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Accounting for the Environment: More Talk and Little Progress

Martin Freedman
Bikki Jaggi
Editors

Emerald

ACCOUNTING FOR THE ENVIRONMENT: MORE TALK AND LITTLE PROGRESS

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ADVANCES IN ENVIRONMENTAL ACCOUNTING &
MANAGEMENT VOLUME 5

ACCOUNTING FOR THE ENVIRONMENT: MORE TALK AND LITTLE PROGRESS

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CONTENTS

EDITORS *vii*

LIST OF CONTRIBUTORS *ix*

LIST OF AD HOC REVIEWERS *xi*

EDITORS' INTRODUCTION *xiii*

AN EXAMINATION OF THE RELATIONSHIP BETWEEN CORPORATE SOCIAL RESPONSIBILITY AND FINANCIAL PERFORMANCE: THE CASE OF CHINESE STATE-OWNED ENTERPRISES
Robert W. Rutledge, Khondkar E. Karim, Mark Aleksanyan and Chenlong Wu *1*

TOWARDS A MORE COMPREHENSIVE FRAMEWORK FOR SUSTAINABILITY CONTROL SYSTEMS RESEARCH
Angelo Ditillo and Irene Eleonora Lisi *23*

MEASURING ENVIRONMENTAL PERFORMANCE: IS *NEWSWEEK*'S GREEN RANKING THE SOLUTION?
Yu Cong, Martin Freedman and Jin Dong Park *49*

CORPORATE GOVERNANCE AND ENVIRONMENTAL ACTIVITY
Martin Stuebs, Jr. and Li Sun *81*

SEC GUIDANCE ON CLIMATE CHANGE RISK DISCLOSURES: AN ASSESSMENT OF FIRM AND MARKET RESPONSES
Joan DiSalvio and Nina T. Dorata *115*

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EDITORS' INTRODUCTION

When we first started working on this series in 1998 the Kyoto Protocol (Protocol) had just been signed and there was tremendous awareness as to the impact of pollution on the planet. It appeared that world leaders, working together, would be able to lead us in an era of rising living standards and diminished pollution. Sustainable development, seemingly, was a realistic goal.

The end of 2012 concluded the first phase of the Protocol. The EU agreed to reduce their pollution emissions to 92 percent of 1990's carbon emissions and they succeeded in accomplishing that goal. Unfortunately, the United States never ratified the Protocol, and Canada, although it did agree to reduce its emissions by 94 percent of 1990's carbon emissions, dropped out of the Protocol. Australia agreed to participate in the Protocol when it was already in effect, and created a carbon tax to facilitate the reduction in carbon emissions. Unfortunately, they recently rescinded the tax. Finally, India and China ratified the Protocol but they agreed to no reductions, and China is now the largest producer of carbon emissions in the world.

Despite what is a litany of mostly bad news about greenhouse gases and especially carbon emissions, some positive events are taking place to deal with pollution problems. In the United States, nine northeastern states have created the Regional Greenhouse Gas Initiative which has reduced carbon emissions about 30 percent since it was implemented in 2009. California has created a similar system that is just being implemented. A consortium of Midwestern states has discussed creating a regional network similar to the northeastern states. The Environmental Protection Agency (EPA) is planning to take drastic steps to limit the use of coal in electricity production. The EU continues to limit carbon emissions based on extending the Protocol and extending emissions goals.

The accounting profession, however, continues to operate as if sustainability is not a meaningful concept. As we discussed in the last volume of this series, it pays lip service to the concept, but it takes no action to provide meaningful information to stakeholders. There is one bright spot,

however. The Securities and Exchange Commission (SEC) issued an interpretive release that went into effect in February 2010 and required the firms impacted by the climate change to divulge all climate-change-related information that has an impact on their financial performance (mainly in their 10K). Therefore, companies reporting to the SEC (essentially all US public companies and foreign registrants to US stock exchanges) must determine the impact of climate change on the firm and report it to the stakeholders. Although the accounting profession is essentially avoiding the issue, the US government is forcing the firms and their accountants (since 10Ks are audited) to deal with the issue.

The views of accounting educators seem to reflect those of the accounting profession. Sustainable/environmental accounting is rarely taught. It is not a topic that is usually covered in accounting undergraduate, Masters, or PhD programs in North America or anywhere else in the world. Although a number of excellent journals publish environmental/sustainability accounting research, some of the top journals in accounting, however, ignore this issue. We find it unfortunate that an issue of such importance to human kind is ignored by these journals.

The first chapter in this volume by Robert W. Rutledge, Khondkar E. Karim, Mark Aleksanyan, and Chenlong Wu is devoted to the study of relationship between corporate social responsibility (CSR) performance and corporate financial performance of Chinese firms. The authors focus on 66 Chinese state-owned enterprises, all of which are listed on the stock exchanges in Shanghai or Shenzhen. Results of the study indicate a negative relationship between CSR performance and financial performance. An interesting aspect of the chapter is that the authors argue that because of the involvement of the Chinese government, resources are devoted to social goals which may have a detrimental effect on financial performance.

Angelo Ditillo and Irene Eleonora Lisi discuss the link between management control systems and sustainability. Arguing strongly that there is a need to link them to make sustainability a reality, they explain limitations in the current approach and suggest a holistic way to create a link. The authors provide a framework for analyzing the effectiveness of the management control system in achieving a measure of sustainability and make suggestions for future research.

Newsweek magazine has been producing an annual issue ranking firms based on their environmental performance. Yu Cong, Martin Freedman, and Jin Dong Park examined the 2009 "Green Ranking" issue to determine whether environmental performance ranked by *Newsweek* is consistent with a measure of hazardous wastes for firms from industries that produce

hazardous wastes. Using Toxics Release Inventory (TRI) amounts that are reported by US firms and adjusting them for risk factors, the authors concluded that the overall *Newsweek* measure, the green score, was consistent with certain risk-based and non-risk-based TRI measures for the utility industry, but not for other industries. However, one of *Newsweek*'s measures of environmental performance, the environmental impact score, is consistent with TRI for all firms. The authors conclude that disaggregating environmental measures may be necessary to obtain meaningful results.

In their chapter Martin Stuebs, Jr., and Li Sun report on a research study linking corporate governance to environmental performance. Using mainly the KLD database to determine environmental performance and correlating that to the IRRC governance and director database, they find a positive relationship between corporate governance and environmental performance. Furthermore, environmental strength has a positive relationship with corporate governance and the environmental concerns have a negative relationship with corporate governance. Although the study does not deal with causality, one may conjecture that having good corporate governance may lead to better environmental performance.

The last chapter provides the findings of a study that reports on the impact on companies of the SEC interpretive release on climate change. Joan DiSalvio and Nina T. Dorata found that firms disclosed more about climate change after the SEC required these disclosures and that companies in industries facing greater climate change disclosures had a greater increase in their disclosures. However, in general, the amount of disclosures provided by the companies in the sample was quite limited. The authors then examined the market reaction to climate change disclosures and discovered that the market reacted favorably to this event.

Since this is the final volume of *Advances in Environmental Accounting & Management* that we will edit, we would like to thank many people who have helped us with this endeavor. Our associate editors, A. J. Stagliano and Dennis Patten have been critical in the editorial process. We have consulted with them often and they made a number of editorial decisions that have helped us to create successful volumes. We would like to thank Stag and Den for their help and support throughout the period of our tenure as editors of the journal.

One of the first things we realized in creating this publication was that having an editorial board you could rely on is essential. Our editorial board has been active in reviewing papers and we have been highly appreciative of their suggestions on improving the editorial process. They have been a

great asset and we wish to thank them all for being there when we needed them and for all they contributed.

Despite having excellent associate editors and a strong editorial board, it is often necessary to find reviewers who have the expertise for a given submission and are not part of the editorial family. We have utilized a number of ad hoc reviewers and they have done an excellent job. What is great about accounting academics is that when asked to do a review they readily accept. We would like to thank all of the people who have reviewed papers for AEAM and we hope that they will be available to review papers for the new editors.

We began this endeavor in 1998 with JAI as our publisher. Subsequently, JAI was purchased by Elsevier and then Elsevier sold us to Emerald. Working with each of these publishers has resulted in successful issues of the series. The publishers were supportive in producing the volumes and letting us publish when we had a sufficient number of high quality articles. For that we thank them. We also wish the best to the new editors Ataur Belal and Stewart Cooper.

Finally we would like to thank our families for their love and support.

Martin Freedman
Bikki Jaggi
Editors

AN EXAMINATION OF THE RELATIONSHIP BETWEEN CORPORATE SOCIAL RESPONSIBILITY AND FINANCIAL PERFORMANCE: THE CASE OF CHINESE STATE-OWNED ENTERPRISES

Robert W. Rutledge, Khondkar E. Karim, Mark Aleksanyan and Chenlong Wu

ABSTRACT

Research in the field of corporate social responsibility (CSR) has grown exponentially in the last few decades. Nevertheless, significant debate remains about the relationship between CSR performance and corporate financial performance (CFP). This is particularly true for the case of Chinese state-owned enterprises (SOEs). The purpose of the current study is to empirically test the relationship between CSR and CFP. We use data for 66 Chinese SOEs listed on the Shanghai and Shenzhen stock

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exchanges. The results are interesting in that they are not consistent with similar studies using US and other Western market data. We find a significant negative relationship between CSR performance and CFP. The results are discussed in light of the preferential government treatment afforded to Chinese SOEs, and social welfare requirements imposed on such entities. Implications for Chinese policy-makers are discussed.

Keywords: Corporate social responsibility; financial performance; social performance; state-owned enterprises

INTRODUCTION

There has been a rapid development of the Chinese economy. The origins of this expansion are rooted in China's economic reforms in 1978. These initial reforms are known as "Socialism with Chinese Characteristics." Since the 1990s, China has allowed expanded privatization, increased foreign investment, a reduction of state-owned industry, and a lifting of price controls. According to the United Nations (2014) National Accounts Main Aggregates Database, nominal GDP of China surpassed Japan in 2011, and China has become the world's second largest economy after the United States. However, the pursuit of maximum profits in many companies leads to a disregard of social responsibility, which can be detrimental to stakeholders' wealth. The impression of China by other countries is one of serious environmental pollution, sweatshops, and substandard products. Ironically, one of the main drivers for Chinese corporate social responsibility (CSR) development is the widespread image of corporate irresponsibility in China.

More recently, the Chinese government has played a significant role in guiding CSR performance. The government has established a requirement for companies to provide social responsibility in the course of their business (as established in Article 5 of the 2006 Chinese Company Law). Further, the Chinese government has promulgated CSR principles that central government controlled companies are required to follow. The question remains, however, as to the real purpose of these CSR initiatives, and is it merely window dressing to improve international images of Chinese companies. Lin (2010) finds that the Chinese government is sincerely promoting human rights and the environmental aspects of CSR that are consistent with their political and economic interests. Chinese state-owned companies are found to have taken the lead in CSR performance and disclosure, and

they provide much more social responsibility resources and disclosures than private enterprises and foreign-invested enterprises.

The purpose of the current study is to examine the relationship between CSR performance and corporate financial performance (CFP) for Chinese state-owned enterprises (SOEs). Very few prior studies have focused on CSR in China, particularly for SOEs. The majority of previous studies have examined the CSR−CFP relationship for US markets, only. Their samples usually come from the KLD 400 index which consists of 400 companies drawn from the universe of the 3,000 largest capitalized US public equities. A motivating factor for studying Chinese SOEs is that China has an unusual institutional background. Approximately 60% of companies listed on China's two major exchanges (Shanghai and Shenzhen) are SOEs. Additionally, there are many "special advantages" enjoyed by Chinese SOEs that are provided by the Chinese government (e.g., special listing benefits, and preferential borrowing terms, etc.). Thus, the current study provides an opportunity to examine the CSR−CFP relationship in one of the world's largest, fastest growing, and unique markets. The special features and advantages enjoyed by Chinese SOEs are discussed in more detail below.

The current study is further motivated by the opportunity to examine the relationship between CSR and CFP for Chinese SOEs using a new measure of CSR (i.e., the latest available Chinese CSR Blue Book) combined with a "preferred" accounting-based measure of CFP.

This study uses a sample of 66 Chinese SOEs from the CSR development index report. CSR performance data are collected from the 2011 Chinese CSR Blue Book published by the Research Center for CSR − Chinese Academy of Social Science. Financial data are obtained from SOE's financial reports and notes through the RESSET database.

The empirical results find that Chinese SOE's overall level of CSR performance is negatively associated with CFP. Four key indicators of CSR are also tested in this study (responsibility management, market responsibility, social responsibility, and environmental responsibility). The overall negative results on CFP are primarily driven by social and environmental responsibility. Alternatively, management and market responsibility are found to be positively associated with CFP. The results are further interpreted within the context of Chinese SOEs that are heavily influenced by government.

The remainder of this study is organized as follows. First, a review of the relevant literature in the area of CSR and CFP is provided, and the testable hypotheses are developed. Next, is a discussion of the research

design including a description of the variables, the data collection, and statistical methods used to analyze the data. This is followed by a presentation of the results of the analyses. Lastly, is a discussion of the results, including practical implications of the findings.

RELATED RESEARCH AND HYPOTHESES DEVELOPMENT

Definition of CSR Activities

CSR has been an increasingly common topic of discussion in the academic literature. However, a lack of clarity about definitions and assumptions has led to confusion in the CSR literature (Margolis & Walsh, 2003). A majority of definitions of CSR in the international literature emphasize the firm's relationship with stakeholders and the social welfare policies of the firm, or they stress the voluntary nature of firms' actions (Fiori, di Donato, & Izzo, 2007).

Many view CSR activities as those designed to improve social and environmental conditions, and are frequently voluntary firm actions. These managerial decisions and actions do not usually have direct economic or technical benefit. Another view suggests that CSR activities provide benefits to society, and go beyond what is legally required (Vogel, 2006). Thus, CSR is usually something above economic profits and legal criteria. Indeed, even some major public policy initiatives support these core assumptions (Brammer, Jackson, & Matten, 2012). For example, the European Commission Green Paper (2001) suggests that CSR focuses on social and environment activities in business operations and in communication with stakeholders on a voluntary basis.

Measures of CSR

Four primary methods exist for the measurement of CSR (Griffin & Mahon, 1997). These can be broadly classified as (1) external social ratings (e.g., the Domini 400 Social Index), (2) reputation survey scores (e.g., *Fortune* reputation survey) (3) actual release data (e.g., Toxics Release Inventory – TRI), and (4) philanthropy. The first two CSR methods require the use of corporate performance perceptions of what the firm is

believed to have done. The second two measures (actual release data and philanthropy) are quantitative and based on the actual actions taken by firms.

The most popular CSR measure is the Domini 400 Social Index. It is constructed by using the Kinder Lydenberg Domini (KDL) rating system, whereby each S&P 500 company is rated on multiple attributes commonly considered to be relevant for CSR (cf. McWilliams & Siegel, 2000; Peters & Mullen, 2009; Waddock & Graves, 1997). These attributes include community, corporate governance, diversity, employee relations, environment, human rights, product quality, and controversial business issues.

The *Fortune* reputation survey (a purely perceptual measure) uses "senior executives, outside directors, and financial analysts" to rate companies within their industry (*Fortune*, 1994, p. 58). The overall corporate reputation index is determined by summing scores from zero to ten for each of eight attributes of a firm's reputation. This measure of CSR is used in one of the more noted longitudinal studies of the relationship between CSR and CFP (Preston & O'Bannon, 1997).

The TRI is a self-reported measure consisting of information on environmental discharges to the water, air, and landfills, and disposal of hazardous waste. It is mandated by Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (U.S. Environmental Protection Agency, 1994). The TRI has been used in scholarly research (Karim, Lacina, & Rutledge, 2006), but is most often used by the government and special interest groups. Lastly, some studies use philanthropy or generosity as a CSR measure (e.g., Godfrey, 2005; Griffin & Mahon, 1997). Such data can be found in sources such as the *Corporate 500 Directory of Corporate Philanthropy*.

