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The Effect of Corporate Environmental Initiatives on Firm Value: Evidence from Fortune 500 Firms

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Abstract
When do firms derive value from investing in environmental initiatives (CEIs)? We examine stock market responses to the announcements of 183 CEIs by 71 Fortune 500 firms during the period 2002 to 2008. We find that the stock market reacts positively to such announcements but does not react differently to CEIs concerning a firm's inputs, throughputs, and outputs. We also find that there is an inverted U-shaped relationship between the timing of a CEI and the abnormal stock market return following its announcement. Overall, this study shows that timing is a relevant explanatory factor for the value firms derive from investing in environmental action..

Key words: Corporate environmental action; environmental sustainability; value creation; event study methodology

INTRODUCTION

"When do firms derive value from investing in environmental initiatives? A central debate in the environmental sustainability and strategy literature focuses on how environmental management and actions affect economic performance (Clemens, 2006; Chien & Peng, 2012; Dowell, Hart, & Yeung, 2000; Hamilton, 1995; Hart, 1995; Hart & Ahuja, 1996; King & Lenox, 2001; Porter & van der Linde, 1995). A rich stream of research in this domain has examined the performance implication of environmental actions by taking a market-based perspective, using event study methodology to track abnormal stock market returns following the announcement of specific environmental actions and events. Such an approach essentially enables the isolation of the performance impact of a firm level action: a statistically significant abnormal stock market reaction to the announcement of environmental action reflects, on the one hand, the stock market's perception of the action's financial impact on the firm and, on the other hand, also indicates causality between the action and the performance outcomes (Jacobs, Singhal, & Subramanian, 2010; McWilliams & Siegel, 1997).

A key assumption in the literature that has examined stock market reactions following the announcement of environmental action is that an event with significant strategic and operational impact will lead the stock market to reconsider its evaluation of the involved firm. Authors in this line of research have examined events such as corporate environmental initiatives (Gilley, et al., 2000; Jacobs et al., 2010), environmental investments (Halme, & Niskanan, 2001), pollution disclosures (Belkaoui, 1976; Freedman & Jaggi, 1994; Hamilton, 1995; Ingram, 1978; Shane & Spicer, 1983); environmental performance awards (Jacobs, et al., 2010; Klassen & McLaughlin, 1996), and environmental crises (Klassen & McLaughlin, 1996). This literature has laid a solid foundation for isolating and better understanding the performance effect of specific environmental action by taking the abnormal stock market return as a financial performance proxy. However, it has not shed much light on the role of the timing of such actions in explaining financial performance outcomes.

A second stream of research focusing on the environmental action-performance link does examine the impact of the timing of environmental investments and initiatives on firm performance (Hart & Ahuja, 1996; Nehrt, 1996). Although this research provides interesting insights into the performance effect of the timing of environmental action and initiatives, it mainly examines longer periods of time, for example, action in a given year and the successive performance effect in the year after. However, this research does not build on insights from the event study-based literature stream and consequently does not shed much light on the performance effect of single environmental actions at more discrete points in time.

In this study, therefore, we aim to address these gaps by linking the two literatures described above to shed new light on how environmental action affects economic performance at specific points in time. More specifically, we build on these literatures and examine stock market responses to the announcements of 183 corporate environmental initiatives by 71 *Fortune 500* firms during the period of 2002 to 2008. In doing so, it is our goal to make two specific contributions to the literature concerned with the performance effect of environmental action. First, we intend to isolate the performance effects of

single environmental actions and investigate whether there is a systematic performance differential related to the timing of these actions. Second, we intend to overcome some of the methodological shortcomings in the existing event study-based works such as the relatively small and homogeneous event sample size and the use of relatively simplistic event study methodology. Here, we introduce a more sophisticated event study methodology by including the Fama and French (1992, 1993) three factors model, the Carhart (1997) four factors model, and a multi-industry sample.

