third, our paper is the first study empirically investigating the impact of environmental performance on investment decisions. We document a negative impact of environmental performance on investment, indicating that investing less is consistent with being more environmentally responsible. Besides, the result that investments by more environmentally responsible companies are more positively related to financial performance suggests that better environment and more profits can be achieved simultaneously.

The reminder of the paper is organized as follow. Section 2 describes the potential determinants of corporate environmental performance and develops main hypotheses. Section 3 discusses the data and methodology. Section 4 reports summary statistics and main empirical findings. Section 5 concludes.

2. Literature Review and hypotheses development

In this section we first discuss the determinants of environmental performance that are selected based on previous studies on corporate social responsibility. We then develop our hypotheses regarding the impacts of environmental performance on investment decisions and financial performance.

2.1. Determinants of environmental performance

Executive compensation

Deckop, Merriman, and Gupta (2006) find that corporate social performance is positively related to the percentage of long-term focused pay in the total compensation of the CEO. They argue that attention to corporate social performance (CSP) is likely to have a long-term impact on the company. For example, by investing in facilities that improve the environmental safety of operations, companies can reduce the costs of environmental litigations in the long-run. However, those investments may have negative impacts on short-term financial performance. Therefore, a CEO will have stronger incentives to fulfill social responsibility if her compensation is linked more closely to the long-term prospect. Mchoney and Thorn (2006) also find a positive relation between CEOs' stock option compensation and CSP for a set of Canadian companies.

Klassen and Whybark (1999), and King and Lenox (2002) find that more resources allocated to pollution prevention result in better operating performance. Klassen and Whyback explain their finding by arguing that pollution prevention requires expertise and skills in technologies and a fundamental re-engineering of production processes, both of which lead to greater competitive advantage during the periods of high uncertainty due to new environmental regulations. A major implication of the finding is that corporate managers should be motivated to

invest in pollution prevention. Berrone and Gomez-Mejia (2009) examine this view and find that environmental performance indeed has a positive impact on a CEO's compensation. Besides, they find that long-term CEO compensation has a positive effect on environmental performance and such effect is stronger in more polluting industries that have greater need for pollution prevention.

Following the above arguments, we hypothesize that

H1: Environmental performance is positively related to the long-term incentive component in the top-executive compensation.

Women executives

Although the number of female top executives has been increasing in recent years, females are still minority in top management positions of large US corporations. In 2005, only 8% of the CFOs are female and 2% of the CEOs are female in major U.S. corporations. (Huang and Kisgen, 2012). Previous studies find that management decisions by women executives are very different from those by males. Peng and Wei (2006) find that corporate investment decisions of female executives are less responsive to cash flow than those of males. Huang and Kisgen document that companies with female CFOs make fewer acquisitions than those with male CFOs, but the stock market reacts more positively to the acquisitions by female-CFO firms. Female CFOs also use debt financing less frequently. Both studies suggest female executives are less over-confident or less aggressive than male. Kruger (2009) finds that firms with a higher fraction of women on the board of directors display more pro-social behaviors, consistent with the experimental results by Croson and Gneezy (2009) that women are more sensitive to social signals than men and Marquis and Lee (2012) that companies with more women executives contribute more charitable funds. Therefore, from both conservatism and social-awareness points of view, women are more likely to promote environmental policies than males. Therefore, we hypothesize that

H2: Environmental performance is positively related to the percentage of women in top management.

Operating activities in foreign countries

Previous studies suggest many reasons why companies in developed countries invest in developing countries. Conventional "pollution haven hypothesis" (PHH) predicts that firms will move their operations from countries with strict environmental regulations to countries with less strict regulations (Chichilnisky, 1994; Copeland and Taylor, 2004). However, empirical evidence on the PHH is mixed because data on regulation is generally unavailable or hard to find (Dam and Scholtens, 2008). Using more direct measures of environmental regulations by World Bank, Dam and Scholtens (2008) find evidence supporting the PHH. Therefore, we hypothesize that

H3: Environmental performance is negatively related to the percentage of operations in foreign countries with poor standards of environmental regulations.

However, other factors such as legal frameworks and political stability may offset the effect of environmental regulations. Indeed, Dam, Scholtens, and Sterken (2007) examine 540 multinational enterprises with their subsidiaries in 188 countries and find that only firms with relatively good governance standards are more likely to locate their subsidiaries in countries with a weak governance system. The evidence is inconsistent with the conventional wisdom that

companies avoid strict governance codes by relocating their operations to countries with less strict codes. Dam, Scholtens, and Sterken argue that companies can convince their stakeholders to set up businesses in countries with weaker governance codes only when their own governance standards are high and they can deal with unforeseen events properly. Following their idea, we hypothesize that

H3a: Environmental performance is positively related to the percentage of operations in foreign countries with poor standards of environmental regulations.[3]

2.2. Environmental performance and investment

Several studies suggest that more environmentally responsible firms may invest more or invest less. For example, Tirole (2001) argues that managers can justify an investment on the environmental ground, even if the investment is economically viable. Barnea and Rubin (2010) argue that insiders may over-invest in CSR if doing so can improve their own images as global citizens but the incentives to do so decrease with insider ownership. Consistent with their prediction, they find that insider ownership is negatively related to a company's social rating. Heinkel, Kraus, and Zechner (2001) theoretically show that in the presence of a large group of green investors, a company can reduce its cost of capital by investing in green technologies. Barnea, Heinkel, and Kraus (2005) further argue that a lower cost of equity of green companies allow them to invest more than polluting companies. Consistent with this theoretical prediction, Sharfman and Fernando (2008) examine a group of 267 U.S. companies and document that firms with better environmental risk management have a lower cost of capital. EI Ghoul et al (2011) use a comprehensive set of CSR ratings provided by KLD STAT and find that CSR investments in environmental policies, employee relations and product strategies reduce firm's cost of equity. Cheng, Ioannou and Serafeim (2011) show that better CSR performance leads to lower capital constraint, which enables firm's ability to undertake major investment decisions. Following the above argument, we hypothesize that

H4: Companies with better environmental performance invest more.

On the other hand, it could be argued that better environmental policies may cause companies to invest more cautiously. Good environmental policies, complemented with appropriate incentives, can induce managers to consider more carefully the full consequences of their investment decisions. As a result, more environmentally responsible companies should invest less because they are more concerned about environment impacts besides financial impacts of investments. Following the above arguments, we hypothesize that

H4a: Companies with better environmental performance invest less.

