

An Empirical Investigation of Environmental Performance and the Market Value of the Firm

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Abstract

This paper analyzes the shareholder value effects of environmental performance by measuring the stock market reaction associated with announcements of environmental performance. We examine the market reaction to two categories of environmental performance. The first category includes 430 announcements of Corporate Environmental Initiatives (CEIs) that provide information about self-reported corporate efforts designed to avoid, mitigate, or offset the environmental impact of the firm's goods, services, or processes. The second category includes 381 announcements of Environmental Awards and Certifications (EACs) that provide information about recognition granted by third parties specifically for environmental performance. Although the market does not react significantly to the aggregated CEI and EAC announcements, we do find statistically significant market reactions for certain CEI and EAC subcategories. Specifically, announcements of philanthropic gifts to environmental causes are associated with significant positive market reaction, voluntary emission reductions are associated with significant negative market reaction, and ISO 14001 certifications are associated with significant positive market reaction. The difference in the market reaction between the CEI and EAC performance categories is statistically insignificant.

(Keywords: *market value, environmental performance, environmental initiatives, awards, certifications, event study*)

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1 Introduction

This paper analyzes the shareholder value effects of environmental performance by measuring the stock market reaction (abnormal returns) associated with announcements of environmental performance. We examine the market reaction to two categories of environmental performance. The first category is announcements that provide information about self-reported corporate efforts designed to avoid, mitigate, or offset the environmental impact of the firm's goods, services, or processes. We refer to such announcements as Corporate Environmental Initiatives (CEIs). We test the market reaction to the broad category of CEIs as well as its subcategories of specific announcement types. The second category is announcements that provide information about recognition granted by third parties specifically for environmental performance. We refer to such announcements as Environmental Awards and Certifications (EACs). We examine the market reaction for the broad category of EACs and its specific subcategories. We also contrast the market reaction to CEIs and EACs.

The issues addressed in this paper are important for a number of reasons. First, Skapinker (2008) highlights the proactive sustainability initiatives of Unilever and Wal-Mart to frame the ongoing debate over whether such initiatives are merely window dressing. Even though Wal-Mart's energy conservation and recycling initiatives, and Unilever's forays into low-cost water purification and eco-friendly detergents are well received by the popular press, the question remains as to whether the market perceives the returns on such CEIs to be as attractive as returns on alternative investment opportunities. In other words, can a firm increase shareholder value by focusing on improvements in its environmental performance? The controversy continues to receive attention in the press (for example, see Elgin 2007, Thomson 2006). Proponents cite direct economic benefits from CEIs such as raw material savings and reduced abatement costs as well as intangible advantages from improved consumer perception, community relations, employee morale, and access to new markets. Skepticism remains, however, due to the perceived high costs of improving environmental performance, and the uncertain and longer term payoffs from such efforts (Engardio, Capell, Carey, and Hall 2007). By examining the market reaction to environmental performance, we provide evidence for the debate on the potential for environmental initiatives to create value.

Second, academics have studied the relationship between environmental performance and financial performance, both theoretically (Walley and Whitehead 1994, Hart 1995, and Porter and van der Linde 1995) as well as empirically (Ullman 1985, Margolis and Walsh 2003). Friedman (1970) argues that any environmental expenses beyond those required for regula-

tory compliance are not in the best interest of shareholders and will result in degradation of firm performance and firm value. However, Barnett and Salomon (2006) suggest that good social performance attracts resources to the firm, including better quality employees and expanded market opportunities. Since proactive approaches to environmental performance require greater intangible skills (e.g., cross-disciplinary activity and problem solving) than do reactive approaches, beyond-compliance environmental efforts create more valuable resources and can be a superior source of competitive advantage (Hart 1995, Russo and Fouts 1997). On the other hand, Walley and Whitehead (1994) propose that instances where environmental efforts can improve firm performance are rare. By analyzing the market reaction to a broad range of environmental initiatives, we shed light on whether these initiatives affect firm value.

Third, although the dominant view today is that good environmental performance translates into improved financial performance, empirical results have been inconclusive and even conflicting (Corbett and Klassen 2006). The inconsistent outcomes of empirical research are due in part to inadequate measures of environmental or firm performance, debatable research methodologies, or small sample sizes. For example, Roman, Hayibor, and Agle (1999), in their review of 51 empirical studies linking financial and social (including environmental) performance, conclude that six of the studies use flawed methodologies, and seven of the studies use invalid measures of either financial or social performance as their dependent variables. In a meta-analysis of 139 published correlations between environmental performance and financial performance, Orlitzky, Schmidt, and Synes (2003) estimate that 40% of the variation in results is explained by either sampling or measurement errors.

The empirical research methods employing secondary data can be categorized into three types: portfolio studies, regression studies, and event studies (King and Lenox 2001, Guenster, Derwall, Bauer, and Koedijk 2006). Portfolio studies determine whether the return on a portfolio of firms with good environmental performance outperforms the market. Regression analyses are used to establish long-term relationships between environmental performance and accounting-based measures of firm performance. Both portfolio and regression analyses require careful matching of the firms under study with control firms to estimate any departures from “normal” financial performance during the study period. Due to the relatively long time periods over which such studies are conducted, they are sensitive to the host of other possible explanatory factors of firm performance. Further, results of positive correlation between environmental and firm performance do not necessarily demonstrate causality.

On the other hand, event studies – with their emphasis on estimating market value impacts of specific events – use environmental announcements as a proxy for the difficult-to-measure

construct of environmental performance. A statistically significant market reaction to environmental performance announcements indicates a causal link between environmental performance and financial performance. Event studies have been used to determine the impact of both positive and negative environmental events (e.g., product and process-related initiatives (Gilley, Worrell, Davidson, and El-Jelly 2000), environmental awards and crises (Klassen and McLaughlin 1996), and lawsuits (Karpoff, Lott, and Wehrly 2005)). The work of Klassen and McLaughlin (1996), and Gilley et al. (2000) is particularly relevant to our work. Klassen and McLaughlin (1996) document the market reaction to independent third-party awards for environmental performance. Using a sample of 110 announcements during the period 1986-1991, they find that third-party environmental awards are associated with a statistically significant average market reaction of 0.82%. Gilley et al. (2000) study the market reaction to environmental activities that improve processes and products. Based on a sample of 71 announcements from The Wall Street Journal during 1983-1996, they find that process-related announcements result in a statistically significant average market reaction of -0.45% but the market does not react to product-related announcements.