Chinese CSR Blue Book

The current study uses a measure of CSR performance that is based on content analysis. We use the *Research Report on Corporate Social Responsibility of China* (Chen, Huang, Peng, & Zhong, 2011). This report is also known as the Chinese CSR Blue Book, and is produced annually (since 2009) by the Chinese Academy of Social Sciences (CASS). CASS developed the Blue Book with consideration to other existing international measures of CSR such as the Global Reporting Initiative (GRI), *Fortune* top 100 ranking index, *Financial Times* and Stock Exchange (FTSE4Good Index), ISO26000, and individual CSR reports of the top 500 world

enterprises. All these international standards or index systems guided CASS in their attempt to design an accurate system to measure CSR in the Chinese economic environment.

There are a few stages for evaluation of CSR index for Chinese enterprises. In the first stage, 4 key CSR indicators are weighted through an analytic hierarchy process, and 13 sub-items within each indicator are also weighted. Next, based on content analysis, the index adopts a methodology called disclosure-scoring. If the enterprise has a structured relevant system and has disclosed performance information about one item, this item will be added to their score. Thus, the original CSR development index is represented by the following equation:

$$\text{Original CSR index} = \sum_{j=1,2,3,4} A_j * W_j \tag{1}$$

where A_j is the score in one of the four key CSR performance indicators, and W_j is the weight of this indicator.

Based on this original CSR index, the CSR development index in an industry can be calculated after adding the score adjustment. In this weighting scheme, the score adjustment contains "reward" points (plus 1 for each sub-item), "penalty" points (minus 2 for each sub-item), and special bonus points awards and honors. If an enterprise only operates in one industry, the CSR development index is also its final score. However, the enterprise engages in multiple industries, the final CSR index is shown as:

$$\text{Final CSR index} = \sum_{j=1\ldots k} B_j * I_j \tag{2}$$

where B_j is the CSR development index of an enterprise in each industry, and I_j is the weight of this industry.

The weight of an industry is decided by the susceptibility to social responsibility. If an enterprise operates in two industries, it will comply with the principle of "6, 4," which means the weight of higher CSR susceptibility is 60% and lower one is 40%. If a company operates in three or more industries, the principle will be changed to "5, 3, 2." The weight of the most susceptible industry is 50%, then 30%, and lastly 20%. The level of susceptibility is mainly depended on an investigation of the environment and its customers. For example, industries with high energy consumption and pollution have higher susceptibility (e.g., mining, construction, and

manufacturing). Industries directly connected with customers also have higher susceptibility. The current study uses CSR indices directly from the latest available Chinese CSR Blue Book (2011).

Institutional Considerations for Chinese SOEs

China has a unique institutional setting. Stock markets in China are a relatively new phenomena. There are currently two major stock markets in China which are the Shanghai and the Shenzhen Stock Exchanges. Both of these markets were founded in the early 1990s. The listed companies in these two markets are not permitted to be cross-listed.

Chinese stock markets have several categories of stocks. The most common stocks traded in the two markets are A and B shares. Initially, there were major restrictions on share transactions. A shares were permitted to be traded only by domestic investors including individuals and institutions, whereas B shares were only allowed to be traded by foreign investors. However, since February 2001, B shares were permitted to be traded by domestic investors. Additionally, in 2002, the Chinese government initiated the Qualified Foreign Institutional Investors (QFII) program which allows licensed foreign investors to deal in A shares. The launch of QFII is considered the start of a gradual liberation of Chinese capital markets.

Although Chinese capital markets have become more open, approximately 60% of companies listed on China's two major stock exchanges are SOEs (Sheng & Zhao, 2013). These SOEs enjoy many "special advantages" not available to other firms. Such advantages include (1) fiscal subsidies (e.g., for losses incurred) and reduced taxes and fees from the central government; (2) preferential financing costs on loans from state banks (1.6% average SOE rate vs. the market rate of 4.7%); and (3) free or subsidized land, buildings, and other resource rents. Even with these many advantages, Chinese SOEs perform worse than non-SOEs (e.g., they have significantly lower return on equity). This may be the result of Chinese SOEs having a different relationship with their constituents than non-SOEs, and different objectives.

The typical perspective of CSR expenditures and related disclosures is that they occur because of shareholders' demand for information and monitoring. Under this perspective, firms would not intentionally engage in CSR activities at the expense of shareholders. However, it is also possible that such expenditures are a result of demands by constituents other than shareholders (Moser & Martin, 2012). This second case may result in costs

of CSR activities in excess of the expected benefits to the firm and at the expense of shareholders. Chinese SOEs do not have the same relationship as other entities with their shareholders and other constituents, and some of their objectives are "other than profit" including social welfare. Such SOEs may incur costs of CSR activities that are not intended only to maximize profits.

The hypotheses development below includes a review of prior research on the relationship between CSR and CFP. This research suggests the relationship between CSR and CFP is positive. However, the government-provided advantages to SOEs, and the SOEs differential relationship with constituents discussed above provide potential forces that might weaken, eliminate, or even reverse the expected relationship between CSR and CFP for Chinese SOEs.

Hypotheses Development

There exists a large body of literature that examines the relationship between CSR and CFP (cf. Bragdon & Marlin, 1972; Carter, Kale, & Grimm, 2000; Cochran & Wood, 1984; Jaggi & Freedman, 1992; Li, 2006; McGuire, Sundgren, & Schneeweis, 1988; Shi & Tang, 2012; Simpson & Kohers, 2002; Waddock & Graves, 1997; Wang, Choi, & Li, 2008, etc.). However, many unanswered questions still exist. For example, currently, CSR reporting does not disclosure the amounts spent on specific CSR activities, nor do they reveal the profitability of such expenditures. This creates a difficulty in directly determining the relationship between specific CSR expenditures and CFP (Moser & Martin, 2012).

Margolis and Walsh (2001) performed a meta-analysis of over 100 research studies in an attempt to quantify the link between CSR performance and CFP. According to their analysis, it is argued that CSR activities generate CFP in the overall orientation. Orlitzky, Schmidt, and Rynes (2003) performed a meta-analysis of 52 previous quantitative studies. They also generally confirm a positive relationship between CSR and CFP.

The most recent and comprehensive meta-analysis of CSR−CRP research to date is Margolis, Elfenbein, and Walsh (2009). They examined 251 different studies (214 manuscripts) published over a 35-year period, and found that the overall relationship between CSR and CFP is positive, but quite small (median $r = 0.085$). Only 28% of the studies found a significant positive relationship, 2% found a significant negative relationship, and 59% found no significant relationship (the remainder of the studies did

not report significance levels). The 106 studies that were published in the most recent 10-year period suggest even less of a relationship between CSR and CFP.

While most prior research has been conducted using US or UK market settings, China has begun to attract attention in the debate about the relationship between CSR performance and CFP. China is a strong economic entity, and has been expanding rapidly over the last decade. However, the development of CSR in China is still in the early stages. Results from studies on the relationship between CSR and CFP in China have produced contradictory results. For example, Li (2006) investigated 521 listed companies in Shanghai Stock Exchange in 2003. He found that increased CSR activities were associated in the short run with a decreased value of a firm (a market measure of CFP); however, no significant relationship exists in the long run. Zhu and Yao (2010) find that CSR disclosures to employees or the government are positively related with CFP, while CSR disclosures to investors are negatively related with CFP. Shi and Tang (2012) examine the relationship between CSR and CFP in China's agriculture companies. They find a significant positive relationship between CSR and CFP.

Overall, past research suggests that a small but positive relationship exists between CSR performance and CFP. The current study examines the CSR−CFP relationship using a new measure of CSR performance (the latest available Chinese CSR Blue Book), and an accounting-based measure of CFP. Given the results of prior research, the following hypothesis is suggested:

Hypothesis 1. The relationship between CSR performance and CFP for state-owned enterprises in China is positive.

The predicted relationship between CSR and CFP in Hypothesis 1 is based on prior CSR−CFP research. However, the prior research has been dominated by samples of public firms with typical ownership structures. The ownership structure for the sample in the current study is dominated by the Chinese government and strongly influenced by nonowner constituents. The current study will provide information as to the effect (in any) of SOE ownership structure on the CSR−CFP relationship.

The summary CSR performance index provided in the Chinese CSR Blue Book evaluates firms based on a combination of four separate subindices, including the: (1) responsibility management index, (2) market responsibility index, (3) social responsibility index, and (4) environmental responsibility index (Chen et al., 2011).

The *Responsibility Management* dimension of CSR performance quantifies firms' CSR development plans, CSR communications, and management of CSR activities. A positive relationship should exist between good management practices and financial performance (Waddock & Graves, 1997). This suggests a positive relationship between the responsibility management dimension of CSR performance and CFP.

Hypothesis 2. The relationship between responsibility management and CFP is positive.

The *Market Responsibility* dimension of CSR rates firms' product quality, integrity, and fair competition, as well as consumer protection efforts. It relates a firm's CSR efforts to its customers. Firms that are socially responsible within a customer context (i.e., having quality products and fair competition) should provide increased customer satisfaction, and increased firm performance.

Hypothesis 3. The relationship between market responsibility and CFP is positive.

The *Social Responsibility* dimension of CSR performance includes consideration of firms' product safety and the public welfare. Also, it includes the assessment of firms' relationships with local government, employees, and safety production. Better financial performance should provide more slack resources for companies to invest in the domain of social activities (Waddock & Graves, 1997). Thus, better financial performance should lead to better social performance through the reallocation of excess resources into the social domain. This suggests a positive relationship between the social responsibility dimension of CSR and CFP.

Hypothesis 4. The relationship between social responsibility and CFP is positive.

The *Environmental Responsibility* dimension of CSR performance includes consideration of resource conservation and emission reduction. Investment in environmental CSR activities should improve a firm's reputation in the market, which may improve product sales. Alternatively, the penalty for environmental pollution may lead to reduces revenues and profits, suggesting a positive relationship between the environmental responsibility dimension of CSR and CFP.

Hypothesis 5. The relationship between environmental responsibility and CFP is positive.

Measures of CFP

CFP is measured in a wide range of methods. Most all studies of the relationship between CSR and CFP use either accounting rates of return or market-based measures of performance (Margolis et al., 2009). The use of accounting returns focuses on how firm earnings respond to different policies. For example, earnings per share (EPS) or price-earnings (P/E) ratios are commonly used measures of accounting returns (Zhu & Yao, 2010). Further, an increasing number of studies use return on assets (ROA), return on equity (ROE), or return on sales (ROS) as measures of CFP (Simpson & Kohers, 2002; Tsoutsoura, 2004). It has been suggested that accounting returns are the most appropriate proxy for CFP (Cochran & Wood, 1984). As a result, the current study uses ROE to proxy for CFP. Because accounting measures of CFP such as ROE have been shown to be affected by several firm attributes, control variables will be used (including size, growth, and operating leverage).

DATA AND METHODOLOGY

Sample Selection

The China Enterprise Directors Association (CEDA) and China Enterprise Confederation (CEC) jointly determine the Top-500 Enterprises in China. CASS selects their Top-100 SOEs to be evaluated in the Chinese CSR Blue Book based on size (sales revenue), after removing SOEs that are in the military industry, and enterprises that have merged, reorganized, or been bankrupted. We began our sample selection with the latest available CSR Blue Book (Chinese Academy of Social Sciences (CASS), 2011); that is, CASS's Top-100 SOEs for the period 2010−2011. The initial sample of 100 firms is then subjected to several filters.

First, sample firms were required to be listed on the Shanghai or Shenzhen Stock Exchange. Sixteen firms were removed because they were not listed on an exchange, and another eight firms were listed on other foreign stock exchanges (leaving 76 SOEs). *Second*, insurance companies (five SOEs), and banks or any other companies that provide financial services (five SOEs) are excluded, thus reducing number of SOEs in the final sample to 66 firms. Full financial information for all 66 sample firms was acquired from the RESSET database, including the ROE data used as the

accounting-based performance measurement. Beijing Gildata RESSET Data Tech Co., Ltd (RESSET) is China's leading provider of financial databases and software for financial and investment research. They collect financial and other data from Chinese companies' financial statements, and rank as the top Chinese database for domestic financial research.

Model Specification

In this study, ROE is the dependent variable, and represents a proxy for the CFP of each sample firm. The primary independent variable of interest is the CSR performance obtained from the 2011 Chinese CSR Blue Book (see Eq. (3)). This study further divides CSR into four parts, and tests the relationship between these four indicators (responsibility management, market responsibility, social responsibility, and environmental responsibility) and ROE (see Eq. (4)). This breakdown of CSR into the four Blue Book categories has not been previously examined in the research.

A significant amount of previous research (e.g., Burke, Logsdon, Mitchell, Reiner, & Vogel, 1986; McWilliams & Siegel, 2000; Ullman, 1985; Wu, 2006) suggests firm size, industry, and risk to be factors that may influence a firm's CSR performance. For example, Burke et al. (1986) find evidence that smaller firms are less committed to socially responsible behaviors. Wu (2006) finds a positive relationship between firm size and CFP, and between firm size and CSR. Growth is also an important control variable, since growth firms may require acquisition of more resources from society or other stakeholders (Burke et al., 1986). Moreover, the leverage of the firm represents management's risk tolerance, which may influence CSR activities due to the impact it produces on the management reputation. As a result of the findings of past research, the current study uses firm size, growth rate, and risk as control variables.

Eq. (3) indicates the OLS model that is used to test Hypothesis 1, and Eq. (4) is used to test Hypotheses 2, 3, 4, and 5.

$$\mathrm{ROE}_{i,t} = \beta_0 + \beta_1\,\mathrm{CSR}_{i,t} + \beta_2\,\mathrm{SIZE}_{i,t} + \beta_3\,\mathrm{GROW}_{i,t} + \beta_4\,\mathrm{DEBT}_{i,t} + \varepsilon_{i,t} \tag{3}$$

$$\begin{aligned}\mathrm{ROE}_{i,t} = {} & \beta_0 + \beta_1\,\mathrm{RM}_{i,t} + \beta_2\,\mathrm{MR}_{i,t} + \beta_3\,\mathrm{SR}_{i,t} + \beta_4\,\mathrm{ER}_{i,t} + \beta_5\,\mathrm{SIZE}_{i,t} \\ & + \beta_6\,\mathrm{GROW}_{i,t} + \beta_7\,\mathrm{DEBT}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{4}$$

Table 1. Variable Definitions.

Variable Name	Variable Description
Financial performance (CFP)	
ROE	Return on equity
Social performance	
CSR	Corporate social responsibility index
RM	Responsibility management
MR	Market responsibility
SR	Social responsibility
ER	Environmental responsibility
Control	
SIZE	Natural logarithm of total assets
GROW	Growth rate of revenue
DEBT	Debt ratio = Total liabilities/Total assets

where the β_i's are the parameters for estimation; CSR is the Chinese CSR Blue Book index (2011); SIZE is the natural log of total assets; GROW is the growth rate of revenue; DEBT is the debt ratio; RM is the Blue Book index for responsibility management; MR is the Blue Book index for market responsibility; SR is the Blue Book index for social responsibility; ER is the Blue Book index for environmental responsibility; and $\varepsilon_{i,t}$ is random disturbance term. Table 1 provides the definitions of each variable.

EMPIRICAL RESULTS AND ANALYSIS

Descriptive Statistics

Table 2 presents average CSR scores by industry (including the subindices RM, MR, SR, and ER). Other descriptive statistics for the 66 SOE sample are provided at the bottom of Table 2. As indicated in Table 2, considerable differences exist in industry average CSR indices. Higher scores indicate a better CSR performance. Electricity rated at the highest of all industries (mean CSR = 63.6), and it performed well under each CSR subindex. Mining is the lowest CSR-rated industry (mean CSR = 23.6). Manufacturing and construction also scored low on their CSR indices (mean CSR = 27.6 and 30.7, respectively). These SOEs with low CSR performance may be still at the stage of building CSR systems or testing effects of investments in CSR activities.

Table 2. Average CSR Summary Scores by Industry Including the Four Subindices (RM, MR, SR, and ER) (for All Industries where $n = 4$ or More SOEs).