2.3. Environmental performance and investment efficiency

We measure investment efficiency using the effect of investment on financial performance. If high investments of environmental-friendly companies are generally decided by entrenched managers (Jensen, 1986; Tirole, 2001) or driven by a misalignment of insiders' and general shareholders' incentives (Barnea and Rubin, 2010), then the investments of companies with better environmental performance should have a less positive (or more negative) impact on financial performance.[4] Therefore, we hypothesize that

H5: *If H4 is true, investments by companies with better environmental performance should have a less positive (more negative) impact on financial performance.*

On the other hand, if more environmentally responsible companies are able to invest more because of a lower cost of capital (Heinkel, Kraus and Zechner, 2001; Barnea, Heinkel and Kraus, 2005), then their investments should have a more positive (or less negative impact) on financial performance. Therefore, we hypothesize that

H5a: *If H4 is true, investments by companies with better environmental performance should have a more positive (less negative) impact on financial performance.*

Alternatively, if more environmentally responsible companies invest less because good environmental policies can alleviate misalignment of incentives in corporate investment decisions and make managers consider carefully the full consequences of investments, then their investments should have a more positive (less negative) impact on financial performance. Therefore, we hypothesize that

H6: *If H4a is true, investments by companies with better environmental performance should have a more positive (or less negative) impact on financial performance.*

3. Data and construction of main variables

Our original sample consists of the US companies that are covered by Newsweek Green Rankings 2009, 2010, and 2011. Firm-level explanatory variables are constructed based on financial data from the Compustat Industrial Annual files. Price and return data are from the Centre for Research in Security Prices (CRSP). Management and compensation data come from Execucomp by Compustat, and geographical segment data by Compustat. For our analysis, we include only firm-years that have non-missing variables for the regressions of environmental performance. This requirement reduces our sample from 1,500 to 1,357 firm-years.

3.1. Environmental performance measure

In 2008, Newsweek collaborated with three agencies, Trucost,[5] KLD Research & Analytics,[6] and CorporateRegister.com,[7] to compile the green rankings and scores for 500 largest US companies in the year. The companies included are the largest companies in fifteen sectors in terms of revenue, market capitalization, and employees, but the list of companies is not constant over time. The three agencies score each company by their own rating systems and then convert their scores to standardized values called Z-scores. Then they map the Z-scores to a 100-point scale to yield three scores on environmental impact, green policy, and environmental reputation respectively. The overall green score (*GREEN*) was calculated as the weighted sums of the three Z-scores in the proportions 45%, 45% and 10% respectively[8], with a scale from 1 (worst performing) to 100 (best performing). We retrieve the green score directly from Newsweek's official website.[9]

The Newsweek's green score has two main advantages. First, it is formed by combining a continuous green policy score from the three agencies, and therefore the score offers a comprehensive picture of a company's overall environmental performance. Besides, from a meta analysis of 52 previous studies, Orlitzky, Schmidt, and Rynes (2003) show that reputation indices are more correlated with financial performance than are other indicators of corporate social performance such as the KLD indicators. This supports the use of the reputation score to supplement the environmental impact score and the green policies score. Second, Newsweek claims that the construction of green score takes into account sector differences, which facilitates comparisons between companies across different industries.

In 2011, Newsweek changed its data sources and methodology in several ways. First, Sustainalytics, another ESG research group, replaced KLD Research & Analytics to produce a new environmental management score after the latter was acquired by RiskMetrics. Second, a new environmental disclosure score also replaced the old reputation score to incorporate the breadth and quality of corporate reporting of environmental impacts and involvement in key transparency initiatives. Third, Newsweek drop the Z-score method but calculate the green score by weighing the environmental impact score, the new environmental management score, and the new environmental disclosure score using the proportions 45%, 45% and 10%, respectively. Newsweek states that the new weighting scheme not only improves the transparency of the score calculation, but also makes the scores in different years comparable. Finally, Newsweek redefined the industry classification and increased the number of industries from fifteen to nineteen.

Nevertheless, the new methodology could affect the distribution of the green score. To examine changes in properties of the green score across two regimes, we compare the simple statistics of the green score in 2009 and 2010 versus those in 2011. We find that the standard deviations of the green score are about the same in two regimes (9.9 in 2011versus 9.3 in 2008 and 2009) but the average score is much lower in 2011 (53.1 versus 71.4). We also examine simple correlations in green score in consecutive years and find that the correlation between 2009 and 2010 is 0.89 and that between 2010 and 2011 is 0.72. Therefore, though the methodology was changed in 2011, the relative green score is not much affected. To account for the impact of the change in methodology on the average green score, we add industry-year interactive dummies to all regressions to allow for differences in group means across years and industries.

3.2. Long-term compensation and women representation in top management

To conduct our analysis, we match the environmental performance measures with the annual financial data, executive compensation data, and geographical segment data from the Compustat. Although Newsweek does not state clearly the measurement period for the green rankings, the KLD mentions in its website that the project started in 2008 and data were compiled and analyzed in the spring and summer of 2009. Therefore, we assume that the rankings in 2009 refer to the environment performance in fiscal year 2008 (fiscal year ended between June 2008 and May 2009), the rankings in 2010 refer to the environment performance in fiscal year 2009, and so on.

Key variables are defined as follows. Women representation in top management (*WOMEN*) is measured as the percentage of women among all executives recorded in Execucomp by Compustat. Long-term incentives (*LONG*) is measured as the sum of the value of stocks, stock options and other long-term incentives awarded to top executives divided by their total compensation. Similarly, we define short-term incentives (*SHORT*) as annual bonus of all executives divided by their total compensation. All three variables take a value between zero and one.

3.3. Foreign operations

We face two limitations in measuring the weight of foreign operations of a company. First, in order to test the PHH, it is optimal to consider only a company's operations in countries that have poor environmental standards. However, companies do not follow a standard way to report the breakdowns of their foreign operations. Some companies list the specific countries of their foreign operations, while many others only report the regions of their operations, such as Asian

Pacific, Eastern Europe, and so on. As a result of the data limitation, we aggregate all foreign operations in calculating the weight of foreign operations of a company. The use of all foreign operations can be justified by the belief that the United States generally have stricter environmental regulations and impose heavier environmental penalties than less developed countries do.

Second, it is perhaps more accurate to calculate the weight of foreign operations based on assets than based on sales because a company can manufacture their products in foreign countries and sell in the United States, and vice versa. However, information on segment assets is less complete than information on segment sales. After balancing all those factors, we calculate the weight of foreign operations (*FOREIGN*) as foreign sales divided by total sales. If no segment sales information is found for a company, we assume *FOREIGN* to be zero.