Our research extends earlier work but also differs from it in several important aspects. First, our approach considers a wider variety of CEIs rather than just process and product-related initiatives considered by Gilley (2000). Second, our study of environmental awards builds upon that of Klassen and McLaughlin (1996) to examine whether, in the time since their study, the increased pervasiveness of and publicity surrounding environmental efforts has affected the market's valuation of the winning of environmental awards. Third, we expand upon Klassen and McLaughlin's work by testing environmental certifications, which were new to the US market at the time of their study but are prevalent today. The impact of an Environmental Management System (EMS) certification on firm performance has been studied primarily using survey data (Delmas 2001, Melnyk, Sroufe, and Calantone 2003). Secondary data and market reaction have not been used to judge the performance impacts of EMS certification. Fourth, by including both CEIs and EACs in our study, we are able to examine the difference between the market reaction to self-disclosed information and to third-party assessments of environmental performance. Finally, prior literature lacks a thorough treatment of how specific types of CEIs and EACs affect share-holder value. We study the market reaction to specific types of CEIs and EACs, many of which have not been examined in the literature.

Our results are based on analysis of 811 announcements (430 CEI announcements and 381 EAC announcements) that appeared in the daily business press during the period 2004-2006. Although the market does not react significantly to the aggregated CEI and EAC categories, the

market does react significantly to certain types of CEI and EAC announcements. Specifically, we find that announcements of: 1) philanthropic gifts to environmental causes, result in statistically significant positive market reaction; 2) pledges or realizations of voluntary emission reductions, result in statistically significant negative market reaction; and 3) attainment of ISO 14001 certification, result in statistically significant positive market reaction. The difference in the market reaction between the aggregate CEI and EAC performance categories is statistically insignificant.

The next section develops our hypotheses. Section 3 describes the data collection effort and the sample. Section 4 provides a discussion of the event study methodology. Section 5 presents the empirical evidence and results. Section 6 summarizes the paper and provides directions for future research.

2 Hypotheses

We use the framework in Figure 1 to develop our hypotheses of the impact of environmental performance on financial performance. In addition to revenue gains and cost reductions, innovation can moderate the effects of environmental performance on revenue gains and cost reductions (Porter and van der Linde 1995). Researchers have proposed different mechanisms for environmental performance to influence revenue gains, cost reductions, and innovation. An examination of these mechanisms illustrates how CEIs can impact firm value.

Revenue growth can be achieved either through improved execution in existing markets or access to new markets. Klassen and McLaughlin (1996) propose that improvement in existing markets can be realized through the reputational benefits of positive environmental performance. They argue that demonstration of reduced environmental impacts of products and processes, and the establishment of an EMS can improve brand reputation. Dowell, Hart, and Yeung (2000) also note that the development and maintenance of stringent environmental management standards can have positive reputational effects. Corbett and Muthulingam (2007) propose that a primary reason for firms to pursue Leadership in Energy and Environmental Design (LEED) certification for building construction is to signal environmental concern to regulators, employees, and the public. Brand recognition and corporate reputation can also be enhanced through “strategic philanthropy” (Seifert, Morris, and Bartkus 2003) to support environmental causes. Similarly, other environmentally conscious initiatives, such as alternative energy purchases or investments required to reduce emissions below regulatory requirements, can signal a firm’s concern for the environment and could have a positive impact on corporate

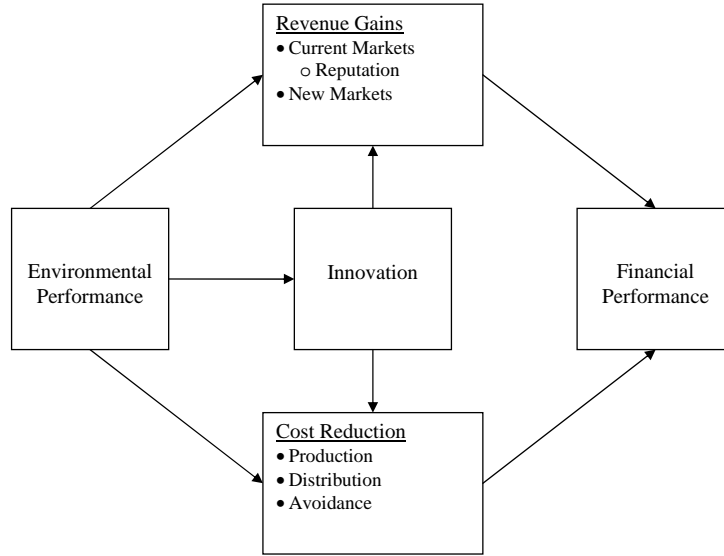


Figure 1: Linking Environmental Performance and Financial Performance

reputation and brand recognition.

Access to new markets can be another important benefit of improved environmental performance. Evolving environmentally-conscious markets, with their increasing desire for eco-friendly products, can lead to new sales opportunities (Porter and van der Linde 1995). Examples range from high-fashion clothing produced with organic materials (Brinkley 2007), to hybrid vehicles and data centers that consume less energy (Bulkeley 2007). In the public sector, US federal agencies – with \$350 billion in annual purchases – are mandated to consider environmental criteria in their purchasing decisions (EPA 2008).

In addition to its effects on revenues, environmental performance can impact costs in a variety of ways. Environmental practices reduce waste and consumption of various production inputs, including energy (Rothenberg, Pil, and Maxwell 2001), material usage (Sroufe 2003), and numbers of components in products (Ashley 1993). Both inbound and outbound logistics benefit from reduced product weights and packaging (Rao and Holt 2005). Pollution prevention may not only reduce disposal and mitigation costs but also avoid the cost of installing and operating pollution control devices (Hart 1995, Hart and Ahuja 1996). Other cost avoidance benefits of effective environmental management include mitigation of risks of losses from crises or regulation (Reinhardt 1999), and preventing the expenses associated with lawsuits and legal settlements (Karpoff et al. 2005). Dowell et al. (2000) note that stringent environmental standards can lower the cost to develop, maintain, and enforce policies and procedures, allowing easy transfer of accrued knowledge, and increasing employee morale and productivity. Similarly, von Paumgarten (2003) argues that LEED-certified buildings can improve worker productivity and retention.

Both revenue growth and cost reduction can be enhanced by innovations spurred by demands from regulators, consumers, and other stakeholders (Porter and van der Linde 1995). Examples include technologies to minimize costs of pollution, initiatives that improve resource productivity, and new or enhanced eco-friendly product designs. For example, 3M's Pollution Prevention Pays program has helped 3M achieve substantial savings through innovations related to waste reduction, process improvement, energy conservation, and product design. Using case studies from automotive assembly paint shops, Geffen and Rothenberg (2000) discuss how tightening regulations and competitive pressures lead to manufacturer-supplier partnerships and subsequent adoption of innovative technologies to simultaneously improve environmental performance and reduce costs. Klassen and Whybark (1999) discuss examples of investments in pollution prevention leading to innovative manufacturing processes in the furniture industry.