Industry	*n*	RM	MR	SR	ER	CSR
Construction	7	22.4	39.6	33.7	22.0	30.7
Electricity	4	58.5	52.5	53.9	60.3	63.6
Manufacturing	14	23.0	33.3	29.6	18.8	27.6
Mining	5	22.5	29.5	30.6	16.3	23.6
Mixed	9	41.0	54.1	45.4	37.8	47.4
Petroleum	4	37.5	53.1	50.9	44.4	47.3
Smelting	12	21.7	41.7	32.0	30.1	33.3
Transportation	7	36.0	37.0	41.7	32.2	38.6
Other	4	2.7	12.5	9.3	8.3	9.2
Overall CSR and subindices scores		RM	MR	SR	ER	CSR
Minimum		0	0	0	0	0
Maximum		87.5	86.7	96.3	99.4	82
Mean		28.7	40.1	35.6	28.8	35.2
Median		26.8	42.5	39.6	21.9	37.4
Standard deviation		25.4	24.6	24.9	25.2	25
Total	66					

RM, responsibility management; MR, market responsibility; SR, social responsibility; ER, environmental responsibility; CSR, corporate social responsibility development index.

The CSR indicator that appears to be receiving the most attention from the sample SOEs is market responsibility (mean score = 40.1, median = 42.5); whereas the areas of responsibility management and environmental responsibility are receiving the least CSR attention (mean scores = 28.7 and 28.8; medians = 26.8 and 21.9, respectively).

Market responsibility includes sub-indicators such as product innovation and relationships with partners. These sub-indicators are more directly related with economic profit than other CSR responsibilities. Alternatively, environmental responsibility requires a large investment in technology and equipment with less direct benefits. This may explain why firms appear to avoid environmental responsibility, and focus more on market responsibility.

Correlation Matrix

Table 3 provides a Pearson's correlation matrix for the variables considered for testing Hypothesis 1 (ROE, CSR, SIZE, GROW, and DEBT). The

Table 3. Pearson's Correlation Coefficients (r).

	ROE	CSR	SIZE	GROW	DEBT
ROE	1				
CSR	−0.19*	1			
SIZE	0.04	0.42***	1		
GROW	0.10	−0.14	−0.21**	1	
DEBT	−0.10	0.06	0.29***	−0.06	1

ROE, return on equity; CSR, corporate social responsibility development index; SIZE, natural logarithm of total assets; GROW, growth rate of revenue; DEBT, debt ratio (=total liabilities/total assets).
***Significant at <0.01 level.
**Significant at <0.05 level.
*Significant at <0.10 level.

analysis examines the level of correlation between dependent, independent, and control variables. Table 3 indicates that CSR has a significant correlation with two variables (ROE and SIZE). The CSR/ROE correlation is significantly negative ($r = -0.19$; $p < 0.10$), and the CSR/SIZE correlation is significantly positive ($r = 0.42$; $p < 0.01$). These initial results are not consistent with previous studies (e.g., Graves & Waddock, 1994; McGuire et al., 1988; Waddock & Graves, 1997). None of the variables combinations are found to have serious multicollinearity due to the low correlation coefficients between each variable (Judge, Griffiths, Lutkepohl, and Lee (1982) suggest multicollinearity is considered as a serious problem when the correlation coefficient between variables exceeds 0.80.) Spearman correlations were also calculated, and only SIZE/CSR (0.51) and SIZE/DEBT (0.31) show significance ($p < 0.10$). As with the Pearson correlations, none of the Spearman correlations approach the 0.80 threshold for concern.

Regression Analysis – Hypothesis 1

Hypothesis 1 suggests that the relationship between CSR and CFP for SOEs in China is positive. A multiple linear regression analysis is performed using the data for the 66 SOEs considered in the study. The form of the regression is as suggested in Eq. (3) and examines the relationship between CSR and CFP. That is, ROE (a proxy for CFP) is regressed on CSR, and SIZE, GROW, and DEBT are included as control variables. The results are presented in Table 4.

Table 4. OLS Regression Results: Eq. (3).

Model: $ROE_{i,t} = \beta_0 + \beta_1\ CSR_{i,t} + \beta_2\ SIZE_{i,t} + \beta_3\ GROW_{i,t} + \beta_4\ DEBT_{i,t} + \varepsilon_{i,t}$				
	Coefficients	SE	*t*-statistic	*p*-Value
Constant	−11.39	18.07	−0.630	0.531
CSR	−0.09*	0.05	−1.889	0.064
SIZE	2.65	1.79	1.480	0.144
GROW	0.04	0.05	0.816	0.417
DEBT	−0.08	0.07	−1.059	0.294
$N = 66$				
$F(4, 61) = 1.35$ ($p = 0.263$)				
$R^2 = 0.081$				

CSR, corporate social responsibility development index; SIZE, natural logarithm of total assets; GROW, growth rate of revenue; DEBT, debt ratio (=total liabilities/total assets).
*Significant at <0.10 level.

Overall, the model does not find a significant linear relationship between the independent variables included in the model and ROE ($F = 1.35$; $p = 0.263$). However, the primary variable of interest, CSR performance, has a significant negative relationship with ROE ($t = -1.889$; $p = 0.064$). For SOEs in China, undertaking social responsibility appears to be negatively related to their financial performance. This result is contrary to most of the research results of Western economies, and it is opposite to what is predicted in Hypothesis 1. Additional findings from Table 4 indicate that none of the control variables have a significant relationship with CFP.

Regression Analysis – Hypotheses 2 through 5

Eq. (4) separates corporate social responsibilities into four key factors: responsibility management, market responsibility, social responsibility, and environmental responsibility. Through analyzing the relationship between these four independent variables and ROE, additional insight into the relationship between CSR performance and CFP can be provided. Hypotheses 2 through 5 predict a positive relationship between each of the four subindices of CSR and CFP. However, this is not likely to be found in the analysis to follow since the analysis above finds overall CSR performance is negatively related to CFP.

The regression results from testing the model suggested by Eq. (4) are shown in Table 5. A significant linear relationship is found between the

Table 5. OLS Regression Results: Eq. (4).

Model: $ROE_{i,t} = \beta_0 + \beta_1\ RM_{i,t} + \beta_2\ MR_{i,t} + \beta_3\ SR_{i,t} + \beta_4\ ER_{i,t} + \beta_5\ SIZE_{i,t} + \beta_6\ GROW_{i,t} + \beta_7\ DEBT_{i,t} + \varepsilon_{i,t}$

	Coefficients	SE	*t*-statistic	*p*-Value
Constant	−24.07	17.18	−1.402	0.166
RM	0.21**	0.10	2.208	0.031
MR	0.21**	0.09	2.394	0.020
SR	−0.32**	0.13	−2.504	0.015
ER	−0.21**	0.08	−2.500	0.015
SIZE	3.56**	1.72	2.069	0.043
GROW	0.06	0.04	1.420	0.161
DEBT	−0.05	0.07	−0.739	0.463
$N = 66$				
$F(7, 58) = 3.16$ ($p = 0.007$)***				
$R^2 = 0.276$				

RM, responsibility management; MR, market responsibility; SR, social responsibility; ER, environmental responsibility; SIZE, natural logarithm of total assets; GROW, growth rate of revenue; DEBT, debt ratio (=total liabilities/total assets).
***Significant at < 0.01 level.
**Significant at < 0.05 level.
*Significant at < 0.10 level.

independent and control variables included in the model and ROE ($F = 3.16$; $p = 0.007$).

All four subindices of CSR are found to have a significant effect on ROE. Both responsibility management (RM) and market responsibility (MR) have significant positive relationships with ROE ($t = 2.208$, $p = 0.031$; and $t = 2.394$, $p = 0.020$ respectively). The results for RM and MR support Hypotheses 2 and 3. That is, increases in RM and MR are related to increases in firms' ROE for Chinese SOEs.

Alternatively, both social responsibility (SR) and environmental responsibility (ER) have significant negative relationships with ROE ($t = 2.504$, $p = 0.015$; and $t = 2.500$, $p = 0.015$ respectively). These results are not consistent with Hypotheses 4 and 5, but they are consistent with the overall negative effect found for CSR on ROE. The results suggest that increases in SR and ER are related to decreases in the ROE for Chinese SOEs.

DISCUSSION AND CONCLUSIONS

Discussion

The relationship between CSR performance and CFP was empirically tested for a sample of Chinese SOEs. Sixty-six Chinese SOEs listed on the Shanghai and Shenzhen stock exchanges are included in the firms examined. Contrary to the results of previous studies on the CSR–CFP relationship, Chinese SOEs' CSR activities are negatively associated with CFP. This suggests a penalty for Chinese SOEs that invest in and report CSR activities. Closer examination of the data reveals that certain CSR activities are associated with the negative impact on ROE (financial performance), while others are found to be associated with a positive impact on ROE. Chinese SOEs engaged in activities related to responsibility management (RM) and market responsibility (MR) are associated with improved financial performance. Alternatively, the negative impact on CFP from social responsibility (SR) and environmental responsibility (ER) appear to outweigh these financial-performance benefits.

Previous studies have generally indicated a positive relationship between CSR and CFP. That is, investing in CSR activities has been found to be associated with improved financial performance. However, these studies are based on sample firms that have a different, nongovernmental,

ownership structure. Chinese SOEs have significant government ownership interests, and pressures from constituents other than owners. Given the results of the current study, it appears that the effect of having strong government and other influences on Chinese SOEs is associated with investments in CSR activities than are at the expense of SOE ownership. This appears to be the case for overall CSR activities, and is particularly true for investments in environmental and social CSR activities. Thus, what the results really imply is that having strong Chinese governmental influence over SOEs may influence undertaking CSR activities that do not result in the profit maximization of the enterprise.

Historically, Chinese SOEs have performed less profitably than non-SOEs. Profitability (ROE) for SOEs from 1993 to 2000 ranged from 2.72% to 4.85%, while profitability for non-SOEs ranged from 5.25% to 6.66% for the same period (Holz, 2002). The performance of SOEs continues to lag behind non-SOEs. In 2009, the ROE for SOEs was 8.2% while non-SOEs are found to have an average ROE of 15.6% (Sheng & Zhao, 2013). This difference would be even greater if it was adjusted for the preferential government treatment enjoyed by SOEs. They receive government subsidies, artificially low financing charges, and subsidized land and other resources. Further clouding the relationship between ownership structure (SOEs vs. non-SOEs) and profitability is the social welfare requirements imposed on SOEs by the Chinese government.

The State-owned Assets Supervision and Administration Commission (SASAC) provides guidelines to SOEs related to their CSR responsibilities and requirements (SASAC, 2011). Chinese SOEs are required to "be responsible to stakeholders and environment, so as to achieve well-balance among the growth of enterprises, social benefit and environment protection … an important measure for promoting the socialist harmonious society" (SASAC, 2011, p. 1).

It is difficult to determine whether the difference in profitability between SOEs and non-SOEs is caused by management ineffectiveness and inefficiencies within the SOEs, or by government imposed policies such as those imposed by SASAC. If the primary goal of certain Chinese SOEs is to serve the public interest, and not to (necessarily) make a profit, then these enterprises should be transformed into nonprofit public enterprises. For other SOEs that are more appropriately suited for performance measured by the market, the Chinese government should reduce their control over these enterprises and allow them to fairly compete in the market. Without significant reform by the Chinese government, SOEs will continue to have difficulty in measuring their "true profitability" and the effects of their CSR

policies. The results of this study need to be viewed in light of the environment that Chinese SOEs currently operate.

Conclusions

The current study examines the relationship between CSR performance and CFP in Chinese SOE markets. On the surface, the results suggest that Chinese SOEs should limit their SOE activities because they reduce financial performance. More specifically, Chinese SOEs should concentrate on the CSR activities of responsibility management and market responsibility to improve financial performance, and they should also avoid social and environmental CSR activities that are associated with reduced financial performance.

However, the results cannot be taken at face value. SOEs that are heavily influenced by the Chinese government have different incentives and constituent demands other than financial performance. They appear to be carrying out CSR activities that do not maximize firm profits, but rather fulfill part of the government's overall social benefit function to serve the public interests and to promote a more "well-off" society. The findings of the current study are useful because they provide new insight into the relationship between CSR performance and CFP for Chinese SOEs.

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TOWARDS A MORE COMPREHENSIVE FRAMEWORK FOR SUSTAINABILITY CONTROL SYSTEMS RESEARCH

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ABSTRACT

Although companies are increasingly embracing the sustainability discourse in their external reporting and disclosures, little is known about how management control systems support sustainability within organizations. This is unfortunate, given the important role that properly designed Sustainability Control Systems (SCS) may play in helping firms to better face their social and environmental responsibilities. Starting from these premises, the aim of this essay is twofold. On the one hand, we present a review of the emerging stream of research on sustainability and management control mechanisms, in order to identify and discuss the link between the two. On the other hand, we try to illustrate the main unaddressed issues in this literature as a premise to exploring one possible way to advance research in this area. Specifically, we make a call for a more holistic approach to the study of SCS, which considers also their organizational and cultural dimensions in addition to their technical

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properties. A framework for informing future work on the topic is proposed, based on the concept of 'control package' (Malmi & Brown, 2008; Sandelin, 2008) complemented with notions from the complementarity-based approach developed in organizational economics (Grandori & Furnari, 2008; Milgrom & Roberts, 1995). By enhancing our understanding on how SCS operate as a package, the application of our framework should allow researchers to develop better theory of how to design a range of controls to support organizational sustainability objectives, control sustainability activities, and drive sustainability performance.

Keywords: Sustainability; environment; control; control package; Sustainability Control Systems

INTRODUCTION

The last decades have witnessed a growing consensus and increasing regulation underpinning the notion that firms have environmental and social responsibilities (Gray, Dey, Owen, Evans, & Zadek, 1997; Gray, Owen, & Maunders, 1987; Unerman, Bebbington, & O'Dwyer, 2007) and that 'good' business practices can provide a contribution towards the achievement of sustainable development[1] goals (United Nations Conference on Trade and Development, 1996; World Business Council for Sustainable Development, 2001). Confronted with ever escalating pressures from multiple sources (governments, NGOs, social rating agencies, public opinion and so on) to operate in a socially and environmentally responsible fashion (Porter & Kramer, 2006), businesses have started to embrace the sustainability rhetoric in their external reporting and disclosures (Gond, Grubnic, Herzig, & Moon, 2012; Spence & Rinaldi, 2012), claiming that engaging in sustainability is an important activity (ACCA, 2006; AccountAbility, 2008). Indeed, over the last 20 years, several thousand companies have started to disclose information about their social and environmental performance and the number of published social, environmental or sustainability reports has rapidly grown (KPMG, 2011). In addition, companies are increasingly adopting voluntary environmental management systems for handling the environmental impacts of their processes, products and services (Adams & Larrinaga-Gonzalez, 2007; Albeda Perez, Correa Ruiz, & Carrasco Fenech, 2007; Buysse & Verbeke, 2003; Perego & Hartmann, 2009).

Academic research on the topic has also flourished (Durden, 2008). This literature, variously named as social accounting, sustainability accounting or social and environmental accountability (Deegan, 2002; Gray, 2002), has so far extensively explored issues relating to external social and environmental reporting and in particular to its determinants (see, e.g. Adams, 2002; Adams & Whelan, 2009; Gray, 2010; Gray, Kouhy, & Lavers, 1995; Owen, 2008; Spence, 2007). Another stream of research in sustainability accounting concerns the relationships among environmental disclosure, environmental performance and economic performance (see, e.g. Al-Tuwaijri, Christensen, & Hughes, 2004; Cho, Freedman, & Patten, 2012a; Cho, Guidry, Hageman, & Patten, 2012b; Clarkson, Li, Richardson, & Vasvari, 2008).

On the contrary, much less attention has been devoted to the intra-organizational impact of sustainability (Bebbington, 2007) and in particular to the role of Management Control Systems (MCS)[2] supporting sustainability within organizations (Bonacchi & Rinaldi, 2007; Durden, 2008; Songini & Pistoni, 2012). This gap is particularly unfortunate given the important role that properly designed Sustainability Control Systems (SCS) may play in helping firms embracing sustainability as a strategic goal to better face their social and environmental responsibilities, pushing them in the direction of sustainability (Gond et al., 2012; Henri & Journeault, 2010; Songini & Pistoni, 2012). Indeed, providing social and environmental performance measures to external stakeholders through sustainability reports is ineffective if these data are not also used for internal decision-making and control purposes (Adams, 2002; Perego & Hartmann, 2009). Literature has long recognized that such reports may represent impression management techniques (Neu, Warsame, & Pedwell, 1998) or 'greenwashing' phenomena (Laufer, 2003) aimed at maximizing perceptions of legitimacy but with little, if any, effects on the real work of organizations (Larrinaga-Gonzalez & Bebbington, 2001). On the other hand, a few studies on the interplay among external sustainability reporting and internal management control mechanisms have also started to shed light on the instances in which external reporting initiatives may spur management accounting change towards more sustainable business operations (see, e.g. Adams & McNicholas, 2007; Bouten & Hoozée, 2013). As noticed by Pondeville, Swaenb, and De Rongé (2013), a well-developed environmental information system – even if adopted for external reporting purposes in the first place – can in turn facilitate the implementation of formal and informal control systems, generating more articulated results that have an impact both externally and internally.

