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Three Essays in Business Management, the Natural Environment, and Environmental Policy

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Three Essays in Business Management,

the Natural Environment, and Environmental Policy

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor in

Environmental Science and Engineering

by

Nicholas S. Nairn-Birch

2012

ABSTRACT OF THE DISSERTATION

Three Essays in Business Management,

the Natural Environment, and Environmental Policy

by

Nicholas S. Nairn-Birch

Doctor in Environmental Science and Engineering

University of California, Los Angeles, 2012

Professor Magali A. Delmas

This dissertation prospectus compiles three studies that constitute the current state and direction of my doctoral research. This includes three empirical analyses focusing on business strategy in the context of the natural environment and environmental policy.

The first paper examines the relationship between environmental and financial performance. There has been a long-standing debate in the business strategy literature over whether firms can profit from improving their environmental performance. Recent studies suggest beyond compliance performance leads to increased profitability. However, there has been minimal theoretical or empirical examination of how emerging environmental issues, such

as climate change, affect competitiveness. This raises important questions about the time horizon over which the environmental-financial performance relationship is evaluated. Furthermore, few studies have examined environmental strategies, such as green supply chain management, that extend beyond traditional organizational boundaries. Building on the resource-based view of the firm and a process-based view of environmental policy issues this study argues that the impact of environmental strategies on financial performance varies according to a short-term versus long-term perspective. This study is also one of the first to directly test the profitability of supply chain environmental strategies. This is achieved by leveraging novel longitudinal environmental impact data for over 1,000 US corporations from 2004 – 2008 to estimate the effect of direct and supply chain emissions on short- and long-term measures of financial performance. The results suggest that proactive environmental strategies to reduce life cycle GHG emissions may only be profitable over a longer time horizon.

Taking an exploratory approach, the second essay examines the dimensionality of environmental performance ratings and its relation to market valuation. The emergence of Socially Responsible Investing (SRI), has led to the development of a large number of methodologies for rating corporate environmental performance. Increased availability of information potentially generates an abundance of riches upon which to base investment decisions, but also raises issues of commensurability, information overload and confusion. Using data from three leading purveyors of environmental ratings, the study identifies the principle components of environmental performance captured by prominent methodologies. The results suggest that in large part, two distinct factors explain 80% of the variance of the data: the environmental processes and practices implemented by firms, and the environmental outcomes they generate. The study also shows corporate financial performance to be correlated to process measures but not to outcome measures.

The third and final essay examines corporate political strategies to confront issues of environmental policy. In 2008, an estimated $3.3 billion was spent on lobbying, the majority of which bankrolled by business, which are mostly perceived as opposing the government at the expense of the public. In this paper, we develop and test hypotheses on how firm performance on a salient political issue influences corporate political strategy. In the context of the recent climate change policy debate in the United States, we hypothesize a U-shaped relationship between greenhouse gas (GHG) emissions and two forms of political activity: lobbying and voluntary public disclosure. To test our hypotheses, the study leverages novel data on corporate GHG emissions, lobbying expenses aimed at climate change legislation and disclosure to the Carbon Disclosure Project. Our results suggest that both dirty *and* clean firms are active in the public policy process, which challenges the popular view that corporate involvement in the environmental policy process is solely adversarial.

The dissertation of Nicholas S. Nairn-Birch is approved.

Matthew Edwin Kahn

George M. De Shazo

Charles J. Corbett

Magali A. Delmas, Committee Chair

University of California, Los Angeles

2012

To my wonderful family

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

I am indebted to the guidance and direction provided by my advisor, Magali Delmas, from whom I learned a tremendous amount. I would also like to thank my committee members for their time, insights and suggestions. Finally, I must thank Arthur Winer for his support and wisdom early on in my doctoral endeavors.

Chapters 2 and 3 of this dissertation are based on papers co-authored with Magali Delmas, and Chapter 4 is based on a co-authored paper with Magali Delmas and Dror Etzion.

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Employing an interdisciplinary perspective, my research focuses on the relationship between business strategy, the natural environmental, and public policy. The goal of this research is to understand how firms react to pressures from various stakeholders to mitigate environmental damage, and the role of information in this process.

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1. Introduction

Managing and mitigating impacts to the natural environment has become a critical strategic consideration for many US firms as they confront increasing pressure to appease demands of multiple stakeholder groups. How these pressures are managed can significantly affect profitability and competitiveness. Since the 1970s, environmental legislation has resulted in unprecedented escalation in regulatory costs for many businesses (Peltzman, 1993; Jaffe et al., 2000). Ignoring demands from advocacy groups and other secondary stakeholder groups can also result in direct operational costs, such as fines, legal fees and managerial attention, as well as less tangible burdens in the form of reputational damage and loss of legitimacy (Eesley & Lenox, 2006). From regulators to environmental advocates, as well as shareholders and institutional investors, managers face expectations to perform well across a suite of environmental issues. This dissertation compiles three studies that examine the strategic implications of meeting such demands in the unique context of climate change, as well as the role of environmental information in balancing the expectations of all stakeholders.

The global scale, timing and uncertainty of the consequences of climate change distinguish it from antecedent environmental issues, such as sulfur dioxide emissions and/or other local/regional scale pollutants, that are more directly connected to individual firm operations and are widely accepted as legitimate environmental concerns (Eesley & Lenox, 2006; Williams & Crawford, 2011). Moreover, the reach of this issue extends beyond the province of traditionally ‘dirty’ industries, affecting a broader segment of the economy than perhaps any other environmental issue (DeShazo & Freeman, 2007). The simultaneous high level of public interest and contentious nature of the issue’s legitimacy has led to a mosaic of climate initiatives at the state and regional level in the United States. Despite the recent passage of several climate change bills in either chamber of Congress, the federal policy response has been minimal, leaving the regulatory fate of carbon emissions unsettled and firms anxious (DeShazo & Freeman, 2007) as the potential costs of carbon mitigation will not be evenly distributed (Cragg & Kahn, 2009). Nonetheless, some firms are taking action to estimate and reduce not only their direct GHG emissions but also their entire carbon footprint (Caro, Corbett, Tan & Zuidwijk, 2011). Meanwhile there is evidence that financial markets may be valuing climate friendly firms, while institutional investors are increasingly concerned with the vulnerability of firms to carbon constraints (Porter & Reinhardt, 2007). Strategy formation in such an atmosphere of uncertainty provides a compelling context to examine the relationship between business and environmental performance.

A natural starting point is to question whether firms can profit from managing their carbon emissions, and how this might be affected by regulatory uncertainty. A large body of research has examined the environmental-financial performance relationship without reaching a strong consensus (Ambec & Lanoie, 2008; Margolis & Walsh, 2003; Orlitsky, Schmidt & Rynes, 2003; Peloza 2009). Scholars attribute the mixed results to several factors, notably methodological inconsistencies and the inherent complexity of the environmental performance construct. The balance of recent studies, however, suggests a positive association between proactive environmental strategies and profitability (Orlitsky et al., 2003), while the majority of studies have focused on institutionalized environmental issues (e.g. local pollutants) endemic to a subset of traditionally dirty industries. *Is the Tail Wagging the Dog: An Empirical Analysis of Corporate Carbon Footprints and Financial Performance* – the first paper of this dissertation – reexamines the 'does it pay to be green?' question in the context of climate change, focusing on two aspects of the environmental-financial performance relationship which have received little attention: First, how is the environmental-financial performance relationship affected by short- versus long-term perspectives of financial performance when the focal environmental issue is in the midst of institutional change? Second, how does this relationship change as efforts to mitigate carbon missions extend beyond traditional operational boundaries to strategies such as product stewardship?

The uncertain regulatory future of climate change also represents a particularly critical window of opportunity for firms to influence favorable climate legislation. The corporate political strategy activity (CPA) literature examines the strategies firms adopt in a non-market setting to gain competitive market advantage. Surprisingly, little attention has been given to such behavior in the context of the natural environment. The few existing studies confirm a popularly held view that environmental regulation burdens the regulated industry as a whole, and that corporate involvement in the public policy process competes with other interests to forestall more stringent environmental standards (Cho et al., 2006; Rivera, 2010). This is despite anecdotal and theoretical evidence suggesting that green firms can benefit from forcing dirtier competitors to meet higher environmental standards and norms. Empirical research in the CPA literature has also relied strongly on campaign contributions to approximate political spending, despite little evidence of its efficacy is obtaining favorable outcomes and the relatively low amounts spent (de Figueiredo, 2002). Money spent on informational lobbying, on the other hand, is typically an order of magnitude higher than campaign financing and regarded as a more direct means of targeting legislation and rule-making (de Figueiredo & Cameron, 2009). Voluntary public disclosure of environmental information is increasingly popular with firms and has been identified as an indirect means of influencing environmental policy (Cho & Patten, 2007; Williams & Crawford, 2011) yet received little empirical attention from CPA scholars.

Overall, little is known about the relationship between environmental performance and political activity. Should it be assumed that it is only the dirty firms that are attempting to influence climate change legislation (or environmental policy in general)? What role, if any, do greener firms play in the public policy process? These questions are addressed in the dissertation's second paper, *Corporate Political Strategies for Salient Issues: The Curvilinear Relationship between Carbon Emissions, Climate Change Lobbying and Disclosure.* The study reveals a U-shaped relationship between environmental performance and corporate political strategies, suggesting greener and dirtier firms both attempt to influence favorable policy outcomes.

Changing from a focus on business and climate change, the motivation for the third and final paper stems from the recent proliferation of third-party environmental ratings. An obvious focal point for business and its stakeholders in the context of the natural environment is measuring environmental performance. Much like metrics developed to evaluate financial performance, information on environmental performance can be a useful tool for firms to develop, implement and assess environmental management strategies and programs to meet stakeholder demands and gain competitive advantage. Environmental performance ratings are also key metrics used by socially responsible investing (SRI) – an investment philosophy that currently influences nearly 12% ($3.07 trillion) of the assets under professional management. Firms can court capital by adopting sustainability practices and improving their environmental ratings to navigate investment screens (Levine & Chatterji, 2006).

However, environmental performance is a complex construct that has to yet to be clearly codified for business managers, while the expectations of various stakeholder groups concerned with ostensibly the same rubric often are motivated by diverging interpretations, expectations and evaluation criteria. Not surprisingly, over fifty distinct rating methodologies for assessing environmental performance have been developed, more than a third of them since 2005 (Sadowski, Whitaker & Buckingham, 2010). Such a surfeit of information – while potentially beneficial – draws into question the criteria and methodologies used to produce each rating, as it is unlikely each conveys unique or complementary information. Moreover, prior research suggests social and environmental performance is a multi-dimensional construct. For example, a firm can receive a high score in one rating system while scoring poorly in another: does this suggest a lack of coherence across ratings systems, or might ratings measure disparate actions, processes and/or impacts? And if so, which is most important to managers and investors?

This dissertation’s final study, entitled *Triangulating Environmental Performance: What do Environmental Ratings Really Capture?,* attempts to determine whether the information provided by leading rating organizations can be reduced to a small number of unique dimensions that capture the cardinal aspects of environmental performance, and whether these dimensions are associated with financial performance. The results suggest environmental performance varies along two dimensions – which we interpret as process and outcome measures – and that financial performance is positively associated only with the former of the two.

2. Is the Tail Wagging the Dog? An Empirical Analysis of Corporate Carbon Footprints and Financial Performance

2.1. Introduction

There has been a long-standing debate in the business strategy literature over whether or not firms profit from improving their impact on the natural environment (Ambec & Lanoie, 2008; Margolis & Walsh, 2003; Orlitsky, Schmidt & Rynes, 2003; Peloza 2009). This literature is supported by a large number of empirical studies and meta-analyses (Margolis, Elfenbein & Walsh, 2007). The balance of recent studies suggests a 'win-win' situation, wherein proactive environmental strategies lead to superior financial performance (Ambec & Lanoie, 2008; Margolis & Walsh 2003; Orlitsky et al., 2003). However, much of this research has focused on well-established environmental concerns particular to traditionally 'brown' and highly regulated industries. There has been minimal theoretical or empirical examination of how emerging environmental issues, such as climate change, affect competitiveness. This raises an important questions about the time horizon over which the environmental-financial performance relationship is evaluated, that is, whether or not the profitability of proactive environmental strategies differs in the short- versus long-term. In addressing this question we answer recent calls in pays-to-be-green research to answer *when*, rather than *whether*, it pays to be green.

Furthermore, few studies have examined environmental strategies, such as green supply chain management, that extend beyond traditional organizational boundaries. This is surprising considering a firm's life cycle emissions are often much greater than its direct emissions. For example, the supply chain is estimated to be responsible for nearly two thirds of all hazardous waste generated in major US economic sectors (Rosenblum, Horvath & Hendrickson, 2000). The practice of extending environmental management beyond traditional firm-level boundaries has recently gained increased attention (Bowen, Cousins, Lamming & Faruk, 2001; Darnall, Jolley & Handfield, 2008; Delmas & Montiel, 2009; Seuring & Muller, 2008; Vachon & Klassen, 2006). Several scholars point out that greener supply chains, for example, also have the potential to improve financial performance (Bowen et al., 2001; Rao & Holt, 2005; Zhu, Sarkis & Geng, 2005). The green supply chain research, however, has evolved largely in isolation of the pays-to-be-green debate and there has been little integration of these related streams of research (Bowen et al., 2001; Rao & Holt, 2005). Should it be assumed that corporate performance is affected only by strategies aimed at reducing direct emissions? Or could the tail be wagging the dog? In this paper, we respond to this by examining strategies aimed at reducing both direct *and* supply chain impacts.

Addressing these gaps is particularly relevant to the issue of climate change. First, as a high profile issue entailing considerable regulatory, as well as scientific, risk and uncertainty it represents a novel environmental issue unique to the pays-to-be-green literature. Second, GHG emissions are released at every stage of a firm's value chain and firms are facing increasing pressure to address supply chain emission (Jira & Toffel, 2011; Kolk & Pinkse 2004; Lash & Wellington, 2007; Porter & Reinhardt, 2007). A recent life cycle assessment estimates that 85% of an average firm's total carbon footprint comes from supply chain sources (Mathews, Hendrickson & Weber, 2008). Finally, where objective, end-of-the-pipe measures of environmental damage (e.g. pollutant emissions) have been available, researchers have focused on a heavily regulated subset of industries. With rare exception have researchers tested their hypotheses with climate-related emissions, which are still largely unregulated yet subject to increasing public scrutiny (Ziegler, Busch & Hoffman, 2009).

Our contribution to the existing pays-to-be-green literature is twofold. First, we investigate the financial outcomes of proactive strategies aimed at *emerging* environmental issues and how this relationship is mediated by the time horizon of analysis. Second, we investigate environmental strategies to reduce direct and supply chain impacts. Our hypotheses draw from the resource-based view of the firm (Hart, 1995) and a process-based view of environmental issues (Rivera, 2010) to evaluate how emerging environmental issue influence performance. We argue that important changes in external conditions during an emerging issue's evolution influence financial performance. Our study is also the first to directly test the profitability of supply chain environmental strategies. This is achieved by leveraging novel longitudinal environmental impact data for over 1,000 US corporations from 2004 – 2008, estimating the effect of direct and supply chain emissions on short- and long-term conceptualizations of financial performance. We find that proactive environmental strategies to reduce life cycle GHG emissions may only be profitable over a longer time horizon.

The following section reviews the existing literature on the link between financial and environmental performance. In section 2, we develop hypotheses that relate climate change strategies to competiveness from short- and long-term perspectives. The methods section describes the data used to measure direct and supply chain GHG emissions, how the financial performance variables are constructed and the empirical methods used to test the hypotheses. In section 5, we present the results of our analysis. In the final section we summarize the main results, discuss their managerial implications and recommend directions for future research.

2.2. Literature Review

2.2.1. Environmental and Financial Performance

Understanding the relationship between corporate social performance and financial performance has been the focus of considerable research since the 1970s (Ambec & Lanoie, 2008; Margolis & Walsh, 2003; Orlitsky et al., 2003). Within this wider context, many scholars have investigated whether or not firms are financially rewarded for improving environmental performance. The conventional answer to this question, derived from neoclassical microeconomics, is that any investment in the natural environment comes as an additional cost to firms and detracts from profit maximization (Friedman, 1970). Without clearly defined ownership rights of a public good such as air or water quality, society incurs the cost of a firm's pollution and for a firm to voluntarily internalize these costs would be tantamount to philanthropy.

An emerging body of research, however, has challenged this long-standing assumption. Proponents of a 'win-win' theory (e.g. Porter & van der Linde, 1995) claim improving environmental performance evinces latent profit opportunities. From an extensive review of the existing literature, Ambec & Lanoie (2008) find theoretical arguments supporting several distinct opportunities for firms to either increase revenue or reduce costs by improving their impact on the environment. For example, by switching to a more environmentally friendly production process, firms gain access to new markets for green products and/or differentiate themselves from dirtier competitors while improving resource efficiencies and reducing costly wastes (Reinhardt, 1999). Similarly, research and development into greener production processes can lead to revenue generating or cost minimizing innovations that would otherwise be unexploited (Porter & van der Linde, 1995). An improved environmental image can also improve relations with external stakeholders (e.g. regulators, environmental NGOs, etc…) and mitigate risks often associated with these relationships (Reinhardt, 1999).

Scholars attempting to empirically test these theories have generated an extensive body of literature. Although the balance of recent studies suggests a positive relationship between improved environmental and financial performance (Ambec & Lanoie, 2008; Margolis & Walsh 2003; Orlitsky et al., 2003), the research question is far from settled. Several methodological concerns draw into question the confidence placed in many existing studies and any collective inference that may be gained. First, researchers have largely overlooked unregulated pollutants (e.g. GHGs) and framed environmental strategy as a choice between complying with environmental regulation and going beyond-compliance. When not relying on subjective environmental performance ratings produced for institutional investors (e.g. KLD, Council on Economic Priorities (CEP) and Innovest), studies using econometric estimation have relied on emissions data from heavily regulated industries (e.g. Toxic Release Inventory (TRI); Elsayed & Paton, 2005; Hart & Ahuja, 1996; King & Lenox, 2002; Konar & Cohen, 2001; Russo & Fouts, 1997). As such, the current literature cannot guide managers regarding emissions reduction strategies for emerging environmental concerns such as climate change.

Second, both theoretical and empirical treatments of environmental performance have rarely extended beyond traditional organizational boundaries, focusing instead on firms' direct environmental impacts. The notion of redefining environmental management practice beyond traditional firm boundaries has received increasing attention as scholars explore the importance of the supply chain to understanding the environmental implications of industrial systems (Hall, 2000). A more comprehensive notion of environmental performance examines the entire value chain, as espoused by environmental LCA and embodied by concepts like ecological footprinting (Mathews et al., 2008). With climate change, for example, there is increasing concern for a firm's carbon footprint, which includes direct emissions as well as those induced in supplier firms (Mathews et al., 2008). While it is widely acknowledged that greening the supply chain has the potential to significantly improve impacts to the natural environment (Green, Morton & New, 1996; Zhu et al., 2005), it is not clear from the few existing studies how such efforts will impact financial performance (Hervani, Helms & Sarkis, 2005; Rao & Holt, 2005; Seuring & Muller, 2008).

Third, the majority of studies rely on measurements of financial performance derived from either internal accounting- or market-based measures (Margolis et al. 2007; Peloza, 2009). Both methods do not necessarily substitute for one another. For example, accounting measures are often used to evaluate initiatives which impact the firm in the short term, such as those that reduce operating costs (Peloza, 2009). In contrast, market valuations are based on investors' perceptions of the future profitability of a firm's current or recent management practices (Dowell, Hart & Yeung, 2000; King & Lenox, 2002; Konar & Cohen, 2001), which account for financial outcomes and/or efficiency gains that may manifest differently over the long-term. Peloza (2009) also notes that accounting-based measures emphasize past performance while market valuation assesses a firm's future performance. Despite providing complementary assessments of financial performance, few studies systematically tested their hypotheses on both measures of financial performance.[1] This is a concern when the economic outcomes of environmental strategies vary temporally, as may be the case if there is a lag between

[1] A notable exception to this statement is the study by King & Lenox (2002), where the authors used both Return on Assets (ROA) and Tobin's q as their dependent variable.

implementing proactive environmental strategies and realizing their competitive outcome. Finally, scholars have recently argued that the research question itself may be poorly specified. That is, it is more realistic to ask *when*, as opposed to *whether*, it pays to be green (Colby et al., 1995; King & Lenox, 2001; Reinhardt, 1999).

2.2.2. The Resource-Base View of the Firm

To this end, the resource-based view (RBV) of the firm has provided a useful framework to evince specific mechanisms relating environmental strategies to economic outcomes (Christmann, 2000; Hart, 1995; Marcus & Nichols, 1999; Russo & Fouts, 1997; Sharma & Vredenburg, 1998). Moreover, it also provides a promising theoretical link to the green supply chain literature. Existing applications of this framework suggest beyond-compliance strategies lead to sustainable competitive advantage. However, they still overlook important external factors that may help answer *when* it pays to be green in terms of timing.

Resource-based theory focuses on distinctive internal resources as the building blocks of organizational capabilities, such as continuous innovation, organizational learning and stakeholder innovation, which create competitive advantage (Hart, 1995; Teece, Pisano & Shuen, 1997). Sustainable competitive advantage is created when these resources meet specific characteristics, the most basic being that they generate value (e.g. have competitive significance) and are not easily imitated or substituted by competitors (Barney, 1991; Dierickx & Cool, 1989; Hart, 1995).

Pollution prevention has been identified by several practitioners of resource-based theory as a strategy supported by internal capabilities which lead to sustainable cost advantages (Christmann, 2000; Hart, 1995; Russo & Fouts, 1997). Prevention results in significant savings from efficiency and productivity gains as well as avoided compliance and liability costs (Hart & Ahuja, 1994; Hart, 1995; Reinhardt, 1999). Critical to resource-based theory, the resources and capabilities required to implement pollution prevention are causally ambiguous, socially complex and people-intensive (Hart, 1995; Russo & Fouts, 1997). As such, the advantages gained from pollution prevention are created by value-generating resources and capabilities endowed with formidable barriers to imitation or replication.