Given the above discussion, we propose our first hypothesis:

Hypothesis 1 *The market reacts positively to CEIs.*

The impacts of different CEI types empirically tested in the event study literature include product-related and process-related initiatives (Gilley et al. 2000), membership in voluntary environmental initiatives (Fisher-Vanden and Thorburn 2008), and various efforts such as investments or favorable government actions (Dasgupta, LaPlante, and Mamingi 2001). While there is some overlap between the types of CEI announcements in our sample and the types of initiatives previously examined in the literature, there are also several important types of initiatives that have not been empirically examined before. These include environmental philanthropy, eco-friendly products, and the use or supply of renewable energy. As discussed later, we classify the CEI announcements into seven distinct subcategories. It is possible that the market reaction could vary across these different subcategories of CEI announcements. To provide further insight, we provide descriptive results of each CEI subcategory. *A priori*, we expect that the market will react positively to each of the seven CEI subcategories.

CEI announcements represent self-disclosed information by the firm without formal, independent verification of the initiatives. EACs, however, are the result of third-party reviews of environmental performance. Thus, it is reasonable to assume that if CEIs effectively signal environmental performance to the market, EACs will as well. In the quality management context, the positive impact of third-party assessments on financial performance is documented by Hendricks and Singhal (1996) for awards and by Corbett, Montes-Sancho, and Kirsch (2005) for ISO 9001 certification. Within the framework of environmental management, Klassen and McLaughlin (1996) find that announcements of environmental awards lead to a significantly positive market reaction. Using surveys, Delmas (2001) finds that the degree and type of stake-

holder involvement in ISO 14001 certification affects the firm's resulting competitive advantage. Melynk et al. (2003) demonstrate that both financial performance and environmental performance are associated with the level of formality of the firm's EMS, with an ISO 14001 certified EMS correlated with the best overall performance. Thus, we state our second hypothesis:

Hypothesis 2 *The market reacts positively to EACs.*

Due to the differing criteria and standards used by various certification and award granting agencies, the market reaction would be sensitive to the certification type or award-giver (Hendricks and Singhal 1996, Klassen and McLaughlin 1996). We therefore separate our EAC announcements into two certification subcategories, namely, ISO 14001 and LEED, and three award-giver subcategories, namely, federal government agencies, state or local government agencies, and non-government agencies. We supplement H2 by presenting descriptive results for each of the five EAC subcategories.

Finally, we posit that a firm's successful attainment of third-party recognition as reflected in EAC announcements sends a stronger signal of environmental performance to the market than CEI announcements. Prior to issuing awards or certifications, third parties typically examine detailed company information and often conduct onsite reviews. Such objective evidence is likely to be valued more by the market since firms have a variety of reasons to understate or overstate their environmental activities (Solomon and Lewis 2002). Given the increased objectivity and importance of third-party awards and certifications, we propose our third hypothesis:

Hypothesis 3 *The market reaction to EACs is greater than that for CEIs.*

3 Sample and Data Description

To generate our sample, we use a preliminary set of keywords to collect a small set of CEI and EAC announcements from different publications. We read these announcements to identify additional phrases and words that are commonly used in announcements of environmental initiatives, awards, and certifications. Panel A of Table 1 presents the keywords we use in our search. We search the headline and lead paragraph of announcements in the three major business wire services, the ten most widely circulated US daily newspapers, and the leading European business daily during the period 2004-2006. Panel B of Table 1 lists the sources we use in the search. We download all announcements that meet the search criteria in these publications. We read the full text of each announcement and exclude the following types of announcement from our search results:

- Announcements that are environmental in nature but strictly pertain to governmental

Table 1: Announcement Search

Panel A: Keywords Used to Search for Announcements

(conservation or conservational or eco or ecosystem or ecology or ecological or environment or environmental or green or greener or greenest or greening or greened or recycle or recycles or recycling)

Near7

(accomplishment or accomplishments or admire or admiration or admirable or advantage or advantages or analysis or announcement or approve or approves or approval or approvals or award or awards or awarded or best or breakthrough or breakthroughs or celebrate or celebrates or celebration or celebrations or certification certified or consult or consultant or contribute or contributes or contribution or discovery or distinction or donate or donates or donation or donations or effort or efforts or endeavor or endeavors or endowment or example or excellent or excellence or exceptional or exemplary or gift or gifts or grant or grants or granted or great or greatest or honor or honors or honored or idea or ideas or initiative or innovate or innovates or innovation or innovations or innovative or invent or invents or invention or inventions or inventive or involvement or key or lead or leads or leader or leadership or master or mastery or message or messages or model or outstanding or patent or patents or patented or preeminent or preeminence or principle or principles or principled or prize or prizes or program or proactive or proclamation or proclamations or quality or qualities or qualify or qualified or qualification or recognize or recognizes or recognition or recognitions or reputation or research or researcher or respect or respected or reward or rewards rewarded or solution or standard or standards or star or strategy or strategies or strategic or study or success or successes or successful or super or superb or technology or technologies or top or tribute or tributes or tremendous or trust or venture or win or wins or won)

Panel B: Announcement Sources

Business Wire	Houston Chronicle	The New York Times
Chicago Tribune	Los Angeles Times	The Wall Street Journal
Denver Post	New York Daily News	USA Today
Dow Jones Business News	Philadelphia Inquirer	Washington Post
Financial Times	PR Newswire (US)	

agencies, NGOs, trade associations, non-profit organizations, non-publicly traded firms, environmental services companies, or individuals.

- Announcements that are very minor in nature. Frooman (1997) recognizes announcements worthy of being studied as those that substantially affect the welfare of identifiable stakeholders. With that in mind, we exclude announcements that relate to sponsorships of local events, and other minor announcements.
- Duplicate announcements that appear in more than one publication. In such cases, we only retain the announcement with the earliest publication date.

- Multiple announcements for the same firm within a span of five trading days. We exclude these announcements since any market reactions for the firm would be confounded between multiple events.

Our final sample consists of 811 environmental announcements from 355 unique firms. Table 2 provides descriptive statistics of our sample. The sample has wide variation in firm size and financial performance but is weighted toward larger firms. The sample includes firms from 21 unique two-digit and 57 unique three-digit NAICS codes.

Table 2: Descriptive Statistics of the Sample Firms[†]

	Market Value (\$M)	Total Assets (\$M)	Sales (\$M)	Net Income (\$M)	Employees (000s)	Debt-Equity Ratio	EPS (\$)
Mean	41,407.0	77,616.9	38,435.4	2,290.4	108.6	0.356	8.42
Median	13,057.4	15,082.0	11,018.0	493.7	26.0	0.297	1.97
Std Dev	75,308.4	218,439.8	69,262.2	5,374.2	272.8	0.230	171.02
Max	439,013.3	1,884,318.0	345,977.0	39,500.0	1,900.0	2.218	4,753.00
Min	32.2	14.8	4.3	-12,613.0	0.1	0.033	-32.92

[†] $N = 811$ firm-announcements with 355 unique firms, 2004-2006 calendar years

Our sample contains 480 CEI announcements. To investigate the impacts of specific CEIs, we separate our sample into the following seven subcategories based on announcement content and the CEI types identified in the literature:

- *Environmental Business Strategies*: Acquisitions of environmental-friendly capabilities, joint ventures or alliances, and new corporate environmental policies or standards.
- *Environmental Philanthropy*: Substantial gifts for environmental causes, such as natural conservation; the majority of such announcements are cash gifts although some are large gifts or easements of land.
- *Voluntary Emission Reductions*: Pledges, investments, or achievements related to reducing emissions levels beyond those required by any regulation. Of the 41 total announcements, 35 relate to greenhouse gas (GHG) reductions and six pertain to reduction of hazardous materials.
- *Eco-Friendly Products*: Introductions of eco-friendly products, environmental enhancements to existing products, or the incorporation of future regulatory requirements into existing products.