3.4. Financial performance, investment, and other control variables

As many previous studies on CSR find inconsistent results based on market-based and accounting performance measures, we use market-to-book ratio of assets (*MBA*), return-on-assets (*ROA*), and return-on-equity (*ROE*) to measure financial performance for our analysis.[10] All variables are measured as of the end of fiscal year. They are defined as follows:

MBA = (book value of assets + market capitalization – book value of equity)/ book value of assets;

ROA = operating income after depreciation / lagged book value of assets;

ROE = net income before extraordinary items / lagged book value of equity.

For the analysis of investment, we use more than one type of investment because environmental policies may have different impacts on different types of investments. McWilliams and Siegel (2000) argue that research and development (R&D) is an important element to realize CSR strategies by improving product safety, making product processes less polluting, reducing the use of pesticide in farming, and so on. This suggests CSP and R&D expense are positively related. Hull and Rothenberg (2008), however, see product innovation, production differentiation, and CSR strategies as substituting strategies for a company to differentiate itself from others. They find that the impact of CSP on financial performance is stronger when a company has lower level of production innovation and differentiation. The finding implies that more socially responsible companies should invest less in R&D. [11]

The bottom line of the above studies is that R&D is different from fixed-asset investment. Therefore, we examine fixed-asset investments, and research and development (R&D) separately for our regression analysis. We define capital expenditure (*CAPX*), R&D espense (*RND*), and operating cash flow (*CF*) as follow, following the literature:

CAPX = capital expenditure / lagged net property, plant and equipment (PPE);

RND = research & development expense / lagged PPE;[12]

CF = (net income before extraordinary items + depreciation expense) / lagged PPE.

We scale *CAPX* and *RND* by lagged *PPE* following Fazzari, Hubbard and Petersen (1988), Hoshi, Kashyap and Scharfstein (1991), and Kaplan and Zingales (1997). The major reasons to use lagged *PPE* as the scalar are that it controls more precisely for the capital base for production, and that *CAPX* will become a part of the *PPE* in accounting and therefore the ratio between the two measures the re-investment rate of a company.

Other control variables include total assets (*ASSET*) and book leverage ratio (*TDB*), and they are defined as follows:

ASSET = book value of assets in millions of dollars;

TDB = total liabilities / book value of assets.

To mitigate the impact of outliers, all financial ratios are winsorized at 0.5^{th} percentile and 99.5^{th} percentile of their respective distributions.

4. Empirical Findings

4.1. Summary statistics of key variables

Table 1 reports the summary statistics of key variables. The mean and median values of *GREEN* are 64.5 and 66.8 respectively, with standard deviation 13.8. In 2009, Hewlett Packard was ranked at the top in green score, followed by Dell, Johnson & Johnson, Intel, and IBM. In 2010, Dell was the leader, followed by Hewlett Packard, IBM, Johnson & Johnson, and Intel. In 2011, IBM took the lead, followed by Hewlett Packard, Sprint Nextel, Baxter International, and Dell.

The average value of total assets (*ASSET*) is $20.0 billion which is much larger than an average firm in the US stock market. An average firm earns 11.2% of return on assets (*ROA*) and 16.1% of return on equity (*ROE*), but profitability varies greatly across firms. The average market-to-book ratio of assets (*MBA*) is 1.62. In other words, most companies in our sample are traded at a premium of their book values. The average capital expenditure (*CAPX*) and R&D expense (*RND*) are 20.6% and 19.3% respectively, of net property, plant and equipment in previous year, with *RND* showing a larger cross-sectional variation.

Long-term incentives for top executives are prevalent among the sample firms. On average, the long-term component in compensation for all top executives is 71.6% of total compensation, while the short-term component amounts only 3.8%. Both figures are consistent with those reported by Deckop, Merriman, and Gupta (2006). Consistent with previous studies, females occupy only 6.7% of top executive positions. Finally, an average firm has about three-quarters of total revenues coming from the local US market.

[Insert Table 1]

Table 2 reports the pair-wise correlation coefficients among key variables. As opposed to previous studies that generally find a positive relation between corporate social/environmental performance and financial performance (Orlitzky, Schmide, and Ryne, 2003), we do not find in our sample a significantly positive correlation between the green score (*GREEN*) and financial performance (*MBA*, *ROA*, *ROE*). On the other hand, both *CAPX* and *RND* are positively related with *GREEN*, with moderate correlations of 0.11 and 0.09 respectively. In other words, companies with better environmental performance invest more.

Long-term incentives (*LONG*) are positively and significantly related with *GREEN*, with a correlation of 0.12, while short-term incentives (*SHORT*) are not significantly correlated with *GREEN*. Female participation in top management (*WOMEN*) is also positively and significantly related to *GREEN*, with a correlation of 0.08. Finally, the percentage of revenues from the foreign market (*FOREIGN*) is positively and significantly correlated with *GREEN*, with a correlation of 0.14. Besides, foreign sales are positively associated with financial performance. These findings echo Dam, Scholtens, and Sterken (2007) who document that companies with more overseas presence have stronger corporate governance than those with less.

[Insert Table 2]

4.2. The determinants of environmental performance

Table 3 reports the results from the regressions of the following model for environmental performance on long-term and short-term compensation (*LONG, SHORT*), female participation in top management (*WOMEN*), foreign sales (*FOREIGN*), together with financial performance (*MBA, ROA or ROE*), R&D expense (*RND*) and the natural logarithm of total assets in $ million (Log(*ASSET*)) as additional control variables (firm indicator omitted intentionally):

$$\begin{aligned} GREEN_t &= \alpha_0 + \alpha_1 Financial\ Performance_{t-1} + \alpha_2 LONG_{t-1} + \alpha_3 SHORT_{t-1} \\ &+ \alpha_4 WOMEN_{t-1} + \alpha_5 FOREIGN_{t-1} + \alpha_6 CAPX_{t-1} + \alpha_7 RND_{t-1} + \alpha_8 Miss\ RND_{t-1} \\ &+ \alpha_9 Log(ASSET_{t-1}) + \alpha_{10} TDB_{t-1} + \sum \beta_{j,t} Ind_j \times Year_t + \varepsilon_t \end{aligned} \quad (1)$$

Financial performance (*MBA*, *ROA*, or *ROE*) is included because they are found by previous studies to be positively related to corporate social/environmental performance. Total debt ratio (*TDB*) is added because Barnea and Rubin (2010) argue and show that debt obligations can discipline managers from overinvesting in CSR. A dummy variable (*Miss RND*) is added because some firms who engage in R&D activity may combine the expense with other expense items. Therefore, the absence of R&D expense in Compustat does not necessarily mean that the firm does not have R&D activity. The dummy variable can account for unknown differences between firms report R&D expense and those who do not.[13] Industry-year interactive dummies are added because Newsweek changed the methodology and industry classification in 2011. The interactive dummies control for variation in average green score across industry-year pairs. The regression model (1) is estimated using the ordinary-least-squares (OLS) method.