Hart's (1995) natural-resource-based view (NRBV) also reveals a positive relationship between product stewardship and financial performance. According to Hart (1995), the advantage of product stewardship is rooted in competitive preemption, whereby firms can secure preferred access to limited resources and/or influence rules, regulations and norms to specifically benefit their capabilities. Where there are emerging green markets, a strategy of product stewardship allows firms to preemptively capture unclaimed reputational space and differentiate their products or services (Hart 1995).

Product stewardship also provides a promising theoretical bridge to a disparate stream of research focused on supply chain environmental performance and its impact of financial performance. Indeed, scholars acknowledge the many parallels between product stewardship and green supply chain management efforts (Hall, 2000; Lamming & Hampson, 1996). Incorporating suppliers into environmental management systems includes a range of practices related to product stewardship, such as incorporating green purchasing, life cycle analysis, design, manufacturing, and reverse logistics (Bowen et al., 2001; Darnall et al, 2008; Delmas & Montiel, 2009; Hervani et al., 2005; Zhu et al., 2005). Nonetheless, these related strategies have received minimal empirical examination (Hervani et al., 2005; Rao & Holt, 2005; Seuring & Muller, 2008).

Scholars of resource-based theory have also stressed the importance of matching internal capabilities and external business (e.g. market) conditions (Hart, 1995). Here it is argued that the ability of environmental strategies to increase profits depends on whether the opportunity to do exists externally (Russo & Fouts, 1997). Such opportunities are created by changes in technology, legislation and market forces associated with environmental concerns (Porter & van der Linde, 1995). For example, Hart's (1995) NRBV is motivated by the contention that changes in external circumstances due to ecological degradation and natural resource depletion create opportunities for firms to develop new and profitable internal capabilities (e.g. those supporting pollution prevention and product stewardship strategies). However, Hart (1995) does not address the process by which these changes occur and how this might affect resource-based opportunities. The external conditions have instead been framed by resource-based view scholars such that environmental strategy is ultimately a choice between complying with environmental regulation and going beyond-compliance (e.g. Hart, 1995; Russo & Fouts, 1997) – a scenario based on static external conditions attendant to institutionalized environmental protection demands. In this sense, the resource-based view addresses how proactive environmental strategies relate to competitive advantage under a fixed set of external conditions. While these conditions may prevail in the long-term, according to a process-based perspective of environmental issues (e.g. Rivera, 2010) they are the terminus of what can be a decades-long progression. As such, current applications of resource-based theory do not explain how the 'win-win' relationship is modulated by external conditions (e.g. uncertainty and ambiguity regarding regulation, standards and norms) associated with emerging environmental issues

In summary, scholars have empirically investigated the relationship between environmental and financial performance for several decades with varying results. Recent studies predominately support a 'win-win' relationship. Characteristic of this research, however, is an almost exclusive focus on regulated pollutants and environmental strategies that do not extend beyond traditional firm boundaries. Additionally, the effect of environmental strategies on complementary measures of financial performance has not systematically been studied. There are also recent calls to refine the research question from *whether* to *when* it pays to be green. Resource-based theory has allowed scholars to identify specific mechanisms relating proactive environmental strategies, including those addressing life-cycle environmental impacts, with economic success. The similarity of product stewardship and green supply chain strategies suggests that resource-based theory can be used to address an important gap in the pays-to-be-green literature. However, applications of resource-based theory overlook the process by which environmental issues emerge and evolve. As such, the resource-based framework has yet to be adapted to emerging environmental issues, such as climate change.

2.3. Hypotheses

In this section we develop hypotheses which elaborate on the 'win-win' relationship between two environmental strategies – pollution prevention and product stewardship – and financial performance first proposed by resource-based theorists. Drawing from a process-based view of environmental issues we posit that the relationship between environmental performance and financial performance depends on whether a long-term compared to a short-term assessment of financial performance is adopted.

We define a short-term assessment of financial performance as taking into account existing cash flows that reflect contemporaneous market conditions. Founded on a market-based perspective of financial performance, in contrast, the long-term assessment integrates estimations of a firm's future profitability under perceived changing external conditions, such as the prospect carbon regulation and institutional change. Thus, while the former emphasizes contemporaneous performance, the latter addresses a firm's future performance (Peloza 2009). We use climate change as the context in which to evaluate a significant yet relatively new and evolving (i.e. emerging) constraint on the business environment. The specific strategies we examine are pollution prevention and product stewardship as they relate to GHG emissions.

2.3.1. The Stages of Environmental Protection

A process-based perspective of environmental issues suggests a more temporally complex relationship between environmental strategies and competitive advantage than proposed by existing resource-based scholarship. This view takes into account the institutional context of firm strategies (Lawrence, Winn & Jennings, 2001), describing how firms respond to institutional pressures from government, public opinion, media and professional associations (Delmas & Toffel, 2008), and how these pressures evolve over time (Bansal, 2005; Delmas & Montes-Sancho, 2010).

Building on this line of research, Rivera (2010) describes the response of business to an evolving institutional environment as a three-stage process. Beginning at the *initiation* stage, managers often underestimate the threat posed by, and the legitimacy of, environmental groups advocating for greater environmental protection. As the issue progresses to the *formulation-selection* stage policy solutions to address the emerging environmental issue are first developed and debated within and across institutions. Here, businesses remain resistant to changes to established modes of legitimate business behavior. Absent a precedent for how to comply with new environmental demands and institutional pressures to do so, only 'first mover' or 'green leader' firms adopt environmentally proactive strategies during the pre-*implementation* stages (Rivera, 2010).

New regulations, standards and norms are formalized only in the final, *implementation* stage of Rivera's (2010) framework. By this point, most managers and stakeholders have internalized the new institutional order and non-compliance with environmental regulation, standards and norms is viewed as illegitimate business behavior. These conditions impose several constraints which do not exist in the preceding two stages: First, failing to comply with established rules, regulations and norms can threaten a firm's legitimacy, resources and survival (Bansal, 2005); second, regulation forces firms to internalize pollution costs.

We argue that current applications of resource-based theory assume a business environment consistent with the *implementation* stage. In the remainder of this section we argue that differing business conditions during the pre-*implementation* stages – those associated with emerging environmental issues – mediate the competitiveness of pollution prevention and product stewardship strategies. This is illustrated using the issue of climate change.

2.3.2. Climate Change

Climate change emerged as perhaps the most pressing and contentious environmental issue of the 2000's (Pinkse & Kolk, 2009). Its relation to energy use links the use of fossil fuels with global-scale environmental impacts, implicating a variety of industries with environmental degradation. Policy developments accelerated during the latter half of the 2000's, including initiation of the European Union Emissions Trading Scheme, publication of the Stern Review, and California's Global Warming Solutions Act (Kolk, Levy & Pinkse, 2008), to name only a few. During this period, Porter & Reinhardt expected GHG emissions "to be increasingly scrutinized, regulated and priced" (2007: 22).

Climate change has also gained the attention of the investment community. Shareholder resolutions asking for GHG emission disclosures have grown more common and shareholder coalitions, such as the Coalition for Environmentally Responsible Economies (Ceres) and the Carbon Disclosure Project (CDP), advocate greater transparency with regard to carbon emissions and carbon management strategies in order to inform asset valuation and investment decisions (Kolk et al., 2008; Makower, Pernick & Wilder, 2008; Pinkse & Kolk, 2009). The number of climate change-related shareholder resolutions filed between the years 2000 and 2007 increased almost 12-fold, while shareholder voting support for these resolutions has also increased significantly (Ceres, 2009; Rindfleisch, 2008).

Nonetheless, the fate of climate change legislation and GHG regulation during the mid- to late 2000s remained uncertain (Kolk et al., 2008). As such, we argue these unique conditions qualify climate change as an emerging environmental issue. Similarly, Rivera (2010) places the issue of climate change in the *formulation-selection* (i.e. pre-*implementation*) stage of the environmental issue process. How pollution prevention and product stewardship strategies relate to climate change are described immediately below.

2.3.3. Direct and Supply Chain Emissions

We contend that reducing direct and supply chain emissions represent pollution prevention and product stewardship strategies, respectively. First, few commercially viable options to reduce carbon emissions exist outside of prevention (Anderson & Newell, 2004; Riahi & Ruben, 2004). It follows that by reducing GHG emissions firms are by default following a pollution prevention strategy. Second, a fundamental requirement of most product stewardship programs is some form of life-cycle assessment, whereby firms minimize upstream (i.e. supply chain) and downstream (e.g. product use) environmental impacts (Hart, 1995; Smart, 1992). This requires a similar suite of internal competencies, including the ability to incorporate environmental criteria into purchasing decisions, design, manufacturing, distribution and reverse logistics (Bowen et al., 2001; Darnall et al, 2008; Delmas & Montiel, 2009; Hervani et al., 2005; Zhu et al., 2005). It follows that reduced supply chain emissions result from a product stewardship strategy. Following resource-based theory, therefore, reducing direct and supply chain GHG emissions will improve financial performance. Below we argue this outcome will prevail according to a long-term view of financial performance and that the opposite will be true in the short-term.

2.3.4. Long-term View of Financial Performance

Recent studies (e.g. Busch & Hoffman, 2007; Busch & Hoffman, 2009) suggest financial markets may be responding to increased corporate reporting of GHG inventories, devaluing more carbon-intensive firms. There are also signs that capital markets value climate friendly practices. For example, the HSBC Global Climate Change Benchmark Index, developed by HSBC as a reference index to measure the stock market performance of companies well-positioned to benefit from climate change mitigation efforts, has been shown to outperform key common benchmark indices by approximately 70% between 2004 and 2007 (HSBC, 2007). Similar funds which screen for climate friendly firms (e.g. Credit Suisse global warming Index and Amro climate change and environment Index) also claim to outperform standard stock market indices since their inception in the early 2000s.[2]

Suppliers also face increasing pressure to adopt better environmental management practices (Darnall, 2006; Plambeck & Denend, 2008; Walton, Handfield, & Melnyk, 1998). Recent initiatives in both the private and public sector indicate firms are beginning to manage their upstream carbon emissions. For example, Wal-Mart recently announced the goal of eliminating 20 million tons of GHG emissions from its supply chain (Lash & Wellington, 2007; Rosenbloom, 2010). Under a recently issued executive order, the US government — the nation's largest single buyer of goods and services — is asking almost 600,000 businesses in its supplier network to disclose their GHG emissions (US GSA, 2010). Companies like Tesco and PepsiCo are also using supply chain GHG emissions information to develop climate friendly product labels (Jira & Toffel, 2011). Similarly, government, investors and consumers are growing more aware of upstream carbon emissions (Kolk & Pinkse, 2004; Lash & Wellington, 2007; Porter & Reinhardt, 2007), as avenues of transparency increase. For example, the CDP — a prominent collaboration of over 200 institutional investors representing $55 trillion in assets — maintains carbon disclosures of a number of the largest firms worldwide and provides businesses with a carbon disclosure framework for their supplier firms. The CDP recently expanded their requests for emissions disclosure to nearly 2,500 suppliers (CDP, 2010).

A long-term measure of financial performance based on investors' perceptions of future markets conditions takes into account the likelihood of climate change progressing from the *formulation-selection* to *implementation* stage. Firms capable of reducing their direct GHG

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[2] http://holtindex.credit-suisse.com/pdf/CSGWM.pdf (accessed on Nov 30, 2010).

emissions, as well those of their suppliers, demonstrate to investors that they possess (or are developing) internal capabilities which will allow them to be more competitive in a business environment facing increased institutional pressure to comply with regulations, standard and norms directed at mitigating climate change. This long-term perspective is consistent with existing applications of resource-based theory.

Using a measure of financial performance which reflects the market's valuation and, thus, a more long-term representation of financial performance under changing external/market conditions, we propose the following hypotheses:

H1A: All else being equal, the more a firm decreases direct carbon emissions the higher the long-term measure of financial performance

H1B: *All else being equal, the more a firm decreases carbon emissions in its supply chain the higher the long-term measure of financial performance*

2.3.5. Short-term View of Financial Performance

The cost savings attributed to pollution prevention depend strongly on savings from two sources: liability/compliance costs and efficiency gains. These savings are difficult to realize in the short-term. First, during the *formulation-selection* stage, when the issue is not regulated, there are no compliance/liability cost savings to be gained from reducing GHG emissions as the negative externalities are paid for by society. Several authors have also argued that cost savings from pollution prevention come from not having to install and operate expensive, non-productive pollution control measures (Hart & Ahuja, 1996; Russo & Fouts, 1997). These savings do not exist if firms don't have a regulatory obligation to reduce emissions.

Second, even without institutional pressures to mitigate climate change there has been a long-standing demand for firms to (implicitly) prevent GHG pollution through energy conservation and efficiency initiatives (DeCanio, 1998).[3] This suggests that, in contrast to other types of pollution (e.g. toxic releases), less unrealized waste (energy) saving opportunities exist for GHGs. In other words, the ‘low hanging fruit’ typically available in the early stages of pollution prevention initiatives (Hart & Ahuja, 1996) is less likely to exist for GHGs. Additional measures to conserve energy (i.e. those induced by demand to mitigate climate change impacts) will thus become progressively more expensive (Hart, 1995; Hart & Ahuja, 1996) and increasingly likely to forestall more immediately productive investments (Sassone & Martucci, 1984). Until institutional pressures increase it will be difficult for firms to offset the costs of energy conservation in the short-term.

According to Hart (1995), reducing supply chain emissions is a strategy leading to the specific advantage of preemptive competition. This is innately a long-term strategy, based on moving early in emerging green markets to secure resources and capabilities that will become advantageous as the institutions surrounding climate change establish themselves. These external conditions will not be in place until the issue reaches the *implementation* stage. In the short-term, moreover, attempting to manage the carbon emissions of suppliers is costly. Firms develop their supply chain networks based on concern for core activities (e.g. cost, quality and faster time-to-market), as opposed to environmental concern, to maximize efficiencies and achieve competitive advantage (Vachon & Klassen, 2006). Non-core efforts often result in increased costs that are difficult to offset in the short-term (Bowen et al., 2001). Monitoring GHG emissions across

[3] According to the EPA, carbon dioxide constituted 85.4% of all GHG emissions in 2007, while fuel combustion accounted for 94 per cent of the carbon dioxide emissions (US EPA, 2007).

multiple tiers and a complex network of suppliers requires devoting additional resources to building corporate information systems to collect and process supplier data, while working directly with suppliers to ensure compliance and mitigate risk also requires considerable investment (Hervani et al., 2005; Jira & Toffel, 2011). Dirtier firms can avoid or postpone such costs while the environmental issue remains relatively obscure (e.g. the *formulation-selection* stage) and the market for environmental performance not yet firmly established.

Thus, using a short-term measure of financial performance that captures external conditions associated with the *formulation-selection* stage of climate change we propose the following hypotheses:

H2 (a): All else being equal, the more a firm decreases direct GHG emissions the lower its short-term measure of financial performance

H2(b): *All else being equal, the more a firm decreases its supply chain's GHG emissions the lower its short-term measure of financial performance*

2.4. Methods

2.4.1. Environmental Performance Data

In this section we describe the data and analysis methods used to test our hypotheses. Environmental performance data was acquired from Trucost. Trucost provides environmental performance data for the socially responsible investment community and has recently been used in peer reviewed academic research (e.g. Dawkins & Fraas, 2011). The data quantify a broad range of environmental impacts of a sample of 1,200 publicly traded US companies each year from 2004 through 2008. The variables cover both direct and supply chain activities, such as emissions and waste production, water abstraction, natural resource use and raw materials extraction. Trucost quantifies the environmental impacts and associated damage costs attributed to both sources (e.g. extraction, resource use) and sinks (e.g. waste, pollutant emissions) in multiple media types, with a total of 751 variables measured for each firm. Each variable is measured as a damage quantity (e.g. mass of pollutant or volume of water) and has a corresponding damage cost. Trucost determines the marginal costs from a review of environmental economics literature, which are vetted by an independent academic advisory panel.

Where available, Trucost collects standardizes, and validates company reported environmental data from annual reports, corporate websites or other public disclosures. Where not disclosed publicly, data are calculated from global fuel use, or imputed by conducting a detailed sector breakdown of each firm and applying a proprietary input-output (IO) economic model based on government census and survey data, industry data and statistics and national economic accounts. Economic IO models estimate the amount of resources (and their associated environmental impacts) from all 426 sectors of the US economy required for a particular firm to produce one unit of its good or service (output) (Rosenblum et al., 2000). Economic IO models account for interactions between sectors and can be augmented to incorporate resource consumption and environmental damages, allowing for the delineation of environmental damage associated with each economic activity into direct and multi-level supply chain activities (Huang, Weber, & Mathews, 2009; Mathews et al., 2008; Rosenblum et al., 2000).

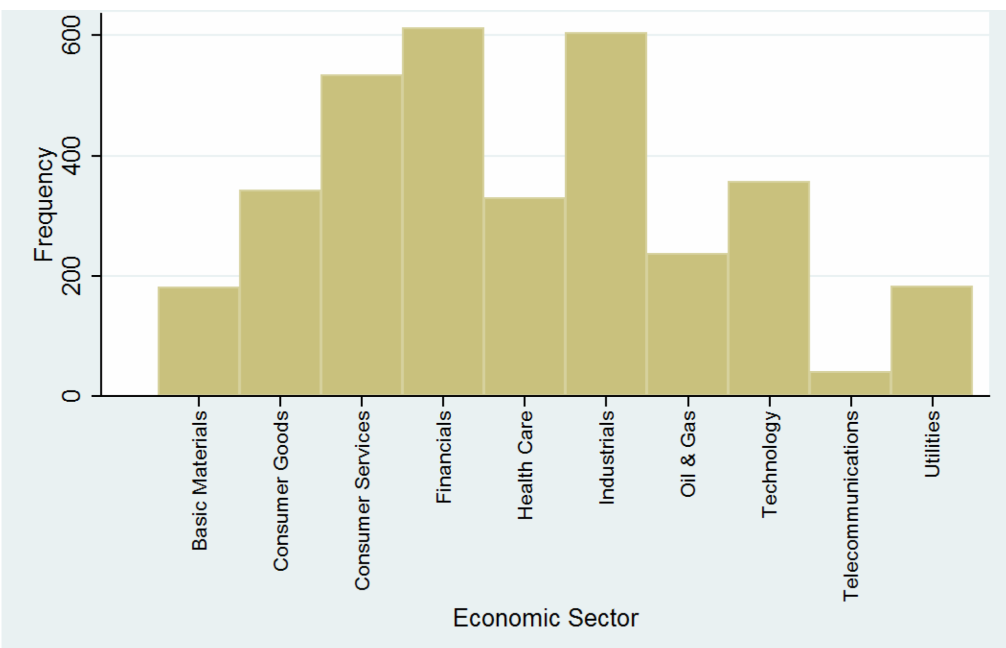
Trucost adapts the IO framework to estimate environmental impacts of over 464 business activities or processes. By mapping each firm's operations to subset of these business activities, Trucost calculates the magnitude of each environment impact variable based on a firm's sub-sector revenue profile. This data is further informed by standardizing and including company reported data, natural resource use, etc... A firm's sub-sector profile is derived from the 6-digit North American Industrial Classification System (NAICS), and segmental revenue data acquired from company accounts. The data produced by Trucost thus measure the environmental impacts of a firm's direct operations, as well as those associated with all levels of its upstream supply chain. *Direct* environmental impacts include all pollutants released or natural resources used by operations owned or controlled by a company, while *indirect* impacts result from activities owned or controlled by the company's upstream suppliers. Companies are given the opportunity to vet the data produced by Trucost. The variables are distributed within seven broad categories of environmental issues: GHGs, general waste, heavy metals, natural resources, volatile organic compounds (VOC), water abstraction and other emissions.

Trucost's environmental impact profile of each firm is a combination of model estimates and standardized company reported data. Thus, the balance of environmental impacts which are imputed versus directly measured varies for each firm and, where high, may obscure unique firm-level characteristics important to our analysis. We control for variation in this ratio by including a disclosure control variable that captures whether a firm's environmental data was publicly available or disclosed versus imputed by Trucost (see the Control variable section below).

We add to the Trucost data environmental performance ratings for each firm produced by KLD Analytics. KLD rates the social performance of all firms listed on the Russell 3000 and are a commonly used source of corporate social performance data in academic research (Chatterji, Levine & Toffel, 2009). The KLD database includes ratings for environmental performance, which are divided into 'strength' and 'concern' categories. In contrast to tangible output-based measures of environmental impact KLD ratings primarily reflect process-based environmental performance (e.g. managerial practices and reputation).

Finally, the Trucost and KLD data are merged with firm financial performance data from Compustat's North American database. All the companies listed in the Trucost database were available in Compustat. Less than one percent of firms from the Trucost sample space were not found in the KLD's universe of firms and were subsequently dropped from the analysis. The use of panel data analysis methods further restricts our sample to firms with at least two consecutive years of complete data. After dropping any additional observations with missing values the sample contains 1,095 firms. Figure 2. 1 shows the firm distribution by industrial sector.

Figure 2. 1 GHG emissions (mean) by sector



2.4.2. Dependent Variables

The two measures of financial performance we use to approximate short- and long-term perspectives of financial performance are return on assets (ROA) and Tobin's q, respectively. We calculate these variables based on financial information provided by Compustat. ROA is a standard accounting measure of financial performance which is calculated by dividing earnings before interest by total assets (King & Lenox, 2002). Tobin's q is defined as the ratio of a firm's market value to the replacement cost of its assets, which this study approximates using the method developed in Chung & Pruitt (1994).