- *Renewable Energy*: Supply or purchase of power from alternative energy sources.
- *Recycling*: Recycling intended to reduce raw material consumption, recycling of internal or employees' personal waste, recycling of post-consumer waste for customer convenience, and recycling programs intended to benefit non-profit groups.
- *Miscellaneous*: All remaining CEI announcements. Includes decisions to join environmental groups or councils, energy conservation efforts, development of new eco-friendly technologies, and other corporate programs or initiatives outside of the aforementioned categories.

Panel A of Table 3 lists the sample sizes of the seven CEI subcategories. Some examples of CEI announcements include:

- “Caterpillar Sets Aggressive Greenhouse Gas Reduction Target, Goal is Part of EPA’s Climate Leaders program”, PR Newswire (US), 18 January 2005. Caterpillar pledged to reduce its greenhouse gas emissions by 20% from 2002 levels, by 2010.
- “Liz Claiborne Inc. Adopts prAna Natural Power Initiative”, PR Newswire (US), 3 November 2005. Liz Claiborne Inc. announced that it would purchase only wind power for its New Jersey headquarters.
- “Abitibi-Consolidated Launches its largest Recycling Expansion; Paper Retriever begins collection in seven additional US markets”, PR Newswire (US), 15 November 2005. Abitibi announced expansion of its paper recycling program from 16 US cities to 23 US cities.

Our sample also contains 381 EAC announcements. Within the EAC subcategory for ISO 14001 certifications, we include RC 14001 certifications. Modeled after ISO 14001, RC 14001 is a chemical industry standard developed by Responsible Care[®] but with additional industry requirements. The awards mentioned in the EAC announcements are specifically those given to recognize environmental performance, including pollution prevention, energy conservation, and habitat conservation. Granting agencies include both governmental and non-governmental entities. Not included are awards in which environmental performance is just one of multiple criteria for the award (e.g., supplier awards given by customers for excellence in quality, cost, delivery, *and* environmental performance).

Panel B of Table 3 presents the sample sizes for the five EAC subcategories. Examples of EAC announcements include:

Table 3: Sample Sizes of Announcement Subcategories

	<i>N</i>
Panel A: Corporate Environmental Initiatives (CEIs)	430
Environmental Business Strategies	53
Environmental Philanthropy	31
Voluntary Emission Reductions	41
Eco-Friendly Products	62
Renewable Energy	40
Recycling	64
Miscellaneous	139
Panel B: Environmental Awards and Certifications (EACs)	381
ISO 14001 Certifications	51
LEED Certifications	22
Federal Government Awards	100
State/Local Government Awards	65
Non-Government Awards	143

- “Smithfield Achieves International ‘Gold Standard’ for its Environmental Management Practices”, PR Newswire (US), 27 April 2005. Smithfield attained ISO 14001 certification for the EMS used in its US-based hog production and processing facilities.
- “Corning’s Wilmington, N.C., Optical Fiber Manufacturing Facility To Be Recognized as an Environmental Steward”, Business Wire, 2 March 2005. A Corning plant was recognized as an “Environmental Steward” by the North Carolina Department of Environment and Natural Resources for its environmental performance.

4 Methodology

We use the event study methodology to estimate the market reaction to announcements of environmental events. This methodology provides a rigorous approach to estimate market returns associated with specific events, while controlling for market-wide influences on stock prices (see Brown and Warner (1980, 1985), and MacKinlay (1997) for a review of this methodology). These adjusted returns (commonly referred to as abnormal returns) provide an estimate of the percent change in stock price associated with an event. The underpinning of event study methodology is that in an efficient market, the wealth impact of an event will be immediately reflected in the stock price. Thus, a measure of the wealth impact can be determined by observing stock price behavior over relatively short time periods.

The first step in executing an event study is determining the event period – the period of time over which to estimate abnormal returns. Consistent with the approach used in most event studies (e.g., Arora 2001, Hendricks and Singhal 2003, Karpoff et al. 2005), we use a two-day event period consisting of the day of the announcement and the preceding trading day. To translate calendar days into event days, we designate the announcement publication day as Day 0. If the announcement is made on either a non-trading day or after 4:00pm Eastern Time on a trading day, the subsequent trading day is treated as Day 0. All other days in the study are measured relative to Day 0. Thus, the trading day immediately preceding the announcement day is Day -1 , while the next trading day is Day 1.

Several competing models have been proposed to estimate abnormal returns. As discussed in the literature (Brown and Warner 1980, MacKinlay 1997), the estimates of the magnitude and statistical significance of abnormal returns are relatively insensitive to the model used. Consistent with most event studies, we use the “market model” to estimate abnormal returns. This model posits a linear relationship between the return on a stock and the market return (i.e., the return on the market portfolio) over a given time period as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} is the return of stock i on Day t , R_{mt} is the market return on Day t , α_i is the intercept of the relationship for stock i , β_i is the slope of the relationship for stock i with respect to the market return, and ε_{it} is the error term for stock i on Day t . The term $\beta_i R_{mt}$ is the portion of stock i 's return attributed to market-wide movements, and the error term ε_{it} is the part of the return that cannot be explained by market movement and thus captures the effect of firm-specific information. To estimate the expected return for each sample firm, we estimate $\hat{\alpha}_i$, $\hat{\beta}_i$, and $\hat{S}_{\varepsilon_i}^2$ (the variance of the error term ε_{it}) using ordinary least squares regression (see equation (1)) over the estimation period of 200 trading days. We end the estimation period two weeks (10 trading days) prior to the event day as this is a large enough interval to effectively shield the estimates from the effects of the announcement and yet short enough to ensure that any non-stationarity in the estimates is not an issue. To estimate the parameters of the market model, we require that a firm must have a minimum of 40 stock returns during the estimation period of 200 trading days.