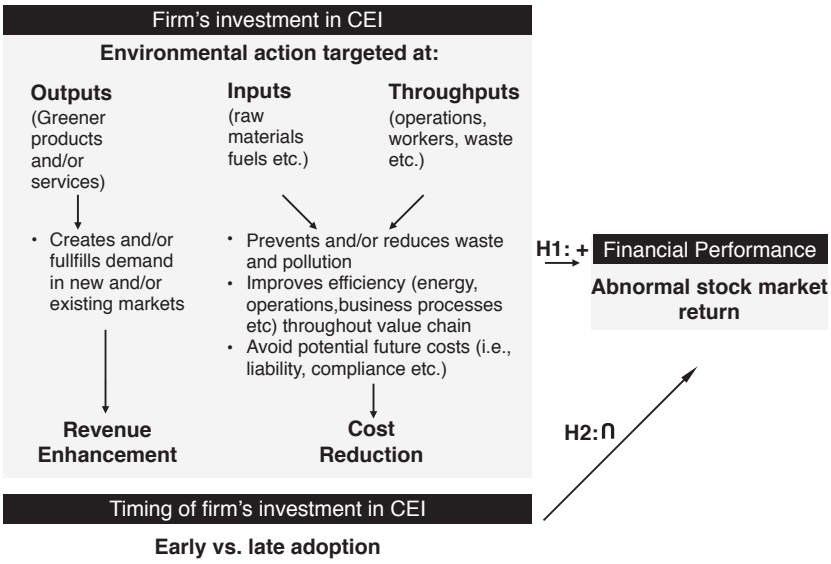
For the purpose of this study, we define corporate environmental initiatives (henceforth "CEIs") as firm-level actions with the goal of reducing negative or generating positive environmental impact in areas such as energy efficiency, pollution prevention, waste reduction, recycling, use of clean energy, environmental management systems, and greener products and services (Jacobs, et al., 2010). We include initiatives that concern a firm's inputs (i.e., raw materials and fuels), throughputs (i.e., plants, workers, wastes, and transportation), and outputs (i.e., products and/or services) (Shrivastava, 1995a, 1995b).

The remainder of this paper is structured as follows. In the next section, we review and draw on the relevant background literature and develop a theory and hypotheses. Next, we describe the sample data and methods used to test our hypotheses. Lastly, we conclude the paper by discussing its findings and limitations, and highlighting avenues for future research.

BACKGROUND LITERATURE AND HYPOTHESES

To examine the effect of CEIs on firm performance, we first set up our baseline argument about stock market reactions to CEIs before we move on to examine how the timing of such investments can explain performance differentials. Figure 1 provides an overview of our conceptual model which we outline in more detail in the following sections.

Figure 1. Conceptual model



Stock Market Reactions and Environmental Initiatives

A rich stream of research has examined stock market reactions to environmental initiatives. The findings of these studies, however, remain inconclusive. While some studies report positive wealth effects following the announcements of environmental action and initiatives, others report negative effects or even no effects at all.

In an early study, Shane and Spicer (1983) found that the stock market reacts more positively to announcements of better pollution performance than it does to announcements of poorer pollution performance. Similarly, Stevens (1984) reported that firms with low pollution control costs trigger more positive abnormal stock market returns than firms with high pollution control costs. Klassen and McLaughlin (1996) reported that positive corporate events, such as firms' environmental awards, generally trigger positive abnormal stock market returns. In their analysis of U.S. firms, Dowell et al. (2000) found that firms with a single rigorous global environmental standard have systematically higher market values than firms with lower and less rigorous standards.

Although there is considerable evidence for positive stock market reactions to the announcement of environmental action, some studies have also provided contrary findings. For example, Hamilton (1995) reported that the first announcement of firms' Toxics Release Inventory pollution figures resulted in a negative abnormal stock market return. In their study of firms in the Finnish forestry industry, Halme and Niskanan (2001) also found that the stock market reacts negatively to environmental investments and the greater the investments are, the more negative the stock market's reaction.

Lastly, some studies reported no effects at all. Yamashita, Swapan, and Mark (1999) examined scores of environmental conscientiousness reported in the press but did not find significant abnormal stock market responses to these scores. In their study, Gilley et al. (2000) found that the stock market did not react significantly to firms' announcements of environmental initiatives and that the market reacts significantly differently to product-driven CEIs than process-driven initiatives. Jacobs et al. (2010) found similar results in that the announcement of CEIs does not trigger significant reactions from the stock market. However, Jacobs and colleagues also found that stock market reactions differ by initiative type: philanthropic initiatives and ISO 14001 certifications trigger a positive market reaction, while voluntary emission reductions trigger a negative market reaction.

There is a clear tension between the literature showing a positive relationship between environmental action and economic performance and the mixed empirical evidence from the event study-based literature on the subject. Consequently, additional empirical evidence is needed to shed further light on the subject. To provide new insights on the stock market's reaction to environmental initiatives, we adopt a value creation, i.e., revenue enhancement and cost reduction view, for our baseline argument. We then move on to examine the role of timing in such initiatives from a broader institutional perspective.