ROA captures the effects of environmental performance on a firm's earnings relative to its assets over a given year. In contrast, Tobin's q incorporates the market value of firms and is thus able to reflect certain intangible effects of environmental performance, such as investor perceptions and estimations of expected future cash flows (Busch & Hoffman, 2009; King & Lenox, 2002; Konar & Cohen, 2001), which are not captured by an accounting-based measure like ROA.

ROA and Tobin's q reflect complementary information regarding a firm's financial performance, which differentially capture the effect of environmental performance. While the former demonstrates how efficiently a firm generates profit per unit of production, the latter reflects intangible measures of performance, like investor confidence and reputation (i.e. market value; Dowell et al, 2000; King & Lenox, 2002; Konar & Cohen, 2001). In this sense, Tobin's q can incorporate how robust the market interprets a firm to be in the face of future climate legislation, whereas ROA only acknowledges a firm's GHG emissions indirectly via the efficiency of its use in producing earnings (Busch & Hoffmann, 2009). Both measures are consistent with the preponderance of empirical research into the effect of environmental performance on financial performance (Dowell et al. 2000; Elsayed & Paton, 2005; King & Lenox 2002).

Calculating Tobin's q requires a relatively high number of financial variables and is more susceptible to missing values compared to ROA. This creates a discrepancy in the number of observations for each dependent variable in this study, resulting in asymmetric sample spaces (see Table 2. 3). To check whether this introduces sample bias, an identical analysis is conducted on the set of observations common to both dependent variables. The results are robust to both sample spaces (results available upon request from the authors).

2.4.3. Independent Variables

Our study accounts for all six of the GHGs identified by the Kyoto Protocol. Each of these is converted into C02-equivalent (C02-e) emissions based on Global Warming Potential factors and are measured in units of mass. Direct and supply chain emissions sources are categorized in accordance with the GHG Protocol, which is the most used international greenhouse gas accounting tool (Ranganathan, Corbier, Bhatia, Schmitz, Gage, & Oren, 2004). The Protocol categorizes emissions into three disparate categories: Scope 1 emissions are all GHGs emitted from sources *directly* owned or operated by the responsible firm; Scope 2 includes all indirect emissions resulting from purchased electricity, heat or steam; and Scope 3 emissions include all other sources. This study defines *direct GHG emissions* synonymously with Scope 1. S*upply chain GHG emissions* is defined as the sum of both Scopes 2 and 3. Natural log transformations were applied to adjust skewed distributions.

2.4.4. Controls

Five additional environmental issues from the Trucost database are included as control variables. These variables account for the range of disparate environmental impacts resulting from each firm's operations. Their inclusion allows our analysis to examine the effect of GHGs on financial performance while assuming all other sources of environmental performance variation are constant. Each environmental issue aggregates a unique subset of Trucost's environmental impact variables under the following categories: general waste, heavy metals, natural resources, volatile organic compounds (VOC), water abstraction, and other emissions. The variables *water abstraction, general waste, and VOCs* aggregate environmental damage quantities (e.g. mass or volume). The remaining environmental issue variables aggregate environmental damage costs, since these issues otherwise lack a common measure of damage quantity. The *other emissions* variable was dropped from our analysis due to collinearity with GHG emissions. To explore collinearity concerns raised by relatively high pair-wise correlations between several of these environmental control variables (see Table 2. 2), we conducted identical analyses excluding the VOCs and general waste variables. Their inclusion does not alter the results or indicate the presence of collinearity. Moreover, the range of variance inflations factors (VIF) for the environmental control variables are within acceptable limits.[4]

As mentioned above, we include a binary *disclosure* variable to account for variation across firms in whether environmental data was imputed versus publicly available or provided by the firm. This variable allows our analysis to control for any potential bias accorded companies based on their disclosure of environmental impact data. Approximately 21 per cent of the firms

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[4] No independent variable produced a VIF greater than 10, which is widely considered an acceptable threshold to obviate concern over multi-collinearity (Kutner, Nachtsheim, and Neter 2004; O'Brien 2007).

in our sample disclosed information on their environmental performance; however, this percentage varies considerably across industries (e.g. less than 5 per cent disclosed performance data in the financial sector versus greater than 60 per cent in the utilities and oil and gas sectors).

Our analysis includes several financial variables to control for sources of firm-level heterogeneity, which are consistent with previous studies of financial and environmental performance (Dowell et al, 2002; Elsayed & Paton, 2005; King & Lenox, 2002). Firm total assets are used to account for variation in *firm size*, while *leverage* is approximated by the ratio of total debt to total assets. Although total sales have been commonly used in the literature as a proxy for production, high collinearity with the GHG emissions variables precludes its use in this analysis. In its place *growth*, defined as the annual change in sales divided by total sales, is included to control for variations in production (King & Lenox, 2002). Capital expenditures divided by total sales is used as a measure of *capital intensity* (Elsayed & Paton, 2005; King & Lenox, 2002). Due to a prohibitively large number of missing values for research and development expenditures in the Compustat database, this variable was not included in our analysis. To correct for skewed distributions, each of the financial control variables are transformed using the natural logarithm.

We create a KLD strength variable as the sum of all environmental *strength* items, and similarly created a KLD concern variable as the aggregate of all *concern* items (Chatterji et al., 2009). Under the *strengths* category, KLD included an item for climate change. This was removed from the aggregated strength variable to avoid correlation with the model's independent variables. The KLD variables were included as controls to account for any effect process-based environmental performance variables could have on financial performance (Chatterji et al, 2009;

Harrison & Freeman, 1999). Industry dummy variables are included for each of the 10 Industrial Classification Benchmark (ICB) Industry sectors to control for sectoral effects. Finally, we use year dummy variables to account for any trend effects.

2.4.5. Data Analysis

Panel data includes observations on N cross-section units (e.g. firms) over T time periods. As panel data analysis uses variation in both these dimensions it is considered to be one of the most efficient analytical methods for econometric data (Asteriou, 2006). Our model of firm performance has the form:

$$y_{it+1} = \alpha_i + \beta X + \mu_{it}, \; i = 1,\ldots,N; \; t = 1,\ldots,T$$

where y_{it+1} is the financial performance of firm i in year t+1, α_i the unobserved firm-level effect, and β the vector of estimated regression coefficients for each of the explanatory variables measured in the matrix, X (Woolridge, 2006). The observations in X are one year behind the dependent variables.

We use fixed effects to estimate our model's coefficients. To the extent that any panel data model of the firm may not be fully specified, fixed effects estimation takes a conservative approach. Viewing each α_i as a fixed constant (i.e. an intercept) unique to each firm, the fixed effects model allows researchers to control for all time-invariant unobserved firm characteristics that might otherwise confound the explanatory variables. This means that variation in financial performance is associated only with changes occurring within each of our model's independent variables. A Hausman test was conducted to compare the appropriateness of fixed effects versus random effects estimation for Models 1 and 4. The test statistic for each model shown in is highly significant ($p<0.01$). This suggests fixed effects is the more consistent and thus more appropriate estimator. We further increase our confidence in the direction of this relationship by lagging the independent variables one year behind financial performance.

2.5. Results

The results used to test our four hypotheses are described below. Descriptive statistics are presented in Table 2. 1, and Table 2. 2 contains the matrix of correlation coefficients for the regression variables.

Figure 2. 2 shows mean total GHG emissions (tons CO2-e) by sector for our sample broken down by direct and supply chain sources. The utilities, oil and gas, and basic materials industries stand out as the most carbon-intensive. Not surprisingly, the average utility produces most of its GHG emissions directly. Supply chain emissions either equal or exceed direct emissions, on average, for the remaining industries.

Figure 2. 2 GHG emissions (mean) by sector

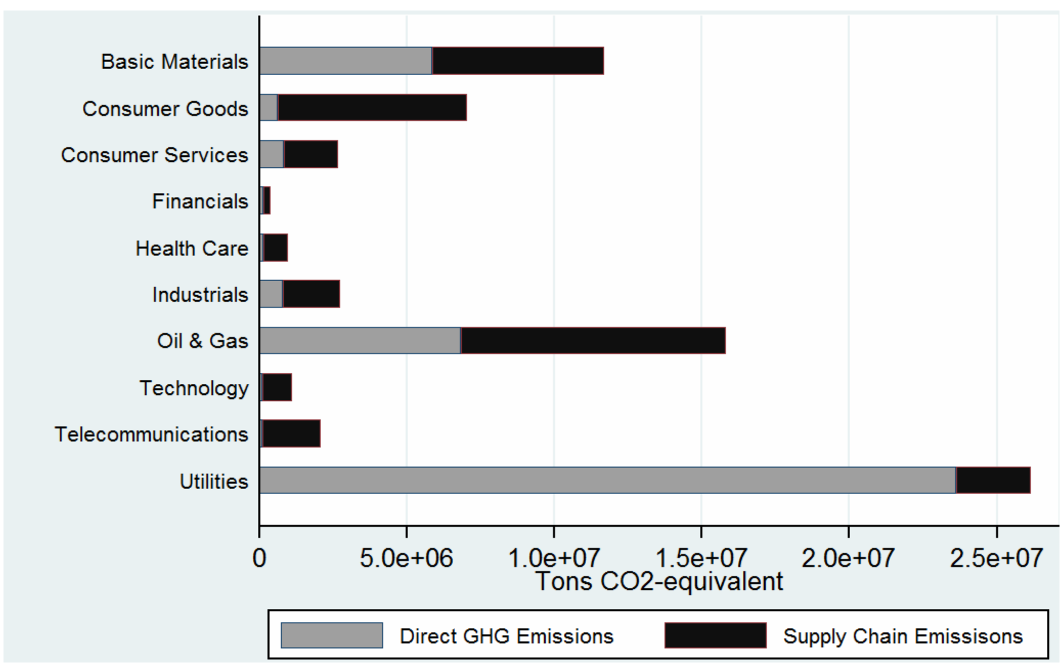


Table 2. 1 Descriptive Statistics

Variable	Description	Mean	Standard deviation	Min	Max
Return on Assets	Earnings before interest over total firm assets	0.05	0.10	-1.24	0.95
Tobin's Q	Market value of assets divided by book value of assets	1.75	1.56	-0.78	36.13
Total GHG Emissions	Log of total GHG emissions (tons $C0_2$-equivalent)	13.45	2.05	3.88	19.64
Direct GHG Emissions	Log of GHG emissions from sources directly owned or operated by the responsible firm (tons $C0_2$-equivalent)	11.21	2.79	-16.12	18.87
Supply Chain GHG Emissions	Log of GHG emissions from all sources other than those owned or operated by the responsible firm(tons $C0_2$-equivalent)	13.11	1.84	3.75	19.12
Water Abstraction	Log of direct water abstraction (volume)	8.19	8.23	0.00	24.71
General Waste	Log of directly generated general waste (mass)	9.03	2.04	0.00	15.15
Volatile Organic Compounds (VOC)	Log of directly produced of VOCs (mass)	4.46	2.69	0.00	14.12
Heavy Metals	Log of damage costs (millions $US) due to environmental release of heavy metals	-4.27	4.48	-16.12	6.00
Natural Resources	Log of damage costs (millions $US) due to direct natural resource use and extraction	-15.00	4.31	-16.12	8.70
KLD Environmental Concerns	Sum of all environmental concerns from the KLD Social Ratings Index	0.40	0.89	0.00	5.00
KLD Environmental Strengths	Sum of all environmental strengths from the KLD Social Ratings Index	0.23	0.62	0.00	4.00
Disclosure	Binary variable indicating whether or not a firm publicly disclosed their environmental performance	0.20	0.40	0.00	1.00
Growth	Log of annual change in sales ratio	-2.26	1.02	-16.12	2.33
Leverage	Log of total debt divided by total assets	-2.83	4.01	-16.12	1.41
Capital Intensity	Log of capital expenditures divided by total sales	-3.92	3.28	-16.12	8.55
Firm Size	Log of total assets	8.53	1.57	0.27	14.61

Table 2. 2 Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Return on Assets	1.00															
2. Tobin's Q	0.38	1.00														
3. Direct GHG	-0.04	-0.38	1.00													
4. Supply Chain GHG	0.05	-0.35	0.77	1.00												
5. Water Abstraction	-0.06	-0.16	0.48	0.42	1.00											
6. General Waste	0.03	-0.29	0.65	0.78	0.20	1.00										
7. VOCs	0.01	-0.25	0.66	0.72	0.45	0.57	1.00									
8. Heavy Metals	-0.04	-0.22	0.68	0.62	0.82	0.40	0.61	1.00								
9. Natural Resources	0.03	-0.09	0.29	0.07	0.21	0.04	0.04	0.18	1.00							
10. KLD Concerns	-0.03	-0.21	0.62	0.52	0.44	0.36	0.38	0.51	0.26	1.00						
11. KLD Strengths	0.03	-0.06	0.22	0.34	0.25	0.19	0.20	0.30	-0.05	0.28	1.00					
12. Disclosure	0.00	-0.14	0.50	0.34	0.36	0.19	0.17	0.40	0.47	0.43	0.36	1.00				
13. Growth	0.02	0.25	-0.19	-0.22	-0.05	-0.20	-0.17	-0.11	0.04	-0.11	-0.11	-0.09	1.00			
14. Firm Size	-0.11	-0.37	0.62	0.75	0.17	0.61	0.49	0.36	0.07	0.42	0.29	0.38	-0.19	1.00		
15. Leverage	-0.22	-0.33	0.29	0.31	0.16	0.25	0.25	0.24	0.08	0.17	0.09	0.16	-0.12	0.30	1.00	
16. Capital Intensity	-0.12	0.00	0.15	-0.11	0.13	-0.15	-0.08	0.13	0.32	0.12	0.00	0.31	0.09	0.05	0.03	1.00

Coefficients above 0.06 are significant ($p<0.05$)

In total, six regression analyses were conducted and the results are organized in Table 2.3. Models 1- 3 pertain to Hypotheses 1(a) and 1(b). These are fixed effects estimations using Tobin's q as the dependent variable. In Model 1, we observe that both *direct* and *supply chain GHG emissions* negatively affect Tobin's q; however, only the *supply chain GHG emission*s variable shows a significant effect ($p<0.01$). Model 1 thus provides support for Hypotheses 1(b) but fails to support Hypothesis 1(a). The results of Model 1 can be interpreted in the following manner: a one percent decrease in carbon emissions from a firm's suppliers improves Tobin's q by 0.008, while a decrease in direct emissions has no impact.

Models 4- 6 pertain to Hypotheses 2(a) and 2(b). These are the fixed effects estimations with ROA as the dependent variable. Model 4 includes both *direct* and *supply chain GHG emissions* variables. We observe that the coefficient estimates for both GHG variables are positive, as predicted in Hypotheses 2(a) and 2(b). Similar to Model 1, however, a statistically significant ($p < .05$) coefficient is found only for *supply chain GHG emissions* while *direct GHG emissions* does significantly affect ROA. These results suggest that while a change in direct emissions does not affect ROA, a one per cent decrease in supply chain emissions decreases ROA by 0.00019. Thus, we find support only for Hypothesis 2(b).

The results of Models 1 and 4 both fail to produce a statistically significant coefficient for *direct GHG emissions.* It is important here to note this variable's significant correlation with *supply chain GHG emissions* (see Table 2. 2). To test for pairwise collinearity we repeated the fixed effects analysis for both Tobin's q and ROA, but kept direct and supply chain variables mutually exclusive in Models 2-3 and 5-6, respectively. The results demonstrate that the coefficient estimates (from Models 1 and 4) for *direct* and *supply chain GHG emissions* are robust to sign change. Nonetheless, their correlation indicates inflated standard error estimates (and p-values), which may conceal the significance of *direct GHG emissions.* We observe that with *supply chain GHG emissions* omitted in Model 2, *direct GHG emissions* remains negative and gains significance ($p < 0.01$). Based on this evidence we do not reject Hypothesis 1A. Consistent with our previous results, *direct GHG emissions* remains statistically insignificant in Model 5.

Overall, the results support all our hypotheses with the exception of Hypothesis 2A. It is also worth noting that the significant correlation between *direct* and *supply chain emissions* corroborates Hart's (1995) proposition that both pollution prevention and product stewardship strategies are strongly interconnected.

Observing the control variables, none of the environmental measures, including the *KLD strength* and *concern* ratings, significantly affect either dependent variable. We note that KLD variables for each firm vary minimally during the time period of our study. As fixed effects estimation relies on within-firm variability, this may explain KLD variables' lack of significance. Observing the financial control variables, both *firm size* and *growth* are statistically significant and their signs (negative and positive, respectively) constant across all models. These results are consistent with antecedent studies (King & Lenox, 2001; King & Lenox, 2002; Elsayed & Paton, 2005). Somewhat surprisingly*, Disclosure* does not have an effect on Tobin's q. This finding suggests that although the market appears sensitive to GHG emissions it is not concerned with how forthcoming firms may be with their environmental performance. It is worth noting this variable reflects overall disclosure of environmental information, not just GHG emissions.

Table 2. 3 Fixed effects analysis of GHG emissions on ROA and Tobin's q

Dependent Variable	Tobin's q (t+1)			ROA (t+1)		
Model	(1)	(2)	(3)	(4)	(5)	(6)
Direct GHG Emissions	-0.097	-0.210		0.002	0.005	
	(0.058)	(0.001)**		(0.005)	(0.005)	
Supply Chain GHG Emissions	-0.762		-0.827	0.019		0.020
	(0.124)**		(0.000)**	(0.010)*		(0.010)*
Controls						
Water Abstraction	-0.007	0.011	0.015	-0.001	0.000	0.000
	(0.011)	(0.012)	(0.0125)	(0.001)	(0.001)	(0.001)
General Waste	-0.012	-0.084	-0.043	0.000	0.001	0.000
	(0.032)	(0.032)**	(0.032)	(0.002)	(0.003)	(0.003)
VOCs	0.016	0.004	0.008	0.000	-0.003	-0.003
	(0.017)	(0.017)	(0.017)	(0.001)	(0.002)	(0.002)
Heavy Metals	-0.022	-0.034	0.006	-0.002	0.004	0.003
	(0.033)	(0.030)	(0.031)	(0.002)	(0.003)	(0.003)
Natural Resources	0.025	0.022	0.027	0.000	0.002	0.002
	(0.016)	(0.016)	(0.016)	(0.001)	(0.002)	(0.001)
KLD Concerns	0.078	0.085	0.075	0.002	0.000	0.001
	(0.055)	(0.054)	(0.053)	(0.003)	(0.005)	(0.005)
KLD Strengths	-0.099	-0.098	-0.094	0.001	0.000	0.000
	(0.049)	(0.049)	(0.049)	(0.003)	(0.005)	(0.005)
Disclosure	-0.072	-0.077	-0.008	0.002	0.005	0.003
	(0.082)	(0.0.081)	(0.080)	(0.005)	(0.007)	(0.007)
Growth	0.046	0.042	0.046	0.007	0.007	0.007
	(0.022)*	(0.022)	(0.022)*	(0.002)**	(0.002)**	(0.002)**
Leverage	-0.010	-0.008	-0.010	-0.001	0.000	0.000
	(0.009)	(0.009)	(0.009)	(0.001)	(0.001)	(0.001)
Capital Intensity	-0.089	0.013	-0.020	0.001	-0.003	-0.003
	(0.059)	(0.058)	(0.057)	(0.002)	(0.003)	(0.003)
Firm Size	-0.513	-0.783	-0.520	-0.047	-0.040	-0.047
	(0.090)**	(0.079)**	(0.089)**	(0.008)**	(0.007)**	(0.008)**
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	2678	2678	2678	3316	3316	3316
Number of firms	880	880	880	1095	1095	1095
Hausman[b]	101.74***			37.07**		

Note: Firm and year dummy effects not presented. Standard errors are in parentheses.
[b] The Hausman test statistic for fixed effects vs. random effects
* p < 0.05; ** p <0.01 ; *** p < 0.001

2.6. Discussion and Conclusion

The relationship between proactive environmental strategies and competitive advantage has been extensively studied. Recent studies corroborate the 'win-win' hypothesis, many drawing from resource-based theory to evince the mechanisms underlying this relationship. However, scholars have largely overlooked the unique conditions associated with emerging environmental demands, such as climate change, that entail regulatory and institutional uncertainty. Moreover, this literature rarely examines environmental strategies, such as green supply chain management, that extend beyond traditional organization boundaries. Drawing from Rivera's (2010) process-based view of environmental issues we integrate a more dynamic view of external conditions with resource-based theory. This approach allows us to examine the economic impacts of proactive climate change strategies, including those aimed at direct and supply chain GHG emissions. We examine impact of these strategies using complementary conceptualizations of financial performance that represent short- and long-term perspectives.

Overall, our results suggest that the relationship between environmental and financial performance depends on the time horizon over which financial performance is evaluated. Using fixed effects estimation and an unprecedented number of control variables, we find that decreased direct, as well as supply chain GHG emissions have a positive effect on Tobin's q. At the same time, our study also shows that decreased supply chain emissions have a negative effect on ROA. These findings suggest that only in the long-term do firms gain competitive advantage from reducing direct and/or supply chain GHG emissions. From a short-term perspective, however, our analysis shows reducing supply change emissions not to be profitable. Surprisingly, no significant effect on ROA is found for direct carbon emissions. This neutral effect suggests firms are able to implement carbon reduction strategies to the point where the marginal cost of reduction balances – rather than overwhelms – marginal savings (Elsayed & Paton, 2005; McWilliams & Siegel, 2001).

We attribute these contrasting relationships to the unique external conditions associated with emerging environmental issues in general and climate change in particular. The time period of our study corresponds to a period of considerable debate, uncertainty and risk with regard to both the science and regulatory fate of GHG emissions. While GHG emissions remained unregulated, the likelihood of regulation under existing statutes (i.e. The Clean Air Act) or the enactment of new legislation (e.g. The Climate Stewardship Acts and California's Global Warming Solutions Act) was relatively high during this period (Kolk et al., 2008). With the costs of pollution external to the firm and the market for climate friendly practices not yet established, the costs of mitigating direct and supply chain emissions are difficult to offset with savings or improved market position. However, our study also indicates that the market places a premium on reduced direct and supply chain GHG emissions. This implies that investors anticipate a change in external conditions that favor firms with a proactive stance towards climate change.