The abnormal return A_{it} for firm i on Day t is computed as the difference between the actual return of firm i and its expected return:

$$A_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

We calculate the mean abnormal return for Day t as:

$$\bar{A}_t = \sum_{i=1}^N \frac{A_{it}}{N} \quad (2)$$

where N is the number of announcements in the sample. To test the statistical significance of the daily mean abnormal return in equation (2), each abnormal return A_{it} is divided by its estimated standard deviation \hat{S}_{ε_i} to yield a standardized abnormal return. Since the abnormal returns are assumed to be independent across firms, with mean 0 and variance $\hat{S}_{\varepsilon_i}^2$, we know from the central limit theorem that the sum of the N standardized abnormal returns is approximately normal with mean 0 and variance N . Thus, the test statistic TS_t for Day t is calculated as:

$$TS_t = \sum_{i=1}^N \frac{A_{it}/\hat{S}_{\varepsilon_i}}{\sqrt{N}}$$

We use a t -test to determine the statistical significance of the daily mean abnormal return. The cumulative abnormal return (CAR) for a given time period $[t_1, t_2]$ is:

$$\text{CAR}[t_1, t_2] = \sum_{t=t_1}^{t_2} \bar{A}_t$$

The test statistic TS_e for a period spanning multiple days is derived in a manner similar to that for a single day.

$$TS_e = \sum_{i=1}^N \frac{(\sum_{t=t_1}^{t_2} A_{it})/\sqrt{\sum_{t=t_1}^{t_2} \hat{S}_{\varepsilon_i}^2}}{\sqrt{N}}$$

To check for the influence of outliers, we supplement the t -tests with two non-parametric tests. We test for the statistical significance of the median abnormal return using the Wilcoxon signed-rank test. We use the generalized sign test to determine if the percent positive abnormal returns during the event period are significantly higher or lower than that during the estimation period. As an example, a sample of 50 announcements will have 10,000 abnormal returns during a 200 day estimation period. If 5,100 of the abnormal returns are positive, we establish 51.0% as the null, percent positive abnormal returns. The percent positive of the 50 abnormal returns during the event period are then compared to the null and a Z -statistic is generated using the normal approximation to the binomial distribution. Note that for all three tests, we report one-tailed p -values since we hypothesize that abnormal returns are positive. We look for consistencies among these three tests to ensure the robustness of our results.

5 Results

5.1 CEI Announcements

For the full sample of 430 CEI announcements, Panel A of Table 4 presents the market reactions from the market model for the day preceding the announcement (Day -1), the day of the announcement (Day 0), and the two-day event period (Days -1 and 0). The mean abnormal returns for Days -1 , 0, and the two-day event period are all positive (0.03%, 0.09%, and 0.12%, respectively) with the returns for Day 0 and the two-day event period significantly different from zero at the 10% level. The median abnormal return for the two-day event period is 0.03%, but insignificantly different from zero (Wilcoxon Signed-Rank Z -statistic is 0.60). Our results also indicate that the 51.2% positive abnormal returns are insignificantly higher than the percent positive abnormal returns during the estimation period (Generalized Sign Z -statistic is 1.24). Results for the five-day period preceding the announcement do not indicate statistically significant market reaction either. The results indicate that the market does not react to CEI announcements.

The lack of market reaction to CEI announcements is somewhat puzzling. It is plausible that the market might partially anticipate the announcements based on certain characteristics of the announcing firms. To explore this further, we examine three factors that could cause the market to partially anticipate environmental announcements by a firm – the size of the firm, frequency of environmental announcements, and environmental reputation.

Firm size has been found to be influential in several event studies (e.g., Chaney, Devinney, and Winer 1991, Girotra, Terwiesch, and Ulrich 2007). Typically, smaller firms have stronger market reactions than larger firms due to the greater relative impact of any one event to the firm's revenues or costs. Also, since smaller firms tend to be less closely followed by analysts, their announcements may have more of a surprise element when compared to announcements by larger firms. Thus, we expect that environmental announcements by smaller firms will have stronger market reactions than those by larger firms. To test for the effect of firm size, we divide our sample into quartiles by total assets. We then compare the market reactions for announcements by firms in the lowest quartile (total assets less than \$2 billion; median total assets are \$647 million) with those for firms in the highest quartile (total assets greater than \$30 billion; median total assets are \$60.8 billion).

Frequent environmental announcements by a firm could reduce the strength of individual announcements. We expect that firms with a lower frequency of announcements will have stronger market reactions to their announcements than firms with a higher announcement

Table 4: Event Period Abnormal Returns for the 430 CEI Announcements

Panel A: Corporate Environmental Initiatives (CEIs)							
		Day -1	Day 0	Days -1 and 0			
Mean Abnormal Return		0.03%	0.09%	0.12%			
<i>t</i> -Statistic		0.44	1.54*	1.40*			
Median Abnormal Return		-0.02%	-0.04%	0.03%			
Wilcoxon Signed-Rank <i>Z</i> -Statistic		0.67	0.17	0.60			
% Abnormal Returns Positive		49.8%	48.4%	51.2%			
Generalized Sign Test <i>Z</i> -Statistic		0.66	0.08	1.24			

Panel B: Corporate Environmental Initiative (CEI) Subcategories							
Subcategory	<i>N</i>	Mean CAR	<i>t</i> Statistic	Median CAR	Wilcoxon Signed-Rank <i>Z</i>	% Positive	Generalized Sign <i>Z</i>
Environmental Business Strategies	53	0.72%	2.92***	-0.01%	0.38	49.1%	0.15
Environmental Philanthropy	31	0.45%	1.38*	0.43%	1.57*	64.5%	1.88**
Voluntary Emission Reductions	41	-0.90%	-2.86***	-0.70%	-2.32**	31.7%	-2.13**
Eco-Friendly Products	62	0.05%	0.28	0.05%	0.68	51.6%	0.44
Renewable Energy	40	0.20%	0.79	0.16%	0.93	57.5%	1.25
Recycling	64	0.32%	1.06	0.05%	0.32	51.6%	0.54
Miscellaneous	139	0.05%	0.24	0.07%	0.17	52.5%	1.03

All tests are one-tailed: * $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$

frequency. We measure announcement frequency as the number of announcements per firm during our three-year study period. We test for the effect of announcement frequency by comparing the market reactions associated with announcements from firms that have an average of one or less announcement per year to those for firms with an average of more than one announcement per year.

Market reaction could also depend upon the firm's environmental reputation. The announcement of an environmental initiative by a firm not known to be a strong environmental performer will contribute to the surprise element of the announcement. Thus, we expect that announcements for firms with good environmental reputation will result in weaker market reactions than those for other firms. We measure a firm's environmental reputation as the indicator of whether the firm is included in the Dow Jones World Sustainability Index (DJSI World) at the time of the announcement. Launched in 1999, the DJSI World uses weights for economic, environmental, and social criteria to annually determine the top performers among the world's 3,000 largest publicly traded firms (Dow Jones 2008). To test for the effect of environmental

reputation, we compare the market reactions for the two announcement groups corresponding to firms either listed or not listed in the DJSI World on the announcement day.

For each of the above three factors, we test for differences in means and medians using t -tests and Mann-Whitney Z -tests. In each case, the resulting change in market reactions is in the theorized direction but is insignificant. For example, small firms have a mean (median) abnormal return of 0.04% (0.09%) compared to 0.00% (−0.01%) for large firms. The mean (median) difference in abnormal returns is 0.04% (0.10%) but is insignificantly different from zero (t -statistic is 0.14; Mann-Whitney Z -statistic is 0.46). The results indicate that firm size, announcement frequency, and environmental reputation cannot explain the market reaction to CEI announcements.