Environmental Action and Value Creation

Research has shown that through proactive environmental management and strategies, firms can achieve positive economic performance outcomes (Aragon-Correa, 1998; Aragon-Correa & Sharma, 2003; Dowell, et al., 2000; Forte & Lamonte, 1998; Hamilton, 1995; Hart, 1995; Hart & Ahuja, 1996; Porter & van der Linde, 1995; Sharma, 2000) and gain a competitive advantage over their rivals (Shrivastava, 1995a). More specifically, acting in an environmentally sustainable fashion provides an opportunity for firms to create value by enhancing revenues and/or reduce costs (Ambec & Lanoie, 2008; Christmann, 2000; Dowell, et al., 2000; Klassen & McLaughlin, 1996).

Through targeted environmental actions and initiatives, firms can create demand for new, environmentally friendly products which can open up new markets leading to enhanced revenues (Hart, 1995; Porter & van der Linde, 1995). Firms can also achieve substantial reputational benefits from environmental action which in turn can lead to increased sales and thus enhance revenues (Dowell, et al., 2000; Klassen & McLaughlin, 1996).

On the cost side of the equation, environmental initiatives can help firms to reduce costs through waste and pollution reduction, improved energy efficiency, and improved business processes throughout their operations and supply chains (Christmann, 2000; Hart, 1995; Hart & Ahuja, 1996; Rao & Holt, 2005; Rothenberg, Pil, & Maxwell, 2001; Sroufe, 2003). Moreover, from a long-term perspective, such initiatives can help to avoid potential future costs related to compliance, environmental crisis, and liabilities (Reinhardt, 1999; Karpoff, Lott, & Wehrly, 2005; Porter & van der Linde, 1995)

Thus, from a stock market-based perspective, the above arguments suggest that firms should expect positive reactions by the stock market to their engagement in environmental initiatives. Therefore, our baseline hypothesis goes as follows:

> *Hypothesis 1: The abnormal stock market return following the announcement of a CEI is positive.*

The Role of Timing in Investing in Corporate Environmental Initiatives

Firms' environmental actions are determined by both internal and external forces (Clemens & Douglas, 2006). From an internal perspective the timing of such action is frequently driven by the quest to achieve a first mover advantage (Nehrt, 1996). From an external perspective, however, the role of timing concerning environmental action and how this timing affects firm performance is less clear. Therefore, to shed more light on the role of the timing of CEIs in explaining performance outcomes, this section will take an external perspective and develop an argument based on tensions between the institutional pressure and "liability of newness" perspectives.

Pressure within the institutional environment is a key driver for firm behavior and, to become legitimate, firms frequently adopt practices that are common within their organizational field (DiMaggio & Powell, 1983; Scott, 1992). One important issue concerning such practice adoption, however, is the relationship between timing and value creation.

Firms that adopt new practices soon after significant external events tend to

do so to respond to pressures to implement initiatives that deliver efficiency gains and performance improvements (Naveh, Marcus, & Moon, 2004; Tolbert & Zucker, 1996; Westphal, Gulati, & Shortell, 1997). By quickly adopting new practices, firms can benefit from learning effects, time compression diseconomies, and asset mass efficiencies and thus may obtain a first mover advantage (Nerth, 1996).

However, the early adoption of new practices may also confront firms with a liability of newness challenge (Stinchcombe, 1965). From a liability of newness perspective, new and not yet established practices are perceived to bear a greater risk of failure than already established ones and thus tend to have a lower level of legitimacy in the organizational field (DiMaggio & Powell, 1983; Freeman, Carroll, & Hannan, 1983; Stinchcombe, 1965). Liability of newness may thus diminish or even supersede the performance benefits obtained by early practice adoption, which incentivizes firms to delay the adoption of new practices until they have become more legitimate within the organizational field.

Firms, however, cannot delay new practice adoption for too long because over time institutional pressure increases on firms that have not yet adopted the common practices and such firms become increasingly pressured to do so. Thus, late adopters often adopt a dominant practice because other organizations have already done so and as a way to achieve legitimacy within the organizational field (DiMaggio & Powell, 1983; Tolbert & Zucker, 1996; Westphal & Zajac, 1998; Zajac & Westphal, 1995). Late practice adoption is, therefore, frequently viewed as a symbolic rather than substantive action that delivers few performance benefits (Naveh, et al., 2004).