Starting from these premises, the aim of this essay is twofold. On the one hand, we present a review of the emerging stream of research examining sustainability accounting from the perspective of how it should fit or align with an organization's MCS. More specifically, we describe the sustainability management accounting and control techniques which have been advanced over the last two decades to overcome the – widely acknowledged – limitations of traditional MCS with respect to the sustainable development agenda. On the other hand, we try to illustrate the main unaddressed issues in this literature as a premise to exploring one possible way to advance research in this area. In so doing, we make a call for a more holistic approach to the study of SCS, which considers also their organizational and cultural dimensions in addition to their technical properties. A framework for informing future research in such sense is also proposed, based on the concept of 'control package' (Malmi & Brown, 2008; Sandelin, 2008) complemented with notions from the complementarity-based approach developed in organizational economics (Grandori & Furnari, 2008; Milgrom & Roberts, 1995). By gaining a broader understanding of how SCS operate as a package, we should be able to develop better theory of how to design a range of controls to support organizational sustainability objectives, control sustainability activities, and drive sustainability (and organizational) performance.

The remainder of the chapter is organized as follows. The next section reviews relevant prior research in sustainability management accounting and control, highlighting the need to carefully consider also the organizational and cultural dimensions of SCS, in addition to their technical facet. The succeeding section develops and discusses our proposed framework. The final section concludes the chapter by offering directions for further research.

SUSTAINABILITY AND MANAGEMENT CONTROL: AN OVERVIEW OF THE LITERATURE

Starting from the early 1970s, sustainability accounting research became established as a substantial discipline in its own right and started attracting increasing scholarly attention, as the number of review papers appearing in recent years demonstrates (see, e.g. Burritt & Schaltegger, 2010; Deegan & Soltys, 2007; Gray, 2002; Gray et al., 1995; Owen, 2008). According to the conceptual classification provided by Durden (2008), such research appears to follow two main themes. The first theme adopts a societal or ethical

perspective and is concerned with the obligations of organizations in relation to the provision and disclosure of social and environmental information (Gray, Owen, & Maunders, 1991). The second theme adopts a managerial perspective and explores issues concerned with the information organizations choose to produce and disclose to stakeholders and how this may be used to legitimize the existence of the organization (Deegan, 2002). Independently of the perspective employed, the context of analysis of this literature tends to be external reporting, whereas there is relatively limited consideration of sustainability accounting from the standpoint of how it should fit or align with an organization's MCS (Durden, 2008; Ferreira & Moulang, 2010; Gond et al., 2012; Norris & O'Dwyer, 2004; Songini & Pistoni, 2012).

However, from a normative point of view, organizations that attempt to embed sustainable principles in practice – beyond external reporting, discourse and mission statements – should have control systems in place enabling them to regularly monitor whether the business is operating in accordance with sustainable development goals (Bonacchi & Rinaldi, 2007; Durden, 2008; Gond et al., 2012; Songini & Pistoni, 2012). As noticed by Bonacchi and Rinaldi (2007), 'it is necessary to provide adequate planning and control systems in order to quantify sustainability, understand the factors that contribute to it and support management in implementing sustainability strategies. An innovative planning and control system is essential for the diffusion of the principles of sustainability' (p. 462). In this context, MCS play a fundamental role due to the fact that in the organizations the objectives that are pursued and the actions that are implemented are those for which managers are responsible and upon which they are evaluated and rewarded.

Yet conventional MCS – which were traditionally developed to assist managers to achieve the economic goals of their organizations – do not seem to be fully suited to the philosophy of sustainable development (Gond et al., 2012), in which environmental, social and economic goals are expected to be achieved simultaneously in a 'triple bottom line' logic (Elkington, 1997). Notwithstanding more recent developments in hybrid and non-financial measurement systems and research suggesting that financial and non-financial information can be considered equally important for strategy development (Bhimani & Langfield-Smith, 2007), traditional MCS are seen to be limited in their ability to address the interests of a broad range of stakeholders other than shareholders and to handle environmental and social issues as well as their interrelationships with financial ones (Bonacchi & Rinaldi, 2007; Burritt & Schaltegger, 2010; Durden, 2008;

Norris & O'Dwyer, 2004). In response to these limitations, over the last two decades several management accounting and control systems specifically tailored to the sustainability challenge have been proposed. Table 1 provides an overview of extant literature on SCS. They are derived from the emerging stream of literature on environmental management accounting and eco-control that, in the last few years, has started to capture the broader aspects of sustainability (Bonacchi & Rinaldi, 2007; Burritt & Schaltegger, 2010; Gond et al., 2012).

As shown in Table 1, research on the topic has to date mainly focused on performance measurement, with particular attention paid to hybrid performance measurement systems. Specifically, many authors have suggested the use of some modified versions of the most prominent hybrid

Table 1. Sustainability Control Systems Literature.

Traditional MCS	Examples of Corresponding SCS	Authors and Publications
Budgeting	Environmental budgeting	Burritt and Schaltegger (2001)
	Sustainability budgeting	Roth (2008)
Financial measurement systems	Environmental/Material flow cost accounting systems	Bennet and James (1998) Bebbington et al. (2001) Wagner and Enzler (2006) Jasch (2009)
	Sustainable value added	Figge and Hahn (2004)
Non-financial measurement systems	Environmental performance evaluation systems	Dias-Sardinha et al. (2002)
	Material and energy flow accounting systems	Wagner and Enzler (2006) Jasch (2009)
Hybrid measurement systems	Sustainability performance measurement	Epstein and Roy (2001) Rouse and Putterill (2003) Schaltegger and Wagner (2006)
	Performance prism	Neely et al. (2002)
	Sustainability dartboard and clover	Bonacchi and Rinaldi (2007)
	Sustainability balanced scorecard	Epstein and Wisner (2001) Figge et al. (2002) Hubbard (2009) Dias-Sardinha et al. (2002)
Project management	Socio-eco-efficiency analysis	Schmidt et al. (2004)
	Environmental investment appraisal	Burritt, Herzig, and Tadeo (2009)
Reward and compensation	Reward system based on multidimensional performance system	Dutta and Lawson (2009)

performance measurement system – the balanced scorecard (BSC) – as an effective way for embedding sustainability principles within organizations' strategies and business processes (Dias-Sardinha, Reijnders, & Antunes, 2002; Epstein & Wisner, 2001; Figge, Hahn, Schaltegger, & Wagner, 2002; Hubbard, 2009). Different approaches to the design of a sustainability BSC have been suggested, depending on how the relationship among business strategy and sustainable strategy has been conceptualized (Songini & Pistoni, 2012). As a first approach, Kaplan and Norton's framework (2004) can be used. Under this approach – which is suited when sustainability goals are considered instrumental and subordinated to the company's business strategy and financial objectives – some sustainability objectives and measures are included in the internal processes perspective, particularly in regulatory and safety processes. Secondly – when sustainability objectives stand alongside the firm's business objectives, but without a complete integration between them – two different options for designing a sustainability BSC have been suggested. According to the first option, a new perspective – the so-called 'non-market perspective' – is added to the traditional BSC model (Figge et al., 2002). The second approach suggests developing a sustainability BSC as a separate tool, distinct from the traditional BSC (Epstein & Wisner, 2001). In this latter case, the sustainability BSC should be specifically designed following both a triple bottom line approach (Elkington, 1997) and a stakeholder perspective. Finally – if sustainability is pervasively integrated within the company's goals and mission as sustainability strategy and business strategy coincide – we should observe sustainability objectives and measures to be included pervasively across the four perspectives – financial, customer, internal business processes and learning and growth – of the traditional BSC.

Other scholars have proposed alternative conceptual frameworks for the integration of sustainability concerns into hybrid performance measurement systems, different from the BSC model (Bonacchi & Rinaldi, 2007; Epstein & Roy, 2001; Neely, Adams, & Kennerly, 2002; Rouse & Putterill, 2003; Schaltegger & Wagner, 2006). For example Neely and colleagues (2002) have developed the 'Performance Prism' model, a multidimensional performance evaluation framework that links strategy to stakeholders. In particular, the authors consider the identification and fulfilment of stakeholders' needs, expectations and desires as a necessary starting point for embedding sustainability principles into companies' day-by-day operations. On this ground, they develop a five-step model which puts stakeholders' explicit needs and contributions at the centre of the strategy formulation and performance monitoring processes. However, the framework

appears limited in its ability to account for and assess trade-offs among conflicting stakeholder expectations. With the intention of broadening the functionality of this and other extant frameworks of sustainability performance measurement, Bonacchi and Rinaldi (2007) suggest a performance measurement system that includes two complementary instruments, called Sustainability DartBoard and Sustainability Clover. This multidimensional and multilevel model attempts to measure the three dimensions of sustainability (economic, environmental, social) through a set of primary and secondary measures connected with stakeholder satisfaction and able to detect and articulate both win–win and trade-off situations.

Moving beyond hybrid performance measurement systems, Table 1 indicates that other streams of SCS research investigated financial and non-financial performance measurement systems (Figge & Hahn, 2004; Jasch, 2009; Wagner & Enzler, 2006). With respect to financial performance measurement, over the last years research has in particular elaborated a plethora of costing techniques for quantifying the environmental impacts of companies' operations (Jasch, 2009; Wagner & Enzler, 2006). Among them, the more popular techniques – such as activity-based costing, quality costing and product/service costing – tend to focus upon internalized, privately incurred costs rather than any imputed costs or measurement of external social and public costs (Buhr & Gray, 2012). For example, by incorporating such internalized environmental costs into an activity-based costing methodology it is possible to allocate the costs of treating toxic waste to the product that creates the waste. As already noticed, such costing techniques rarely extend to the whole supply chain (cradle to grave) or the whole of society (Amigoni, Caglio, & Ditillo, 2003; Bennett & James, 1998; Caglio & Ditillo, 2008a, 2008b, 2012b). Indeed, taking a broader view of a company's environmental impacts poses undeniable challenges as it requires organizations to struggle with externalities that impact all stakeholders, even those as yet unborn as future generations. However, notwithstanding such (sometimes exceedingly complex) difficulties, accountants have also developed more inclusive costing methodologies – known as full-cost accounting, life cycle costing and cost-benefit analysis – which include a monetization of externalities. For example, Bebbington, Gray, Hibbitt, and Kirk (2001) describe how full-cost accounting includes: (1) the usual direct and indirect costs; (2) hidden costs such as regulatory, monitoring and safety costs; (3) liability costs including fines and future clean-up costs; (4) less tangible costs such as the loss or gain of goodwill arising from a project and the impact of changing stakeholder attitudes; and (5) costs to ensure that a project has zero environmental effect.

Finally, regarding non-financial performance measurement systems, two examples of tools advanced by the literature are represented by material flow/eco-balance analysis and eco-efficiency indicators. Physical flow analysis is a non-financial quantification of organizational resource usage and outputs (Jasch, 2009; Wagner & Enzler, 2006). It is a crucial first step in the management of an organization's environmental impacts given that – to effectively control the environmental impacts of waste, effluents and emissions – it is essential that the organization monitors the physical flow of these contaminants in the first place. Eco-efficiency indicators are meant to measure such things as energy and material intensity. They are expressed in non-financial ratios – for example, energy consumed by the company divided by unit of output – that can be used as benchmarks to improve the efficiency of resource usage by companies (Buhr & Gray, 2012).

The SCS literature summarized in Table 1 and briefly reviewed in the previous paragraphs undoubtedly contributed to the development of several management accounting techniques and control systems aimed at helping companies to face their social and environmental responsibilities and to attain their sustainable development goals.[3] However, SCS research is still at its infancy (Gond et al., 2012; Henri & Journeault, 2010; Songini & Pistoni, 2012). As noticed by Henri and Journeault (2010), most of this literature is either conceptual or descriptive and often based on a limited number of case studies.

In addition – and more interestingly to the ends of this work – attention has often been paid to the development of *individual* systems and tools of sustainability management accounting and control, such as environmental budgeting, environmental/sustainability performance evaluation systems or sustainability BSC (Gond et al., 2012). In contrast, we have nearly no research investigating the interplay among these individual systems and the improvements in decision-making created through their interactions. With the exception of a very few in-depth case studies that have examined the relationships between different types of MCS in the context of socially responsible managerial decision-making (Durden, 2008; Norris & O'Dwyer, 2004), empirical evidence is scarce and our understanding of the interaction among these new forms of SCS is limited.

Finally – and relatedly – to date research on SCS has nearly exclusively investigated the *technical* dimension of sustainability accounting and control systems, at the expense of their *organizational* and *cultural* components. However, embedding sustainability principles within companies' strategies and internal business processes is a particularly complex process

which – starting from top managers' ethical values and commitment – requires the mobilization of an holistic approach considering also organizational and cultural aspects, in addition to technical ones. Indeed, the few empirical, case-based papers to date conducted on the use of management accounting tools and systems in the context of sustainability (see, e.g. Acquier, 2010; Adams & McNicholas, 2007; Bouten & Hoozée, 2013; Larrinaga-Gonzalez & Bebbington, 2001) convey quite well the challenges and difficulties for environmental and sustainability management accounting interventions in effectively encouraging organizations to change in ways that reduce their unsustainability (Hopwood, 2009). For example, Larrinaga-Gonzalez and Bebbington (2001) provide a nice account of a failed attempt to achieve substantive organizational change through the implementation of environmental accounting. While it was possible to identify marginal improvements in the environmental performance of the case study organization, the way in which the company viewed the environment and its underlying rationale (i.e. to generate profits through expanded sales) remained the same. In attempting to explain this failure, the authors mobilize the concept of 'assemblage' (Duncan & Thomson, 1998) and suggest that the assemblage of events, structures and conditions (including internal organizational and cultural factors) that would have been necessary for organizational change to have been effected was not present in their case. As this example indicates, organizational responses exclusively focused on the technicalities of SCS are likely to fail in substantively shaping organizational strategies and actions towards improved sustainability. Management accounting techniques, in their own, do not appear to suffice.

In sum SCS research, as an emerging field of literature, has up to now provided us with precious insights on the challenges of designing and implementing SCS by focusing on their technical properties. While this focus on the technical dimensions of environmental and sustainability accounting is certainly understandable – and also appropriate – given the novelty of the discipline, we argue that it is now time to turn to a more holistic approach (Ditillo, 2004, 2012) which considers also the organizational and cultural dimensions of SCS. Starting from these premises, the next section will suggest a framework incorporating both organizational and cultural dimensions – as well as the notion of interrelationships among SCS – which could hopefully provide an impetus for future research and practice on sustainability management accounting and control.

TOWARDS A MORE COMPREHENSIVE FRAMEWORK FOR SCS RESEARCH: THE 'SCS PACKAGE'

Given the considerations expressed thus far, a particularly useful framework for informing future research on SCS – we argue – could be derived by adapting to the sustainability context under investigation the MCS 'package' proposed by Malmi and Brown (2008).[4] The starting point of their work is the recognition that, despite the fact that the idea of MCS operating as a package has existed for a long time (Otley, 1980), and notwithstanding several calls to study the phenomenon (Chenhall, 2003; Flamholtz et al., 1985), there has been little explicit theorizing or empirical research on the topic (Abernethy & Chua, 1996; Caglio & Ditillo, 2012a; Simons, 1995). However, studying specific MCS elements in isolation has 'the potential for serious model under-specification' (Chenhall, 2003, p. 131) as failing to recognize the links between various MCS can lead to erroneous conclusions. Starting from these premises, Malmi and Brown (2008) develop a comprehensive but parsimonious typology of an MCS package which could be used to study the phenomenon empirically. The framework is structured around five groups of control mechanisms: planning, cybernetic (i.e. budgets, financial measurement systems, non-financial measurement systems, hybrid measurement systems), reward and compensation, administrative, and cultural controls.