Table 3 reports the results from environmental performance regressions with the dependent variable being the green score. In column 1, financial performance is measured as *MBA*. The results reveal that financial performance has a significantly positive impact on environmental performance, consistent with slack resources theory of CSR that good financial performance provides necessary resources for managers to develop and implement environmental policies. Inconsistent with *H1*and Table 2, long-term incentives (*LONG*) are positively but insignificantly related with *GREEN*, after controlling for other firm characteristics. Short-term incentives (*SHORT*), on the other hand, are negatively and marginally related with *GREEN*. It is possible that short-term incentives make corporate managers more myopic and therefore reluctant to invest in pollution prevention and controls that reduce short-term earnings. Consistent with *H2* and *H3a*, as well as Table 2, women representation (*WOMEN*) and foreign operations (*FOREIGN*) are both positively related to *GREEN*. The economic significance is that a one-standard-deviation increase in *WOMEN* is associated with 1.1% increase in *GREEN*, and a one-standard-deviation increase in *FOREIGN* is associated with 2.4% increase in *GREEN*.[14]. In addition, we find that the impact of investment (*CAPX*, *RND*) on environmental performance is not statistically significant in regressions. Environmental performance is found to be positively and significantly related to *TDB*.

In columns 2 and 3, we replace *MBA* by *ROA* and *ROE*, respectively, as alternative measures of financial performance. The results are qualitatively the same as that of column 1. Therefore, the positive association between environmental performance and financial performance are robust to alternative measures of financial performance.

Overall, the results in Table 3 are consistent with hypotheses *H2* and *H3a* that women executives and foreign operations are positively associated with corporate environmental performance, after controlling for firm characteristics. However, our results do not show a significant relation between environmental performance and long-term incentives, inconsistent with hypothesis *H1*.

[Insert Table 3]

4.3. Environmental performance and investment decisions

To examine whether companies with better environmental performance invest more or less, we follow previous studies (e.g., Fazzari, Hubbard, and Petersen 1988) to regress capital expenditure (*CAPX*) on contemporaneous cash flow (*CF*) and lagged market-to-book ratio of assets (*MBA*). *CF* is the annual internal fund available for investment and *MBA* is a proxy for investment opportunities of a company. They are widely used by previous empirical studies to explain capital expenditure in different countries.[15] In addition, *GREEN* is added to the regression and the sign is expected to be negative. For the sake of reporting, the coefficient of *GREEN* is multiplied by 100. The regressions also control for industry-year interactive dummy variables.

$$CAPX_t\,(RND_t \text{ or } CAPX_t + RND_t) = \phi_0 + \phi_1 CF_t + \phi_2 MBA_{t-1} + \phi_3 GREEN_t + \phi_4 Miss\ RND + \sum \beta_{j,t} Ind_j \times Year_t + \mu_t \quad (2)$$

Column 1 of Panel A in Table 4 reports the results from the OLS regression for *CAPX*. It shows that *GREEN* is negatively related to *CAPX*, consistent with the hypothesis *H4a* but not *H4*. The economic impact is that a one-standard-deviation increase in *GREEN* results in a 4.6% reduction in *CAPX* from its mean.[16] Columns 2 and 3 report the results from the OLS regression for *RND* and *CAPX+RND* respectively. Both results show a negative impact of environmental performance on the level of investment..

It is possible that investment and environmental performance are simultaneously determined. Therefore, if environmental performance is included in the OLS regression for investment, endogeneity problem may exist, which leads to biased coefficients. To address the potential econometric problem, we run three-stage-least-squares (3SLS) models for investment and environmental performance and report the results in Panel B. The model for investment (*CAPX*, *RND*, and *CAPX+RND*) is the same as model (2), and the model for *GREEN* is model (1) with contemporaneous investment (*CAPX*, *RND*, or *CAPX+RND*) added and *MBA* as financial performance measure.

Columns 1 through 3 of Panel B report the results from the investment regressions estimated by 3SLS. Consistent with columns 1 through 3, *GREEN* (instrument) is negatively related to both fixed-asset investment and research and development.

In sum, the results in Table 4 are consistent with hypothesis *H4a* that investment is negatively associated with environmental performance. This supports our above argument that good environmental policies can alleviate agency problems in corporate investment decisions by forcing managers to consider carefully their investment decisions and therefore they invest more cautiously. On the other hand, the findings do not support the alternative hypothesis *H4* that more environmentally responsible companies invest more because they enjoy a lower cost of capital or entrenched managers enjoy private benefits from over-investing in pollution prevention and control.

[Insert Table 4]

4.4. Environmental performance and investment efficiency

To test hypothesis *H6* that good environmental policies can be used to control agency problems in corporate investment decisions and therefore result in better decision making, we split the sample companies into two groups according the median values of respective environmental performance variables for each year.[17] We then regress financial performance

variable *MBA* on investment variables (*CAPX* and *RND*), together with other firm characteristics for each group individually. As it may take time for investments to be effective and integrated in operations, we use three-year average *CAPX* and *RND* in the regressions. The results are qualitatively the same if *CAPX* and *RND* lagged one year are used instead. The regression model is presented as follows:

$$\begin{aligned} Financial\ Performance_t &= \alpha_0 + \alpha_1\ Avg.\ CAPX_{t-3,t-1} + \alpha_2\ Avg.\ RND_{t-3,t-1} \\ &+ \alpha_3 Miss\ Avg.\ RND_{t-3,t-1} + \alpha_4 Log(ASSET_{t-1}) + \alpha_5 TDB_{t-1} + \alpha_6 LONG_{t-1} \\ &+ \alpha_7 SHORT_{t-1} + \alpha_8 WOMEN_{t-1} + \alpha_9 FOREIGN_{t-1} + \sum \beta_{j,t} Ind_j \times Year_t + \varepsilon_t \end{aligned} \quad (3)$$

The financial performance variable is one of *MBA*, *ROA* and *ROE*.

Table 5 presents the finding. If *H6* is true, the coefficient of investment should be more positive for more environmentally responsible companies. Consistent with *H6*, the results indicate that the impact of *CAPX* on financial performance, especially *ROA* and *ROE*, is stronger for more environmental responsible (high-*GREEN*) companies than for less (low-*GREEN*) responsible companies. On the other hand, *RND* only has significant and positive impact on *MBA* but not *ROA* and *ROE*. This is consistent with the general belief that R&D provides long-term benefits rather than short-term improvement in performance. In addition, we do not find the impact of R&D on financial performance is significantly different between firms with high and low green scores.