From a stock market perspective, we therefore expect that firms that invest in CEIs at an early stage, i.e., immediately after a significant external event, will obtain lower wealth gains because environmental best practices have not yet become legitimate and thus prevent these firms from reaping the full benefits. Similarly we expect that late movers, i.e. firms that invest in environmental initiatives at a late stage, will not derive as much financial value from these initiatives because environmental best practices will become a standard over time and will thus be less valued by the stock market. Consequently, firms that are neither early nor late movers concerning investments in environmental initiatives will obtain higher wealth gains than the early and late movers. Therefore, we hypothesize:

> *Hypothesis 2: There is an inverted U-shaped relationship between timing and the abnormal stock market return following the announcement of a CEI.*

METHODS

Data

To select a time period where it was possible to have an early mover and late mover period, we chose 2002 to 2008 as the time period for this study. The year 2002 was the year of the World Summit on Sustainable Development (Johannesburg Earth Summit) and took place ten years after the first Earth

Summit in Rio de Janeiro. One consequence of the 2002 Johannesburg Earth Summit has been that firms, not-for-profit organizations, and governments have become more active in addressing related sustainable development issues. Thus, the Johannesburg Summit can be regarded as a landmark event that started a new era in sustainable development practices.

Our departing point was *Fortune* magazine's *Fortune 500* list, which is an annually compiled list that ranks the top 500 U.S. publicly and privately held firms by revenues and profits in each year. As a first step, we created a list of companies that had ranked in the top 500 at least once during the seven year period of study. Furthermore, as we implemented an event study research design, we then excluded all privately held firms and firms for which the daily stock market returns could not be obtained from the CRSP database. As a next step in constructing our dataset, we then conducted an extensive key word search in the *Factiva* press database for all *Fortune 500* companies that met the above described criteria in order to identify CEIs.

Our search terms included key words such as "carbon neutral", "carbon offset", "clean energy", "climate neutral", "energy efficiency", "green energy", "green power", "green product(s)", "pollution control", "pollution prevention", "recycling", "renewable energy", "waste reduction", "zero emission" and "zero greenhouse gas", amongst others. In this search, we only included announcements in which the type of environmental initiative was explicitly specified. We also excluded announcements about CEIs that were only at the planning stage and CEI announcements in which it was unclear when the environmental action would take place. In the case of multiple announcements of the same initiative, we selected the announcement with the earliest date to be consistent with the efficient market hypothesis which suggests that subsequent identical news will have no additional effect on the stock price. This procedure yielded 210 events of 71 firms. Table 1 provides an overview of our sample characteristics and also contrasts our study with relevant prior work.

Table 1. Sample characteristics in comparison to prior research

Study	Our study	Gilley, et al. (2000)	Halme & Niskanan (2001)	Jacobs, et al. (2010)	Klassen & McLaughlin (1996)
Number of events	183	71	64	417	162
Number of firms	71	Not specified	10	340	96
Number of unique industries	26	16 (by two-digit SIC code)	1	22 (by unique two-digit NAICS code); 63 (by unique three-digit NAICS code)	14
Sample firms and sample process	Announcements by *Fortune 500* firms in the *Factiva* press database (2002 to 2008)	Any announcement (i.e., no criterion to select firms) in the *Wall Street Journal* (1983 to 1996)	Announcements of Finnish forestry industry firms in the daily *Helsingin Sanoma*t (1979 to 1996)	Any announcement (i.e., no criterion to select firms) in three major business wire services, the 10 most widely circulated US daily newspapers, and leading European daily newspapers (2004 to 2006)	Any announcement (i.e., no criterion to select firms) in the NEXIS database of newswire services (1985 to 1991)

For robustness check purposes, we then coded the 210 corporate initiative announcements in three categories: (1) initiatives concerning a firm's inputs, e.g., raw materials, fuels, etc.; (2) initiatives concerning a firm's throughputs,

e.g., operations, workers, wastes, etc.; and (3) initiatives concerning a firm's outputs, e.g., products, packaging, etc. (Shrivastava, 1995a, 1995b). Table 2 provides some examples of environmental initiative announcements in these three categories.

Table 2. Example announcements of CEIs

CEI type	Example announcement
Concerning a firm's inputs (e.g., raw materials, fuels, etc.)	"Dell is doing its share to help clean Central Texas air. The company has joined the Clean Air Partners, a program to reduce ozone emissions and improve air quality; committed to purchasing at least 10 percent of its electricity requirements supplied by Austin Energy through the GreenChoice program for renewable energy; and joined the U.S. Environmental Protection Agency's SmartWay Transport Partnership, a program to increase energy efficiency while reducing air pollution and greenhouse gas emissions."
Concerning a firm's throughputs (e.g., Operations, workers, wastes, etc.)	"Office Depot recently broke ground on its first green store in Austin. Upon its completion this summer, the store will be Office Depot's first registered project to certify within USGBC's LEED Volume Certification Program. Office Depot currently has 138 stores in Texas and eight stores in Austin."
Concerning a firm's outputs (e.g., products and/or services)	"Bank of America Corp. has launched the Brighter Planet credit card. The bank said that it has teamed up with Brighter Planet (TM) to offer a credit card that is expected to help customers reduce their contribution to climate change. The card is also expected to help customers invest in the development of clean, renewable energy projects."