The strength of this MCS typology – and the reason for it being particularly interesting to our purposes – lies in its explicit inclusion of the organizational and cultural dimensions of MCS, dimensions which management accounting literature has tended to overlook. As the authors state, 'while much management accounting research has studied accounting-based controls and this is typically focused on formal systems, there is still limited understanding of the impact of other types of control (such as administrative or cultural) and whether/how they complement or substitute for each other in different contexts' (Malmi & Brown, 2008, p. 288). These remarks parallel very closely what we observed with respect to extant literature on sustainability management accounting and control. Indeed, if we confront the types of SCS reviewed in Table 1 with the five groups of control mechanisms of Malmi and Brown's (2008) typology, it is apparent that nearly all of them (with the exception of project management and reward and compensation) fall within the category of cybernetic control systems. However, if the neglect of administrative and cultural types of control represents a limitation for management accounting literature in general,

this gap is even more problematic for sustainability management accounting research, given the specificities of the sustainable development agenda and the previously mentioned complexities of the process of embedding sustainability principles within companies' strategies and internal business practices. With the aim of advancing research on such topics, the rest of this section will be devoted to the discussion of administrative and cultural controls and of their application to the sustainability domain.[5]

According to Malmi and Brown (2008), administrative control systems direct employee behaviour through the organizing of individuals and groups, the monitoring of behaviour and the establishment of accountability relations, and the process of specifying how tasks are to be performed. Specifically, the authors identify three groups of administrative controls: organizational design and structure, governance structures within the firm, and policies and procedures.

Organizational design – interpreted here not as a contextual variable imposed on managers but something managers can change – can be an important control device, as by using a particular structural type an organization can encourage certain types of contact and relationships (Abernethy & Chua, 1996; Alvesson & Karreman, 2004). This can be expected to be particularly important within the sustainability context, as the implementation of sustainable development initiatives directly impacts, in most of the cases, on the activities that are already managed by existing departments (Pedrini & Ferri, 2011). For instance, the introduction of social and environmental concerns to supply chain management impacts procurement department activities (Caglio & Ditillo, 2012c), or the implementation of a social and environmental packaging could involve the operational activities. Thus, implementing sustainability asks a broad number of firm's departments to align their processes with sustainability goals (Elkington, Emerson, & Beloe, 2006). Therefore it becomes critical to define organizations' formal structures in ways that facilitate the socialization of sustainability managers and/or specialists, allowing them to regularly and personally interact with other departments' decision makers for co-ordinating their highly interdependent activities (Gond et al., 2012). Short of this, SCS – although technically flawless – may remain peripheral and decoupled from core business activities and fail to reshape strategy (Weaver, Trevino, & Cochran, 1999).[6] In this respect, it is exemplary the – already cited – case described by Larrinaga-Gonzalez and Bebbington (2001), in which accountants appeared to find environmental issues irrelevant to their work, despite these issues being converted into accounting mechanisms. In this case, indeed, the ownership of the environmental

initiative appeared to be quarantined to the environmental department and other departments were not required to adopt the environmental initiatives. Therefore, the decision to introduce a specialized sustainability unit, and its positioning within the organizational chart can impact the extent to which sustainability principles come to permeate a company's overall business conduct. For example, it seems reasonable to expect that a sustainability unit belonging to a communication or public relations department will run a higher risk of being 'marginalized' and disconnected from the organization's everyday workings (Weaver et al., 1999). This contrasts with the case in which such unit is part of the accounting/finance department or directly reports to the CEO. In the first case, we argue, sustainability activities and structures can easily end up in playing the role of façade, buffering mechanisms (Thompson, 1967) adopted to protect companies' (unsustainable) internal operations from the growing pressures concerning sustainability coming from the external environment. An encouraging signal in this respect is offered by a recent survey of practice conducted across the 40 largest companies listed on the French stock market, finding that 70% of such companies have subordinated their sustainability unit to executive committee or board level, and with a decision-making role at group level (Arjaliès & Mundy, 2013).

Governance structures, according to Malmi and Brown (2008), refer to the company's formal lines of authority and accountability as well as the systems (i.e. committees, task-forces, meetings and individual contact) which are in place to ensure that representatives of the various functions and organizational units meet to co-ordinate their activities both vertically and horizontally. With reference to the sustainability context, the role played by such integrative liaison devices (Abernethy & Lillis, 1995; Grafton, Abernethy, & Lillis, 2011) can be particularly critical, given the co-ordination challenges previously noticed. In addition, the more integrative liaison devices are effective in allowing regular, personal and intensive contact among a company's sustainability managers/specialists and other departments' decision makers, the lower the – already cited – risk that sustainability structures will be reduced to a peripheral, façade machinery. A research report by SDA Bocconi School of Management (2012) describes the case of an Italian listed company in which the highest level sustainability governance body is represented by a Sustainability Steering Committee chaired by the CEO and composed by the functional directors most directly involved in the successful implementation of the company's sustainability strategies (e.g. Procurement, R&D, Operations, Human Resources). Moreover, such a body is assigned specific executive responsibilities such as

defining and approving the company's sustainability targets. Clearly, we can expect the implications of such a governance structure – in terms of inter-functional co-ordination and commitment to sustainability targets – to be quite different from the case of another Italian listed company, in which the highest level body in the sustainability governance system is represented by a Control and Risk Committee made up of non-executive board members and assigned with quite a generic supervisory role on sustainability activities (SDA Bocconi, 2012).

The last type of administrative controls in Malmi and Brown's (2008) framework, policies and procedures, refers to what Merchant and Van der Stede (2003) call action controls, that is behavioural constraints, pre-action reviews and action accountability. With regard to the sustainability context, the integration of specific sustainability considerations within – for example – companies' procurement or capital expenditure approval procedures may represent another way to foster a full deployment of sustainability principles within organizations. The HSBC and BT cases described by Hopwood et al. (2010) are representative in this respect. HSBC has implemented the Equator Principles and in-house policies to allow sustainability risk management as the bank, by collecting information on what loans will be used for, is able to refuse to make loans where social and environmental consequences will likely endanger repayments. Concerning procurement, BT has introduced several procedures aimed at ensuring that suppliers treat their workforce with dignity. In this respect, the already quoted survey by Arjaliès and Mundy (2013) reports that 83% of the largest French listed companies have included social and environmental criteria within their suppliers' evaluation procedures.

Finally, in Malmi and Brown's (2008) typology, culture is also a control system if it is used to regulate behaviour. Specifically, an organization's culture can be defined as 'the set of values, beliefs and social norms which tend to be shared by its members and, in turn, influence their thoughts and actions' (Flamholtz et al., 1985, p. 158). Accordingly, senior managers may mobilize specific types of cultural controls – namely value-based, symbol-based or clan controls – to promote an organizational culture encouraging some desired behaviours and outcomes. This seems to be of particular importance within the sustainability context, as an organization's journey towards less unsustainable business conduct is also a matter of culture (Maon, Lindgreen, & Swaen, 2009, 2010). In this respect, environmental and sustainability management research has long recognized that one of the main drivers to the adoption of sustainability initiatives by firms is represented by top management's moral values and attitude towards social

and environmental ills (Banerjee, Iyer, & Kashyap, 2003; Bansal & Roth, 2000; Fraj-Andrés, Martínez-Salinas, & Matute-Vallejo, 2009; Paulraj, 2009). For example, Bansal and Roth (2000) found that firms motivated by ecological responsibility often pointed to a single individual who had championed their ecological responses.[7] However, theoretical arguments and empirical evidence also suggest that – even if the adoption of sustainability and its integration into business processes is viewed as necessary by single sustainability 'champions' within an organization – this is easier said than done (see Gond et al., 2012 and references therein). In order for sustainability principles to succeed in permeating organizational life, it is necessary that they become widely shared across organizational decision makers and members, that is they become embedded within a company's organizational culture. According to many observers of organizational life, this situation – if empirically rare – corresponds to the highest level of sustainability or social responsibility implementation described in prior models of sustainability deployment (Maon et al., 2009, 2010). In this respect, it is exemplary the paper by Duncan and Thomson (1998), which attempts to explain the role of waste accounting in processes of organizational change by using two case studies of cleaner technology implementation. In the cases they document, the waste accounting systems were technically well developed and similar to each other, but their influence on the extent to which the two companies were actually able to achieve organizational change was markedly different. As explained by Larrinaga-Gonzalez and Bebbington (2001), in these two cases 'the different roles accounting played were dependent on an array of factors, which could be described as corporate culture' (p. 280). Therefore, we argue, it is fundamental that SCS are appropriately mobilized in order to foster the diffusion of sustainability values and to enhance sustainability awareness across organizational decision makers and members, as a way to overcome those cognitive and psychological barriers that are socially and environmentally dysfunctional and that perpetuate unsustainable practices within organizations (Gond et al., 2012; Hoffman & Bazerman, 2007). In this respect, for a company attempting to integrate sustainable development principles within its strategy and day-to-day operations, an explicit reference to such principles should at least be included within its 'belief systems' (Simons, 1995), that is the set of organizational definitions (mission statements, vision statements, credos and the like) espousing the values and direction that senior managers want subordinates to adopt. In this respect, the last few years have witnessed a lot of companies formally adopting documents variously termed as ethics policies, ethics codes and the like (Stevens, Steensma, Harrison, & Cochran,

2005). However, research demonstrates such ethics documents can be easily decoupled from organizational everyday workings (Weaver et al., 1999). Therefore, sustainability principles and values should then also be reinforced through appropriate personnel controls such as selection and training (Merchant & Van Der Stede, 2003) or more subtle yet powerful socialization processes such as clan control (Ouchi, 1979). Symbols, that is visible expressions such as building/workspace design and dress codes, can also be mobilized to develop a particular type of culture (Merchant & Van Der Stede, 2003). For example, an organization may employ green painting for offices' internal walls or environment-related pictures to communicate a culture of environmentalism. Arjaliès and Mundy (2013) find French listed companies employ a variety of means – including ad hoc training sessions or seminars, company intranet and physical artefacts such as posters – to establish a shared vision of social and environmental responsibility and to unite employees around a set of organizational values.

In the next section, after having summarized the chapter's contribution, we offer specific guidance on how the proposed framework could be mobilized to inform future SCS research, by leveraging on notions from the complementarity-based approach developed in organizational economics (Grandori & Furnari, 2008; Milgrom & Roberts, 1995).

CONCLUDING COMMENTS AND DIRECTIONS FOR FUTURE RESEARCH

The aim of this essay was to review the emerging stream of literature on SCS and to illustrate the main unaddressed issues in this area of research as a premise to exploring one possible way to advance it. In so doing, we made a call for a more holistic approach to the study of SCS. In particular, we proposed the Malmi and Brown's (2008) typology as a useful framework for studying 'SCS packages' in their whole, therefore considering also their organizational and cultural dimensions in addition to the technical one. We offered several hints as to how this framework could be applied to the sustainability context, providing practical examples of administrative and cultural types of sustainability controls and discussing their potential contribution in favouring a full deployment of sustainability principles within organizations.

One of the main challenges for future SCS research – we argue – lies in the conceptual and empirical investigation of how the different types of

SCS relate to each other and operate as a package, for example whether they act as substitutes or complements. This is a challenge management accounting research more in general is also confronted with, as there is currently little theory that enables researchers to establish the relationships between the systems in a control package (Abernethy & Chua, 1996; Chenhall, 2003; Malmi & Brown, 2008). Yet, addressing such issues could enable us to shed light on some important questions, for example whether and to what extent the effectiveness of each control system depends on the existing configuration of the overall package. In the above mentioned case studied by Larrinaga-Gonzalez and Bebbington (2001), for instance, it seems highly plausible that the observed failure was due not to ineffectiveness in the environmental accounting systems per se, but to misalignments between such systems and the organizational structure used to group environmental activities and tasks. When researchers study the impact of particular controls individually, they might conclude that they are ineffective per se, when it is the misfit with other elements of the control package that is the problem.

Certainly, when considering such important issues, an analytical approach allowing researchers to study the way in which different elements in a SCS package are interrelated is needed. In this respect, Malmi and Brown (2008) suggest leveraging on the reconceptualization of loosely coupled systems proposed by Orton and Weick (1990). Alternatively, researchers may find useful hints by looking at the complementarity-based approach developed in organizational economics (Milgrom & Roberts, 1995). 'Complementarity' exists when the adoption of one element increases the value of using another element (Grandori & Furnari, 2008; Milgrom & Roberts, 1995). Applying this logic to the analysis of SCS as a package has many potential advantages. First of all, it incorporates the relationships among many control attributes (systemic fit), and not their pair-wise fit with external contextual variables. Secondly, it recognizes that two control configurations may possess the characteristics of equifinality, which means that while the control packages may have contrasting elements and therefore look quite different, they both produce an equally good outcome, as a result of internal consistency between the chosen elements in each of the packages (Malmi & Brown, 2008; Sandelin, 2008). Finally, it clarifies the notion of 'consistency': it is more comprehensive than 'similarity in kind' and includes also 'complementarities' that derive from differences (Grandori & Furnari, 2008).

With more refined analytical approaches such as the ones just mentioned, the complexities of SCS functioning as packages would become

amenable to empirical investigation. In this respect, we see longitudinal case studies as particularly suited to exploring principles on how to construct these combinations of control mechanisms in a consistent way, considering also leading and lagged effects. By gaining a broader understanding of SCS as a package, therefore, we should be able to develop better theory of how to design a range of controls to support organizational sustainability objectives, control sustainability activities and drive sustainability (and organizational) performance.

NOTES

1. The sustainable development concept came to particular prominence with the Brundtland Report of 1987 which defined it as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987).
2. To our ends we refer to the definition provided by Anthony and Govindarajan (1998), who see MCS as the 'processes by which managers influence other members of the organization to implement the organization's strategies' (p. 6).
3. Such SCS, in turn, are being increasingly adopted by companies, as recent surveys of practice and collections of case studies seem to suggest (see, e.g. Arjaliès & Mundy, 2013; Herzig, Viere, Schaltegger, & Burritt, 2012; Hopwood, Unerman, & Fries, 2010).
4. Specifically, the authors develop a conceptual framework of management controls based on an extensive review of about 40 years of management control literature and covering the works of Chenhall (2003), Fisher (1995), Flamholtz, Das, and Tsui (1985), Langfield-Smith (1997), Otley (1980) and Simons (1995) among others.
5. On the contrary, we exclude from our discussion more traditional, accounting-based types of control – that is planning, cybernetic, and reward and compensation, in Malmi and Brown's (2008) framework – since these mechanisms are already quite well covered by extant SCS literature, as reviewed in the second section.
6. As Weaver et al. (1999) notice: 'Integrated structures and policies affect everyday decisions and actions; decisions are made in light of these policies, and people occupying these specialized structures have the confidence of and regular interaction with other departments and their managers. […] But not every structure or policy developed in an organization in response to external pressures will be integrated into everyday decisions and actions. Some structures can be decoupled easily. Structures that might, with the proper supports, have an impact on the organization can also be marginalized or disconnected from its everyday workings' (p. 540). The dichotomy among integrated and decoupled structures is central to neoinsitutional theories (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Powell & DiMaggio, 1991). Indeed, the insitutional perspective has been fruitfully applied within sustainability accounting research (cf. for instance, Bebbington, Higgins, & Frame, 2009;

Chen & Roberts, 2010; Larrinaga-Gonzalez, 2007; O'Dwyer, Owen, & Unerman, 2011) to investigate the ceremonial and symbolic roles sustainability reporting initiatives may play in signalling ritual conformity to intitutionalized myths (Meyer & Rowan, 1977). In this chapter, we aim at complementing the institutional understanding of the sustainability accounting phenomenon by focusing on the substantive roles it may play. Therefore, we adopt – in Burrit and Schaltegger (2010)'s terms – a 'managerial' perspective focused on offering guidance on how companies may achieve a satisfactory approach to sustainability.

7. Similar insights on the influence of top management's ethical values on organizational culture have been also reported in auditing literature (see, e.g. Beaulieu, 2001 and references therein).

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MEASURING ENVIRONMENTAL PERFORMANCE: IS *NEWSWEEK*'S GREEN RANKING THE SOLUTION?