Our study makes an important contribution to the literature on environmental performance and financial performance. First we show that environmental strategies have differing effects on long term versus short term measures of financial performance. This demonstrates the importance of including a temporal dimension to the pay to be green debate. Second, we investigate the financial impact of green supply chain strategies and therefore expand the scope of analysis of the existing literature. Our results indicate that supply chain strategies are fundamental to the analysis of the environmental and financial performance relationship.

Our study takes a perspective relevant to managers confronting emerging environmental protection concerns. In evaluating how to respond, our results suggest that managers adopting a short-term perspective will eschew proactive strategies in favor of less risky and more immediately profitable investments. On the other hand a forward-looking manager who anticipates a shift toward conditions more amenable to proactive environmental behavior will gain competitive advantage over a longer time horizon by developing the necessary resource base and capabilities. This study also illustrates the need for managers to consider the entire value-chain when responding strategically to emerging environmental issues. As our results show, it may be a case of the tail wagging the dog.

It is important to note a limitation of our study. This is a caveat regarding the measure of environmental performance, which is not uncommon to this literature. While the Trucost environmental performance data provide novel information on both direct and supply chain environmental impacts they are produced by a combination of public disclosure and model estimates. Ideally we would prefer to analyze only emissions reported due to regulatory obligation to ensure accuracy and minimize measurement error. However, in the absence of regulatory requirements the data used in our study provide one of the most comprehensive firm-level GHG inventories available. Finally, our study focused on economic outcomes of proactive strategies to address emerging environmental issues. A promising area for further research would be to investigate the organizational factors that influence the response of firms to inchoate environmental concerns, such as nanotechnology, which are likely to increase in prominence in the coming years.

3. Corporate Political Strategies for Salient Issues: The Curvilinear Relationship between Carbon Emissions, Climate Change Lobbying and Disclosure

3.1. Introduction

While many scholars would agree with the assertion that political issue salience – the importance of the political issue to the firm – is a primary motivator of corporate political activity (CPA), the concept of issue salience has been largely conceived as a factor external to the firm and therefore received relatively little attention in the management literature (Hillman, Keim & Schuler, 2004). Most of the research to date considers political issues as "either widely salient or not for reasons that are exogenous to the firms' strategies" (Bonardi & Keim, 2005: 556). Because this perspective considers issue salience as exogenous, it rarely accounts for the possibility of a political issue's salience to vary across firms, and has barely begun to address an issue fundamental to business strategy research: for a given political issue how does salience vary across firms within a sector and how does salience influence their strategies?

For a given issue, greater political salience is commonly viewed as harmful to corporate performance, that is, more likely to provoke regulation and public scrutiny that penalizes firms that perform poorly on the issue (Bonardi & Keim, 2005). This is exemplified in the environmental policy context, where the prevailing view of corporate political involvement is one of dirty firms opposing, through lobbying and/or election campaign contributions, government and social demands to clean up (e.g. Cho, Patten & Roberts, 2006). In 2008, for example, businesses in the energy/natural resources sector spend over $385 million on lobbying (OpenSecrets.org, 2012). In the same year, one of the highest polluting electric power generators, Southern Company, spent an estimated $15 million and registered twice as many lobbyists for climate change policy than any other company (Lavelle & Donald, 2011).

The view of a political issue salience as a threat to business at the industry level, however, does not accommodate opportunities for select firms to benefit from highly politicized issues that risk government intervention. A less adversarial view of environmental performance and regulation emphasizes the opportunity for environmentally proactive firms with strong performance records to leverage new regulations and performance standards to gain competitive advantage against industry rivals (Reinhardt, 1999; Vogel, 1995). As Baron (1995) suggests, effective business strategy integrates non-market (i.e. political) and market strategies, as well as attendant firm-level competencies (e.g. exemplary environmental performance). This suggests a strategic incentive for firms on the opposite end of the environmental performance spectrum – those with proactive environmental strategies – to be politically active as well. Despite being one of the greenest utilities in the nation, for example, Pacific Gas and Electric (PG&E) spent an estimated $27.8 million (more than a ten-fold increase over the mean of all firms lobbying the same issue) lobbying climate change and energy issues at the federal level in 2008 (CPI, 2011).

In this paper, we take a firm-level perspective of issue salience to develop and test a hypothesis on how firm performance on a salient issue influences corporate political strategies. The context for our analysis is the recent climate change policy debate. Whether and how to mitigate climate change has been the subject of considerable political debate in the US (Kolk & Pinkse, 2007) and is widely regarded as a critical socio-political policy issue for business (Bonardi & Keim, 2005; Cho, Patten & Roberts, 2006; DeShazo & Freeman, 2007; Porter & Reinhardt, 2007; Reid & Toffel, 2009). Operationalizing issue salience at the firm level, we hypothesize a U-shaped relationship between greenhouse gas (GHG) emissions and corporate political activity. We examine two forms of political activity – lobbying and voluntary public disclosure – which are tactics of information and constituency-building strategies, respectively (Hillman & Hitt, 1999; Cho et al., 2006; Williams & Crawford, 2011).

To robustly test our hypothesis, we analyze novel data produced by the Center for Public Integrity (CPI) estimating lobby expenditures aimed specifically at climate change and energy related issues in 2008 and 2009. To measure disclosure, we examine responses to climate change strategy disclosure requests from the Carbon Disclosure Project (CDP) from 2004 through 2008. Our results suggest that both dirty *and* clean firms are active in the public policy process, which challenges the popular view that corporate involvement in the environmental policy process is solely adversarial. Firms which have taken the middle road with regard to environmental strategy – having neither poor nor exemplary performance records – demonstrate the lowest levels of political activity. Our findings also imply that politically active firms may have diverging intentions and that business competes amongst itself, as well as with other interests, for political influence.

Our analysis makes important theoretical and empirical contributions to the corporate political strategy literature. We operationalize the concept of political issue salience at the firm-level and in doing so answer calls for increased attention in this area (e.g. Hillman et al., 2004). The current literature implicitly assumes that firms are adopting corporate political strategies for the same reasons (i.e. desired political outcome) but does not address the question of potential diverging intentions. Indeed, firms within the same field and affected by a widely salient issue could desire opposite political outcomes. We reveal a U-shaped relationship between environmental performance and corporate political strategies suggesting greener firms also devote resources to promote stringent standards.

Furthermore, to our knowledge no study has empirically examined the relationship between environmental performance and lobbying. The extant literature has relied strongly on election campaign contributions via political action committees (PACs) to proxy political strategies and activity (de Figueiredo & Tiller, 2001; Hansen & Mitchel, 2000; Brasher & Lowery, 2006; Kim, 2008). Lobby expenditures, which are typically an order of magnitude higher than campaign contributions, have been markedly absent from empirical studies (de Figueiredo & Cameron, 2009). This is surprisingly considering the dearth of credible evidence that campaign contributions affect political outcomes and mounting evidence that lobbying (i.e. information) is the most effective means to influence public policy (de Figueiredo, 2002). In addition we are comparing the effect of environmental performance on information disclosure, which has been described as complementary to lobbying (Hillman & Hitt, 1999; Cho et al. 2006), and are therefore able to assess the impact of environmental performance on a broader set of corporate political strategies.

In the ensuing two sections we review the relevant literature and then develop our hypotheses. This is followed by an overview of our data and analysis methods. After describing the results of our analysis, we discuss the implications and limitation of findings, and conclude by suggesting areas for future research.

3.2. Literature Review

3.2.1. Issue Salience

The corporate political strategy literature, which focuses on the strategies firms use to shape government policy (Baron, 1995; Baysinger, 1984; Hillman et al., 2004; Keim & Baysinger, 1988; Keim & Zeithaml, 1986), has made important strides toward explaining firms' rationales for developing political strategies (Baron, 2010; Hillman & Hitt, 1999). Within this literature, there is general agreement amongst scholars that as the salience of a policy debate increases firms are more likely to become politically active (Hillman & Hitt, 1999; Hillman et al. 2004; Vogel, 1996; William & Crawford, 2011). Schuler & Rehbein (1997) define issue salience as "a policy's net impact of the firm's competitive strategies and performance" (pg. 121). Getz (1997) suggests issue salience affects the intensity of corporate political activity, while Hillman & Hitt (1999) posit issue salience affects the likelihood of a firm to engage in collective action.

Salience has largely been conceived as factor which varies across issues (and time) rather than across firms. Bansal & Roth (2000), for example, infer issue salience from how an issue's characteristics affect a generalized group of stakeholders rather than individual firms. Focusing on the competitiveness of the political environment, Bonardi & Keim (2005) define salience at the issue-level based on the attention it receives from the voting public. The authors further examine the process by which an issue becomes *widely salient* and its strategic implications. As many scholars have emphasized, salience is not constant across time: issues begin as fringe concerns and a few become *widely salient*.[5] Issues deemed *widely salient* (e.g. the health content of fast food and climate change) are fully politicized and the focus of intense competition

[5] The process-based view of political issues delineates the progression of an issue's salience into distinct stages. For a compendious overview of this literature, see Rivera (2010).

amongst interest groups to sway policy-makers and voters to support one of two well-delineated policy options (Bonardi & Keim, 2005; Hillman & Hitt, 1999; Rivera, 2010). Scholars note that variation in salience across issues affects the choice and efficacy of political strategies (Bonardi & Keim, 2005; Hillman & Hitt, 1999; Rivera, 2010). Knowing an issue is widely salient, however, does little to explain variation in political activity of individual firms (within a similar organizational field). Such conceptualizations of salience depend primarily on the awareness and interest of the voting public and media, distinguishing variation in salience across issues – or for a given issue variation only over time – rather than across firms.

Schuler & Rehbein (1997) develop a theoretical model wherein salience is also the product of factors external to the firm (e.g. political, industry and macroeconomic factors), but firm-level characteristics (i.e. organization structure and resources, political experience, and stakeholder dependency) act to filter external cues and ultimately determine how the costs and benefits of political involvement are idiosyncratically calculated. Although the author's model explains variation in perceived salience at the firm-level, it draws from an organizational rather than strategic perspective that, similar to issue-level conceptualizations, explains political activity across multiple issues.

Overall, models of corporate political activity have yet to accommodate how characteristics of the firm relevant to a contested political issue impact its perceived salience. Conceptualized as exogenous to the firm, salience addresses *whether* a policy will affect an industry or set of industries and magnitude of this impact relative to other issues. Explaining firm-level variation in political activity is then left to factors such as firm size, age, or formalized structures (Hillman et al., 2004) that, independent of a particular issue, indicate general propensity and/or ability to be politically active (Schuler & Rehbein, 1997). These factors offer little insight into *how* a particular issue's characteristics relate to firm strategies, however, assuming instead that all politically active firms are unanimous in their desired political outcome.

3.2.2. Environmental Policy

The often politically contentious issue of environmental regulation, a consistent source of tension between government and business, has received little attention in the corporate political strategy scholarship (Hillman et al., 2004; Lyon & Maxwell, 2008; Richter, 2012). This is surprising considering the significant expansion of government regulation in this area and increased political clout of environmental groups over the past several decades (Vogel, 1995; Rivera, 2010). As such, the corporate political strategy literature has yet to produce a treatment of salience with regard to policies to protect the natural environment, or adapt existing models of political behavior to this important context.

A very small number of studies have empirically examined the relationship between environmental performance and political activity. Cho and colleagues (2006) conduct one of the few empirical studies specifically examining corporate political behavior with regard to environmental policy. The authors find corporate political campaign spending increases as firm-level environmental performance declines and conclude that dirtier firms use political strategies to mitigate policy pressure.

Focusing on climate change, Williams & Crawford (2011) find that in addition to dirty firms, those with strong environment performance records are also likely to be political active. Contrary Cho et al. (2006), their findings suggests that the issue of climate change may be salient to firms for opposing reasons, that is, based on exemplary (poor) performance green (dirty) firms see an opportunity to gain (maintain) competitive advantage through political involvement. As their study looked only at firms targeted by climate change resolutions in 2007 and 2008, however, their sample was restricted to only 109 observations. As the authors point out themselves, moreover, poor performers are often targets of shareholder resolutions and thus the study results likely reflect selectivity bias.

In summary, considerable scholarly research has been devoted to evincing various antecedents of corporate political behavior. There is little disagreement that salience is the primary motivator of political activity, but it has not been conceptualized as a firm-level factor and therefore does little to explain firm-level variation in its current conceptualization. Moreover, the literature has given very little attention to what has been an increasingly important policy issues to businesses over recent decades: environmental policy.

3.3. Hypothesis

In this section we develop a hypothesis to explain political activity as a function of each firm's performance on a political issue (henceforth "issue performance"). Our model applies specifically to issues that are – relative to other issues – considered salient, by this we mean highly politicized issues wherein the debate has polarized around two well-delineated policy options (Bonardi & Keim. 2005; Rivera, 2010). For such issues, the economic implications of policy alternatives are most visible and managers are capable of a more precise calculation of either outcome's impact on profitability (i.e. salience) (Rivera, 2010). We thus frame the political debate as a choice between two mutually exclusive policy options that either support the *status quo* or support new regulation. We argue that issue performance modulates the salience of the issue to the firm and thus political activity.

With only two policy options to consider, the intentions of a firm's political activity are also more clearly linked with its respective performance on the issue. Issue performance is the outcome of each firm's management philosophy and strategic choices, and thus an indication of its interest in maintaining current regulatory order. A firm with poor performance on an issue will likely view regulation as a threat to profitability and wish to preserve the *status quo*. A firm with exemplary performance, on the other hand, may perceive regulation as an opportunity to engender market conditions that favor good performance.

As such, we posit that the salience of an issue is highest for firms approaching either end of the performance spectrum. Firms with the least interest in the political outcome are those with average performance records, that is, middle-of-the-road performers. Taking this perspective of salience and its relationship to issue performance allows evaluation of how a contested policy's impact – and thus political activity – varies within an industry. We now narrow our focus on political issues to the context of environmental policy, which has been a setting of considerable strategic importance for business.

3.3.1. Poor Performers

Scholars note that the adversarial relationship between business and government is perhaps most acutely displayed in the environmental context (Vogel, 1996; Rivera, 2010). With vested interest in the *status quo* business is typically a source of particularly well-organized resistance (Bonardi, Hillman & Keim, 2005) to policy changes. Firms should not be in favor of internalizing social costs (Friedman, 1970) and with rare exception should firms benefit from environmental regulation (Palmer, Oates & Portney, 1995). As such, business involvement in policy process – especially with regard to social and environmental issues – is largely viewed as a unified force of resistance to government intervention and changes to the *status quo* (Fremeth & Richter, 2011; Shaffer, 1995), while firms who attempt to wield political influence are widely considered to be 'evil' (Richter, 2012). Indeed, scholars note that the prevailing behavior of business is to resist demands to provide environmental protection (Rivera, 2010) and empirical research has shown that poor environmental performance is associated with increased levels of political activity (Cho et al., 2006).

The burden of environmental regulation depends on the firm's environmental management strategies, capabilities and resulting level of performance (Leone, 1986; Reinhardt, 1999). Dirtier firms following a compliance-oriented strategy have an interest in keeping environmental standards as low as possible (Russo & Fouts, 1997). Relative to an environmentally proactive firm, one which has eschewed a strategy of managing their environmental impacts will likely incur greater costs complying with newly imposed regulation (Reinhardt, 1999; Richter, 2012; Vogel, 1995).

Additionally, poor performance is penalized by a broader set of stakeholders than just regulators, as policy debates attract greater scrutiny from media, civil society and other non-market actors (Baron, 2010; Fremeth & Richter, 2011) and threaten to usher in new norms and standards that could harm the legitimacy of poor performing firms (Bonardi & Keim, 2005; Rivera, 2010). By preventing or forestalling environmental regulation (i.e. maintaining the *status quo*), poor environmental performers protect the value of their investments in dirtier technologies and keep demand for cleaner products and processes from otherwise rising. These arguments suggest environmental regulatory change is most salient to poorer performing firms – those with the most to lose by meeting higher performance standards – and thus that the salience of an environmental policy issue increases as environmental performance declines (Cho et al., 2006).

3.3.2. Exemplary Performers

However, as the economic theory of regulation has for a long time argued, business can often achieve private benefits through promoting environmental regulation, which can engender barriers to entry and other sources of competitive advantage (Gruenspect & Lave, 1989; Peltzman, 1976; Stigler, 1971). New environmental policies create both losers and winners (Leone, 1981; Shaffer, 1995). Firms with greater capabilities for adapting to new legislation or rule-making can use public policy strategically to capture firm-specific advantages over industry competitors (Russo & Fouts, 1997; Shaffer, 1995).

As management scholars have more recently pointed out, the asymmetric effects of environmental regulation can be exploited by exemplary environmental performers. According to this perspective, government intervention can create missing markets for environmental quality (Vogel, 1995; Reinhardt, 2000). New environmental regulations can also disproportionately increase the operating costs of dirtier competitors (Leone, 1986; Moloney & McCormick, 1982; McEvily, Sutcliffe & Marcus, 1994; Reinhardt, 1999). In other words, environmental regulation can foster competitive advantage for greener firms who are capable of meeting the newly generated demand (from both regulators and consumers) for environmental quality at a lower cost (Leone, 1981; Reinhardt, 1999).

A recent example of a company's use of environmental policy to gain market advantages is Michelin's pursuit of government standards for 'rolling resistance" (RR). RR is responsible for, on average, one fifth of the car's total fuel consumption and as such can have a significant effect on carbon emissions. In the mid-1990's Michelin achieved what was a considered a breakthrough innovation for reducing the RR for their tires and used this feature as a source of environmental differentiation. To embolden its environmental differentiation strategy and secure costly technological barriers, Michelin successfully appealed to policy makers at the national and international level to incorporate RR ratings into environmental performance standards for automobile carbon emissions (Hanateau, 2009).[6] Similarly, in the mid-1980s Chrysler surprisingly opposed the Reagan administration's decision to lower the Corporate Average Fuel Economy (CAFÉ) standards, as the company felt the existing higher standard would raise costs for its less efficient competitors, General Motors and Ford (Nivola & Crandall, 1995).

As Fremeth & Richter (2011) argue, by advocating for stricter standards firms can 'shape future policy around existing environmental strengths' (p. 145). Firms that have invested in costly 'clean' technologies, such as renewable energy, recycling or waste prevention processes, which exceed current compliance standards, may see regulation as an opportunity to enhance the value of these past investments. Such firms are also well-positioned to receive government subsidies designed to encourage adoption and growth of clean practices should new legislation be enacted. Similarly, some firms may also have strong performance records from having to meet state- or local-level environmental policies, giving them an incentive to level the competitive playing field through harmonizing local regulatory stringency at the federal level (Vogel, 1995).

[6] In 2003, California passed AB844 requiring manufactures to label the energy efficiency of tires. The California Energy Commissions was charged with developing the standard based on RR ratings. In 2005, the International Energy Agency held a workshop on the energy efficiency of tires where Michelin was the keynote speaker. Michelin has also lobbied the European Commission in its consideration of reducing carbon dioxide emissions to set upper limits and establish a grading system for tire RR (Hanateau, 2009). Michelin North America also reported spending nearly $150,000 lobbying the US Congress on RR standards.

For example, in the 1980s BMW's largest US market was California, so the luxury car company acquired considerable experience producing cars that met the state's increasingly strict emission standards, including the mandate that all cars be equipped with catalytic converters. As this expensive and complex technology was not required in their domestic market, BMW realized it could maximize the value of its investment and raise costs for domestic competitors by importing California's standards to Europe (Vogel, 1995). Moreover, harmonizing all European Union member markets with California's standard meant BMW would no longer have to differentiate its production lines and could thus reduce costs (Hanateau, 2009).

To summarize, firms with exemplary environmental characteristics regulation can: (1) raise operating costs of poor performing competitors; (2) exploit increased demand (from regulators and consumers) for social/environmental quality; (3) maximize return on existing investments and sunk costs; and/or, (4) harmonize discordant institutional contexts (e.g. state versus federal regulation) (Baron, 1995; Reinhardt, 1999; Vogel, 1995). The above arguments and supporting examples suggest that the salience of environmental policy also increases as firms become greener.

3.3.3. Middle-of-the-road Performers

Environmental policy doesn't just create losers (i.e. poor performers) and winners (i.e. exemplary performers); there are also subsets of firms which are minimally affected. Firms which have taken the middle road with regard to environmental strategy – having neither poor nor exemplary performance records – have the least at stake in the policy outcome. Without a clear environmental strategy such firms are uncertain about how proposed regulation will affect profitability and thus what side of the issue to be on (William & Crawford, 2011). Middle-of-the-road firms also likely receive little attention – either positive or negative – from media and the general public regarding their environmental stance and/or impacts. Recent research suggests that both exemplary and poor environmental performers attract the greatest media attention and public scrutiny, rendering environmental issues relatively less important to middle-of-the-road firms (Luo, Meier, & Oberholzer-Gee, 2012).