[Insert Table 5]

Collectively, Table 4 and Table 5 support our proposed argument that good environmental policies can alleviate agency problems in corporate investments by forcing managers to be more cautious when making investment decisions. Companies with better environmental performance also invest more efficiently, as indicated by a more positive sensitivity of financial performance to capital expenditure. Together with the finding in previous studies that financial performance is positively related to environmental performance, we conclude that good financial performance and good environmental performance can co-exist.

5. Conclusions

Environmental performance has been getting increasing public attention in recent years, in light of the sign of global warming and some big environmental events done by corporations. Using the green rankings published by Newsweek in 2009, 2010, and 2011, this study examines the determinants and financial impacts of environmental performance of the largest companies in the United States. Three main findings emerge. First, women representation in top management and foreign sales are associated with better environmental performance. Second, more environmentally responsible companies invest less, consistent with our proposed argument that good environmental policies can cause a company to invest more cautiously by forcing the managers to have a second thought about the full consequences of their investment decisions. Third, more environmentally responsible companies also invest more smartly and their investments are more enhancing to their financial performance. In sum, this study suggests that being more environmental responsible is not necessarily detrimental to financial performance. Although "greener" firms invest less, they do invest more smartly.

We are aware of the potential limitations of our study. First, this study only has the environmental performance for 500 large US companies in three years. This restricts us from

observing the time-series pattern of corporate environmental performance. Therefore, our major findings may not be generalized to other periods of time. Second, we have also observed strong auto-correlations for financial performance variables and environmental performance variables. However, having a short panel data also disallows me to use more advanced empirical methods such as system generalized method-of-moments (Arellano and Bond, 1991; Blundell and Bond, 1998) to model financial performance and environmental performance.

Another limitation of this study is that the sample firms come from different industries that are fundamentally very different from each other, especially in terms of their really production activities. Although Newsweek claims that the construction of green score has taken sector differences in consideration, the adjustment made may be imperfect.[18]

Although this study cannot be taken as the final words about determinants and real effects of corporate environmental performance, it does provide some directions for corporate policies and related research. First, it indicates that corporate governance policies affect corporate environmental performance and policies. Investors should take these findings into account when formulate corporate governance policies. Second, it suggests that investing less is not necessary detrimental to firm performance. The good news to investors is that good environmental policies and good financial performance can co-exist. The bad news is that requiring managers to investing less seems to contradict with their tendency of building empires (as suggested by Jensen, 1986). Investors have to think of additional governance policies to limit managers' decision making.

References

Arellano, Manuel, and Stephen R. Bond, 1991. "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", Review of Economic Studies 58, 277-297.

Barnea, Amir, Robert Heinkel and Alan Krause, 2005. "Green investors and corporate investment", Structural Change and Economic Dynamic 16, 332-346.

Barnea, Amir and Amir Rubin, 2010. "Corporate social responsibility as a conflict between shareholders", Journal of Business Ethics 97, 71-86.

Berrone, Pascual and Luis R. Gomez-Mejia, 2009. "Environmental performance and executive compensation: An integrated agency-institutional perspective", Academy of Management Journal 52, 103-126.

Blundell, Richard, and Stephen R. Bond, 1998. "Initial conditions and moment restrictions in dynamic panel data models", Journal of Econometrics 87, 115-143.

Brown, James R., Steven M. Fazzari and Bruce C. Petersen, 2009. "Financing innovation and growth: Cash flow, external equity, and the 1990s R&D boom", Journal of Finance 64, 151-185.

Brown, James R. and Bruce C. Petersen, 2009. "Why has the investment-cash flow sensitivity declined so sharply? Rising R&D and equity market developments", Journal of Banking and Finance 33, 971-984.

Brown, James R. and Bruce C. Petersen, 2011. "Cash holdings and R&D smoothing", Journal of Corporate Finance 17, 694-709.

Campbell, John L., 2007. "Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility", Academy of Management Review 32, 946-967.

Chang, Xin, Lewis H.K. Tam, Tek Jun Tan and George Wong, 2007. "The real impact of stock market mispricing - Evidence from Australia", Pacific-Basin Finance Journal 15, 388-408.

Cheng, Beiting, Ioannis Ioannou, and George Serafeim, 2011. "Corporate social responsibility and access to finance", working paper, Harvard Business School.

Chichilnisky, Graciela, 1994. "North-south trade and the global environment", American Economic Review 84, 851-874.

Copeland, Brian R. and M. Scott Taylor, 2004. "Trade, growth, and the environment", Journal of Economic Literature 42, 7-71.

Croson, Rachel and Uri Gneezy, 2009. "Gender differences in preferences", Journal of Economic Literature 47, 448-474.

Dam, Lammertjan and Bert Scholtens, 2008. "Environmental regulation and MNEs location: Does CSR matter?" Ecological Economics 67, 55-65.

Dam, Lammertjan, Bert Scholtens and Elmer Sterken, 2007. "Corporate governance and international location decisions of multinational enterprises", Corporate Governance: An International Review 15, 1330-1347.

Deckop, John R., Kimberly K. Merriman and Shruti Gupta, 2006. "The effects of CEO pay structure on corporate social performance, Journal of Management 32, 329-342.

El Ghoul, Sadok, Omrane Guedhami, Chuck C. Y. Kwok, and Dev R. Mishra, 2011, "Does corporate social responsibility affect the cost of capital?", Journal of Banking and Finance 35, 2388-2406.

Fazzari, Steven M., R. Glenn Hubbard and Bruce C. Petersen, 1988. "Financing constraints and corporate investment", Brookings Papers on Economic Activity 1, 141-195.