It is plausible that the market may not perceive all subcategories of CEIs to be value creating. Given the different subcategories of CEI announcements in our sample, it is possible that market reaction could differ by subcategory. For example, the market may not react at all to some categories, and in some cases it may even react negatively. By aggregating announcements of different types, the average reaction could well be insignificantly different from zero. To provide further insight into market reaction, we provide descriptive results for each of the seven CEI subcategories. Panel B of Table 4 presents these results for the two-day event period (Days -1 and 0).

In the subcategory of environmental business strategies, the mean abnormal return is 0.72%, significantly different from zero at the 1% level. However, the median return of -0.01% is statistically insignificant (Wilcoxon Signed-Rank Z -statistic is 0.38). Only 49.1% of the abnormal returns are positive, which is insignificantly higher than the percent positive abnormal returns during the estimation period (Generalized Sign Z -statistic is 0.15). Thus, the evidence suggests that the market does not react to announcements in the environmental business strategies subcategory.

The mean (median) abnormal return for environmental philanthropy is 0.45% (0.43%), statistically significant at the 10% (10%) level. In addition, 64.5% of the abnormal returns are positive, which is significantly higher (at the 10% level) than the percent positive abnormal returns during the estimation period. This could be because such philanthropic actions generate customer goodwill and enhance brand and corporate reputation, thus contributing to future profitability growth. Our results are supported by Wang, Choi, and Li (2008), who document that financial performance is increasing in low-to-moderate levels of philanthropy.

Perhaps our most surprising result is for announcements of voluntary emission reductions. The mean (median) abnormal return is -0.90% (-0.70%), statistically significant at the 5%

(5%) level. The 31.7% positive returns are also significantly lower (at the 5% level) than the percent positive during the estimation period. Thus, contrary to our prediction, announcements of voluntary emission reductions significantly decrease market value. This finding has some support in the literature. In addition to the theoretical arguments of Friedman (1970) discussed earlier, Hart and Ahuja (1996) suggest that since initial emission reductions are often achieved through “at-source” reductions (e.g., pollution prevention), financial performance improves, but subsequent reductions are more likely to result from costly pollution control. Fisher-Vanden and Thorburn (2008) find that membership in the EPA Climate Leaders program yields a negative abnormal return of -0.90% ; the negative abnormal returns are even stronger when specific pledges are made for GHG reductions. The EPA Climate Leaders Program is referred to in 12 of the 41 announcements in the voluntary emissions reduction subcategory; the remainder of the announcements relate to other air emissions or hazardous waste reductions. Thus, our results indicate that voluntary emissions reductions are viewed negatively by the market.

The market reactions for the remaining CEI subcategories – eco-friendly products, renewable energy, recycling, and miscellaneous – are statistically insignificant.

5.2 EAC Announcements

Panel A of Table 5 presents the results for the full sample of 381 EAC announcements. The mean abnormal return for Days -1 , 0 , and the two-day event period are all negative (-0.09% , -0.03% , and -0.12% , respectively) but are statistically insignificant. Similarly, the median abnormal returns are negative but statistically insignificant, and the percent positive abnormal returns are insignificantly lower than the percent positive during the estimation period. Results for the five-day period preceding the announcement do not indicate significant market reaction either. The evidence suggests that the market does not react significantly to announcements of EACs.

As with CEI announcements, we determine whether firm size, announcement frequency, and environmental reputation can influence the market reaction to EAC announcements. For each of the three factors, we divide our sample of EAC announcements into two groups and test for differences in means (medians) using t -tests (Mann-Whitney Z -tests). The resulting changes in market reactions are statistically insignificant. As an example, small firms have a mean (median) abnormal return of 0.16% (0.10%) compared to the mean (median) abnormal return of 0.03% (-0.02%) for large firms. The mean (median) difference in abnormal returns is 0.13% (0.12%) but is insignificantly different from zero (t -statistic is 0.30 ; Mann-Whitney Z -statistic is 0.86).

Table 5: Event Period Abnormal Returns for the 381 EAC Announcements

Panel A: Environmental Awards and Certifications (EACs)							
		Day -1	Day 0	Days -1 and 0			
Mean Abnormal Return		-0.09%	-0.03%	-0.12%			
<i>t</i> -Statistic		-0.62	-0.76	-0.98			
Median Abnormal Return		-0.03%	-0.01%	-0.10%			
Wilcoxon Signed-Rank <i>Z</i> -Statistic		-0.08	-0.42	-0.36			
% Abnormal Returns Positive		48.8%	49.6%	46.7%			
Generalized Sign Test <i>Z</i> -Statistic		0.29	0.60	-0.53			

Panel B: Environmental Award and Certification (EAC) Subcategories							
Subcategory	<i>N</i>	Mean CAR	<i>t</i> Statistic	Median CAR	Wilcoxon Signed-Rank <i>Z</i>	% Positive	Generalized Sign <i>Z</i>
ISO Certifications	51	0.33%	0.78	0.65%	2.10**	58.8%	1.64*
LEED Certifications	22	0.01%	0.58	0.34%	0.30	63.6%	1.48*
Federal Government Awards	100	-0.12%	-0.35	-0.09%	-0.09	45.0%	-0.57
State/Local Government Awards	65	-0.29%	-0.72	-0.04%	-1.00	47.7%	-0.14
Non-Government Awards	143	-0.22%	-1.51*	-0.18%	-1.10	40.6%	-1.85**

All tests are one-tailed: * $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$

The results indicate that firm size, announcement frequency, and environmental reputation cannot explain the market reaction to EAC announcements.

However, as with CEIs, we expect that the market does not equally value all categories of EACs. To provide more insight into the market reaction, we provide descriptive results for each of the five EAC subcategories. Panel B of Table 5 presents the results for the two-day event period for each of the five EAC subcategories. There are a number of interesting results that we highlight.

First, the market reacts positively to announcements of ISO 14001 certifications. The mean (median) abnormal return is 0.33% (0.65%) with the median abnormal return statistically significantly at the 5% level. 58.8% of the abnormal returns are positive, significantly higher (at the 10% level) than the percent positive during the estimation period. The literature offers support for the positive impact of EMSs in general, and provides some evidence using survey data (Delmas 2001, Melynk et al. 2003) that ISO 14001 certification improves firm performance. To our knowledge, we are the first to provide empirical evidence of the impact of ISO 14001 certification on market value.

Second, although 63.6% of the abnormal returns for LEED certifications are positive and significantly higher (at the 10% level) than the percent positive during the estimation period, the mean (median) abnormal return is 0.01% (0.34%) and is statistically insignificant. Thus, despite the benefits of LEED certification cited in the literature (e.g., von Paumgartten 2003, Corbett and Muthulingam 2007), the market reaction is statistically insignificant.