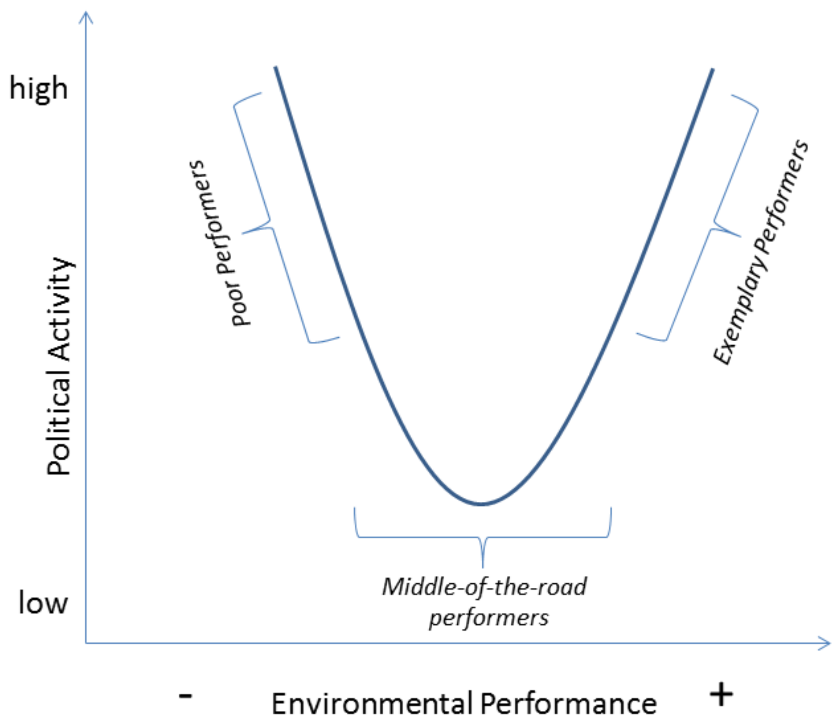
The small benefits these firms may gain from either supporting or opposing regulation are easily outweighed by the costs. Moreover, as there are likely many more firms with average – rather than exceeding good or poor – performance records the benefit of either political outcome will be concentrated within a relatively small number of firms on either end of the environmental performance spectrum. The benefits of a political outcome will be diffusely distributed for firms in the middle of this spectrum, which – according to collective action theory – suggests a strong incentive to adopt a free-riding strategy (Olson, 1965; Yoffie, 1987). As such, we would expect that the salience of an environmental policy debate decreases as environmental performance approaches an ambiguous middle ground, which is neither particularly poor nor exemplary.

3.3.4. Summary

Together these arguments imply U-shaped relationship between issue salience and performance: salience is highest for both exemplary and poor performers, and lowest for middle-of-the road performers. This relationship is depicted in Figure 3.1. As salience increases so does political activity (Getz 1997; Bonardi et al., 2005; Bonardi & Keim 2005; Hillman et al., 2004; Rivera, 2010; Vogel, 1996; Williams & Crawford, 2011; Yoffie, 1987). As such, we would expect environmental performance and political activity to have a U-shaped relationship. Stated formally:

H1: All else equal, the relationship between environmental performance and corporate political activity is U-shaped.

Figure 3. 1 Diagram of political issue salience versus issue performance



3.4. Methods

To robustly test our hypothesis we run two separate analyses, each using a different form of political activity as the dependent variable. We test for a U-shaped relationship between environmental performance and lobbying expenditures, followed by test for a U-shaped relationship between environmental performance and voluntary environmental disclosure. Lobbying and disclosure are tactics of disparate environmental strategies – information and constituency building, respectively (Cho et al., 2006; Hillman & Hitt, 1999; William &

Crawford, 2011). Although disparate, scholars note these strategies may be used in parallel and as such may be complementary (Hillman & Hitt, 1999; Cho et al., 2006).

Lobbying – a tactic of an information strategy – is targeted directly at political decision makers wherein firms convey information (e.g. political, technical and economic assessment) that supports their preferred political outcome (Hillman & Hitt, 1999; Rivera, 2010). Scholars also note that firms are most likely to lobby when an issue has become highly politicized and when the debate has focused on several specific policy options (Hillman & Hitt, 1999).

In contrast to information strategy, constituency-building attempts to influence decision-makers indirectly by first procuring the support of voters. By disclosing information related to environmental strategies and performance, dirty firms can either demonstrate to voters and policy makers that they are clean (i.e. through greenwashing; Delmas & Cuerel Burbano, 2011) or their intention to mitigate environmental harm and actions taken to this end (Kolk & Pinkse, 2007; Williams & Crawford, 2011). By doing so, they send the message that government intervention is redundant. At the same time, exemplarily performing companies convey to voters an achievable standard by which competing firms should be held and thus the legitimacy environmental legislation (Reinhardt, 1999).

3.4.1. Data

We now describe the data and analysis methods used to conduct this analysis. GHG emissions data were acquired from Trucost. Trucost provides a range environmental performance data for the socially responsible investment community and is increasingly used in peer reviewed academic research (e.g. Dawkins & Fraas, 2011; Jira & Toffel, 2012; Marquis & Toffel, 2012). Where available, Trucost collects standardizes, and validates company reported environmental data from annual reports, corporate websites or other public disclosures. Where not disclosed publicly, data are calculated from global fuel use, or imputed by conducting a detailed sector breakdown of each firm and applying a proprietary input-output (IO) economic model based on government census and survey data, industry data and statistics and national economic accounts. The data cover annual performance from 2004 through 2008.

Corporate lobbying expenditures on issues related to climate change and energy policy were produced and made publically available by the Center for Public Integrity (CPI) for the years 2008 and 2009. [7] CPI examined lobbying disclosure reports filed with the Secretary of the Senate's Office of Public Records. The records became available electronically for the first time in 2008, allowing for key word searches. CPI researchers included all lobbyists registered to represent clients using the keywords "climate" and "global warming," and/or bill numbers and terms associated with climate change legislation during 2008 and 2009. To estimate amount spent, CPI coded each disclosure record to reflect whether the lobbyist was hired for representation on the issue of climate change exclusively or multiple issues. Expenses reported only as "less than $5,000" were not included.

Environmental disclosure data was acquired from the Carbon Disclosure Project (CDP), a non-profit group based in the UK that works with institutional investors to promote greater climate change transparency. In 2002, the CDP sent questionnaires the executives of Financial Times 500 (FT500) companies soliciting information pertaining to each firm's stance on climate change, related strategies and GHG emissions. The questionnaire was subsequently sent out on an annual basis, expanding coverage in 2006 to include the S&P500.

[7] http://www.publicintegrity.org/investigations/climate_change/pages/methodology/

Data on corporate transparency relevant to our second hypothesis was taken from KLD Analytics, a source of ratings used widely in the management literature (Chen & Delmas, 2010). Financial data used to construct our control variables were obtained from Compustat. For lobbying, 285 observations – 120 lobbying firms in 2008 and 165 in 2009 – from the CPI data were matched completely with Compustat, Trucost and KLD. For disclosure, 1839 complete observations (560 unique firms) from 2005 through 2009 were common to Compustat, Trucost, KLD and CDP. A number of firms which lobbied the issue of climate change in 2008 and 2009 were not sent disclosure requests by the CDP. As such, the sample common to all five data bases from 2008-2009 excludes 53 of the 285 original lobbying observations.

3.4.2. Dependent Variable

Employing the two-step Heckman methodology (see Data Analysis section below), two dependent variables are constructed to test Hypothesis 1. For the first stage a dichotomous variable *Selection* was coded '1' if a firm spent at least $5000 on lobbying the issue of climate change in 2008 or 2009, and '0' otherwise. To synchronize the sample of firms used to test both hypotheses, any firm coded '0' had to have been sent a disclosure request from the CDP. The dependent variable for the second stage, *Expense*, is the annual amount spent on lobbying in US dollars.

Our dependent variable for the second part of our analysis is dichotomous variable indicating whether or not a firm responded to a request from the CDP to provide information on their corporate climate change policy. Our dependent variable, *Disclosure,* was coded '0' if a requested firm failed to respond to the questionnaire, declined to participate or didn't allow their response to be publically disclosed. Disclosure was coded '1' only when responses were provided and allowed to be public (Reid & Toffel, 2009). Disclosure data was purchased from the CDP and coded in consultation with the organization's staff.

3.4.3. Independent Variables

Each firm's GHG emissions include all GHG Protocol gases weighted by global warming potential factors and measured as tons of CO_2-equivalent ($C0_2$-e). We include only Scope 1 emissions as defined by the GHG Protocol – the most commonly used international greenhouse gas accounting protocol (Ranganathan, Corbier, Bhatia, Schmitz, Gage, & Oren, 2004). Scope 1 emissions are all GHGs emitted from sources directly owned or operated by the responsible firm. We label this variable *GHG Emissions.* This variable is log transformed to adjust for skewedness and obviate the influence of outliers. To avoid collinearity with the square-transformed variable it is also centered. To test the U-shaped relationship a second variable was generated by squaring *GHG Emissions*. This is labeled *GHG Emissions* ^{2}.

3.4.4. Control Variables

Several control variables are included to account for factors other than environmental performance that affect lobby expenditures. Firms are more likely to act collectively when the private benefits are concentrated within a smaller group of firms (Olson, 1965). To control for this we include *Concentration Ratio*, calculated from Compustat as the market share of 4 largest firms at the 3-digit naics code level. Shareholders can exert pressure on firms to influence their stance on social and environmental issues (Reid & Toffel, 2009) and political involvement (Schuler & Rehbein, 1997). To account for heterogeneity in shareholder activism we include a binary *Resolutions* variable, which is coded '1' if a firm is targeted by at least one shareholder resolution related to climate change or other environmental issues in a given year or '0' otherwise (Reid & Toffel, 2009). Resolutions data were gathered from Risk Metrics.

We also include the control variable, *Transparency Strength*, to account for firm's innate willingness to disclose social and environmental information independent of political strategy. This is a dichotomous variable produced by KLD Analytics as part of its corporate governance ratings. Firms which demonstrate transparency in a range of social and/or environmental performance information are coded '1', and '0' otherwise.

Scholars note that the political behavior of firms is likely influenced by antecedent state-level political debates and regulatory efforts (Reid & Toffel, 2009). This consideration is especially relevant to climate change, as there is considerable variation in each state's stance on the issue (Cragg & Kahn, 2009; DeShazo & Freeman, 2007; Reid & Toffel, 2009). According to DeShazo & Freeman (2007), this motivates firms to seek uniformity and regulatory certainty through federal legislation. To account for heterogeneity in the state-level regulatory setting, we include three binary variables indicating whether a firm is headquartered in a state that (at the time): (1) has passed climate change legislation (i.e. California); (2) is a member of the Regional Greenhouse Gas Initiative (RGGI); or (3) has enacted Renewable Portfolio Standards (RPS).[8] We label these variables, respectively: *CA*, *RGGI*, and *RPS*.

We include several financial variables shown in prior research to affect CPA, which are all constructed using data from Compustat. We construct the variable *Firm Size* as total assets (King & Lenox, 2002). Hillman et al. (2004) note that firms with less debt have greater organizational slack and can afford to lobby more intensely. As such we include the variable

[8] Reid & Toffel (2009) differentiate between firms from these states in sectors that are likely to be impacted by climate change regulation from sectors less likely to be impacted.

Leverage, calculated as the ratio of total debt to total assets. Similarly, slack resources are also affected by firm performance. We proxy *Firm Performance* as return on assets (ROA), which we calculate as earning performance interest divided by total assets (King & Lenox, 2002). We also include *Capital Intensity*, capital expenditures divided by total sales, to account for variation across firms in available capital. With the exception of *Firm Performance*, all financial control variables are log transformed. Finally, we include industry dummy variables based on 20 Industrial Classification Benchmark (ICB) super sectors, as well as year dummy variables.

3.4.5. Data Analysis

3.4.5.1. Lobbying

Our model of the determinants of lobbying expenditures is as follows:

$$y_{i,j,t} = \beta_1 GHG_{i,t} + \beta_2 GHG^2{}_{i,t} + \alpha X_{i,j,t} + \delta T_t + \gamma \lambda_{i,t} + \varepsilon_{i,t}$$

where $y_{i,j,t}$ represents lobby expenditures for firm *i* in industry *j* in year *t*, and $GHG_{i,t}$ and $GHG^2{}_{i,t}$ are the linear and quadratic-transformed GHG emissions variables, respectively. X_{ijt} is the matrix of control variables, T represents the year dummy variable (to control for secular changes) and λ_{it} represents the propensity to lobby in a given year. We lag both independent variables, as well as *Resolutions*, one year behind the dependent variable.

We use the two-step Heckman selection model, which is commonly used with lobbying data in the corporate political strategy and related literature (Brasher & Lowery, 2006; Hansen & Mitchell, 2000; Kim, 2008). As our sample of firms only those lobbying issues related to climate change there is a high risk of selectivity. Selectivity is a concern if similar variables are likely to influence participation in the treatment groups (i.e. the decision to lobby) and treatment outcome (i.e. lobbying expenditures). The Heckman methodology controls for self-selectivity bias by estimating a two-step process. The first step estimates the propensity (of both lobbying and non-lobbying firms) to lobby using a probit model. The estimate of propensity (i.e. the "hazard rate" or lambda) is then included an OLS model in second step, in effect controlling for self-selectivity bias. The sample of firms analyzed includes all lobbying firms as well as those sent CDP disclosure requests during 2008 and 2009.[9]

3.4.5.2. Disclosure

We use the following logistic regression model for the likelihood of disclosure:

$$Pr(y_{i,j,t} = 1) = F(\beta_1 GHG_{i,t} + \beta_2 GHG^2{}_{i,t} + \alpha X_{i,j,t} + \delta T_t + +\varepsilon_i)$$

where $y_{i,j,t}$ represents disclosure of firm *i* in industry *j* in year *t*. $GHG_{i,t}$ and $GHG^2{}_{i,t}$ are the linear and quadratic-transformed GHG emissions variables, respectively, X_{ijt} is the matrix of control variables and T represents the year dummy variable (to control for secular changes). Due to repeated measures for each firm over time, standard errors are clustered by firm. We lag both independent variables, as well as *Resolutions*, one year behind the dependent variable.

3.5. Results

Table 3. 1 displays summary statistics of lobbying expenditure, disclosure and mean GHG emissions by sector. The table shows firms from almost all sectors of the economy lobbied the issue of climate change at the federal level. The industrial goods and services, oil and gas, technology and utilities sectors appear most active in lobbying, which is consistent with the expected economic impact of climate change legislation (Reid & Toffel, 2009). Firms from

[9] By restricting analysis to the sample space common to both lobbying and disclosure requests, 53 observations (lobbying firm-years) were lost. The results are robust to a separate analysis which included these observations.

sectors less sensitive to carbon regulation also show climate change lobbying expenditures, such as banks, financial services and healthcare. The mean estimated lobby expenditure across all sectors is approximately $2.15 million with a relatively high standard deviation (approximately $3.9 million) and a maximum of $27.8 million spent by PG&E in 2008.[10] Overall, the average proportion of firms responding to CDP disclosure requests is just over 50%. The three sectors with the highest proportion of disclosure (>70%) are: chemicals, food and beverage, and utilities.

Table 3. 1 Climate change lobbying expenditures, CDP disclosure & GHG emissions by sector

Sector	2008 -2009 Lobbying (USD in thousands)				2005-2009 CDP Disclosure		GHG Emissions (Tons CO_2-e)
	N	Mean	Min	Max	N	Mean	Mean
Automobiles & Parts	7	5252	180	13,500	26	0.54	836,759
Banks	1	200	200	200	83	0.50	10,164
Basic Resources	20	1754	30	5,570	36	0.64	7,623,982
Chemicals	19	1324	50	5,200	53	0.76	3,772,340
Construction & Materials	10	473	70	2,116	23	0.48	441,484
Financial Services	6	1042	80	3,580	101	0.30	298,511
Food & Beverage	11	1109	20	6,544	69	0.73	933,679
Healthcare	5	794	60	1,720	187	0.53	131,376
Industrial Goods & Services	53	2859	6	19,600	222	0.48	824,359
Insurance	3	4517	1480	8,460	78	0.45	28,242
Investment Instruments	0	0	0	0	0	n/a	359
Media	3	195	136	240	52	0.38	24,501
Oil & Gas	37	3555	5	26,600	130	0.56	6,508,602
Personal & Household Goods	7	579	170	1,415	114	0.36	429,589
Real Estate	3	230	20	400	40	0.23	26,891
Retail	5	817	130	1,750	148	0.36	343,838
Technology	24	1173	40	5,080	226	0.55	123,056
Telecommunications	0	0	0	0	31	0.58	128,655
Travel & Leisure	7	2129	110	5,440	55	0.27	3,295,664
Utilities	64	2145	5	27,800	168	0.77	25,300,000
Overall	*285*	*2148*	*5*	*27,800*	*1839*	*0.51*	*2,847,392*

[10] In 2008, Exxon Mobil recorded the second highest amount at $26.6 million (CPI, 2011).

3.5.1. Lobbying

Variable descriptions and summary statistics for the analysis of lobbying expenditures are shown in Table 3. 2. Variable correlations are contained in Table 3. 3, which also includes the binary *Selection* variable used in the first stage of the Heckman analysis. As expected, *Firm Size* and both *GHG Emissions* variables are positively correlated with lobbying expenditures. The variable *Resolutions* is also positively correlated to lobbying expenditures. Interestingly, while concentration ratio shows a positive correlation with lobby expenditures there is no significant association with the decision to lobby (i.e. *Selection*).

Table 3. 2 Summary Statistics (lobbying analysis)

Variable	Variable Description	N	Mean	Standard Deviation	Min	Max
Expenditures (CPI)	Total annual lobby expenditures on issues related to current climate change legislation ($1000 USD)	285	2,145	3,935	5	27,800
Concentration Ratio (Compustat)	Market share of 4 largest firms in industry based on 3-digit naics code	988	0.38	0.19	0.19	1.00
Leverage (Compustat)	Total debt divided by total assets (logged)	988	-1.64	1.03	-4.61	0.34
Growth (Compustat)	Annual change in sales ratio (logged)	988	0.05	0.46	-12.68	1.43
Capital Intensity (Compustat)	Capital expenditures divided by total sales (logged)	988	-2.82	0.96	-5.88	0.64
Firm Performance (Compustat)	Return on Assets (ROA)	988	0.05	0.10	-0.85	0.41
Firm Size (Compustat)	Total assets (logged)	988	9.45	1.36	6.70	14.60
Transparency Strength (KLD)	Firm demonstrates strong ability to report on wide range of social and environmental performance measures (Binary)	988	0.15	.36	0	1.00
Resolutions (Risk Metrics)	At least one climate change or environment related resolution directed at firm	988	0.13	0.34	0.00	1.00
State Regulatory Threat	Firm headquartered in state that has passed climate legislation or is member of WRI or RGGI	980	0.22	0.42	0	1.00
GHG Emissions (Trucost)	GHG emissions directly emitted by the firm (log transformed and centered)	988	1.04	2.69	-5.35	7.66
GHG Emissions^2 (Trucost)	Quadratic transformed GHG emissions	988	8.30	11.51	0.00	58.67

Table 3. 3 Correlation matrix (lobbying analysis)

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Selection	1.00												
2	Expenditures	0.05	1.00											
3	Concentration Ratio	-0.04	0.17	1.00										
4	Leverage	0.08	-0.05	-0.08	1.00									
5	Growth	0.03	-0.03	0.00	-0.05	1.00								
6	Capital Intensity	0.28	0.00	-0.07	0.14	-0.02	1.00							
7	Firm Performance	-0.01	-0.01	0.02	-0.26	0.12	0.02	1.00						
8	Firm Size	0.14	0.54	-0.08	0.13	-0.14	-0.07	-0.17	1.00					
9	Transparency Strength	0.19	0.35	-0.08	0.02	-0.01	0.04	0.01	0.30	1.00				
10	Resolutions	0.11	0.38	0.08	0.03	-0.01	0.11	0.00	0.19	0.09	1.00			
11	State Reg. Threat	-0.07	0.04	-0.08	-0.20	0.05	-0.06	0.04	-0.11	0.03	-0.06	1.00		
12	GHG Emissions	0.51	0.29	0.00	0.26	0.02	0.46	0.04	0.16	0.23	0.23	-0.19	1.00	
13	GHG Emissions^2	0.46	0.33	-0.12	0.13	0.03	0.34	-0.05	0.22	0.15	0.20	-0.13	0.66	1.00

* All coefficients greater in absolute value that 0.06 are significant

The results of the two-step Heckman regression analysis are tabulated in Table 3. 4. The quadratic transformation of the GHG emissions variable is added in model 2. Columns 1(a) and 2(a) contain the results from the first stage probit estimates for the factors influencing the likelihood of lobbying. Looking at Models 1(a) and 2(a), we find concentration ratio to be associated with a greater likelihood of lobbying. This is consistent with Olson's (1965) prediction that firms are more likely to act collectively when the private benefits are concentrated within a smaller group of firms. The results show a firm's rate of growth ($p<0.05$) is also associated with an increased proclivity to lobby, as found in prior research (Kim, 2008). Although positive, surprisingly the effect of *Firm Size* does not differ significantly from zero. In contrast to prior studies, this suggests larger firms are no more likely to lobby than their smaller counterparts. The coefficient estimate for *GHG Emissions* is positive and significant, indicating firms are more likely to lobby as their pollution levels increase. Adding *GHG Emissions*^{2} in model 2(a), however, does not appear to increase likelihood of lobbying.

Noteworthy differences are apparent between the first (i.e. Models 1(a) and 2(a)) and second stages (i.e. Models 1(b) and 2(b)). Although *Firm Size* had no significant effect on the likelihood of lobbying, it shows a relatively large positive effect on lobby expenditures ($p < 0.01$). Together this suggests firms with greater resources spend more than smaller firms but are not necessarily more likely to become politically active. Similarly, *Leverage* was insignificant in the first stage, but has a negative effect ($p <0.05$) on expenditures. The negative relationship between leverage and lobby expenditures confirms a relationship similar to that of firm size mentioned above: firms with less debt have greater organizational slack and can afford to lobby more intensely (Hillman et al. 2004). *Concentration Ratio*, as predicted, displays a large and significant positive effect on lobby expenditures. This provides evidence that firms from industries where market share is increasingly shared by fewer firms devote more resources to influence policy (Hansen et al. 2005; Kim 2008). *Transparency Strength* also shows a positive significant effect of lobbying expenditures only. Interestingly, the coefficient for *Resolutions* in Models 1(b) and 2 (b) suggests that *ceteris paribus* being the target of at least one shareholder resolution increases lobbying expenditures by approximately $1.6 million. Of the variables controlling for state-level climate change policy initiatives, the indicator variable for California is significant in the model's second stage. This suggests that being headquartered in California increases lobbying expenditures by approximately $1.3 million.