Heinkel, Robert, Alan Kraus and Josef Zechner, 2001. “The effect of green investment on corporate behavior”, Journal of Financial and Quantitative Analysis 35, 431–449.
Hoshi, Takeo, Anil Kashyap and David Scharfstein, 1991. “Corporate structure, liquidity, and investment: evidence from Japanese industrial groups”, Quarterly Journal of Economics 106, 33-60.
Huang, Jiekun and Darren J. Kisgen, 2012. “Gender and corporate finance: Are male executives overconfident relative to female executives?”, Journal of Financial Economics, forthcoming.
Hull, Clyde Eirikur and Sandra Rotherberg, 2008. “Firm performance: The interactions of corporate social performance with innovation and industry differentiation”, Strategic Management Journal 29, 781-789.
Jensen, Michael C., 1986. “Agency costs of free cash flow, corporate finance, and takeovers”, American Economic Review 76, 323-329.
Kaplan, Steven N. and Luigi Zingales, 1997. “Do investment-cash flow sensitivities provide useful measures of financing constraints?” Quarterly Journal of Economics 112, 169-215.
King, Andrew and Michael Lenox, 2002. “Exploring the locus of profitable pollution reduction”, Management Science 48(2), 289-299.
Klassen, Robert D. and D.Clay Whybark, 1999. “The impact of environmental technologies on manufacturing performance”, Academy of Management Journal, 42(6), 599-615.
Kruger, Philipp, 2009. “Corporate social responsibility and the board of directors”, working paper, Toulouse School of Economics.
Lougee, Barbara and James Wallace, 2008. “The corporate social responsibility (CSR) trend”, Journal of Applied Corporate Finance 20, 96-108.
Mahoney, Lois Schafer & Linda Thorn, 2006. “An examination of the structure of executive compensation and corporate social responsibility: A Canadian investigation”, Journal of Business Ethics 69, 149-162.
Marquis, Christopher and Matthew Lee, 2012. “Who is governing whom? Executives, governance and the structure of generosity in large U.S. Firms”, Strategic Management Journal, forthcoming.
McWilliams, A. and D. Siegel, 2000. “Corporate social responsibility and financial performance: Correlation or misspecification?”, Strategic Management Journal 21, 603-609.
Orlitzky, Marc, Frank L. Schmidt and Sara L. Rynes, 2003. “Corporate social and financial performance: a meta-analysis”, Organization Studies 24, 403-441.
Peng, Qian and K.C. John Wei, 2006. “Women executives and corporate investment: Evidence from the S&P 1500”, working paper, HKUST.
Renneboog, Luc, Jenke Ter Horst and Chendi Zhang, 2008a. “Socially responsible investments: Institutional aspects, performance, and investor behavior”, Journal of Banking and Finance 32, 1723-1742.
Renneboog, Luc, Jenke Ter Horst and Chendi Zhang, 2008b. “The price of ethics and stakeholder governance: The performance of socially responsible mutual funds”, Journal of Corporate Finance 14, 302-322.
Sharfman, Mark P. and Chitru S. Fernando, 2008. “Environmental risk management and the cost of capital”, Strategic Management Journal 29, 569-592.
Tirole, Jean, 2001. “Corporate governance”, Econometrica 69, 1–35.
Walls, Judith L., Pascual Berrone, Phillip H. Phan, 2012. “Corporate governance and environmental performance: is there really a link?”, Strategic Management Journal 33, 885-913.

Table 1: Summary statistics of key variables

This table shows the summary statistics of the green score, as well as other key variables for analysis. The environmental performance measure is the Newsweek green score (*GREEN*). *ROA* is defined as operating income after depreciation divided by lagged book value of assets. *ROE* is net income before extraordinary items divided by lagged book value of equity. *MBA* is the book value of assets plus market capitalization minus book value of equity, scaled by book value of assets. *CAPX* is capital expenditure divided by lagged net property, plant and equipment (PPE). *RND* is R&D expense divided by lagged PPE. *ASSET* is the book value of assets in millions of dollars. Women representation in top management (*WOMEN*) is measured as the percentage of women among top executives. Long-term incentives (*LONG*) is measured as the sum of the value of stocks, stock options and other long-term incentives awarded to top executives divided by the total compensation of all executives. Similarly, we define short-term incentives (*SHORT*) as annual bonus divided by the total compensation of all executives. *FOREIGN* is the weight of foreign operations, defined as foreign sales divided by total sales.

	Mean	Median	Std. dev.	Min	Max	N
Green score (*GREEN*)	64.5	66.8	13.8	1	100	1,357
Total assets in $ million (*ASSET*)	20,041	12,571	17,535	1,047	51,125	1,357
Return-on-assets (%) (*ROA*)	11.2	9.8	8.6	-23.0	48.6	1,357
Return-on-equity (%) (*ROE*)	16.1	14.7	23.9	-258.3	86.1	1,357
Market-to-book ratio (*MBA*)	1.62	1.36	0.85	0.63	7.11	1,341
Capital expenditure (%) (*CAPX*)	20.6	17.1	16.2	0	2.88	1,327
R&D expense (%) (*RND*)	19.3	0	61.3	0	9.89	1,327
Long-term compensation (%) (*LONG*)	71.6	75.6	15.6	0	99.4	1,357
Short-term compensation (%) (*SHORT*)	3.8	0	9.2	0	77.2	1,357
Pct. of female top executives (%) (*WOMEN*)	6.7	0	11.0	0	60.0	1,357
Pct. of sales from foreign (%) (*FOREIGN*)	27.8	22.6	28.0	0	100	1,357

Table 2: Pair-wise correlations of key variables

This table shows the Pearson's pair-wise correlations for the key variables. The environmental performance measure is the Newsweek green score (*GREEN*). *ROA* is defined as operating income after depreciation divided by lagged book value of assets. *ROE* is net income before extraordinary items divided by lagged book value of equity. *MBA* is the book value of assets plus market capitalization minus book value of equity, scaled by book value of assets. *CAPX* is capital expenditure divided by lagged net property, plant and equipment (PPE). *RND* is R&D expense divided by lagged PPE. *ASSET* is the book value of assets in millions of dollars. Women representation in top management (*WOMEN*) is measured as the percentage of women among top executives. Long-term incentives (*LONG*) is measured as the sum of the value of stocks, stock options and other long-term incentives awarded to top executives divided by the total compensation of all executives. Similarly, we define short-term incentives (*SHORT*) as annual bonus divided by the total compensation of all executives. *FOREIGN* is the weight of foreign operations, defined as foreign sales divided by total sales. Correlation coefficients significant at the 10%, 5%, and 1% levels are respectively marked with *, **, and ***.

	GREEN	*ROA*	*ROE*	*MBA*	*CAPX*	*RND*	*LONG*	*SHORT*	*WOMEN*
ROA	-0.01								
ROE	-0.04	0.60***							
MBA	0.02	0.70***	0.42***						
CAPX	0.11	0.23***	0.10***	0.28***					
RND	0.09	0.10***	-0.02	0.29***	0.31***				
LONG	0.12***	0.12***	0.08***	0.13***	0.10***	0.10***			
SHORT	-0.02	-0.10***	-0.07**	-0.08***	0.03	0.01	-0.51***		
WOMEN	0.08***	-0.01	0.02	-0.06**	-0.05*	-0.01	0.02	-0.02	
FOREIGN	0.14***	0.14***	0.06**	0.20***	0.15***	0.22***	0.07***	0.04	-0.06**

Table 3: The determinants of environmental performance

$$GREEN_t = \alpha_0 + \alpha_1 Financial\ Performance_{t-1} + \alpha_2 LONG_{t-1} + \alpha_3 SHORT_{t-1} + \alpha_4 WOMEN_{t-1} + \alpha_5 FOREIGN_{t-1} + \alpha_6 CAPX_{t-1} + \alpha_7 RND_{t-1} + \alpha_8 Miss\ RND_{t-1} + \alpha_9 Log(ASSET_{t-1}) + \alpha_{10} TDB_{t-1} + \sum \beta_{j,t} Ind_j \times Year_t + \varepsilon_t$$

This table reports the results from ordinary-least-squares (OLS) regressions for environmental performance. *Miss RND* is a dummy variable that equals one if a firm does not report R&D expense. *TDB* is total liabilities divided by book value of assets. All other explanatory variables are defined in previous tables and lagged one period. Industry-year interactive dummies are included in the regressions but not reported. Industries are defined based on Newsweek's classification. *t*-statistics are reported in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are respectively marked with *, **, and ***.