As a next step, we matched the event study sample to Bloomberg tickers to obtain firm level financial data and we identified confounding events. More specifically, we identified confounding events for each of the 210 announcements over a one week window (i.e., from day -3 to +3) which is in line with previous research (McWilliams & Siegel, 1997). Confounding events included major other events such as CEO or board changes, posting of operating results, stock splits, mergers and acquisitions, strategic alliances and restructuring, amongst others. This procedure reduced our initial sample of 210 events to a usable sample of 183 events by 71 firms in 26 industries, which we grouped into five industry groups by using the first digit of the four-digit SIC code. Tables 3a and 3b show the distribution of events by industry and year.

Table 3a. Breakdown of events by industry

	Industry Group	Events
Group1	Beverages	1
	Retail Apparel/Shoes	1
	Forest Products & Paper	1
	Chemicals	5
	Healthcare Products	5
	Pharmaceuticals	3
	Oil Companies (Integrated)	4
	Subtotal	**20**
Group2	Mining	7
	Machinery (Diversified)	1
	Semiconductors	2
	Computers	11
	Office/Business Equipment	2
	Miscellaneous Manufacturing	6

	Telecommunications	1
	Cosmetics/Personal Care	1
	Medical Products	1
	Subtotal	**32**
Group3	Transportation	4
	Electric	99
	Gas	1
	Environmental Control	1
	Subtotal	**105**
Group4	Retail	15
	Food	3
	Subtotal	**18**
Group5	Banks	4
	Insurance	1
	Commercial Services	1
	REITS	2
	Subtotal	**8**
	Total	**183**

Table 3b. Breakdown of events by year

Year	Events
2002	17
2003	17
2004	4
2005	14
2006	22
2007	51
2008	58
Total	**183**

Variables

The dependent variable in this study is the *Cumulative Average Abnormal Return* (*CAAR*) following the press announcement of a CEI. We followed a standard event study approach (Koh & Venkatraman, 1991; Madhavan & Prescott, 1995; McWilliams & Siegel, 1997; Park & Kim, 1997) and estimated a market model for each firm and then calculated the abnormal return for each announcement. In our market model we included dividends and used equally weighted benchmark indices. We also used more advanced event study methodology by including the Fama and French (1992, 1993) three factors model and the four factors model (Cahart, 1997) which includes the momentum term[1]. Moreover, we used the expected returns before the firms took any investment decisions as the benchmark and retrieved the stock

1. Fama and French (1992, 1993) posit that the performance of managed portfolios and individual stocks should be evaluated by comparing their average return with the average returns of benchmark portfolios which have similar sizes and book-to-market characteristics. Cahart (1997) introduced an additional momentum factor and analyzed the spread in the best and worst-performing. The Cahart (1997) four factors model is widely used in mutual fund markets.

return and market index return data from the CRSP database. As information noise is more difficult to control in long event windows and because there was no reason to believe that, in the given contexts, information is revealed to investors more slowly than normal or leaked out before the event, we used a three-day event window during which we calculated the cumulative average abnormal return. The three-day day event window is centered around the day of the event $t = 0$, starting with the day prior to the event $t = -1$ and ending with the day after the event $t = +1$ (*CAAR*-1/+1). Such a three-day window is in line with previous event study-based strategy research (e.g., Park, 2004) and more importantly allows us to be "[…] reasonably confident that an abnormal return is due to an event, because it is relatively easy to identify confounding effects" (McWilliams & Siegel, 1997: 637). For the estimation period, we used approximately one year of daily stock returns, i.e. 255 trading days (Park & Kim, 1997), beginning with day $t = -301$ and ending with day $t = -46$. By excluding the 46 days prior to the announcement from the estimation of the market model, we made sure that data that may have been affected by the event was removed. We used a minimum of 60 days of return data as the requirement for parameter estimation and also converted any non-trading date to the next trading date.

The independent variable *Timing* of a CEI was operationalized by using the year in which the environmental initiative was announced. In other words, announcements of CEIs close to or within the year of the Johannesburg Earth Summit, i.e., 2002, were considered as early.