Yu Cong, Martin Freedman and Jin Dong Park

ABSTRACT

In 2009, Newsweek *published a report in which they ranked the 500 largest US companies and the 100 largest global companies based on its environmental performance measures (http://greenrankings2009.newsweek.com/). This ranking is referred to as* Newsweek*'s Green Ranking. Included in this ranking is information about water and air pollution, solid waste disposal, toxic wastes, carbon emissions, and enforcement actions. The question we are addressing in this study is how well it measures pollution performance? The question is relevant to environmental accounting/reporting since it is part of a dilemma yet to be answered: Aggregated environmental indices/scores are easy for average information users to percept, while specific information may not be preserved when it is aggregated into the overall score(s).*

Specifically, we examine whether Newsweek*'s Green Ranking is correlated with pollution measures based on Toxics Release Inventory (TRI) in order to determine how valid or reliable* Newsweek*'s Green Ranking is – in other words, how much* Newsweek*'s Green Ranking can explain*

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the pollution by the toxic releases. We find that there is no significant correlation between Newsweek*'s Green Ranking and the TRI measures except for the firms in the utilities industry. Concluding that on one measure, which we consider a very important one, there is no justification for the overall Green Ranking Score presented by* Newsweek. *However, in* Newsweek*'s three-part score the element that is termed the Environmental Impact Score captures pollution performance measured based on TRI. The contrast between the overall ranking and performance ranking indicates that a composite index that incorporates hard performance and soft measures can dilute the information carried by performance data.*

Keywords: Environmental performance; *Newsweek*'s Green Ranking; Toxics Release Inventory; accountability

MEASURING POLLUTION PERFORMANCE: IS *NEWSWEEK*'S GREEN RANKING THE SOLUTION?

Pollution of the air we breathe, the water we use for drinking, fishing and swimming, and the land we reside and work on is a fact of life for most of the world's population. There have been efforts, locally, regionally, nationally, and globally to curb pollution. Some efforts have been successful in reducing pollution (US 1990 Clean Air Act) and some not as successful (the Kyoto Protocol). There have been a number of different approaches in reducing pollution including command and control, pollution taxes, pollution trading schemes, the use of voluntary programs, and disclosure and right-to-know laws.

A major source of the world's pollution is from certain industries which produce more pollution than others do. Fossil-fuel burning electric utilities, chemical plants, pulp and paper mills, metal mining and production, and oil and gas are among the more polluting industries. All of these industries have been impacted to some degree by the approaches outlined above that have been employed to reduce pollution emissions.

If we accept that the role of accounting should be concerned with stewardship and accountability then the reporting of pollution information should be part of accounting disclosures – particularly, for firms that are major contributors to pollution. However, many academicians and practitioners often argue that there is no systematic disclosure framework

regarding environmental pollution disclosure and particularly there are a number of problems with measuring and reporting pollution information. First, there is a dearth of audited reliable pollution information that is reported by firms causing the pollution (Fekrat, Inclan, & Petroni, 1996; Freedman & Stagliano, 1998; Patten, 2000). In other words, there is no reliable tool to measure the extent to which a firm pollutes environments or reduces pollution. Second there has been no accepted way to measure overall pollution performance at a corporate level. The pollution information (e.g., the amount of pollutant emitted) which is currently available is often at a plant or region level rather than at a corporate level, making it hard to compare pollution performance between firms.

Although the environmental accounting literature has utilized various techniques to assess pollution performance (see, e.g., Freedman & Jaggi, 1992; Patten, 2000; Spicer, 1978) there has been no approach that utilizes an interval scale as a pollution measure. Furthermore, the approaches used in the prior studies are not considered comprehensive. It has been argued that some proprietary sources provide comprehensive corporate pollution measurements (e.g., KLD and Trucost). However, the sources are costly to information users, and, more importantly, it is not clear how these sources are measuring and assessing pollution at a corporate level.

In 2009, *Newsweek* published a report in which they ranked the 500 largest US companies and the 100 largest global companies based on its pollution performance measures (http://greenrankings2009.newsweek.com/). This ranking, often referred to as *Newsweek*'s Green Ranking, is relatively comprehensive compared to other corporate environmental rankings, in the sense that this ranking attempts to reflect various aspects of pollution performance.

Delmas and Blass (2010) indicate that corporate environmental rankings vary depending on the definitions of pollution performance. Prior corporate environmental rankings tend to focus on either the corporate pollution level or the quality of environmental policy and disclosure. However, the *Newsweek*'s Green Ranking attempts to reflect various aspects of corporate pollution performance. Specifically, the Green Score (GS) in *Newsweek*'s Green Ranking is comprised of three components: the Environmental Impact Score (EIS), the Green Policies Score (GPS), and the Reputation Survey Score (RSS).[1]

In this chapter corporate pollution performance is defined in terms of firm's pollution level rather than the quality of environmental disclosure or policy, therefore the EIS in *Newsweek*'s Green Ranking would be more relevant for our study than the GPS and the RSS. The EIS in *Newsweek*'s

Green Ranking is determined based on information about water and air pollution, solid waste disposal, toxic wastes, carbon emissions, and enforcement actions.

Although *Newsweek*'s Green Ranking is limited to the 500 largest US companies and the 100 largest global companies it is among the most comprehensive measures available. The question we are addressing in this study is *how well it measures corporate pollution performance*?

The question is relevant to environmental accounting/reporting since it is part of a dilemma yet to be answered. Aggregated environmental indices/scores are easy for average information users to perceive, while specific information may not be preserved when it is aggregated into the overall score(s). An analogy can be drawn from financial reporting. Average users of financial statements always prefer using earnings as a collect-all indicator of firm performance, but they often find that they have to look into the break-downs of the aggregated earnings, namely earnings components or even transaction level information.

Although *Newsweek*'s methodology to produce the ranking is fairly extensive and some justification can be given to the weighting of its components, it is just one way to assess pollution performance. Firms in the major polluting industries are also among the major producers of toxics releases in the United States. These hazardous chemical releases (as deemed by the Environmental Protection Agency (EPA)) are among the most dangerous industrial releases in the United States. A pollution measure based on these hazardous chemical releases provides a good measure of how well the firm is dealing with these dangerous releases. Therefore, we argue that if *Newsweek*'s Green Ranking is consistent with a pollution measure based on these hazardous chemical releases then this would be strong support for *Newsweek*'s approach.

Specifically, we examine whether *Newsweek*'s Green Ranking – in particular, the overall ranking and the sub-ranking based on firm's pollution performance – is correlated with pollution measures based on Toxics Release Inventory (TRI).[2] Essentially we are trying to determine whether using TRI for those industries that produce the most toxic emissions will confirm *Newsweek*'s rankings. We are not attempting to assess whether the measures based on TRI are a better way to rank firms than *Newsweek*'s much richer methodology. Additionally, from a societal perspective, we believe that the production of toxic emissions is the pollution problem that is most in need of immediate correction. Including these industries with other industries (some of which really do not pollute) and arriving at an overall measure of pollution performance is like adding apples and oranges. Hence, the examination validates whether a ranking/indexing system on the

basis of cross-industry samples can still preserve the granules of information that are useful for stewardship and environmental accountability.

We find that there is no significant correlation between *Newsweek*'s Green Ranking and the TRI measures except for the firms in the utilities industry. Concluding that on one measure, which we consider a very important one, there is no justification for the GS which is the overall Green Ranking Score presented by *Newsweek*. However, in *Newsweek*'s three-part score the element that is termed the EIS captures pollution performance measured based on TRI. The contrast between the GS and performance ranking indicates that a composite index that incorporates hard performance and soft measures can dilute the information carried by performance data.

There are a number of differences between what *Newsweek* included in their assessment and what we are doing in this study. *Newsweek* included both the 500 largest US companies and the Global 100 largest companies. This study is concerned with only US companies. In assessing the US companies, *Newsweek* utilized data that included US companies' pollution performance throughout the world. In this study just TRI from US plants is utilized. Furthermore, as was stated above, much of *Newsweek*'s data are about aspects of pollution performance other than pollution emissions. Our data are only concerned with toxic emissions. Fundamentally the difference between these approaches is how "green" is defined. *Newsweek*'s overall ranking is taking a broad view including emissions, management actions, and outsiders' perceptions. We are taking a very narrow view and considering only toxic emissions as listed by EPA.

The remainder of the chapter is organized as follows. In the next section the background including the history of pollution performance measures, the prior literature using pollution performance measures, and a description of risk-based TRI are presented. Then a description of *Newsweek*'s methodology for Green Ranking is provided. The hypotheses and research methodology are presented in the section that follows. In the next section the results are presented and analyzed and this is followed by the limitations and conclusion.

BACKGROUND

History of Pollution Performance Measures

In this chapter, we adopt the TRI-based variables as pollution performance measures. However, TRI is just one source of pollution performance

information. Historically, determining pollution performance has been a difficult endeavor. In the United States, raw data on emissions has mainly been generated by the EPA, but they never created a comprehensive dataset. Rather, in the 1970s monthly water pollution data were available by pipe and plant. In the 1980s air pollution data were available for coal-fired electric utilities by smokestack and plant. After the 1990 Clean Air Act went into effect in 1995 air pollution data for electric utilities were available by plant and company. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted in 1986 and provided a dataset for those deemed responsible for hazardous waste sites. In 1988 TRI was made available and that became the most comprehensive pollution dataset that the US government made publicly available. It also focused on toxics produced at the plant level. Since early 1990s, EPA has continuously improved the TRI database and made it more accessible to the public. TRI aggregated by weight/volume has been used as a more comprehensive measure of pollution performance.

Prior Literature Using Pollution Performance Measures

Despite the limited availability of pollution data a number of accounting researchers attempted to utilize measures of pollution performance to assess its relationship with economic performance and/or pollution disclosures. Most of the early studies were based on pollution studies that were developed by the Council on Economic Priorities (CEP). CEP analyzed the pollution performance of firms in pulp and paper (Ellen, Kaufman, & Underwood, 1972), steel (Cannon, 1974), and oil refining (Kerlin & Rabovsky, 1975) industries. Some of the CEP studies used emissions data, but most relied on an assessment of the effectiveness of pollution control facilities. Spicer (1978) utilized the pulp and paper study to associate it with economic performance. Freedman and Jaggi (1982) utilized all three CEP studies and correlated them with pollution disclosures. Wiseman (1982), Rockness (1985), Freedman and Wasley (1990), and Hughes, Sander, and Reier (2000) utilized an updated CEP study to correlate with pollution disclosures.

Some of the studies used the weight or volume of a single type of emissions as the basis for pollution performance. Freedman and Jaggi (1992) utilized water pollution data and correlated it with economic performance measures, and Rockness, Schlacter, and Rockness (1986) utilized hazardous

waste disposal data and correlated it with environmental disclosures. Campbell, Sefcik, and Soderstrom (1998) and Barth and McNichols (1994) utilized Superfund data to assess environmental liabilities. Patten (2000) utilized Superfund disclosures to contrast them with other environmental disclosures. Air pollution data from electric utilities have also been used by a number of researchers. Freedman, Jaggi, and Stagliano (2004) associated sulfur dioxide releases with environmental disclosures.

The problem with using a single weight/volume measure to determine pollution performance is that other possibly critical pollution sources are ignored. For example using only water pollution data from pulp and paper firms ignores the fact that these plants are major sources of air pollution and toxic wastes. When some of these studies were done it was probable that they used the only pollution data that were publicly available.

TRI has been used in a number of studies, but all without taking toxicology into account. Hughes et al. (2000) related a ratio using TRI and correlated it with pollution performance. Patten (2002) and Freedman and Patten (2004) correlated measures of TRI in lbs. with environmental disclosure. Clarkson, Li, Richardson, and Vasvari (2008) used a ratio using TRI (confirmed by data from Investor Responsibility Research Center (IRRC)) and associated it with environmental disclosures. Although TRI is also a single measure of pollution it does include emissions that occur in the air, water, and the land. The limitation other than the lack of toxicology factor in these studies is that it does not include pollution that is not considered to be hazardous. Thus, sulfur dioxide, carbon dioxide, nitrous oxides, BOD, and TSS measures are not included.

There have been organizations other than CEP who created datasets for assessing pollution performance. Hughes et al. (2000) utilized a dataset created by *Fortune* magazine that considered toxic releases, violations of environmental laws, and rankings by environmental groups which was supervised by CEP. They then correlated this with environmental disclosures.

A number of researchers have utilized KLD database to assess pollution performance. The KLD database rates the social performance of US corporations. In the area of pollution performance the database is based on environmental planning, use of resources, compliance records, emissions, environmental controls, and the nature of the product. KLD assigns a zero or one score for each strength or weakness instead of interval values (KLD, 2003). Cho, Patten, and Roberts (2006) used the KLD database as a basis for pollution performance in an attempt to assess the relationship between pollution performance, disclosure, and political expenditures. Cho, Michelon, and

Patten (2012) utilized KLD dataset to assess the veracity of environmental disclosures as expressed in graphs in sustainability reports.

In sum, there are pros and cons for each measure of pollution performance. Currently, it is extremely challenging for researchers to find a perfect measure to assess firm's pollution performance in a fair manner. For this study, we adopt TRI among all available sources to measure pollution performance because the hazardous chemical releases are considered the most dangerous pollution. However, as indicated earlier, the raw TRI data need to be adjusted to create a more valid measure. The next section discusses this issue in detail and presents the TRI-based variables we adopted for this study.

Risk-Based TRI

TRI (EPA, 2010, http://www.epa.gov/tri/) is a raw database which provides information on annual releases of hazardous chemicals (so designated by the EPA) from US plants and was created so that the community would be aware that local plants were emitting these dangerous pollutants (Konar & Cohen, 1997). This section of the Superfund legislation was considered the "community right to know." TRI is available online from the EPA. One advantage of TRI is that it can be used as a measure of corporate pollution. The emissions can be provided by chemical and by destination (air, water, or land). Although it does not include all the different types of pollutants it does include the ones that are most immediately hazardous.

However, TRI has a number of limitations as a tool for measuring corporate pollution performance. The emissions consist of only hazardous chemicals as defined by the EPA. Other pollutants such as sulfur oxides, nitrogen oxides, carbon dioxide, particulates, and measures such as total suspended solids and bio-oxygen demand are not included in TRI. Much of the research using TRI uses total emissions and considers all chemical releases to be equal (see, e.g., Freedman & Patten, 2004; Hamilton, 1995). TRI is only available on a plant basis so using it to determine corporate pollution can be a difficult task.

Recently in the environmental and ecological literature more comprehensive metrics are developed to measure the impact of pollutants. Toxicologists have assessed the toxicity of an individual hazardous chemical and derived a weighting of toxicology by each chemical (EPA, 1990b;

SRC, 2002). Models to quantify the diffusion of toxic chemicals and the exposure of humans to these chemicals have also been built (EPA, 1986a, 1986b, 1988, 1990a, 1991a, 1991b, 2007). Furthermore, the population density around the release can be accurately estimated with the aid of Geographic Information Systems and US Census data. These scientific advents enable models to jointly use the volume metric of releases, the toxicology of the releases, and the exposed population in assessing pollution performance.

Among them the Risk-Screening Environmental Indicators (RSEI) metrics built by EPA are arguably the most prominent (EPA, 2013). Cong and Freedman (2011) review the use of more sophisticated measures of hazardous pollutions and find evidence in environmental science literature that RSEI metrics are more accurate on the measure of the impact of the pollutants. RSEI metrics are built on the basis of TRI disclosure. It includes all the TRI chemicals whose toxicity has been determined and covers the same facilities under TRI. The Pound-Based Results (PBR) is the total weight of TRI chemicals.[3] Two other RSEI metrics are recognized as highly comprehensive. Modeled Hazard Population Results (MHPR) incorporate toxicity and exposed population with the chemical release and thus overcome the alleged evenly weighting problem of using solely the chemical pound release, namely PBR. Risk-Related Results (RRR) use fate and transport parameters on top of the three factors in MHPR.[4]

By using RSEI database more powerful measures of pollution performance are created. For those industries that are the major producers of toxic emissions using RSEI can provide a comparative assessment of pollution performance.

However, it is difficult to determine which metric out of PBR, MHPR, and RRR is most useful to information users in a practical manner. PBR is a relatively naïve measure but it might be useful to average users since they might utilize the TRI data in their decision making in a similar way as PBR. But, RRR is very sophisticated and powerful so it might be a more precise measure than the others but it is questionable if the information users are sophisticated enough to consider all the factors used in RRR. Additionally, RRR values can be distorted due to missing values as discussed in footnote 4. MHPR appears to be between PBR and RRR, in terms of simplicity or sophistication. Therefore, it is another empirical question which measure out of PBR, MHPR, and RRR is the most useful to information users in a practical manner.