Supporting our hypothesis, the quadratic GHG emissions term is positive and highly significant ($p<0.01$). The model results also show that the complete effect of GHG emissions on lobby expenditures includes a negative linear term ($p<0.01$). All else equal, the estimated relationship between lobby expenditures and direct greenhouse emissions is represented by the following model:

$$y = \beta_1 x + \beta_2 x^2$$

where x is GHG emissions, β_1 and β_2 are the estimated coefficients for the linear and quadratic terms, respectively. A graphical interpretation of these results, depicting the estimated relationship between GHG emissions and lobby expenditures holding all other factors at their mean, is shown in Figure 3. 2. The graph shows a concave-up parabola with the minimum expenditure corresponding to a logged emission level approximately 14 (i.e. 1.2 million tons). This tells us expenditures increase as GHG emissions either increase *or* decrease from this value; thus, evidence of a curvilinear relationship between GHG emissions and lobby expenditures.

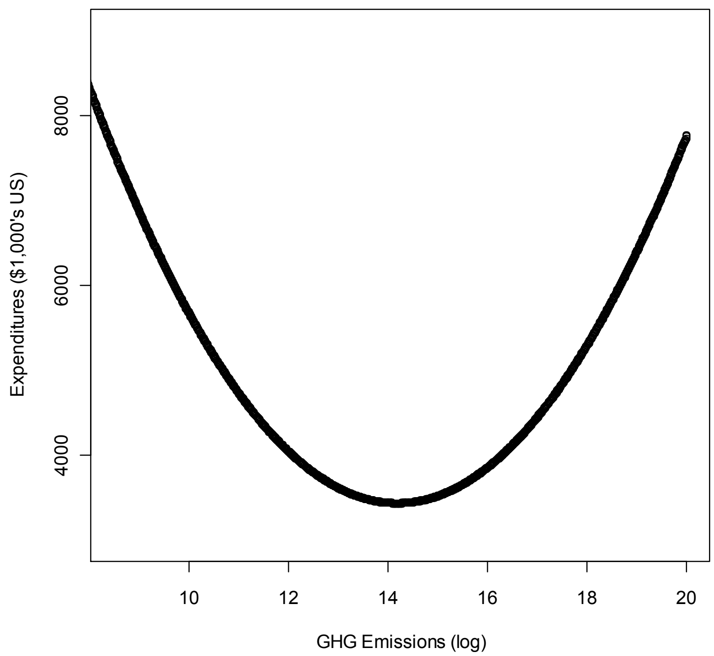
Table 3. 4 Heckman regression results (lobbying analysis)

Model	1(a)	1(b)	2(a)	2(b)
	1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
Variables				
Concentration Ratio	0.32	3,564,508***	0.32	3,427,832***
	(0.511)	(0.003)	(0.517)	(0.003)
Log Leverage	-0.10	-1002058***	-0.09	-766,894***
	(0.310)	(0.001)	(0.375)	(0.007)
Growth	0.37	894,206	0.37	482,809
	(0.303)	(0.420)	(0.314)	(0.654)
Capital Intensity	0.12	-5,275	0.13	126,175
	(0.243)	(0.983)	(0.225)	(0.594)
Firm Performance	0.72	-5088144**	0.79	-4106446
	(0.466)	(0.050)	(0.425)	(0.103)
Firm Size	0.07	1,928,119***	0.08	1,932,983***
	(0.422)	(0.000)	(0.355)	(0.000)
Transparency Strength	0.31	1,181,346**	0.32	1,019,395**
	(0.146)	(0.011)	(0.136)	(0.023)
Resolutions	0.05	1,841,096***	0.02	1,642,508***
	(0.814)	(0.000)	(0.917)	(0.001)
State Reg. Threat	0.06	528,110	0.06	626,755
	(0.767)	(0.320)	(0.764)	(0.223)
GHG Emissions	0.31***	-78,246	0.26***	-715,209***
	(0.000)	(0.606)	(0.001)	(0.000)
GHG Emissions ^{2}			0.01	124,911***
			(0.351)	(0.000)
Sector Dummies	Yes		Yes	Yes
Year Dummies	Yes		Yes	Yes
Lambda	149,439		658,239	
	(0.889)		(0.495)	
Observations	988	285	988	285

p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In summary, the results corroborate our hypothesis. All else equal, the likelihood of lobbying increases linearly as a firm's GHG emissions increase. This finding is consistent with prior research that suggests higher polluting firms become politically active to avoid costly protective regulation (Cho et al. 2006). However, the results from the second stage provide evidence that the likelihood of lobbying does not necessarily determine expenditures. The findings show GHG emissions instead exhibit a curvilinear relationship with expenditures, implying that spending increases for lobbying firms as they approach either end of the environmental performance spectrum. Together, the results from both stages of the Heckman analysis also reveal differences between the association of GHG emissions with the decision to lobby and GHG emissions and amount subsequently spent lobbying. This is also true for control variables (e.g. firm size and leverage) commonly thought to affect political activity in prior research.

Figure 3. 2 Curvilinear relationship between GHG emissions and lobby expenditures



3.5.1.1. Tests of Robustness

It is important to note that our analysis thus far includes all economic sectors. However, in industries with minimal carbon intensity, such as the financial services and insurance, a firm's motivation to influence climate change policy likely has little to do with firm-level environmental performance. Moreover, our measure of environmental performance – Scope 1 GHG emissions – accounts only emissions that result from processes directly owned by each firm, that is, it excludes downstream emissions from product use. For certain industries, firm's interest a specific climate change policy outcome likely comes from the environmental performance of its product(s) rather than its own processes. For example, a firm with a strategy of producing fuel efficient cars may view a price on carbon and an increase in fuel prices as an opportunity to gain market share. Likewise, a firm developing renewable technology may have a similar interest in encouraging constraints on fossil fuels. The 'greenness' of each of these firms, however, is not captured by Scope 1 emissions. Using such a measure, we should expect to strongest evidence of the relationship described in the hypothesis section for industries with relatively high levels of direct GHG emissions. As a robustness check, we repeat the above analysis but restrict our sample to sectors most sensitive to climate change regulation. This includes the five highest polluting sectors (see Table 3. 1): basic resources, chemicals, oil and gas, travel and leisure, and utilities. The results using the restricted sample space are displayed in Table 3. 5, where the number of observations is reduced from 285 to 146. The results are consistent with our initial findings.

In addition to Scope 1, Trucost also provides measures of Scope 2 and 3 emissions. We chose Scope 1 emissions as these are most likely to reflect each firm's strategy with regard to climate change. However, as Scope 2 emissions are those produced by electricity consumption and heating these are (to a certain degree) also influenced by a firms climate strategy (e.g. through efficiency programs). To ensure the robustness of our findings we estimate the same model (using Tobit regression) with an independent variable that includes both Scope 1 and Scope 2 GHG emissions. The results (see Appendix Table A. 1) are robust.[11]

[11] Due to missing values in our data set for Scope 2 emissions, the sample size is reduced.

Table 3. 5 Heckman analysis (lobbying) including only climate sensitive industries

Model	3(a)	3(b)	4(a)	4(b)
	1st Stage	2nd Stage	1st Stage	2nd Stage
Variables				
Concentration Ratio	-1.00	-547,407	-0.77	357,777
	(0.441)	(0.868)	(0.553)	(0.908)
Log Leverage	-0.43	-970,050	-0.43	-684,805
	(0.134)	(0.109)	(0.134)	(0.230)
Growth	-4.85***	755,302	-5.04***	-210,645
	(0.001)	(0.714)	(0.001)	(0.913)
Capital Intensity	0.00	-412,652	0.05	-297,624
	(0.978)	(0.277)	(0.793)	(0.404)
Firm Performance	-2.12	1,823,415	-1.80	1,350,278
	(0.380)	(0.699)	(0.436)	(0.759)
Firm Size	-0.29	2,143,303***	-0.31	1,771,015***
	(0.146)	(0.000)	(0.117)	(0.000)
Transparency Strength	0.69	2,080,432***	0.70	1,370,312*
	(0.119)	(0.008)	(0.120)	(0.069)
Resolutions	-0.53	1,987,096***	-0.68*	1,605,312**
	(0.135)	(0.005)	(0.075)	(0.016)
CA	-0.08	2,342,924*	-0.03	3,927,153***
	(0.893)	(0.083)	(0.963)	(0.003)
RGGI	-0.49	-1,466,494	-0.48	-1,605,021
	(0.284)	(0.213)	(0.304)	(0.147)
RPS	-0.40	-592,102	-0.39	-377,929
	(0.192)	(0.352)	(0.209)	(0.527)
GHG Emissions	0.34***	-5,407	0.09	-2,350,065***
	(0.000)	(0.984)	(0.712)	(0.000)
GHG Emissions ^{2}			0.04	314,995***
			(0.240)	(0.000)
Sector Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Lambda	1,704,492		1,176,080	
	(0.162)		(0.301)	
Observations	262	146	262	146

p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Next, we conducted a set of robustness tests aimed at the estimation method used in the analysis. Although the Heckman methodology was used to correct for anticipated selection bias in testing our hypothesis, this appears to have been unnecessary. The coefficient for lambda (i.e. the unobserved proclivity to lobby) included in the second is not significant. An insignificant lambda suggests the decision to lobby and expenditures are not endogenous. Indeed that is what our results show (without looking at lambda): the results of the 1st stage probit model (Models 1a and 2a) demonstrate the likelihood of participation increases linearly with GHG emissions. This suggests that the proclivity to lobby isn't necessarily an indicator of how much firms intend to spend. Since lambda is insignificant in the Heckman analysis, we use a Tobit analysis with clustered errors as a robustness test for our second hypothesis (i.e. model 2(b)). Under this model, the non-negative distribution of expenditures is a result of being censored at zero rather than self-selection. The clustered errors allow for robust estimation of coefficient standard errors when the data contain repeating units over time. The results (shown in Table 3. 6) are consistent with the second stage Heckman findings, supporting our hypothesis.

Finally, the U-shaped relationship may be affected by varying levels of financial performance. For example, a middle-of-the-road firm that is performing well financially may not wish to alter the current regulatory order, while one that is performing poorly could be more willing to stir the pot. To examine whether the U-shaped relationship is robust to changes in financial performance, we interact ROA with each of the two independent variables. Tobit regression results for the resulting model are shown in Table A. 2. Model 1 contains both interaction terms: we see that both are marginally significant ($p<10\%$), while the quadratic GHG Emissions term loses significance. Figure A. 1 shows the graphical interpretation of these results at varying levels of financial performance. Overall, as financial performance increases the U-shape becomes increasingly narrow indicating that firms with increasingly poor/good environmental performance and willing to spend more on lobbying when also performing well financially. Nonetheless, the U-shape is persistent *except* in the extreme case of poor financial performance (i.e. lowest 1 percent of ROA). Here the U-shape is inverted, which suggests that – when faced with extremely poor financial prospects – middle-of-the-road environmental performers actually spend the more than their cleaner/dirtier firms competitors.

Table 3. 6 Tobit regression (lobbying)

	All Sectors		Climate Sensitive	
	(1)	(2)	(3)	(4)
Concentration Ratio	3,683,395**	3,693,610**	884,709	257,773
	(0.002)	(0.003)	(0.679)	(0.912)
Leverage	-718,157*	-962,608**	-564,774	-813,108
	(0.013)	(0.001)	(0.369)	(0.253)
Growth	497,805	888,689	562,215	1,951,898
	(0.642)	(0.422)	(0.650)	(0.206)
Capital Intensity	147,658	2,629	-244,443	-323,569
	(0.539)	(0.991)	(0.454)	(0.404)
Firm Performance	-3,874,426	-4,738,484	1,971,171	2,822,469
	(0.135)	(0.077)	(0.609)	(0.561)
Firm Size	1,841,821**	1,875,429**	1,847,419***	2,242,451***
	(0.000)	(0.000)	(0.001)	(0.000)
Transparency Strength	970,804*	1,163,709*	1,147,731	1,809,521*
	(0.032)	(0.013)	(0.223)	(0.077)
Resolutions	1,521,832**	1,772,822**	1,683,914*	2,067,599**
	(0.002)	(0.000)	(0.069)	(0.026)
CA	1,401,177	1,127,173	4,109,421	2,506,265
	(0.062)	(0.146)	(0.181)	(0.455)
RGGI	691,693	334,144	-1,457,438	-1,240,627
	(0.258)	(0.594)	(0.200)	(0.296)
RPS	-72,283	-132,712	-360,799	-550,566
	(0.861)	(0.756)	(0.451)	(0.340)
GHG Emissions	-751,802**	-75,075	-2,445,833***	-118,453
	(0.000)	(0.584)	(0.001)	(0.701)
GHG Emissions^2	131,789**		315,973***	
	(0.000)		(0.002)	
Industry Dummy	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes
Observations	285	285	146	146
Firms	178	178	83	83
Pseudo R-squared	0.0234	0.0212	0.0254	0.0220

p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.5.2. Disclosure

Summary statistics and correlations for the variables used in the second part of our empirical analysis are shown in Table 3. 7 and Table 3. 8, respectively. Consistent with prior research, *Firm Size* and *Resolutions* show positive associations with disclosure (Reid & Toffel, 2009; Clarkson, Li, Richardson & Vasvari, 2008), albeit not high enough to raise concerns about collinearity. Notably, *concentration ratio* has a negative correlation with disclosure.

The results of logistic regression (coefficient estimates) are shown in Table 3. 9. We focus on Model 2, which contains the *GHG Emissions*^{2} variable. Of the financial control variables, *Capital Intensity* and *Firm Size* both increase the likelihood of disclosing, while *Growth* and *Leverage* appear to have no effect. Not surprisingly, the relatively large coefficient estimate for *Transparency Strength* suggests that constitutively transparent firms are a greater likelihood of disclosing information regarding their climate change policies. The insignificant result for *Concentration Ratio* suggests that – in contrast to the finding for lobbying – the collective action problem does not manifest in a disclosure strategy. Surprisingly, we find that *Resolutions* does not have a significant effect on the likelihood of disclosure.

Table 3. 7 Summary statistics (disclosure analysis)

Variable	Variable Description	N	Mean	Standard Deviation	Min	Max
Disclosure (CDP)	Responded to request from CDP to disclosure climate change policy	1839	0.51	0.50	0.00	1.00
Concentration Ratio (Compustat)	Market share of 4 largest firms in industry based on 3-digit naics code	1839	0.36	0.18	0.14	1.00
Leverage (Compustat)	Total debt divided by total assets (logged)	1839	-1.71	1.03	-4.61	0.34
Growth (Compustat)	Annual change in sales ratio (logged)	1839	0.07	0.27	-8.80	1.43
Capital Intensity (Compustat)	Capital expenditures divided by total sales (logged)	1839	-2.89	0.89	-5.88	0.53
Firm Performance (Compustat)	Return on Assets (ROA)	1839	0.06	0.08	-0.85	0.50
Firm Size (Compustat)	Total assets (logged)	1839	9.58	1.40	6.60	14.60
Transparency Strength (KLD)	Firm demonstrates strong ability to report on wide range of social and environmental performance measures (Binary)	1839	0.16	0.36	0.00	1.00
Resolutions (Risk Metrics)	At least one climate change or environment-related resolution directed at firm	1839	0.12	0.33	0.00	1.00
State Regulatory Threat	Firm headquartered in state that has passed climate legislation or is member of WRI or RGGI	1839	0.18	0.38	0.00	1.00
GHG Emissions (Trucost)	GHG emissions directly emitted by the firm (log transformed and centered)	1839	1.05	2.67	-5.35	7.66
GHG Emissions^2 (Trucost)	Quadratic transformed GHG emissions	1839	8.23	11.69	0.00	58.67

Table 3. 8 Correlation matrix (disclosure analysis)

		1	2	3	4	5	6	7	8	9	10	11	12
1	Disclosure	1.00											
2	Concentration Ratio	-0.12	1.00										
3	Leverage	0.07	-0.06	1.00									
4	Growth	-0.05	-0.01	-0.07	1.00								
5	Capital Intensity	0.18	-0.07	0.12	-0.02	1.00							
6	Firm Performance	-0.04	0.07	-0.28	0.12	0.04	1.00						
7	Firm Size	0.30	-0.06	0.16	-0.08	-0.09	-0.22	1.00					
8	Transparency Strength	0.34	-0.07	0.04	-0.03	0.08	0.04	0.24	1.00				
9	Resolutions	0.13	0.08	0.07	-0.07	0.13	-0.01	0.23	0.11	1.00			
10	State Reg. Threat	0.02	-0.09	-0.13	0.03	-0.05	0.01	-0.07	0.04	-0.03	1.00		
11	GHG Emissions	0.31	0.03	0.27	-0.01	0.47	0.03	0.17	0.26	0.26	-0.15	1.00	
12	GHG Emissions^2	0.25	-0.12	0.16	0.01	0.35	-0.06	0.21	0.15	0.22	-0.11	0.68	1.00

* All coefficients great in absolute value that 0.04 are significant

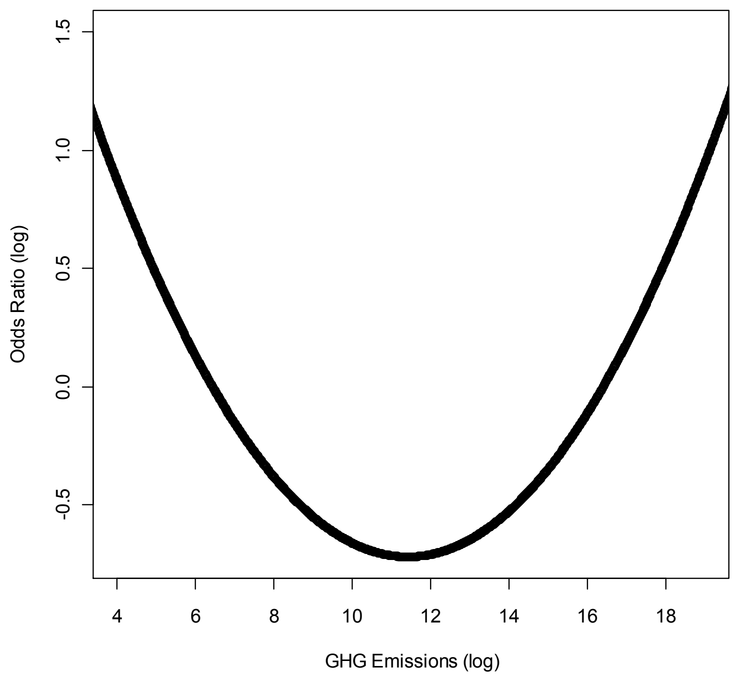
Table 3. 9 Logistic regression coefficient estimates (disclosure analysis)

	All Sectors		Climate Sensitive Sectors	
	(1)	(2)	(3)	(4)
Concentration Ratio	-0.58	-0.47	1.34	1.18
	(0.353)	(0.442)	(0.295)	(0.359)
Leverage	0.03	0.01	-0.57*	-0.58*
	(0.683)	(0.867)	(0.088)	(0.089)
Growth	-0.28	-0.27	-0.93	-0.91
	(0.459)	(0.432)	(0.484)	(0.487)
Capital Intensity	0.28**	0.27**	0.57**	0.54**
	(0.031)	(0.032)	(0.021)	(0.022)
Firm Performance	0.10	-0.06	-5.16*	-5.32*
	(0.908)	(0.942)	(0.071)	(0.064)
Firm Size	0.60***	0.58***	0.73**	0.74**
	(0.000)	(0.000)	(0.012)	(0.012)
Transparency Strength	2.02***	2.01***	1.42**	1.40**
	(0.000)	(0.000)	(0.043)	(0.047)
Resolutions	0.19	0.20	0.04	0.08
	(0.340)	(0.295)	(0.922)	(0.852)
CA	0.61**	0.63**	-0.21	-0.24
	(0.049)	(0.043)	(0.891)	(0.870)
RGGI	-0.01	0.00	0.10	0.09
	(0.962)	(0.996)	(0.870)	(0.880)
RPS	0.01	-0.03	0.02	0.00
	(0.958)	(0.891)	(0.953)	(1.000)
GHG Emissions	-0.01	0.07	0.04	0.24*
	(0.863)	(0.304)	(0.877)	(0.052)
GHG Emissions^2	0.03**		0.03	
	(0.029)		(0.468)	
Industry Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Observations	1839	1839	442	442
Firms	549	549	135	135
McFadden's R=squared	0.2367	0.2334	0.31	0.31
Log-likelihood	-974.4	-978.6	-198.9	-199.2

Robust p values in parentheses
* significant at 5%; ** significant at 1%

Again, we focus on the coefficient estimates for *GHG Emissions* and *GHG Emissions*^{2} in Model 2. We see in Table 3.9 that the coefficient for the linear term does not affect the likelihood of disclosure; however, the quadratic term is positive and significant ($p < 0.05$). This result confirms our hypothesis and suggests – similar to lobbying – a concave-up, curvilinear relationship between GHG emissions and disclosure. A graphical representation of this relationship – holding all other variables at their mean – is shown in Figure 3. 3. All else equal, we see that firms are the least likely to disclose when their GHG emissions are neither low nor high. As their emissions approach either end of the performance spectrum, however, the likelihood of disclosure increases.

Figure 3. 3 Curvilinear relationship between EP and disclosure



3.5.2.1. Tests of Robustness

A set of robustness tests similar to those applied to lobbying analysis were conducted for voluntary disclosure. The logistic regression results for climate sensitive industries are shown in Table 3. 9 (models 3 and 4). Unlike lobbying, however, the coefficient estimates for the independent variables (see model 3) are not robust to the sample change. The linear term in model 4 is positive and significant, suggesting that for climate sensitive industries the propensity to voluntarily disclosure climate change information increases with GHG emissions. Similarly, only the linear term is significant when the independent variable includes both Scope 1 and Scope 2 emissions (see Appendix Table A. 3), albeit a loss of 310 observations (due to missing values for Scope 2 emissions) weakens the comparability of these findings.