	(1)	(2)	(3)
Dependent Variable	*GREEN*	*GREEN*	*GREEN*
MBA	0.909***		
	(2.97)		
ROA		8.644***	
		(2.71)	
ROE			2.081*
			(1.74)
LONG	1.731	1.734	1.549
	(0.95)	(0.95)	(0.85)
SHORT	-5.307	-5.735*	-6.072*
	(-1.57)	(-1.70)	(-1.78)
WOMEN	6.464***	6.014***	6.179***
	(3.15)	(2.93)	(2.99)
FOREIGN	5.488***	5.674***	5.711***
	(4.67)	(4.89)	(4.82)
CAPX	-0.664	-0.269	0.223
	(-0.42)	(-0.17)	(0.14)
RND	-0.972**	-0.690*	-0.776**
	(-2.52)	(-1.80)	(-2.01)
Miss RND	-1.618**	-1.694**	-1.769***
	(-2.40)	(-2.52)	(-2.59)
log (*ASSET*)	2.838***	2.801***	2.709***
	(10.85)	(10.61)	(10.23)
TDB	2.941*	2.988*	1.865
	(1.81)	(1.87)	(1.12)
Industry × Year dummies	Yes	Yes	Yes
Adjusted R-sq	0.611	0.610	0.610
N	1322	1322	1310

Table 4: Environmental performance and investment policies

$$CAPX_t (RND_t \text{ or } CAPX_t + RND_t) = \varphi_0 + \varphi_1 CF_t + \varphi_2 MBA_{t-1} + \varphi_3 GREEN_t + \varphi_4 Miss\ RND_t + \sum \beta_{j,t} Ind_j \times Year_t + \mu_t$$

Panel A reports the results from the OLS regressions for the capital expenditure (*CAPX*), R&D expense (*RND*), and the sum of two (*CAPX+RND*). *CF* is the sum of net income before extraordinary item and depreciation expense, divided by lagged net property, plant and equipment. *Miss RND* is a dummy variable that equals one if a firm does not report R&D expense. All other variables are defined in previous tables. The actual coefficients of the environmental performance variable (*GREEN*) are the listed values times 10^{-2}. Industry-year interactive dummies are included in the regressions but not reported. Industries are defined based on Newsweek's classification. *t*-statistics are reported in parentheses.

Panel B reports the results from the three-stage-least-squares (3SLS) estimation of investment. The models for investment (*CAPX*, *RND*, and *CAPX+RND*) are the same as those in Panel A, and the model for *GREEN* is the model in column (1) of Table 3 with contemporaneous investment (*CAPX*, *RND*, or *CAPX+RND*) added. Only the models for capital investment are reported. *z*-statistics are reported in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are respectively marked with *, **, and ***.

Panel A OLS Dependent variable	(1) *CAPX*	(2) *RND*	(3) *CAPX+RND*
Cash flow (*CF*)	0.013* (1.67)	-0.008 (-0.20)	-0.004 (-0.09)
Lagged *MBA*	0.043*** (5.60)	0.125*** (2.81)	0.178*** (3.36)
Green variable ($\times 10^{-2}$)	-0.068** (-2.00)	-0.514** (-2.41)	-0.613** (-2.54)
Miss RND	-0.008 (-0.68)	-0.336*** (-11.60)	-0.345*** (-9.94)
Industry x year dummies	Yes	Yes	Yes
Adjusted R-sq N	0.268 1315	0.292 1315	0.312 1315
Panel B 3SLS Dependent variable	**(1) *CAPX***	**(2) *RND***	**(3) *CAPX+RND***
Cash flow (*CF*)	0.014*** (4.22)	-0.012 (-0.91)	-0.009 (-0.59)
Lagged *MBA*	0.043*** (9.14)	0.127*** (6.55)	0.182*** (8.13)
Green variable (instrument) ($\times 10^{-2}$)	-0.523*** (-4.04)	-3.742*** (-7.01)	-4.407*** (-7.18)
Miss RND	-0.021* (-1.85)	-0.429*** (-9.15)	-0.455*** (-8.44)
Industry x year dummies	Yes	Yes	Yes
Pseudo R-sq N	0.234 1311	0.099 1311	0.110 1311

Table 5: The determinants of financial performance – sub-samples by environmental performance

$$Financial\ Performance_t = \alpha_0 + \alpha_1\ Avg.\ CAPX_{t-3,t-1} + \alpha_2\ Avg.\ RND_{t-3,t-1}$$
$$+\alpha_3 Miss\ Avg.\ RND_{t-3,t-1} + \alpha_4 Log(ASSET_{t-1}) + \alpha_5 TDB_{t-1} + \alpha_6 LONG_{t-1}$$
$$+\alpha_7 SHORT_{t-1} + \alpha_8 WOMEN_{t-1} + \alpha_9 FOREIGN_{t-1} + \sum \beta_{j,t} Ind_j \times Year_t + \varepsilon_t$$