Third, average market reactions for awards granted by both federal governments and state/local governments are statistically insignificant. Our findings are different from those reported by Klassen and McLaughlin (1996). Using announcements made during the period 1985-1991, they find a significant positive abnormal return of 0.82% for environmental awards and no significant differences across award-giver types (whether national/international or state/local). A possible explanation for our results is that the growing presence of environmental management in general is such that the market may now routinely expect the level of performance required by awards; i.e., the market partially anticipates the announcement of environmental awards. The lack of positive market reaction to environmental awards may also be due to the increasing frequency of such awards over time. As an example, the US EPA/DOE Energy Star Program has grown from one award in its first year of existence (1993) to 92 awards in 2007 (Energy Star 2008).

Finally, non-government awards result in a -0.22% mean abnormal return, statistically significant at the 10% level. 40.6% of the abnormal returns are positive, significantly lower (at the 5% level) than the percent positive during the estimation period. The market views winning of non-government awards negatively. This suggests that the market might perceive the efforts in seeking such awards to be expensive.

5.3 Self-Disclosed Information vs. Third-Party Assessment

To determine whether the market values self-disclosed environmental performance information differently than third-party assessments, we test whether the market reactions for CEIs and EACs are different. Using two-tailed tests, we find that the means (medians) are insignificantly different from each other (t -statistic is 1.44; Mann-Whitney Z -statistic is 1.14). The market does not react differently to the two categories. A possible explanation for this result is that our sample consists mainly of large firms (330 of the 355 firms in our sample have total assets greater than \$250 million; median total assets are \$15.1 billion) and, as discussed in recent studies, self-disclosed environmental information increasingly reflects actual environmental performance, particularly for large firms (Patten 2002, Al-Tuwaijri, Christensen, and Hughes 2004).

6 Summary

This paper analyzes the shareholder value effects of environmental performance by measuring the market reaction associated with announcements of environmental performance. We examine the market reaction to two categories of environmental performance. The first category includes 430 announcements of Corporate Environmental Initiatives (CEIs) that provide information about self-reported corporate efforts designed to avoid, mitigate, or offset the environmental impact of the firm's goods, services, or processes. The second category includes 381 announcements of Environmental Awards and Certifications (EACs) that provide information about recognition granted by third parties specifically for environmental performance. Although we find that the market does not react to announcements in the aggregate categories of CEIs and EACs, we do find significant market reactions for certain CEI and EAC announcement types. Specifically, announcements of philanthropic gifts to environmental causes result in a statistically significant mean (median) abnormal return of 0.45% (0.43%); announcements of voluntary emission reductions are associated with a statistically significant -0.90% (-0.70%) abnormal return; and announcements of ISO 14001 certification result in a statistically significant median abnormal return of 0.65%. We find that announcements of environmental awards do not result in a positive market reaction. Interestingly, the difference in the market reaction between the CEI and EAC performance categories is statistically insignificant.

The above findings translate into three key observations. First, the market is highly selective in reacting to environmental efforts. Second, when the market does react, it does not do so uniformly; certain environmental efforts are even significantly discredited by the market. Third, the market has changed substantially since the time of the last relevant study that found significant and positive market reaction to environmental awards. The implications for managers seeking to improve market performance through environmental efforts are immediate. It is naïve to join the bandwagon of environmental activity with the hope that the market will respond favorably. Additionally, since budgets for environmental efforts are typically limited, it is important that potentially value-improving efforts be identified and pursued. To the extent that managers can influence the perception of efforts undertaken, the competitive rationale behind such efforts must be justified and communicated.

Avenues for future research include a detailed study of the long-term relationship between environmental and market performance. While we observe that the market's reaction to awards is quite different than reported in the literature a decade ago, statistical evidence across time will inform managers as to the changing nature of the market's assessment of environmental efforts

and will also provide valuable input for awarding and certifying agencies to tailor commendations to specific attributes sought after by the market. Another interesting direction is the use of alternative measures for financial performance. If CEI or EAC announcements truly affect shareholder value, the changes will eventually be reflected in measures such as return on assets (ROA) or return on sales (ROS). A study focusing on the effects of environmental initiatives on accounting-based measures would yield added insights on the link between environmental performance and financial performance. A limitation of our study is that self-reported announcements of environmental efforts do not imply that associated environmental objectives will indeed be realized. Although challenging, a treatment of the possibility of window dressing or that of ineffectiveness of demonstrated efforts, will allow for interesting additional insights into the continuing debate.

References

- Al-Tuwaijri, S. A., T. E. Christensen, K. E. Hughes. 2004. The Relations Among Environmental Disclosure, Environmental Performance, and Economic Performance: a Simultaneous Equations Approach. *Accounting, Organizations, and Society*. 29 (5-6), 447-471.
- Arora, S. 2001. Voluntary Abatement and Market Value: an Event Study Approach. Stanford Institute for Economic and Political Research.
- Ashley, S. 1993. Designing for the Environment. *Mechanical Engineering*. 115 (3), 52-56.
- Barnett, M. L., R. M. Salomon. 2006. Beyond Dichotomy: the Curvilinear Relationship between Social Responsibility and Financial Performance. *Strategic Management Journal*. 27 (11), 1101-1122.
- Brinkley, C. 2007. Green Fashion: Beyond T-Shirts. *The Wall Street Journal*. 18 October 2007, D8.
- Brown, S. J., J. B. Warner. 1980. Measuring Security Price Performance. *Journal of Financial Economics*. 8 (3), 205-258.
- Brown, S. J., J. B. Warner. 1985. Using Daily Stock Returns: the Case of Event Studies. *Journal of Financial Economics*. 14 (1), 3-31.
- Chaney, P. K., T. M. Devinney, R. W. Winer. 1991. The Impact of New Product Introductions on the Market Value of Firms. *Journal of Business*. 64 (4), 573-610.
- Corbett, C. J., M. J. Montes-Sancho, D. A. Kirsch. 2005. The Financial Impact of ISO 9000 Certification in the United States: An Empirical Analysis. *Management Science*. 51 (7), 1046-1059.
- Corbett, C. J., R. D. Klassen. 2006. Extending the Horizons: Environmental Excellence as Key to Improving Operations. *Manufacturing & Service Operations Management*. 8 (1), 5-22.
- Corbett, C. J., S. Muthulingam. 2007. Adoption of Voluntary Environmental Standards: The Role of Signaling