3.6. Discussion and Conclusion

In summary, our results support our hypothesis that environmental performance relates to political activity in a U-shaped manner. We find that firms on opposite ends of the environmental performance spectrum spend the most lobbying policy-makers and have greatest likelihood of voluntarily disclosing environmental information. Middle-of-the-road performers – firms with neither exemplary nor particularly poor performance records – spend the least and are the least likely to disclose. The U-shaped relationship is found to be robust for lobbying, while less consistent evidence is found for voluntary disclosure. We discuss the theoretical and empirical implications of these findings to the corporate political strategy literature.

Although it is widely accepted that greater political issue salience increases political activity, relatively little attention been devoted to unpacking this concept at the firm-level. Prior research has largely viewed salience as a factor external to the firm. But this perspective assumes no heterogeneity in the orientation of firms to the outcome of a given political issue. More specifically, scholars have largely viewed increased issue salience as a threat to business. This perspective is particularly evident in the context of environmental policy, where politically active firms are assumed to be unanimous in their opposition to environmental regulation. It follows from this view that green firms have little incentive to participate in the public policy process.

A small body of theoretical work and anecdotal evidence indicate, however, that greener firms can benefit from more stringent environmental standards. This suggests variation in issue salience across firms for a given issue and motivates this study to develop a conceptualization of issue salience that allows operationalization at the firm-level. By doing so, we show that firms with increasingly good or bad performance have a greater stake in the outcome of contested environmental policy issue (i.e. greater salience). These results shed new light on the perceived adversarial relationship between business and environmental policy. While confirming the stereotype that dirtier firms are more politically active, our findings suggest that greener firms are also vying for political influence. More generally, our results suggest that the salience of a given political issue can be both harmful and advantageous depending on whether the firm performs negatively or positively on the issue, respectively. These findings also support Baron's (1995) integrated strategy perspective, which posits a complementary relationship between non-market and market components required of an overall effective strategy. That our results imply firms are adapting their political strategies to issue performance suggests firms may indeed be integrating non-market and market strategies. More specifically, our results suggest firms may be reacting strategically to environmental regulatory uncertainty by aligning their environmental strengths and political strategies in the manner proposed by Fremeth & Richter (2011).

We also test our hypotheses on two complementary political tactics that have received surprisingly little attention in the empirical corporate political strategy literature: lobbying and voluntary disclosure. To the author's knowledge, this is the first study to test the relationship between environmental performance and lobbying. It also extends a small but growing literature that identifies voluntary disclosure as a tactic of a constituency building political strategy (e.g. Cho et al., 2006; William & Crawford, 2011). By testing both information and constituency building strategies, we show that the U-shaped relationship between environmental performance and political influence exists for direct and indirect channels. Focusing on environmental policy in general and climate change specifically, we also address a class of political issues with considerable material implications for business and a specific issue that is considered widely salient. To achieve this we create and analyze a novel data set that merges multiple years of GHG emissions, estimates of lobbying expenditures aimed at the issue of climate change, and responses to disclosure requests from the CDP.

Before highlighting avenues for future research, it is prudent to note several limitations of our study. First, although our results suggest heterogeneity in the desired policy outcome of politically active firms, this is inferred indirectly from environmental performance. Greater confidence in this inference could be gained from a more direct measure of each firm's stance on climate change. Second, while we find evidence of the U-shaped relationship between GHG emissions and voluntary disclosure, this disappears when the sample of firms is restricted to what we deem climate sensitive industries. Finally, the time period for our study concluded at what could be considered a peak in public concern for climate change. Since this period climate change legislation has stalled and public concern for climate change has flagged. This suggests a period of temporal variation in the issue's salience. Future research could examine how this change affects political activity and the firm-level factors that may modulate it.

4. Triangulating Environmental Performance: What do Environmental Ratings Really Capture?

4.1. Introduction

The emergence of Socially Responsible Investing (SRI), an investment philosophy that uses screens based on environmental and social preferences to select or avoid investing in companies (Renneboog, Ter Horst & Zhang, 2008), has led to the proliferation of ratings assessing corporate social responsibility and environmental performance. SRI has grown consistently in recent years, and currently some 12 percent ($3.07 trillion) of assets under professional management in the United States are invested with social responsibility in mind (Social Investment Forum, 2010). The financial sector is in a unique position to move corporations towards corporate sustainability (Levine & Chatterji, 2006; O'Rourke, 2003). This is because socially responsible firms included in these screens might be in a better position to attract capital. As SRI indexes become more prevalent, firms might compete to be part of such indexes by improving their environmental and social performance (Chatterji & Toffel, 2010).

Over fifty distinct rating methodologies for assessing environmental performance have been developed, more than a third of them since 2005 (Sadowski, Whitaker & Buckingham, 2010). In large part, these ratings are produced by small, specialized organizations, with an aim to provide non-financial performance indicators to supplement more traditional financial metrics. The proliferation of rating methodologies is attributable not only to increased demand but also to the inherent complexity of "environmental performance", an essentially artificial construct that can be interpreted and evaluated in many ways. Emphasis can be placed, for example, on greenhouse gas emissions, which contribute directly to climate change, an issue that many consider to be the most dire of environmental concerns. But climate change is only one of many ways in which corporate activity impacts the natural environment. In fact, environmental concerns are apparent in many other domains, including issues as diverse as water usage, biodiversity loss, and the release of toxic materials. The manner in which data is selected and aggregated in a single score inevitably prioritizes some issues over others, whether purposefully or not. Yet, the proprietary nature of rating methodologies often precludes full transparency and, as a consequence, little is known about the specifics behind each rating (Delmas & Doctori-Blass, 2010; Chatterji & Levine, 2006).

Unlike financial performance indicators, which over time have become well defined and standardized, there appears to be little convergence upon universally accepted environmental performance indicators. Yet, with an increasingly large number of ratings systems available, it is inevitably less likely for each new methodology to provide unique or complementary information on this construct. Ultimately, the emergence of a wide variety of rating systems, coupled with the disparity and opacity of the methodologies employed, calls into question the reliability and comparability of ratings, as well as their utility to investors, managers and researchers alike (Levine & Chatterji, 2006; Chatterji & Levine, 2008; Porter & Kramer, 2006). Because of the use of different metrics, investors might have little confidence in basing investment decisions on SRI screens (Levine & Chatterji, 2006). Furthermore, corporate managers might be confused on how to prioritize their investments in environmental improvements in order to improve the reputation of their firm with investors (Delmas & Doctori-Blass, 2010).

At the core of socially responsible investing is a fundamental question: can good environmental performance can be associated with good financial performance? While there is an important literature analyzing the link between environmental and financial performance, there is still uncertainty about the significance of the relationship (Barnett & Salomon, 2006; Brammer & Millington, 2008; Dowell, Hart, & Yeung, 2000; King & Lenox, 2001; Margolis & Walsh, 2003; Orlitzky, Schmidt, & Rynes, 2003; Ramchander, Schwebach, & Staking. 2012; Russo & Fouts, 1997; Sharfman, & Fernando. 2008; Waddock & Graves, 1997). Some have argued that these mixed results might be partly due to the difficulty of measuring environmental performance and to important differences among screening methodologies (Griffin & Mahon, 1997).

In this study, we attempt to determine whether the information provided by leading rating organizations can be reduced to a small number of unique dimensions that capture the cardinal aspects of environmental performance. To do so, we examine the environmental evaluations of over 200 US firms as assessed by KLD Analytics, Trucost and Sustainable Asset Management (SAM) from 2004 through 2007. We identify two underlying dimensions of environmental performance that explain the majority of variation in these three widely used sources of performance ratings. These two dimensions can be summarized as process measures and outcome measures. Importantly, we find that the process dimension of environmental performance is more significantly related to financial performance than the outcome dimension.

4.2. Environmental ratings

Rating methodologies for environmental performance are as varied as the data upon which they are based. Data that companies are legally required to disclose is minimal, and perhaps more importantly, not necessarily quantitative. To overcome these severe data constraints, some ratings organizations prefer to rely on self-reported information provided by companies, others utilize publicly available information such as media coverage, and yet others relying on sophisticated modeling based on industrial processes utilized in manufacturing processes (Delmas and Doctori-Blass, 2010). Each methodology has advantages and disadvantages, limited not only to the availability, granularity and veracity of data, but also the way in which it is aggregated and presented.

Although multiple methodological approaches can be viewed as sub-optimal, they can also provide insight and perspective (Ilinitch, Soderstrom, & Thomas, 1998). Akin to multiple measures of financial performance, such as Tobin's q, ROA and ROE, (Chakravarthy, 1986; Venkatraman & Ramanujam, 1986) distinct methodologies for assessing environmental performance add nuance to a complex concept. This variety gives investors and other audiences several options to evaluate performance and inform decision-making. However, whereas environmental performance is a construct no less complex than financial performance, its underlying dimensions are not as clearly defined or well understood.

4.2.1. Two Dimensions?

Researchers have developed various models for conceptualizing the corporate environmental performance (CEP) construct, the majority of which identify two dimensions. In particular, several recent studies posit a clear distinction between doing environmental "good" versus "bad." In other words, these studies suggest that positive environmental performance and negative environmental performance are not mirror images, and therefore one cannot be expressed as a linear transformation of the other. Minor & Morgan (2011), for example, claim that by "doing good" firms aren't necessarily "avoiding harm" to the environment. Using product ratings from KLD, the authors demonstrate the disparity between these two dimensions and how each (as well as their interaction) relates uniquely to firm value. Similarly, Mattingly & Berman

(2006) use KLD ratings to corroborate the claim that positive and negative social actions are empirically and conceptually distinct aspects of a more general social performance construct. Surprisingly, however, they do not find that this distinction applies to positive and negative environmental action. Strike, Gao & Bansal (2006) also show that responsible and irresponsible social behavior require separate measurement and that each has a distinct correlation to financial performance.

Other researchers, again using KLD ratings, have also identified two dimensions of corporate environmental performance based on the target stakeholder group. Focusing on the financial consequences of social actions, Hillman & Keim (2001) differentiate between actions aimed at primary (e.g. employees, customers, and communities) versus secondary stakeholders (e.g. those associated with social issues not directly related to the firm) and demonstrate that only the former are associated with profitability. In contrast, yet using the same data set, Godfrey, Merrill & Hansen (2009) show that firms derive an 'insurance-like' benefit from engaging in *institutional* CSR activities (i.e. those which benefit secondary stakeholders), but not from *technica*l CSR activities (i.e. those targeting primary stakeholders).

Finally, researchers have dichotomized social and environmental ratings as forward- versus backward looking. In their assessment of the accuracy of KLD environmental ratings, Chatterji, Levin & Toffel (2009) emphasize the need for ratings to capture both historical environmental performance and current managerial practices. Historical performance is based on "hard" measures of prior environmental impacts (e.g. toxic pollutants and greenhouse gas emissions). Measures of current managerial practices are more process-oriented. They include what Chen & Delmas (2010) call "soft" measures (e.g. adoption of the international environmental management standard ISO 14001), and can provide an assessment of future performance, that will be attainable through the processes that are in place. Busch & Hoffmann (2011) distinguish environmental ratings along similar lines, but adopt instead an output- versus process-based framework originally developed by Wood (1991). Output-based measures take into account only environmental impacts whereas process-based measures consider internal efforts, such as commitment to environmental causes, sophistication of environmental management systems and managerial quality in general. Using survey responses, Busch & Hoffmann (2011) find that their output-based measure – self-reported GHG emissions – has a positive relationship with financial performance, while the opposite is true for process-based measures.

In summary, researchers have relied on multiple independent ratings to quantify the environmental performance construct. Attempting to more clearly delineate it, scholars have both conceptually and empirically identified two dimensions underlying environmental performance. While there appears to be agreement on the number of dimensions and that they may differentially relate to financial performance, there is little consensus in the literature on what each dimension represents and thus what environmental ratings actually measure. Moreover, in investigating these dimensions, scholars have relied primarily on social and environmental ratings produced by KLD, rather than incorporating multiple independent ratings to more robustly capture the essence of environmental performance (for a recent exception, see Walls, Phan & Berrone, 2011).

4.3. Methods

4.3.1. Environmental Performance Ratings

We examine environmental performance ratings produced by three different companies: Trucost, KLD and SAM. The widespread reliance on these ratings in scholarly publications is depicted in Table 4. 1.

4.3.1.1. Trucost

Trucost performance indicators quantify a broad range of environmental impacts for the largest publicly traded US companies, including all Standard and Poor (S&P) 500 firms. The variables cover both direct and supply chain activities, such as emissions and waste production, water abstraction, natural resource use and raw materials extraction. Where available, Trucost collects, standardizes, and validates company reported environmental data from annual reports, corporate websites or other public disclosures. Where not disclosed publicly, data are calculated from global fuel use, or imputed by conducting a detailed sector breakdown of each firm and applying a proprietary input-output (IO) economic model based on government census and survey data, industry data and statistics and national economic accounts. Trucost then quantifies the various environmental impacts and damage costs associated with these extractions and emissions using methodologies developed in the environmental economics literature, which are vetted by an independent academic advisory panel.

Table 4. 1 Environmental performance ratings literature

Publication	Article(s)	KLD	SAM	Tru-cost
Strategic Management Journal	Chatterji & Toffel (2010); Choi & Wang (2009); Godfrey, Merrill & Hansen (2008); Hillman & Keim (2001); Hull & Rothenberg (2008); Kacperczyk (2009); Muller & Kraussl (2011); Sharfman & Fernando (2008); Waddock & Graves (1997b); Walls, Berrone & Phan (2012)	10	0	0
Academy of Management Journal/Review	Agle et al. (1999); Berman et al. (1999); Brown & Perry (1994); Graves & Waddock (1994); Johnson & Greening (1999); Marquis et al. (2007); Rhee & Valdez (2009); Slater & Dixon-Fowler (2010); Thomas & Simerly (1995); Turban & Greening (1996); Wong et al. (2011)	11	0	0
Journal of Management	Chiu & Sharfman (2011); de Villiers, Naiker & va Staden (2011); Deckop et al. (2006); Doh, Howton, Howton & Seigel (2010); Neubaum and Zahra (2006); Ruf et al. (1998); Wang & Choi (2010)	7	0	0
Intl. Journal of Management	Kennelly & Lewis (2002); Simerly (2003)	2		
Business & Society	Backhaus et al. (2002); Dawkins (2002); Garcia-Castro, Arino & Canela (2011); Godfrey, Hatch & Hansen (2010); Griffin & Mahon (1997); , Luce et al. (2001); Mattingly & Berman (2006); Moura-Leite, Padgett & Galan (2011); Post, Rahman & Rubow (2011); Rehbein et al. (2004); Shropshire & Hillman (2007); Waddock & Graves (1997a); Walls, Phan & Berrone (2011); Williams & Crawford (2011)	14	0	0
Journal of Business Ethics	Albinger & Freeman (2000); Banea & Rubin (2010); Bartkus & Glassman (2008); Bear, Rahman & Post (2010); Bingham, Dyer Jr., Smith & Adams (2011); Bird et al. (2007); Bouquet & Deutsch (2008); Briscoe & Safford (2008); Cai, Jo & Pan (*Forthcoming*); Cai, Jo & Pan (2011); Chen et al. (2008); Chen & Delmas (2010); Cho et al. (2006); Dawkins & Fraas (2011a); Dawkins & Fraas (2011b); Garcia-Castro, Arino & Canela (2010); Harjoto & Jo (2011); Igalens & Gond (2005); Jackson & Apostolahou (2009); Jo & Harjoto (2011); Liston-Heyes & Ceton (2008); Makni, Francoeur & Bellavance (2009); Manner (2010); McGuire et al. (2003); Minor & Morgan (2011); Schreck (2011); Padgett & Galan (2010); Ruf et al. (2001); Slater & Dixon-Fowler (2009); Van der Laan et al. (2008); Wagner (2010)	28	2	1
Other	Amato & Amato (2011); Atriach, Lee & Belson (2010); Cambell & Sherman (2010); Chang & Kuo (2008); Chatterji, Levine & Toffel (2009); Cho & Patten (2007); Cho, Roberts & Patten (2010); Dahlmann & Brammer (2011); de Villiers & van Staden (in press); Delmas & Blass (2010); Eccles, Ioannou & Serfeim (*HBS, Working Paper*); Etzion (2009); Fisher-Vaden & Thornburn (2011); Henriques & Sadorsky (2010); Jira & Toffel (*HBS, Working Paper);* Kane et al. (2005); Kempf et al. (2007); Landier et al. (2009); Marquis & Toffel (*HBS, Working Paper*); Meric, Watson & Meric (2012); Neiling & Webb (2009); Slater & Dixon-Fowler (2010); Strike, Gao & Bansal (2006); Waldman et al. (2006); Webb (2004); Ziegler & Schroder (2010)	16	5	5
Totals	*101*	*88*	*7*	*6*

4.3.1.2. KLD

KLD Research & Analytics rates the social performance of all firms listed on the Russell 3000, representing approximately 98% of the investable U.S. equity market. The KLD database creates seven individual binary ‘strength’ and ‘concern’ scores, respectively, across a range of environmental performance categories, including: products and services (e.g. beneficial products and services and agricultural chemicals); operations and management (e.g. pollution prevention, recycling, management systems, and substantial emissions) and climate change (e.g. clean energy and revenues from coal oil and derivative products). These assessments are based on publicly available information from a comprehensive set of media providers, and do not rely at all on data provided by the companies themselves. While thus ensuring greater objectivity, KLD ratings are much less granular than those found in other methodologies, capturing primarily noteworthy environmental activity, whether positive or negative, as reported by media sources. It is by far the most widely used data set in research on environmental performance (Etzion, 2007)

4.3.1.3. SAM

Sustainable Asset Management (SAM) is a Swiss company specializing in sustainability investments. SAM partners with Dow Jones Indexes and STOXX in determining and tracking the Dow Jones Sustainability Index (DJSI), and focuses primarily on the largest 2500 companies (by market cap) listed in the Dow Jones Wilshire Global Total Market Index, comprised of the largest firms in developed and emerging markets. Unlike KLD, the basis of SAM’s rating methodology is firm responses to sustainability surveys, performed and analyzed annually. SAM asks companies in its universe to fill in detailed web-based questionnaires regarding various aspects related to their economic, social and environmental performance. Response rates are roughly 20%. An additional group of companies, also comprising around 20% of the SAM universe, is analyzed with publicly available information. These are firms that have participated in past surveys, or that SAM analysts believe are especially worthwhile of coverage, usually because they are large. In sum, analysis is available for around 40% of the world's largest companies.

4.3.2. Measures

We extract from each of the three data providers the most significant measures of environmental performance that have been used in the literature (See Table 4. 2). From Trucost we use the *Total Environmental Damage Cost* variable for each firm, which aggregates all direct and indirect damage variables. Based on the KLD data, we create two variables – *Total Strengths* and *Total Concerns* – by separately aggregating all environmental strength and concern scores, respectively, for each firm. From SAM, we use two measures: eco-efficiency and environmental reporting. *Eco-efficiency* is based on comparison of resource inputs (i.e. water use (in cubic meters) and total energy consumption (giga-joules)) to outputs (i.e. greenhouse gas emissions (in metric tons of CO2 equivalents) and total waste generation (metric tons)). *Environmental reporting* evaluates the quality and degree of transparency in environmental reporting based on company disclosures and reports

Our analysis incorporates all firms common to all three data sets, essentially encompassing the largest public US firms in the years 2004 – 2007. Merging these data yields an unbalanced panel encompassing 475 firms and a total of 1072 complete firm-year observations. Table 4. 3 and Table 4. 4 provide descriptive statistics and correlations.

Table 4. 2 Environmental ratings descriptions

Ratings	Variable Name	Description
Trucost	Total Damage Cost	Total environmental damage cost (mUSD) associated with firm activity
KLD	Concerns Total	Total Environmental Concerns: Hazardous waste, regulatory problems, substantial emissions, climate change
	Strengths Total	Total Environmental Strengths: Beneficial products & services, pollution prevention, recycling, clean energy, communication, management systems
SAM	Eco-efficiency	Energy and water usage (inputs) versus GHG emissions & waste (outputs)
	Reporting	Environmental Reporting

Table 4. 3 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Trucost Total Damage	741	665.23	1314.77	1.21	13323.73
KLD Total Concerns	741	0.63	1.09	0.00	5.00
SAM Eco-efficiency	741	21.45	34.09	0.00	100.00
SAM Reporting	741	36.56	36.93	0.00	100.00
KLD Total Strengths	741	0.54	0.90	0.00	4.00
PC *environmental processes*	741	0.09	1.04	-2.91	3.42
PC *environmental outcomes*	741	0.04	1.03	-1.47	6.94
Leverage	741	-2.55	3.45	-16.12	0.24
Growth	741	-2.36	0.99	-16.12	-0.32
Capital Intensity	741	-2.99	0.97	-6.69	0.38
Firm Size	741	9.05	1.25	6.10	12.53

Table 4. 4 Correlation matrix of environmental ratings

	Variable	1	2	3	4	5
1	Trucost *Total Damage*	1.00				
2	KLD *Total Concerns*	0.61	1.00			
3	SAM *Eco-efficiency*	0.35	0.46	1.00		
4	SAM *Reporting*	0.32	0.44	0.76	1.00	
5	KLD *Total Strengths*	0.23	0.38	0.66	0.58	1.00

*All coefficients are significant at the 5% level

4.3.3. Stage 1: Principal Component Analysis

We use Principal Component Analysis (PCA), a method developed to reduce the dimensionality of a data set in which there are a number of interrelated variables, while retaining as much of the variation as possible (Jolliffe, 2002). PCA replaces *p* correlated variables with q uncorrelated variables (called 'components') in such a way that minimizes loss of information, where $p > q$. Each component is a linear combination of the measured variables:

$$y_j = a_{1j}x_1 + a_{2j}x_2 + \cdots + a_{pj}x_p ,$$

where $x_1x_2, \ldots, x_p$ are the standardized original measurement and the a_{ij}'s are *coefficients* for variable *i* on component j. The coefficients reflect the relative contribution each variable makes the component, and are commonly rescaled to reflect the most important components. The rescaled coefficients are called *component loadings* and are interpreted as the correlation coefficient between variable *i* and component *j*. Each component y_j accounts for a portion of the overall variation. The principal components are the q components that account for the highest amount of variation. By construction, the components are orthogonal to each other and thus describe a unique dimension of variation. The components can therefore be interpreted by examining how the variables in each subset relate to one another and, in turn, are distinct from other subsets.