NEWSWEEK'S METHODOLOGY

Newsweek's Green Ranking provides one of the most extensive and freely available analyses of pollution performance of the 500 largest US companies and the 100 largest global companies. In developing the methodology for its ranking *Newsweek* utilized a number of sources. These included MSCI ESG research (formerly KLD), Trucost, CorporateRegister.com, and ASAP Media. Each of these organizations has some expertise in assessing pollution performance. Based on these companies' research the GS was derived. According to the *Newsweek* website (http://www.newsweek.com/green-rankings-2009-methodology-79621), "The GREEN SCORE for each company is based on three components": (1) EIS, (2) GPS, and (3) RSS. Specifically, the GS is computed as a weighted average of the three scores (EIS, GPS, and RSS): 45% for EIS, 45% for GPS, and 10% for RSS.

The first component of the GS is the EIS. According to the *Newsweek* website, "The ENVIRONMENTAL IMPACT SCORE, based on data compiled by Trucost, as a comprehensive and standardized quantitative performance measurement that captures the total cost of all environmental impacts of a corporation's global operations." Using data compiled by Trucost the EIS is calculated by analyzing pollution emissions data which is publicly available,[5] estimating pollution data based on an input–output model and determining the environmental impacts per total economic output. Even though *Newsweek* does not provide detailed information about the computation process, it indicates that more than 700 variables are included in computing the EIS and the figure is adjusted based on firm size using annual revenue. Thus, the EIS can be considered a comprehensive and standardized quantitative measure that attempts to capture the total impacts of a corporation's operations on the environment. Also included in this measure is a disclosure score which accounts for 10% of the total EIS (*Newsweek*, 2010). The actual pollution data that are included in the EIS appears to be greenhouse gas emissions (GHG), water use, solid waste disposal, nitrous oxide, and sulfur dioxide. Trucost uses TRI data to further refine their model.

Based on only the description provided by *Newsweek* it is impossible to determine what pollution data are specifically used. GHG emissions are self-reported by many companies on their websites, in social/environmental/sustainability reports and from the Carbon Disclosure Project. However much of the data is not audited by an external organization. The US government requires electric utilities to report their carbon dioxide emissions

as well as sulfur dioxide and nitrous oxides. In 2009 they were the only industry with that requirement. Although water pollution is a required disclosure by all plants emitting a navigable body of water, water pollution is not included in their analysis. Furthermore, it is not clear what constitutes solid waste disposal. Does being named a potentially responsible party for a toxic waste dump constitute solid waste disposal or is it some other factor?

The second component of the GS is the GPS. According to the *Newsweek* website, "The GREEN POLICIES SCORE, derived from data collected by KLD, reflects an analytical assessment of a company's environmental policies and performance." Specifically, the GPS is based on 70 individual indicators divided into five major areas: climate change policies and performance, pollution policies and performance, product impact, environmental stewardship, and management of environmental issues. Thus, the GPS attempts to assess a company's environmental policies, regulatory compliances, and community impacts.

In determining what constitutes a green company the company's actions concerning regulation and compliance is critical. Regulation is a variable that is dependent on the level of enforcement that the regulatory authority wishes to pursue. For example, the EPA is divided into regional offices with each of the regions having much autonomy. Therefore the location of a given plant may have as much to do with whether a violation is enforced as would the nature of the violation. One can assume a random distribution of the plants among the regions and thereby rendering location moot, but that is not a realistic assumption. Although, *Newsweek* probably was careful in its analysis there is still much judgment in determining the GPS. Furthermore, weighting the GPS equal to actual pollution emissions is another area of judgment.

The final component used in computing the GS is the RSS. According to the *Newsweek* website, "The REPUTATION SCORE is based on an opinion survey of corporate social responsibility (CSR) professionals, academics and other environmental experts who subscribe to Corporate Register.com." This score is based on a survey which is completed by users of CorporateRegister.com (one of the authors of this chapter is a survey participant). Although the "experts" filling out the survey may have more knowledge than the lay public about the pollution performance of specific companies, we believe their knowledge is quite limited. On average it is an educated opinion which may be mostly driven by public relations. We think there is no good justification for including it in the overall score especially since the index already includes actual performance measures.

HYPOTHESIS AND METHODOLOGY

Sample

The firms listed in *Newsweek*'s Green Ranking include the 500 largest US companies and the 100 largest global companies. In our sample, we include only the 500 US firms because TRI data are available only for US firms. Many of these companies are not major contributors to environmental degradation due to the nature of their business. Since TRI is concerned with plants that emit hazardous chemicals our sample focuses on those industries that contribute the most to these problems. Based on *Newsweek*'s industry description those industries are basic materials, industrial goods, general industry, oil and gas, and utilities. Basic materials include chemicals, metals, mining, and pulp and paper. All of these industries are major producers of toxic emissions. Metal mines are the largest producers of toxic emissions (EPA, 2010). Oil and gas also is a major producer of toxic emissions. Utilities are probably the second largest producer of toxic emissions, but they also produce a number of other pollutants not included in TRI. Coal-fired power plants are the largest industrial producer of carbon dioxide, sulfur dioxide, and nitrous oxide in the United States. Power plants also heat the discharge water to levels that make the water toxic for living things. Since *Newsweek*'s Green Ranking probably includes these other pollutants, in terms of electric utilities it may provide a more complete analysis. In sum, we include in our sample only the firms that are in the above five heavily polluting industries.

Also, the industrial sectors must be consistent with the ranking methodology used by *Newsweek*. Additionally, the firms must be included in COMPUSTAT database. We downloaded all the rankings and scores of 2009 Green Ranking US 500 from *Newsweek* website (http://greenrankings2009.newsweek.com). The ranking used an industrial classification system that is different from SIC or NAICS system. Even though the classification overlaps with SIC and NAICS, significant differences exists between them. Additionally *Newsweek* provides rankings within the sections indicating the classification is a fundamental element in the ranking. Hence we adopt their classification rather than SIC or NAICS in our study.

Our initial sample includes all the 171 firms in the five industrial sectors described above. All 171 firms are included in the COMPUSTAT annual database. Like most other studies utilizing TRI as a basis for pollution performance it is challenging to match these firms with the facilities in the TRI database. We developed a fuzz-match utility program in PERL that

Table 1. Sample Firms by Industry Sector.

Sector	Number	RANK_H[a]	RANK_MEAN[b]	RANK_L[c]
Basic materials	27	80	300	500
General industrials	24	30	228	484
Industrial goods	28	37	256	459
Oil and gas	20	100	278	425
Utilities	28	66	410	499
Total	127	37	297	500

[a]RANK_H denotes the highest rank of *Newsweek*'s Green Ranking score.
[b]RANK_MEAN denotes the average of *Newsweek*'s Green Ranking score.
[c]RANK_L denotes the lowest rank of *Newsweek*'s Green Ranking score.

can identify all proximate matches of a firm name with the parent name, parent ID, or facility name in TRI disclosure. Two human experts then proofread the matches and used Google Finance and firm websites to verify the match. We also compared our match results with the query results of Right-To-Know Network (2010, www.rtknet.org). The results contain 127 firms and their matching facilities. Table 1 presents the summary of the firms in the sample.

Hypothesis

We set out to examine the relation between *Newsweek*'s Green Ranking and TRI pollution performance. The ranking, as an aggregated measure of pollution performance, should be able to capture the information about pollution and pollution controls. Specifically, the ranking utilizes data sources such as MSCI ESG and CorporateRegister.com. These institutions all take pollution performance as part of their evaluation of corporate pollution performance. Hence, if the measurement is properly gauged and used in the ranking, we expect the ranking is inversely related to pollution: The higher the pollution is the lower the rank is. The relation, stated in null form, is specified as:

H1. *Newsweek*'s Green Ranking is not correlated with TRI pollution performance.

If the scores in *Newsweek*'s Green Ranking are derived from quantitative model to measure pollution performance, they would be more informative

than the scores which are based on mere ordinary measures. Specifically, we expect that the GS and EIS are more likely to be affected by the hazardous pollution measures so long as the metrics to produce them are effective, because they reflect more on firm's pollution performance than the other scores such as GPS and RSS. In short, the following two testable hypotheses are developed in order to test H1:

H1a. GS is not correlated with TRI pollution performance.

H1b. EIS is not correlated with TRI pollution performance.

TRI pollution performance is measured by the risk measures at three levels: PBR, MHPR, and RRR. PBR measures only chemical release and has been the most widely used acknowledged measure of pollution in the environmental accounting and economics literature (see for instance, Freedman & Patten, 2004; Hamilton, 1995). MHPR measures the three-way interaction between chemical release, exposed population, and toxicity and therefore overcomes alleged evenly weighting problem of PBR. Moreover, MPHR incorporates the effect of exposed population, which may play an important role in *Newsweek*'s design of the ranking system. RRR integrates the release, fate, and transport parameters, toxicity, and population in one single measure. Theoretically, the measuring power and complexity escalate in the order PBR, MHPR, and RRR.

As the simplest metric, PBR is easy to calculate and comprehend and thus has been the most acknowledged and utilized metric ever since TRI caught the attention of academia and the public. MHPR incorporates toxicity and exposed population with chemical release volume. Even though it is relatively more complex than PBR, the two added factors are intuitive. On top of MHPR, RRR incorporates chemical transfer pathway, physiochemical properties, and/or geographical properties. It requires profound understanding of several scientific disciplines to gain a fair command of the knowledge of these properties. Complex mathematical and statistical methods are also necessary to understand the model that includes these properties. It is likely that the experts who design and prepare an index/ranking like the *Newsweek*'s Green Ranking are unable to fully comprehend the information contained in these complex metrics. Even if the experts understand the metrics, for the sake of communication with the general public, they may select the metrics that are easier to understand and explain. Hence we expect RRR is less strongly related

to the ranking than are the other two metrics. The null hypothesis is stated as:

H2. The correlations between *Newsweek*'s Green Ranking and the metrics of TRI pollution performance (PBR, MHPR, RRR) are equally significant.

Again, GS and EIS are more likely to be associated with pollution performance than are GPS and RSS. H2 is testable for GS and EIS.

H2a. The correlations between GS and the metrics of TRI pollution performance (PBR, MHPR, RRR) are equally significant.

H2b. The correlations between EIS and the metrics of TRI pollution performance (PBR, MHPR, RRR) are equally significant.

Models to Test

Our hypotheses require tests of models using GS and EIS as dependent variables. GPS and RSS are less likely to be related to the pollution performance. Even so, a better understanding of whether the latter two are related to pollution performance is desirable since it can provide evidence about the effectiveness of firm-level environmental policies and whether society perceives a firms pollution performance correctly (e.g., Cho & Roberts, 2010). Inevitably a ranking that factors in public opinion is influenced by characteristics other than pollution performance of a firm. Hence it is helpful to include variables that can control for these effects. The firm size (SIZE) is related to reputation, socio-politico attention, and power and thus is used as a collect-all control variable. Table 2 presents the definitions of the dependent and independent variables.

In short, having SIZE controlled for, we use each of the three TRI pollution performance risk measures (PBR, MHPR, and RRR) as independent variables and each of the four *Newsweek*'s Green Ranking scores (GS, EIS, GPS, and RSS) as a dependent variable in each specification. For Ordinary Least Square (OLS) regression analyses, we performed statistical tests to see if each of the dependent variables (GS, EIS, GPS, and RSS) is normally distributed. The test results for normality show that the variables are not normally distributed. To resolve this issue, we performed the Box-Cox transformation for each of the dependent variables in order to find the most proper power transformation for normalizing it.[6]

Table 2. Variable Definitions.

Variable	Description
GS	*Newsweek*'s Green Score, which is based on three components of EIS, GPS, and RSS.
EIS	*Newsweek*'s Environmental Impact Score, which is "a comprehensive and standardized quantitative performance measurement that captures the total cost of all environmental impacts of a corporation's global operations."
GPS	*Newsweek*'s Green Policies Score, which "reflects an analytical assessment of a company's environmental policies and performance."
RSS	*Newsweek*'s Reputation Survey Score, which "is based on an opinion survey of corporate social responsibility (CSR) professionals, academics and other environmental experts who subscribe to CorporateRegister.com."
PBR	Pound-Based Results; TRI's total pounds of chemicals × Toxicity of a chemical release; Natural log of the product is taken.
MHPR	Modeled Hazard Population Results; TRI's total pounds of chemicals × Toxicity of a chemical release × Population that is exposed to the release; Natural log of the product is taken.
RRR	Risk-Related Results; Fate and transport parameters in addition to the three factors in MHPR (TRI's total pounds of chemicals, Toxicity of a chemical release and Population) are considered.
UTIL	Dummy Variable for the utilities sector: 1 if a firm is in the sector; 0 otherwise.
SIZE	Natural logarithm of total assets.

With the transformed dependent variables, we run total 16 regression models. Eight of the models whose dependent variable is either GS or EIS are the direct tests of the sub-hypotheses. The specifications are presented below:

$$\begin{aligned}&\text{Transformed variable of } \textit{Newsweek}\text{'s Green Ranking Score}\\&\quad(\text{GS, EIS, GPS, or RSS})\\&= \alpha + \beta * \text{TRI Pollution Measure (PBR, MHPR, or RRR)} + \gamma * \text{SIZE} + \varepsilon\end{aligned}$$

In the above regression model, the estimated coefficient β represents the relationship between *Newsweek*'s Green Ranking scores and TRI pollution measures. β is expected to be significantly negative if *Newsweek*'s Green Ranking scores are informative: the lower the TRI pollution measures are the higher the *Newsweek*'s Green Ranking scores are. H1 would be rejected if the estimated coefficient β is significantly different from zero in the regression models with the dependent variable GS or EIS. For H2, we would compare the signs and significance levels of β for each TRI pollution measure: PBR, MHPR, and RRR.

We use additional tests to replicate the above regression analyses with the two subsamples – Utilities sector and non-Utilities sector. The prior literature found that industrial sector plays an important role in environmental regulation and protection. The public may evaluate firm's pollution performance using benchmarks in the same industry. Particularly, we conjecture that the relationship between *Newsweek*'s Green Ranking scores and TRI pollution measures would have different patterns between Utilities sector and the other sectors.

RESULTS

Descriptive Analysis

Table 3 presents the descriptive statistics of variables. Panel A shows the statistics of the full sample. Panels B and C present the descriptive statistics of Utilities and non-Utilities sectors, respectively.

The means and medians for the *Newsweek*'s Green Ranking scores and TRI pollution performance measures are similar between Utilities sector and non-Utilities sector except that the mean and median of the overall GS and EIS of the Utilities sector are apparently lower than those of non-Utilities sector. The lower scores of Utilities sector suggest the *Newsweek*'s ranking treats the utilities industry differently from the other industries.

Correlations

Table 4 presents the correlations between the variables. In each panel, the lower half matrix shows the *Spearman's* correlations while the upper half presents Pearson's correlation of the research variables.

Panel A of the table shows the correlations of the full sample. Strong and positive correlations are identified between the *Newsweek*'s overall GS and the *Newsweek*'s other three ranking scores (EIS, GPS, and RSS). The high correlations are not surprising since GS is an aggregation of the other three ranking scores. It is particularly interesting to see the lack of correlations between EIS and RSS. The results imply public opinion, even if made by professionals who are knowledgeable about environmental issues, are disconnected from the reality of pollution performance and management. The finding also suggests that firm's environmental reputation tends to be

Table 3. Descriptive Statistics.