To ensure the robustness of the results, we included various control variables commonly used in the analysis of the environmental performance-economic performance link. We controlled for *Firm Size*, which is widely used as a control variable in studies focusing on performance outcomes and which we measured as the natural logarithm of a focal firm's total assets in the year of the announcement (King & Lenox, 2001). Like firm size, the riskiness of firms may impact the stock market's reaction to the announcement of CEIs. More specifically, the level of financial leverage is an endogenous decision taken by the firm and it proxies for bankruptcy costs. Leverage has a disciplinary role to management, reducing agency costs (Jensen, 1986). The higher the leverage, the more cash flow is committed to debt service and therefore any investment decisions should add value and less pet projects are undertaken. Thus, to control for the effects of the financial leverage of a focal firm in a given year (King & Lenox, 2001), we added the control variable *Leverage*, which we operationalized through the ratio of the firm's total liabilities to its total assets in the year the initiative was announced. Additionally, to control for potential growth, we deployed the control variable *Capital Expenditures,* which we operationalized as capital expenditures divided by total assets (in US$) (King & Lenox, 2001). To control for risk heterogeneity amongst the sample firms, we added the control variable *Volatility*, which accounts for market volatility (i.e., externally perceived risk) by computing the standard deviation of stock returns over the five years previous to the investment announcement. Lastly, because of the multi-industry nature of our sample and because some industries are cleaner than others, we controlled for industry effects by including five *Industry* dummy variables. To generate the five dummy variables, we grouped the 27 industries present in our sample into five industry groups by using the first digit of the four-digit SIC code (see Table 3a).

Analysis and Results

Tables 4a and 4b present the descriptive statistics and the correlation matrix for all the variables.

Table 4a. Descriptive statistics

	N	Mean	S.D.	Min.	Max.
CAAR-1/+1	183	0.001	0.037	-0.348	0.112
CAAR-2/+2	183	0.005	0.033	-0.134	0.115
CAAR-3/+3	183	0.007	0.054	-0.466	0.141
Firm Size	183	10.435	1.050	7.517	14.449
Leverage	183	0.684	0.146	0.149	0.981
Capital Expenditures	183	-0.019	0.010	-0.074	0
Volatility	183	0.213	0.155	0.002	0.810
Industry Group 1	183	0.109	0.313	0	1
Industry Group 2	183	0.175	0.381	0	1
Industry Group 3	183	0.574	0.496	0	1
Industry Group 4	183	0.098	0.299	0	1
Industry Group 5	183	0.044	0.205	0	1
Timing	183	2006.140	2.010	2002	2008

Table 4b. Correlations

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1.	CAAR-1/+1	1												
2.	CAAR-2/+2	0.546	1											
3.	CAAR-3/+3	0.766	0.679	1										
4.	Firm Size	-0.005	-0.073	-0.034	1									
5.	Leverage	0.012	0.000	0.025	0.284	1								
6.	Capital Expenditures	-0.058	-0.066	-0.029	0.336	0.255	1							
7.	Volatility	0.016	0.033	0.066	-0.242	0.101	0.051	1						
8.	Industry Group 1	0.054	-0.011	-0.010	0.093	-0.353	0.048	-0.184	1					
9.	Industry Group 2	-0.016	-0.069	-0.002	0.187	-0.032	0.309	0.170	-0.161	1				
10	Industry Group 3	0.051	0.032	0.047	-0.209	0.391	-0.155	-0.070	-0.406	-0.534	1			
11.	Industry Group 4	0.037	0.062	0.098	-0.212	-0.382	-0.268	0.172	-0.116	-0.152	-0.383	1		
12.	Industry Group 5	-0.231	-0.023	-0.238	0.323	0.208	0.118	-0.117	-0.075	-0.098	-0.248	-0.071	1	
13.	Timing	0.025	0.075	-0.009	0.081	-0.003	0.081	-0.408	-0.104	0.104	-0.033	-0.069	0.145	1

Table 5 reports the average daily abnormal returns for the market model over a two-week period starting at day *t* = -10 and ending at day *t* = +3, the Patell Z-statistic (Patell, 1976), the generalized Z-statistic, and the proportion of positive returns (McWilliams & Siegel, 1997). The returns are averaged over all the events.

Table 5. Average daily abnormal returns
Market model, equally weighted index, excluding dividends

Event Day	Mean Abnormal Return	Patell Z	Generalized Sign Z	Proportion of positive returns
-10	0.05%	0.731	0.245	104:106
-9	0.01%	0.593	0.383	105:105
-8	0.24%	-2.793**	-1.826*	-89:121<
-7	-0.38%	-3.189***	0.107	103:107
-6	-0.07%	-0.188	-0.860	96:114
-5	-0.15%	-1.483†	0.107	103:107
-4	-0.08%	-2.146*	-1.964*	88:122<
-3	0.28%	2.716**	0.935	109:101
-2	0.12%	0.825	0.107	103:107
-1	0.01%	-0.241	1.349†	112:98)
0	0.14%	1.847*	0.935	109:101
+1	0.00%	0.318	2.040*	117:93>
+2	0.18%	1.281	0.383	105:105
+3	-0.10%	-0.323	0.107	103:107
CAAR-1/+1	0.15%	1.110	2.730**	122:88>>
CAAR-2/+2	0.45%	1.802*	2.592**	121:89>>
CAAR-3/+3	0.63%	2.427**	2.454**	120:90>>