In the first part of our analysis we identify the principle components captured by the three methodologies. We used IBM SPSS Statistics 19 PCA command with Varimax rotation. Table 4. 5 describes the results, and the two most significant components – accounting for nearly 80% of the variance in the data – suggesting that indeed environmental performance can generally be disentangled into two primary dimensions.

Looking at the loadings of each environmental rating on the principal components suggests that the processes and practices that a company adopts (whether symbolically or substantively) to mitigate the environment impacts of producing its product or service constitute the first dimension. The environmental ratings loading on the first principal component – KLD Strengths, SAM Eco-efficiency and Reporting – have little to do with measurable, 'end-of-the-pipe' environmental damages. KLD strengths, for example, takes into account whether: the firm's revenue comes from products or services that benefit the environment; the firm has adopted pollution prevention, recycling, and clean energy technologies; the firm clearly and transparently communicates its environmental initiatives; and/or has committed to voluntary environmental management systems (e.g. ISO 14001). That SAM Eco-efficiency also loads highly suggests that this dimension can be more loosely conceptualized as a firm's production function, that is, how a firm uses its inputs relative to what it produces. Thus, we label the first dimension *PC environmental processes.*

Both KLD Concerns and Trucost Total Environmental Damage load highly on the second principal component. It is clear the latter environmental rating attempts to measure actual environmental impact, and – on closer inspection – so too does the former. KLD Concerns indicates whether a firm has poor record of managing: hazardous waste, agricultural chemicals, toxic emissions, regulatory compliance and GHG emissions. As such, the second dimension appears to represent the externalities (i.e. direct environment impacts) resulting from a firm's economic activity. Thus, we label the second dimension *PC environmental outcomes*.

Table 4. 5 Principal component analysis

Data Source	Environmental Performance Variable	Component (rotated)		Component	
		1	2	1	2
SAM	Eco-efficiency	0.87	0.26	0.87	-0.28
SAM	Reporting	0.85	0.24	0.83	-0.29
KLD	Strengths Total	0.85	0.11	0.76	-0.39
KLD	Concerns Total	0.11	0.92	0.74	0.49
Trucost	Total Damage	0.32	0.83	0.62	0.69
	Eigenvalue	2.32	1.66		
	Variation Explained	46.34%	33.17%		
	Cumulative Variation Explained	46.34%	79.50%		

4.3.4. Stage 2: Financial Impact

In the second stage of our analysis we use panel data analysis to examine the relationship between each of the two principal components and firm value. Below we describe the variables and methods.

4.3.4.1. Dependent Variable

Tobin's q is used to measure firm value. Tobin's q is defined as the ratio of a firm's market value to the replacement cost of its assets, which this study approximates using the method developed in Chung & Pruitt (1994). Tobin's q is widely used in empirically studies of the environmental-financial performance relationship (Busch & Hoffmann, 2011; Dowell, Hart & Yeung, 2000; King & Lenox, 2002; Konar & Cohen, 2001). Calculating Tobin's q requires a relatively high number of financial variables, making it susceptible to missing values. As such, the sample size for the regression analysis is reduced (see Table 4. 7).

4.3.4.2. Independent Variable

The two principal components *PC environmental processes* and *PC environmental outcomes* constitute our independent variables. Each principal component is a linear transformation of the original five environmental ratings.

4.3.4.3. Control Variables

We include several financial variables to control for firm-level heterogeneity. Firm total assets are used to account for variation in *firm size*, while *leverage* is approximated by the ratio of total debt to total assets. We include the variable *growth*, defined as the annual change in sales divided by total sales, to control for variations in production (King & Lenox, 2002). Capital expenditures divided by total sales is used as a measure of *capital intensity* (Elsayed & Paton, 2005; King & Lenox, 2002). Although suggested as a necessary control variable (McWilliams & Siegel, 2000), due to a prohibitively large number of missing values for research and development expenditures in the Compustat database, this variable was not included in our analysis. To correct for skewed distributions, each of the financial control variables is transformed using the natural logarithm. Finally, year and industry dummy variable control for annual trends and differences across sectors.

4.3.5. Analysis

Our model of firm financial performance is:

$$y_{it+1} = \alpha_i + \beta X + \mu_{it}, \; i = 1,\dots,N; \; t = 1,\dots,T$$

where y_{it+1} is the financial performance of firm i in year $t+1$, α_i is the unobserved firm-level effect, and β is the vector of estimated regression coefficients for each of the explanatory variables measured in the matrix, X (Woolridge, 2006). To account for time it takes for environmental information to become available to the market (Chatterji et al, 2009), the observations in X are one year behind the dependent variables.

Coefficients are estimated based on a random effects model. Random effects is appropriate when the number of panels (i.e. firms) greatly exceeds the time dimension, as is the case with our unbalanced sample (i.e. 475 firms over four years). Randomly assigning the firm-level effect allows for estimation to be based on variation across firms. The fixed effects, although a conservative approach, relies on variation within firms (Baltagi, 2005). Moreover, the random effect is appropriate as we wish to draw inference to a larger population of firms than those represented in our sample. We thus base our model choice on the structure of our panel data (Baltagi, 2005; Dowell et al., 2000; Elsayed & Paton, 2005).

Table 4. 6 contains the correlation matrix of regression variables, and regression results are described in Table 4. 7. We focus on model 3, which includes the *PC environmental processes* and *PC environmental outcomes* variables. The results show that *PC environmental processes* has a significant and positive impact on Tobin's Q ($p > 0.001$). The estimated marginal effect suggests that, all else equal, a one standard deviation increase in the environmental processes dimension is associated with a 0.116 increase in Tobin's q (6% increase relative to the mean). The coefficient for *PC environmental outcomes* is also positive, but does not differ significantly from zero. To confirm the validity of our findings, we repeated the analysis using Return on Assets (ROA) as the dependent variable and obtained substantively identical results. As a further robustness test, we run the same analysis with no lag structure and again find identical results.

Interestingly, when we use the individual variables that constitute the principal components (model 2), only *eco-efficiency* is significant ($p > 0.05$). This is likely a result of collinearity (see Table 4. 6) between the constituent variables and evidence that model 2 is overly specified. With just two principal components – which explain nearly 80% of the variation in the independent variables of model 2 – the results of model 3 are more reliable.

Table 4. 6 Correlation matrix of regression variables

	Variable	1	2	3	4	5	6	7	8	9	10	11
1	Trucost *Total Damage*	1.00										
2	KLD *Total Concerns*	0.59	1.00									
3	SAM *Eco-efficiency*	0.30	0.39	1.00								
4	SAM *Reporting*	0.25	0.37	0.74	1.00							
5	KLD *Total Strengths*	0.19	0.30	0.64	0.57	1.00						
6	PC *environmental processes*	0.05	0.24	0.87	0.84	0.84	1.00					
7	PC *environmental outcomes*	0.90	0.82	0.19	0.16	0.05	-0.09	1.00				
8	Leverage	0.14	0.17	0.14	0.09	0.09	0.09	0.15	1.00			
9	Growth	-0.10	-0.10	-0.10	-0.16	-0.13	-0.13	-0.08	-0.05	1.00		
10	Capital Intensity	0.10	0.19	0.06	0.12	-0.01	0.03	0.16	0.06	0.02	1.00	
11	Firm Size	0.47	0.40	0.38	0.38	0.26	0.29	0.43	0.23	-0.11	0.11	1.00

*All coefficients above 0.061 are significant at the 5% level

4.1. Discussion and Conclusion

Corporate environmental performance, like financial performance, is an elusive and contestable metric. Yet it is undoubtedly becoming an important one, as attested to by increased reporting and scrutiny, with ever increasing amounts of data churned out by corporations, regulators and rating organizations. This abundance of riches, however, may well constitute a double-edged sword. More information can yield more precise analysis and verifiability, but it can also be misleading and confusing. Our study has attempted to identify a useful balance between the competing needs for robustness and simplicity by assessing the commonality and distinctiveness of measures of environmental performance generated by three of the rating organizations covering large US corporations.

Table 4. 7 Regression analysis (Tobin's q)

Variables		Model	
	1	*2*	*3*
PC environmental processes			0.116
			(0.005)**
PC environmental outcomes			0.030
			(0.568)
Trucost Total Damage		0.000	
		(0.408)	
KLD *Total Concerns*		-0.051	
		(0.273)	
SAM *Eco-efficiency*		0.004	
		(0.018)*	
SAM *Reporting*		0.002	
		(0.240)	
KLD *Total Strengths*		-0.030	
		(0.518)	
Leverage	-0.041	-0.042	-0.042
	(0.000)**	(0.000)**	(0.000)**
Growth	0.036	0.036	0.041
	(0.215)	(0.230)	(0.162)
Capital Intensity	0.100	0.090	0.088
	(0.026)*	(0.043)*	(0.050)*
Firm Size	-0.132	-0.174	-0.168
	(0.000)**	(0.000)**	(0.000)**
Observations	741	741	741
R-squared	0.27	0.31	0.30
Number of groups	391	385	385

p values in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Corroborating prior research, we found that environmental performance cannot be reduced to one dimension, but that two dimensions are perhaps sufficient to depict it accurately, by capturing nearly 80% of the variance of the data. Whereas prior research has suggested a dichotomy of "good" vs. "bad" dimensions *or* process vs. outcome dimensions *or* historical vs. current dimensions, our results suggest that these dimensions in fact overlap. The practices and processes companies adopt ostensibly to mitigate future environmental impacts constitute one dimension, whereas actual environmental impacts (i.e. the externalities) constitute a different dimension.

Yet, the fact that there are indeed two distinct dimensions implies that process and outcome, at least as pertains to environmental impacts, are less linked than we would perhaps expect. Companies may excel at reporting, governance and the utilization of environmental performance systems, yet they may still emit substantial amounts of pollution. Or, more cynically, they may put in place processes for symbolic purposes, but not meaningfully pursue substantial outcomes. Process measures can be easily communicated by companies, and so are convenient for environmental rating purposes. Simply due to this fact, they might be utilized more widely than outcome performance measures which are often not required by law and more difficult to attain.

If this is indeed true, it is perhaps unsurprising to find financial performance uncorrelated with outcomes measures, yet positively correlated with process measures. Markets can only respond to information available to them. If process measures are more abundant and can be easily fed into ratings methodologies, they will influence market valuation. Interpreting the process dimension more generically as a firm's production function, it may also serve as an indicator of overall managerial acumen and competence. As socially responsible investors must balance environmental performance with profitability it is, again, not surprising that such a measure has a positive association with financial performance. This may also explain the positive relationship found in studies of the environmental-financial performance relationship. Indeed, as many scholars have suggested, higher environmental ratings may simply identify better managed firms.

Ideally, these processes would translate into expected outcomes. However, as our analysis demonstrates, processes and outcomes are distinct dimensions. Even if one is ascertained precisely, it sheds little light on the other. But it is these actual environmental outcomes, with their tangible and material impacts on the earth that ultimately matter. Our financial systems, it seems, have yet to embrace this fact.

Because there are so many ways to evaluate firms' environmental performance and because of the current lack of standards in this area, there is the risk that investors might lose confidence in the approach. Transparency will increase the credibility of sustainability ratings and will also facilitate the standardization and potential diffusion of these ratings. Although we focused on corporate environmental performance, similar issues would be raised for the measurement of social performance and further research should incorporate these social dimensions in the analysis.

5. Appendix

Table A. 1 Tobit regression (lobbying) using redefined independent variable (i.e. Scope 1 & Scope 2 GHG emissions)

	All Sectors		Climate Sensitive	
	(1)	(2)	(3)	(4)
Concentration Ratio	4,498,865**	4,279,891**	172,079	-504,057
	(0.001)	(0.005)	(0.937)	(0.839)
Leverage	-434,608	-887,671	117,577	-126,180
	(0.323)	(0.110)	(0.877)	(0.879)
Growth	289,870	1,290,626	2,714,969	5,487,262**
	(0.862)	(0.492)	(0.238)	(0.030)
Capital Intensity	365,851	269,752	-68,084	-107,028
	(0.317)	(0.508)	(0.890)	(0.838)
Firm Performance	-7,130,444	-8,134,447	17,163,502*	17,242,855*
	(0.079)	(0.072)	(0.061)	(0.080)
Firm Size	2,278,395**	2,096,616**	2,334,332**	2,787,161***
	(0.000)	(0.000)	(0.013)	(0.007)
Transparency Strength	1,109,579	1,367,271	1,882,017	2,358,471*
	(0.137)	(0.081)	(0.137)	(0.095)
Resolutions	1,005,222	1,419,849	1,233,651	1,692,746
	(0.286)	(0.122)	(0.339)	(0.188)
CA	2,169,787	1,416,531	6,220,144	4,496,046
	(0.379)	(0.586)	(0.168)	(0.352)
RGGI	781,122	265,300	-1,569,996	-1,555,344
	(0.345)	(0.728)	(0.361)	(0.360)
RPS	-107,165	5,401	-542,098	-557,754
	(0.822)	(0.992)	(0.405)	(0.465)
GHG Emissions	-1,638,875**	-152,128	-3,636,136**	-319,840
	(0.001)	(0.745)	(0.014)	(0.675)
GHG Emissions^2	263,378**		482,021**	
	(0.008)		(0.013)	
Industry Dummy	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes
Observations	151	151	73	73
Firms	143	143	72	72
Pseudo R-squared	0.0237	0.0206	0.0240	0.0205

p values in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table A. 2 Tobit regression (lobbying) including interaction of environmental and financial performance

	(1)	(2)	(3)	(4)
Concentration Ratio	3,663,394**	3,650,247**	3,683,395**	3,693,610**
	(0.004)	(0.004)	(0.004)	(0.005)
Leverage	-674,212*	-739,250*	-718,157*	-962,608*
	(0.015)	(0.017)	(0.023)	(0.013)
Growth	683,630	728,629	497,805	888,689
	(0.337)	(0.345)	(0.518)	(0.294)
Capital Intensity	198,974	142,642	147,658	2,629
	(0.408)	(0.596)	(0.595)	(0.993)
Firm Performance	-5,781,796	-9,976,615*	-3,874,426	-4,738,484
	(0.061)	(0.017)	(0.126)	(0.060)+
Firm Size	1,819,235**	1,920,090**	1,841,821**	1,875,429**
	(0.000)	(0.000)	(0.000)	(0.000)
Transparency Strength	857,468	799,729	970,804	1,163,709*
	(0.125)	(0.154)	(0.090)	(0.045)
Resolutions	1,443,927*	1,540,785*	1,521,832*	1,772,822**
	(0.029)	(0.020)	(0.023)	(0.009)
CA	980,173	1,204,706	1,401,177	1,127,173
	(0.530)	(0.453)	(0.375)	(0.491)
RGGI	748,458	715,499	691,693	334,144
	(0.303)	(0.327)	(0.348)	(0.629)
RPS	-89,992	-124,420	-72,283	-132,712
	(0.807)	(0.737)	(0.843)	(0.739)
GHG Emissions	-468,321*	-877,633**	-751,802**	-75,075
	(0.036)	(0.001)	(0.001)	(0.699)
GHG Emissions^2	54,780	127,271*	131,789*	
	(0.309)	(0.010)	(0.014)	
GHG x Firm Performance	-5,692,215+	2,525,588		
	(0.094)	(0.189)		
GHG^2 x Firm Performance	1,483,318+			
	(0.068)			
Industry Dummy	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes
Observations	285	285	285	285
Firms	178	178	178	178
Pseudo R-squared	0.0256	0.0240	0.0234	0.0212

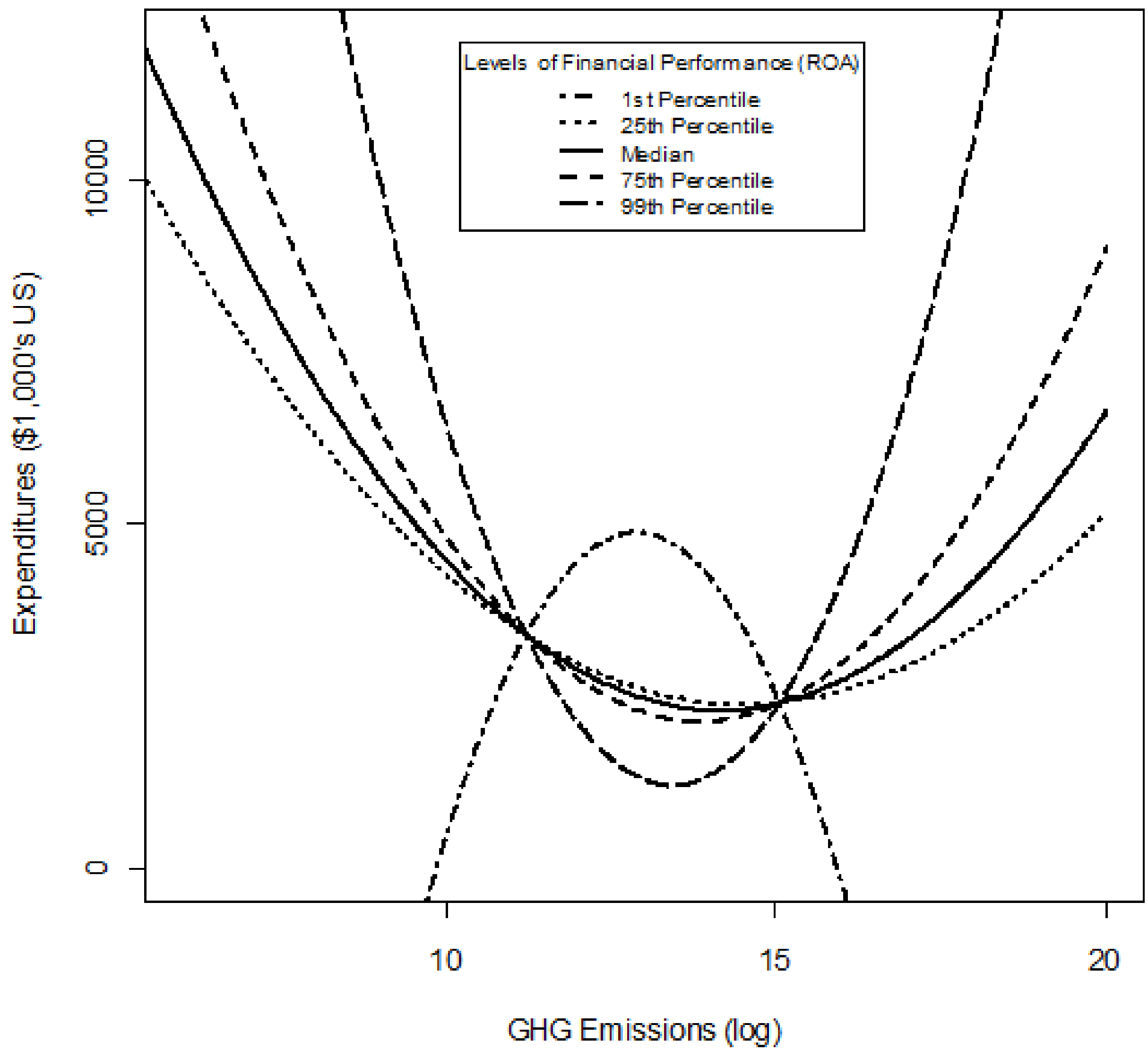
Robust p-values in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table A. 3 Logistic regression (disclosure) using redefined independent variable (i.e. Scope 1 & Scope 2 GHG emissions)

	All Sectors		Climate Sensitive Sectors	
	(1)	(2)	(3)	(4)
Concentration Ratio	-0.52	-0.49	2.07	1.97
	(0.423)	(0.445)	(0.168)	(0.191)
Leverage	-0.01	-0.01	-0.90**	-0.92**
	(0.936)	(0.875)	(0.020)	(0.019)
Growth	-0.22	-0.22	-1.53	-1.51
	(0.534)	(0.531)	(0.262)	(0.267)
Capital Intensity	0.34***	0.34***	0.69***	0.67***
	(0.009)	(0.009)	(0.007)	(0.006)
Firm Performance	-0.36	-0.40	-6.98	-6.96
	(0.724)	(0.695)	(0.123)	(0.128)
Firm Size	0.37***	0.36***	0.52	0.52
	(0.002)	(0.002)	(0.105)	(0.106)
Transparency Strength	2.01***	2.01***	1.60**	1.57**
	(0.000)	(0.000)	(0.027)	(0.029)
Resolutions	0.16	0.16	0.02	0.03
	(0.454)	(0.449)	(0.964)	(0.952)
CA	0.60*	0.60*	0.02	-0.02
	(0.053)	(0.052)	(0.991)	(0.987)
RGGI	-0.01	-0.01	0.25	0.26
	(0.964)	(0.967)	(0.668)	(0.664)
RPS	0.09	0.08	-0.01	-0.02
	(0.674)	(0.707)	(0.977)	(0.951)
GHG Emissions	0.25**	0.27***	0.16	0.34**
	(0.010)	(0.002)	(0.616)	(0.029)
GHG Emissions^2	0.01		0.03	
	(0.553)		(0.545)	
Industry Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Observations	1,529	1,529	343	343
Firms	520	520	127	127
McFadden's R-squared	0.2456	0.2453	0.3429	0.3417
Log-likelihood	-799.5	-799.7	-147.8	-148.1

Robust p-values in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure A. 1 Graphical interpretation (lobbying) of curvilinear effect at varying levels of financial performance



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