This table reports the results from the OLS regression for MBA, ROA and ROE. We split the sample into two groups according to the median values of *Green* for each year. Column 1, 3 and 5 report results for less environmentally responsible companies and column 2, 4 and 6 report results for more environmentally responsible companies. *Avg. CAPX* is the average of *CAPX* from *t*-3 to *t*-1, *Avg. RND* is the average *RND* from *t*-3 to *t*-1, and *Miss Avg. RND* is a dummy variable that equals one if a firm does not report *RND* from *t*-3 to *t*-1. All other variables are defined in previous tables. Industry-year interactive dummies are included in the regressions but not reported. Industries are defined based on Newsweek's classification. *t*-statistics are reported in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are respectively marked with *, **, and ***.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	*MBA*		*ROA*		*ROE*	
Environmental performance	*Low*	*High*	*Low*	*High*	*Low*	*High*
Avg. CAPX	0.869***	1.170***	-0.012	0.057***	-0.021	0.148**
	(4.30)	(6.49)	(-0.56)	(3.04)	(-0.36)	(2.26)
Avg. RND	0.234***	0.075	0.002	-0.001	-0.002	-0.024
	(5.26)	(1.10)	(0.32)	(-0.13)	(-0.14)	(-0.98)
Miss Avg. RND	-0.018	-0.251***	-0.005	-0.018**	-0.044*	-0.077***
	(-0.22)	(-3.16)	(-0.60)	(-2.19)	(-1.80)	(-2.70)
Log (*ASSET*)	-0.285***	-0.217***	-0.031***	-0.018***	-0.054***	-0.048***
	(-7.54)	(-6.43)	(-7.52)	(-5.25)	(-4.84)	(-3.93)
TDB	-0.664***	-0.875***	-0.083***	-0.115***	0.346***	0.267***
	(-3.47)	(-4.82)	(-4.01)	(-6.19)	(6.22)	(4.12)
LONG	0.454**	0.746***	0.048**	0.099***	0.131**	0.212**
	(2.15)	(3.21)	(2.03)	(4.11)	(2.08)	(2.52)
SHORT	-0.061	0.538	0.006	0.095**	0.010	0.261*
	(-0.17)	(1.29)	(0.15)	(2.20)	(0.10)	(1.73)
WOMEN	-0.669**	-0.467**	-0.038	-0.012	-0.132	-0.015
	(-2.24)	(-2.10)	(-1.16)	(-0.51)	(-1.48)	(-0.19)
FOREIGN	0.070	0.058	0.008	-0.014	0.040	-0.015
	(0.54)	(0.45)	(0.53)	(-1.07)	(1.04)	(-0.33)
Industry x year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-sq	0.373	0.369	0.284	0.335	0.152	0.098
N	629	608	637	615	637	615

[1] For example, Orlitzky, Schmidt, and Rynes (2003) conduct a meta-analysis of 52 studies on the relationship between corporate social/environmental performance and corporate financial performance. They find a positive but weak relationship between corporate environmental performance and corporate financial performance.

[2] In 2011, Newsweek changed the data source and methodology of producing the green score in several ways. We discuss the potential impacts of the changes on our main findings in Section 3.1. Environmental performance measure.

[3] This hypothesis is based on the argument that firms with better corporate governance have better environmental performance. The literature is unsettled on this argument, however. Campbell (2007) argues that monitoring of corporate stakeholders is able to increase the probability corporations will behave in a social responsible way. Walls, Berrone and Phan (2012) show that corporate environmental performance suffers when boards are more independent, larger, and less diverse.

[4] Misalignment of incentives may exist if managers get personal benefits or prestige of being identified as environmental friendly.

[5] Trucost uses more than 700 metrics to assess the global environmental impacts of a company's operations (90%) and the related disclosure (10%). It uses publicly disclosed environmental data on emissions and related studies for the environmental costs of production inputs/outputs, together with other data sources such as TRI and, to evaluate a company's total environmental damage cost per dollar of revenue. It also closely examines the consistency between a company's disclosure on emissions and the actual emissions.

[6] KLD Research & Analytics uses more than 70 indicators and categorize them into several main issues, which aim to reflect how a company manages its carbon emissions, non-carbon emissions, the life-cycle impacts of its products and services, the use of local resources, and environmental risks, and whether a company has fallen into controversies or litigations in environmental issues. It collects information from media, government, and non-governmental organizations, by corporate communication, and by using third-party research. KLD Research & Analytics has become part of the MSCI ECG Research since MSCI's recent acquisition of RiskMetrics. As the name KLD is commonly known among scholars, we keep this name throughout the paper.

[7] CorporateRegister.com conducts survey of CSR professionals and scholars, environmental experts, and corporate CEOs, and asks them to rank a company in terms of its environmental performance, commitment, and communications. It then gives take the weighted average of the scores from CEO (weight of 3), sector specialists (2), and other participants (1) to come up with the raw reputation survey score.

[8] The background information of the three agencies and methodology can be found from the website for the green rankings at http://www.newsweek.com/2010/10/18/green-rankings-us-companies.html.

[9] http://www.newsweek.com/feature/2010/green-rankings.html.

[10] See Orlitzky, Schmidt, and Rynes (2003) for a summary of findings and the list of financial performance measures in previous studies.

[11] Studies in corporate finance also suggest R&D is different from fixed-asset investment. Brown and Petersen (2009) argue that R&D-intensive companies rely more on equity financing than debt financing because R&D is associated with high information asymmetry and low collateral value. Brown, Fazzari, and Petersen (2009) empirically find a strong connection among external equity finance and R&D boom in 1990s. Brown and Petersen

(2011) argue that R&D has high adjustment costs and they show that financially constrained companies use cash holdings to smooth R&D expense.

[12] R&D expense is assumed to be zero if it is missing.

[13] In a robustness check, we exclude firms without R&D expense from our sample and re-run all the tests, and the main conclusions are consistent with those stated in the paper. The results are available upon request.

[14] The standard deviation of *WOMEN* is 0.11, the coefficient of *WOMEN* in column 1 is 6.464 and the mean value of *GREEN* is 64.5. The economic impact of *LONG* on *GREEN* is therefore equal to 0.11×6.464/64.5. Similarly, the impact of *FOREIGN* on *GREEN* is equal to 0.28 × 5.488/64.5.

[15] See Fazzari, Hubbard and Petersen (1988), and Brown and Petersen (2009, 2011) for evidence in the United States, and Hoshi, Kashyap and Scharfstein (1991), and Chang et al (2007), for evidence in Japan, and Australia respectively.

[16] The standard deviation of *GREEN* is 13.8, the coefficient of *GREEN* in column 1 is -0.068 $\times 10^{-2}$ and the mean value of *CAPX* is 0.206. The economic impact of *GREEN* on *CAPX* is therefore equal to $-0.068\times 10^{-2} \times 13.8/0.206$.

[17] In an alternative test (unreported), we split the sample companies into two groups within each industry and re-run the regressions and the findings are qualitative the same as those reported in Table 5. The results are available upon request.

[18] For example, financial companies tend to be less polluting than firms in other industries because they do not involve in the production of tangible products. On the other hands, utilities are polluting because they consume a lot of resources in the production of energy. To address the potential bias in the construction of green score, we remove financial companies and utilities (i.e. companies in regulated industries) from our sample in a robustness check. Most of the results in the robustness check are consistent with the results reported in Tables 3, 4 and 5.