N = 183; † p < 0.10; p < 0.05; ** p < 0.01; *** p < 0.001. The symbols (,< or),> etc. correspond to $,* and show the direction and generic one-tail significance of the generalized sign test.*

To test Hypothesis 1, we inspected all the results to determine where the abnormal returns of the CEIs were significant. We considered the abnormal return following the announcement of an environmental initiative as significant, when (1) both the Patel Z and the Generalized Sign Z test statistics were significant, at the level of 0.10 or lower or (2) at least one of them was significant, at the level of 0.05 or lower. For the Fama-French time series models, only the Generalized Sign Z test was available and a minimum significance level of 0.05 was accepted. The results support Hypothesis 1 which suggested that the market positively reacts to the announcement of CEIs.

As a robustness check, we analyzed whether the stock market reacts significantly differently to different types of CEIs (Gilley, et al., 2000; Jacobs, et al., 2010). We examined the three different sub-samples of CEIs in our dataset: (1) CEIs concerning a firm's inputs, (2) CEIs concerning a firm's throughputs, and (3) CEIs concerning a firm's outputs (Shrivastava, 1995a, 1995b). However, we did not find any statistically significant results that suggest that different CEI types trigger different reactions by the stock market.

Table 6 provides the multiple regression results, with the focal firm's cumulative average abnormal stock market return over the three-day event window acting as the dependent variable. As some of the sample firms invested in more than one CEI (183 initiatives by 71 different firms), we adjusted the standard errors of the regression coefficients by using the robust estimates of the standard errors (White, 1980), clustered by firm (Rogers, 1993)[2].

2. To do this, we used the Huber-White sandwich cluster function in STATA

Table 6. Regression results

	Model 1	**Model 2**	**Model 3**
Dependent Variable	CAAR-1/+1	CAAR-2/+2	CAAR-3/+3
Intercept	-5670.932* (2221.135)	-5518.745* (2394.622)	-7357.517† (4099.020)
Explanatory Variables			
Timing	5.654* (2.212)	5.502* (2.389)	7.337† (4.085)
Timing Squared	-0.001* (0.001)	-0.001* (0.001)	-0.002† (0.001)
Control Variables			
Firm Size	0.003 (0.004)	-0.001 (0.002)	0.003 (0.006)
Leverage	0.030 (0.025)	0.012 (0.027)	0.049 (0.052)
Capital Expenditures	-0.289 (0.297)	-0.181 (0.278)	-0.125 (0.476)
Volatility	0.009 (0.014)	0.015 (0.020)	0.014 (0.026)
Industry Group 1	0.059 (0.044)	0.007 (0.015)	0.078 (0.071)
Industry Group 2	0.046 (0.041)	-0.002 (0.013)	0.069 (0.067)
Industry Group 3	0.048 (0.043)	0.003 (0.013)	0.070 (0.068)
Industry Group 4	0.053 (0.047)	0.005 (0.017)	0.090 (0.078)
Industry Group 5	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
R2	9.44	4.23	9.36
N	183	183	183

*Note: † p < 0.10; * p-value < 0.05; ** p < 0.01; *** p < 0.001.*

Model 1 presents our baseline model with *CAAR*-1/+1 as the dependent variable. The results of Model 1 show that the root term of the independent variable Timing is significant and positive ($\beta = 5.654$, $p < 0.05$) and the squared term is significant and negative ($\beta = -0.001$, $p < 0.05$). This indicates an inverted U-shaped relationship as hypothesized. As a robustness check, we also deployed two alternative event windows, both centered around the event day t= 0, to compensate for the potential uncertainty involved in determining the precise moment new information arrives in the market. In Model 2, the dependent variable *CAAR*-2/+2 is calculated over a five-day event window, starting at day $t = -2$ and ending at day $t = +2$. The results of Model 2 show that the root term of the independent variable Timing is significant and positive

($\beta = 5.502$, $p < 0.05$) and the squared term is significant and negative ($\beta = -0.001$, $p < 0.05$). In Model 3 the dependent variable *CAAR*-3/+3 is calculated over a one-week event window, starting at day $t = -3$ and ending at day $t = +3$. The results of Model 3 show that the root term of the independent variable Timing is significant and positive ($\beta = 7.337$, $p < 0.1$) and the squared term is significant and negative ($\beta = -0.002$, $p < 0.1$). Given the longer event window of the dependent variable in Model 3, it is not surprising that the significance levels for the independent variable Timing and its squared term dropped to $p < 0.1$. Overall, these results provide support for Hypothesis 2 which suggested an inverted U-shaped relationship between the timing of a CEI and the abnormal stock market return following the announcement of the initiative.