- and Intrinsic Benefits in the Diffusion of the LEED Green Building Standards. Working Paper, UCLA.
- Dasgupta, S., B. LaPlante, N. Mamingi. 2001. Pollution and Capital Markets in Developing Countries. *Journal of Environmental Economics and Management*. 42 (3), 310-335.
- Delmas, M. 2001. Stakeholders and Competitive Advantage: the Case of ISO 14001. *Production and Operations Management*. 10 (3), 343-358.
- Dow Jones. 2008. Dow Jones Sustainability World Indexes Guide, version 9.1. January 2008.
- Dowell, G. A., S. Hart, B. Yeung. 2000. Do Corporate Global Environmental Standards Create or Destroy Market Value? *Management Science*. 46 (8), 1059-1074.
- Elgin, B. 2007. Little Green Lies. *Business Week*. 29 Oct 2007, 45-52.
- Energy Star. 2008. <http://www.energystar.gov/index.cfm?c=pt-awards.pt-es-awards>.
- Engardio, P., K. Capell, J. Carey, K. Hall. 2007. Beyond the Green Corporation. *Business Week*. 29 Jan 2007, 50.
- EPA. 2008. Environmentally Preferable Purchasing. <http://www.epa.gov/epp/index.htm>.
- Fisher-Vanden, K., K. S. Thorburn. 2008. Voluntary Corporate Environmental Initiatives and Shareholder Wealth. Working Paper, Dartmouth College. <http://ssrn.com/abstract=1089113>.
- Friedman, M. 1970. The Social Responsibility of Business is to Increase Profits. *New York Times Magazine*. 13 Sept 1970.
- Frooman, J. 1997. Socially Irresponsible and Illegal Behavior and Shareholder Wealth. *Business and Society*. 36 (3), 221-249.
- Geffen, C. A., S. Rothenberg. 2000. Suppliers and Environmental Innovation: the Automotive Paint Process. *International Journal of Operations and Production Management*. 20 (2), 16-186.
- Gilley, K. M., D. L. Worrell, W. N. Davidson, A. El-Jelly. 2000. Corporate Environmental Initiatives and Anticipated Firm Performance. *Journal of Management*. 26 (6), 1199-1216.
- Girotra, K, C. Terwiesch, K. T. Ulrich. 2007. Valuing R& D Projects in a Portfolio: Evidence from the Pharmaceutical Industry. *Management Science*. 53 (9), 1452-1466.
- Guenster, N., J. Derwall, R. Bauer, K. Koedijk. 2006. The Economic Value of Corporate Eco-Efficiency. Available at SSRN: <http://ssrn.com/abstract=675628>.
- Hart, S. L. 1995. A Natural-Resource-Based View of the Firm. *Academy of Management Review*. 20 (4), 986-1014.
- Hart, S. L., G. Ahuja. 1996. Does it Pay to be Green? An Empirical Examination of the Relationship between Emission Reduction and Firm Performance. *Business Strategy and the Environment*. 5 (1), 30-37.
- Hendricks, K. B., V. R. Singhal. 1996. Quality Awards and the Market Value of the Firm: An Empirical Investigation. *Management Science*. 42 (3), 415-436.
- Hendricks, K. B., V. R. Singhal. 2003. The Effect of Supply Chain Glitches on Shareholder Wealth. *Journal of Operations Management*. 21 (5), 501-522.
- Karpoff, J. M., J. R. Lott, E. Wehrly. 2005. The Reputational Penalties for Environmental Violations: Empirical Evidence. *Journal of Law and Economics*. 48 (2), 653-675.
- King, A. A., M. J. Lenox. 2001. Does it Really pay to be Green? An Empirical Study of Firm Environmental

- and Financial Performance. *Journal of Industrial Ecology*. 5 (1), 105-116.
- Klassen, R. D., C. P. McLaughlin. 1996. The Impact of Environmental Management on Firm Performance. *Management Science*. 42 (8), 1199-1214.
- Klassen, R. D., D. C. Whybark. 1999. The Impact of Environmental Technologies on Manufacturing Performance. *Academy of Management Journal*. 42 (6), 599-615.
- MacKinlay, A. C. 1997. Event Studies in Economics and Finance. *Journal of Economic Literature*. 35 (1), 13-39.
- Margolis, J. D., J. P. Walsh. 2003. Misery Loves Company: Rethinking Social Initiatives by Business. *Administrative Science Quarterly*. 48 (2), 268-305.
- Melnik, S. A., R. P. Sroufe, R. Calantone. 2003. Assessing the Impact of Environmental Management Systems on Corporate and Environmental Performance. *Journal of Operations Management*. 21 (3), 329-351.
- Orlitzky, M., F. Schmidt, S. Synes. 2003. Corporate Social and Financial Performance: a Meta-Analysis. *Organization Studies*. 24 (3), 403-441.
- Patten, D. M. 2002. The Relation Between Environmental Performance and Environmental Disclosure: a Research Note. *Accounting, Organizations, and Society*. 27 (8), 763-773.
- Porter, M., C. van der Linde. 1995. Green and Competitive: Ending the Stalemate. *Harvard Business Review*. 73 (5), 120-134.
- Rao, P., D. Holt. 2005. Do Green Supply Chains Lead to Competitiveness and Economic Performance? *International Journal of Operations & Production Management*. 25 (9), 898-916.
- Reinhardt, F. 1999. Market Failure and the Environmental Policies of Firms. *Journal of Industrial Ecology*. 3 (1), 9-21.
- Roman, R. M., S. Hayibor, B. R. Agle. 1999. The Relationship between Financial and Social Performance: Repainting a Portrait. *Business and Society*. 43 (3), 239-267.
- Rothenberg, S., F. K. Pil, J. Maxwell. 2001. Lean, Green, and the Quest for Superior Environmental Performance. *Production and Operations Management*. 10 (3), 228-243.
- Russo, M. V., P. A. Fouts. 1997. A Resource-Based Perspective on Corporate Environmental Performance and Profitability. *Academy of Management Journal*. 40 (3), 534-559.
- Skapinker, M. 2008. Virtue's Reward? Companies Make the Business Case for Ethical Initiatives. *Financial Times*. 28 Apr 2008, 8.
- Seifert, B., S. A. Morris, B. R. Bartkus. 2003. Comparing Big Givers and Small Givers: Financial Correlates of Corporate Philanthropy. *Journal of Business Ethics*. 45 (3), 195-211.
- Solomon, A., L. Lewis. 2002. Incentives and Disincentives for Corporate Environmental Disclosure. *Business Strategy and the Environment*. 11 (3), 154-169.
- Sroufe, R. 2003. Effects of Environmental Management Systems on Environmental Management Practices and Operations. *Production and Operations Management*. 12 (3), 416-431.
- Thomson, T. S. 2006. Green is Good for Business. *Business Week*. 8 May 2006, 124.
- Ullman, A. E. 1985. Data in Search of a Theory: A Critical Examination of the Relationships among Social Performance, Social Disclosure, and Economic Performance of US Firms. *Academy of Management Review*. 10 (3), 540-557.
- von Paumgartten, P. 2003. The Business Case for High-Performance Green Buildings: Sustainability and its

Financial Impact. *Journal of Facilities Management*. 2 (1), 26-34.

Walley, N., B. Whitehead. 1994. It's Not Easy Being Green. *Harvard Business Review*. 72 (3), 46-52.

Wang, H., J. Choi, J. Li. 2008. Too Little or Too Much? Untangling the Relationship Between Corporate Philanthropy and Firm Financial Performance. *Organization Science*. 19 (1), 143-159.