DISCUSSION AND CONCLUSION

In this section, we discuss the implications of this study for the literature focusing on the link between corporate environmental action and firm performance. We also examine the implications for practitioners. We end this discussion by highlighting some of the limitations of this study and suggesting future avenues for empirical research.

The results of this study further the understanding of how environmental action affects firm performance and suggest that investments in CEIs have the potential to create firm value. On the aggregate level, our results show that it appears to be the simple fact that a firm invests in a CEI that creates value rather than the specific type of CEI the firm invests in (i.e., CEIs concerning a firm's inputs, throughputs, and outputs). However, our results show that the timing of CEIs, i.e. when firms invest in such initiatives, is a critical factor in explaining differentials in the financial rewards that firms derive from such initiatives. More specifically, the results of our study suggest that neither early movers nor late followers reap the highest financial benefits but rather what we could call "early followers", i.e. firms that time their initiatives so that they occur between the early mover and late follower phases. From the perspectives of liability of newness and institutional pressure, opposite forces are at work in the early mover and later follower phase, making an early follower strategy most attractive from a value creation perspective.

As managers tend to face pressures from various stakeholder categories on issues concerning the natural environment (Girard, 2013), managers of firms that invest in greening their business should, therefore, carefully consider the timing of their investments in CEIs. To determine the ideal timing managers need to have a detailed understanding of their external environment, especially the environmental practices that have been adopted and are in the process of becoming an institutionalized standard following major external events, e.g. the 2002 Johannesburg Earth summit (DiMaggio & Powell, 1983; Scott, 1992). In light of this, our empirical evidence can help managers to be more sensitive concerning the timing of environmental investments.

Inevitably, this study has several limitations. First, our event study research design choice is open to the traditional criticism of market efficiency. In adopting such a design, we assume that CEIs are significant enough events that they will lead investors to reconsider their evaluations of the involved firms. Second, although we deliberately excluded announcements about CEIs that

were at the planning stage or for which the timing was unclear from our data collection, the announcements included in our sample do of course not give any indication of how initiatives evolve over time and what future organizational impact they have on the announcing firms[3]. This issue, however, is a common limitation of event study research designs. Lastly, the generalizability of the results may be constrained by the particular characteristics of the sample firms and their respective industries. First, the fact that we used firms from the *Fortune 500* list may limit the generalizability of the results to smaller firms. Second, the fact that a large proportion of the sample firms operate in natural resource intensive industries such as transportation, electricity, gas, and environmental control may also limit the generalizability of the results to firms that operate in cleaner and less natural resource intensive industries.

3. We are grateful to a reviewer for pointing this issue out to us.

Thus, future research could focus on a number of issues. First, one promising direction for research would be to further investigate the industry effects mentioned above by including some industry level variables that capture the relative cleanliness or dirtiness of an industry and examining whether differentials in stock market reactions can be explained by such variables. Another future research opportunity would be to investigate if there are systematic differences for cost reducing and revenue enhancing CEIs (Ambec & Lanoie, 2008). However, most likely this would require fine-grained firm-level data and thus would need a data collection method different from the one used in this study, since secondary data sources such as press announcements do not normally contain such detailed information. Survey-based research could be a promising avenue to collect such data.

To conclude, this study started by noting that existing literature on the performance effect of environmental action has not shed much light on the role of the specific timing of such action in relation to the reaction of the stock market. Therefore, this study set out to answer the research question: do firms derive value from investing in environmental initiatives? We submit that the contribution of this study rests in the following areas. First, we have bridged the gap between the extant literature that has taken a stock market perspective on environmental action (Belkaoui, 1976; Freedman & Jaggi, 1994; Halme & Niskanan, 2001; Hamilton, 1995, Klassen & McLaughlin, 1996) and the literature that has examined the effect of such action over longer time periods (Hart & Ahuja, 1996; Nehrt, 1996). Second, we have introduced a more sophisticated event study methodology, drawn from finance literature (Cahart, 1997; Fama, 1992, Fama, 1993). We are confident that this study provides a useful perspective on and further understanding of the issue of the performance implications of environmental action.

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