Variable	*N*	Mean	Std. Dev.	Minimum	Median	Maximum
Panel A: Full						
GS	127	66.035	12.940	1.000	68.110	83.820
EIS	127	22.869	15.806	0.200	22.200	72.700
GPS	127	39.075	15.599	4.590	38.450	72.350
RSS	127	36.295	10.765	8.860	34.580	94.300
PBR	127	5.377	2.361	−3.546	5.706	9.536
MHPR	125	25.621	4.463	−5.964	26.529	30.668
RRR	127	44.983	91.346	0.000	8.088	511.149
SIZE	127	9.436	1.004	7.832	9.391	13.131
Panel B: Utilities						
GS	28	54.741	15.234	22.750	59.470	79.770
EIS	28	6.293	7.219	0.600	3.800	28.200
GPS	28	40.389	14.870	15.490	42.005	67.600
RSS	28	37.523	8.996	23.680	34.805	58.590
PBR	28	6.464	2.549	−2.896	7.314	8.984
MHPR	28	28.042	3.286	15.113	29.198	30.668
RRR	28	39.331	64.256	0.000	16.598	247.158
SIZE	28	9.449	0.709	8.272	9.533	10.896
Panel C: Non-utilities						
GS	99	69.229	10.228	1.000	69.540	83.820
EIS	99	27.558	14.357	0.200	26.100	72.700
GPS	99	38.703	15.853	4.590	37.820	72.350
RSS	99	35.947	11.232	8.860	34.550	94.300
PBR	99	5.070	2.224	−3.546	5.297	9.536
MHPR	97	24.922	4.527	−5.964	25.987	30.322
RRR	99	46.582	97.872	0.000	6.850	511.149
SIZE	99	9.432	1.075	7.832	9.339	13.131

formed based on information other than the actual pollution performance. EIS is not correlated with GPS, indicating the green policies and procedures do not improve pollution performance. More importantly, GS and EIS are significantly correlated with the TRI performance measures of PBR and MHPR (p-value < 0.01). EIS is also significantly correlated with RRR (p-value < 0.05). All the correlations bear a negative sign and indicate the *Newsweek*'s ranking scores are informative: the lower the pollution measures are the higher the *Newsweek*'s ranking scores are. The correlations provide evidence of the usefulness of the *Newsweek*'s ranking as a measure of pollution performance.

Table 4. Variable Correlation.

Variable	GS	EIS	GPS	RSS	PBR	MHPR	RRR	SIZE
Panel A: Full								
GS	.	0.525***	0.582***	0.214**	−0.291**	−0.286***	−0.066	−0.006
EIS	0.489***	.	−0.049	−0.043	−0.442***	−0.484***	−0.033	0.030
GPS	0.723***	−0.085	.	0.309***	0.063	−0.052	−0.017	−0.026
RSS	0.284***	−0.102	0.345***	.	0.092	0.147	−0.040	0.341***
PBR	−0.267***	−0.511***	0.085	0.085	.	0.607***	0.205**	−0.034
MHPR	−0.310***	−0.459***	−0.002	0.069	0.580***	.	0.383***	0.141
RRR	−0.127	−0.213**	−0.023	0.067	0.490***	0.891***	.	−0.147
SIZE	−0.019	−0.023	−0.001	0.318	0.010	0.099	0.086	.
Panel B: Utilities								
GS	.	0.668***	0.626***	0.348*	−0.654***	−0.533***	−0.428**	−0.170
EIS	0.899***	.	0.239	0.055	−0.702***	−0.519***	−0.233	−0.136
GPS	0.656***	0.320*	.	0.353*	−0.307	−0.376**	−0.054	−0.198
RSS	0.378**	0.227	0.395**	.	−0.380**	−0.379**	0.002	0.341*
PBR	−0.785***	−0.800***	−0.286	−0.406**	.	0.855***	0.339*	−0.133
MHPR	−0.530***	−0.469**	−0.262	−0.481***	0.677***	.	0.384**	0.141
RRR	−0.538***	−0.474**	−0.294	−0.336*	0.634***	0.887***	.	0.240
SIZE	−0.184	−0.146	−0.176	0.303	−0.032	0.284	0.369*	.
Panel C: Non-utilities								
GS	.	0.293**	0.854***	0.312**	0.109	−0.027	0.004	0.060
EIS	0.174	.	−0.049	−0.008	−0.356***	−0.425***	−0.107	0.088
GPS	0.923***	−0.120	.	0.292**	0.165	−0.005	0.009	−0.005
RSS	0.390***	−0.089	0.312**	.	0.189	0.218*	−0.042	0.346***
PBR	0.050	−0.347***	0.173	0.196	.	0.529***	0.212*	−0.019
MHPR	0.013	−0.267**	0.064	0.202*	0.496***	.	0.410***	0.155
RRR	0.020	−0.213*	0.052	0.188	0.493***	0.965***	.	−0.175
SIZE	0.065	0.079**	0.012	0.322***	−0.000	0.086	0.066	.

The upper half shows the Pearson's and the lower half shows Spearman's Correlations.
***, **, and * indicate the statistically significant level at p-value = 0.01, 0.05, and 0.10, respectively.

Panels B and C present the correlations for Utilities sector and non-Utilities sector, respectively. Similarly to the full sample in Panel A, GS is significantly and positively correlated with GPS and RSS. However, GS is significantly associated with EIS (p-value < 0.001) in only Utilities sector. This significant association is not found in non-Utilities sector. Noting that the same correlation in the full sample is highly significant (p-value < 0.001), we infer that the highly significant correlation in the Utilities sector alone accounts for the correlation in the full sample. Said differently, only in the Utilities sector GS effectively incorporates EIS, whereas in the non-Utilities sector GS is mostly driven by GPS. In terms of the TRI pollution performance measures, there is an overall relationship in both Utilities and non-Utilities sector; however the correlations are not always consistently significant. Essentially these measures are interaction terms between chemical releases, toxicity weights, and exposed populations. Hence strong correlations between these measures are not always expected. For instance, it is entirely possible that firm A releases a large volume of chemicals with very low toxicity while firm B releases a small volume of extremely toxic chemicals. If firm A and B are in the same sector, then the correlation between the volume-based metric PBR and volume-toxicity-population based metric MHPR is adversely affected. In a sector that comprises multiple types of subsectors/industries, the correlation is very likely insignificant. In a highly homogeneous sector, for example, utilities, the correlation can be highly significant. This is exactly what we observed from the results.

More importantly, the correlations between the *Newsweek*'s Green Ranking scores and the TRI pollution performance measures are somewhat inconsistent between Utilities sector and non-Utilities sector. In the Utilities sector, all the correlations between the GS and the TRI performance measures are significant and negative (p-value < 0.01). However, the association is not significant in non-Utilities sector. This finding suggests that the significantly negative association between GS and TRI performance measures in the full sample is mainly driven by the Utilities sector. In contrast with the association between GS and TRI performance measures, the correlations between the EIS and the TRI performance measures are significantly negative in both Utilities and non-Utilities sector.

Another interesting point commonly found in both full sample and subsamples is that the firm size is overall insignificantly correlated with all the other variables. Even though there are a few exceptions, it can be inferred with caution that: (1) the *Newsweek*'s Green Ranking scores are not affected by firm size; and (2) TRI pollution performance measures, adjusted by sales, do not vary significantly across firms of different sizes.

OLS Regression Analysis with Full Sample

As a multivariate test to examine whether the *Newsweek*'s Green Ranking scores capture TRI pollution performance, we run an OLS regression. Given that our primary focus is on GS and EIS, we could regress the transformed variables of these two dependent variables on TRI performance measures. However, to gain a better understanding of how GS is affected by the other two dimensions such as GPS and RSS, we also include the transformed variables of these two as dependent variables.

The independent variables we use, except for the control variable SIZE, are all the metrics of TRI pollution performance. Given that these TRI metrics can be closely correlated, as discussed in the analysis of correlations, it is statistically less appealing to include all of them in one single model. Additionally, the size of our tested sample is moderate. A model with an inflated number of independent variables may adversely affect the power of the statistical inference. Hence, we adopt a strategy in which we regress each of the *Newsweek*'s Green Ranking score on one of TRI pollution measures with size (SIZE) as the collect-all control variable. Table 5 presents the results from these regressions with the full sample.

Panel A of Table 5 contains the results of regressing the transformed GS on TRI pollution measures. In the model with all TRI measures as independent variables, only the coefficient of MHPR is significantly negative at 10% level. But, in the model with only one TRI measure, the coefficient of PBR is significantly negative at 10% level and the coefficient of MHPR is significantly negative at 1% level. However, the coefficient of RRR is not found significant in all the models. Panel B shows the results of the model with the transformed EIS as the dependent variable. Again, the two predictors (PBR and MHPR) bear the negative sign and are significant at the 1% level. Inconsistent with our expectation, the coefficient of RRR is significantly positive at 5% level in the model with all TRI measures, but not significant in the model with RRR as only one TRI measure.

The two panels together show that *Newsweek*'s GS indeed captures the information about pollution performance. Specifically, the lower the pollution is, as measured by PBR and MHPR, the higher the ranking scores are, as measured by GS and EIS.

The F statistics and adjusted R^2 both provide additional support for the results regarding coefficients. Particularly, the F statistics and adjusted R^2 of the model with the transformed EIS as a dependent variable are much higher than those of the model with the transformed GS as a dependent

Table 5. OLS Regression Results – Full Sample.

Panel A: Dependent variable: Transformed GS					*Panel C: Dependent variable: Transformed GPS*				
Intercept	449,080	341,708	449,682	294,132	Intercept	22.710	19.177	22.705	21.257
	(3.91)***	(3.00)***	(3.91)***	(2.59)**		(3.67)***	(3.29)***	(3.67)***	(3.69)***
PBR	−7,688	−9,559			PBR	0.463	0.297		
	(−1.22)	(−1.94)*				(1.36)	(1.18)		
MHPR	−6,763		−8,335		MHPR	−0.229		−0.076	
	(−1.97)*		(−3.33)***			(−1.24)		(−0.56)	
RRR	98			−72	RRR	0.001			−0.001
	(0.74)			(−0.55)		(0.14)			(−0.18)
SIZE	7,148	1,593	7,388	1,531	SIZE	0.047	−0.099	−0.098	−0.144
	(0.62)	(0.14)	(0.67)	(0.13)		(0.08)	(−0.17)	(−0.16)	(−0.24)
Pr > *F*	0.013	0.152	0.005	0.839	Pr > *F*	0.692	0.488	0.829	0.961
Adj. R^2	0.070	0.014	0.069	−0.013	Adj. R^2	−0.014	−0.005	−0.013	−0.016
R^2	0.100	0.030	0.084	0.003	R^2	0.018	0.012	0.003	0.001
Panel B: Dependent variable: Transformed EIS					*Panel D: Dependent variable: Transformed RSS*				
Intercept	15.282	10.789	15.327	7.041	Intercept	4.266	4.670	4.259	5.158
	(4.69)***	(3.17)***	(4.52)***	(1.97)*		(2.57)**	(3.02)***	(2.58)**	(3.39)***
PBR	−0.477	−0.630			PBR	0.052	0.067		
	(−2.68)***	(−4.29)***				(0.57)	(1.01)		
MHPR	−0.346		−0.428		MHPR	0.040		0.045	
	(−3.56)***		(−5.79)***			(0.82)		(1.26)	
RRR	0.008			−0.001	RRR	−0.001			0.000
	(2.09)**			(−0.30)		(−0.70)			(−0.22)
SIZE	0.359	0.015	0.340	0.059	SIZE	0.501	0.556	0.513	0.544
	(1.10)	(0.04)	(1.04)	(0.16)		(3.03)***	(3.54)***	(3.23)***	(3.42)***
Pr > *F*	<.0001	0.0002	<.0001	0.937	Pr > *F*	0.009	0.002	0.002	0.003
Adj. R^2	0.266	0.115	0.203	−0.015	Adj. R^2	0.076	0.082	0.084	0.075
R^2	0.290	0.129	0.216	0.001	R^2	0.106	0.097	0.099	0.090

Numbers in parentheses denote *t*-values of estimated coefficients.

***, **, and * indicate the statistically significant level at *p*-value = 0.01, 0.05, and 0.10, respectively.

variable. The higher magnitude of adjusted R^2 indicates that the two TRI pollution measures (PBR and MHPR) affect EIS much more than GS. The differences are expected on both theoretical and common-sense grounds.

Overall, GS and EIS are not significantly associated with the pollution performance as measured by RRR. Counter-intuitively, one model shows a significantly positive correlation between EIS and RRR. RRR is a very complicated measure that uses a surrogate dose that depends on exposure modeling. Even though RRR is scientifically superior as a measure of the pollution impact to humans, its complexity is beyond what we think the media and public can understand. We believe the complexity of RRR modeling is what causes its insignificant results.

Specific to H1, GS and EIS capture the information in PBR and MHPR but not in RRR. Even though GS and EIS are incapable of capturing more complex information regarding the fate and transport parameters and physiochemical effects of pollutions, they still carry information about pollution performance that is easy to understand and interpret. The null H2 is rejected because of the sharp contrast between the coefficients of PBR and MHPR and the ones of RRR. On the flip side, the coefficient of MHPR is significant, indicating that GS and EIS capture information beyond pound-based metrics and support our conjecture that GS and EIS take into account the exposed population in the design of the ranking system.

The other two *Newsweek*'s ranking scores, GPS and RSS do not have any significant relationship with TRI measures in Panels C and D. The insignificance is not surprising since, the scores are not about actual pollution performance but other aspects such as environmental policies.

It is worthwhile to note that SIZE is highly significant in the model with the transformed RSS as a dependent variable (p-value < 0.001). The positive coefficients indicate that the opinions of the surveyed experts are heavily influenced by the size of the firms: the bigger a firm is the more likely it is to be ranked higher. Since SIZE is a collect-all control variable in our test, we are unable to identify more specific latent factors. Factors such as the greater power of public relations and brand (firm name) image may all be relevant.

Overall our results show the *Newsweek*'s Green Ranking scores – particularly GS and EIS – can capture an easy and well-accepted pollution measure (PBR) and its easy-to-measure impact on humans (MHPR). Factors that are scientifically more relevant but less intuitive (RRR) are not well understood.

OLS Regression Analysis with Subsamples

To test whether the correlations between *Newsweek*'s Green Ranking scores and TRI pollution measures are relatively different by industry sectors – particularly, Utilities sector versus non-Utilities sector – we replicate the regression analyses with the two subsamples of Utilities sector and non-Utilities sector.

Table 6 shows the regression results with a subsample composed of only Utilities firms and Table 7 with non-Utilities firms. From the comparison between Tables 6 and 7, we find that the GS captures the actual pollution performance much more effectively in Utilities industry than the other industrial sectors. Specifically, the estimated coefficients of PBR and MHPR are significantly negative in Panel A of Table 6, but, not in Panel A of Table 7. The positive relationship between the transformed GS and PBR in Panel A of Table 7 is even counter-intuitive. The findings suggest that *Newsweek*'s GS effectively captures the information of actual pollution performance in the Utilities sector whereas it does not in non-Utilities sector. In other words, the significant association between GS and TRI performance with the full sample in Table 5 is mainly attributed to Utilities sector.

Panel B of Tables 6 and 7 presents the results with the transformed EIS as a dependent variable. In Panel B of Table 6, PBR and MHPR are strongly and negatively associated with the transformed EIS. However, RRR is not significantly correlated with the transformed EIS. The results imply that EIS can capture PBR and MHPR effectively in Utilities sector. In Panel B of Table 7, only MHPR is significantly negative. This finding still supports that EIS would be more useful than GS in perceiving firm's pollution performance both in Utilities and non-Utilities sector.

Panels C and D of Tables 6 and 7 present the results from the analysis with each of the transformed GPS and the transformed RSS as a dependent variable. Overall the three TRI performance measures are not significantly negative with GPS and RSS except that MHPR has a significantly negative association with RSS in Utilities sector and PBR has a significantly negative association with GPS in non-Utilities sector.

In summary, the results from the analyses with subsamples indicate that the *Newsweek*'s GS and EIS are capturing the pollution performance more effectively in the Utilities sector than in the non-Utilities sector.

Table 6. OLS Regression Results – Utilities Sector.

Panel A: Dependent variable: Transformed GS					*Panel C: Dependent variable: Transformed GPS*				
Intercept	853,680	1,016,863	1,122,330	437,389	Intercept	53.819	44.745	50.249	35.799
	(3.57)***	(4.86)***	(3.81)***	(1.32)		(2.80)**	(2.74)**	(2.90)***	(2.13)**
PBR	−58,502	−41,961			PBR	−0.415	−0.824		
	(−4.51)***	(−7.12)***				(−0.40)	(−1.79)*		
MHPR	15,126		−25,897		MHPR	−0.494		−0.665	
	(1.51)		(−4.28)***			(−0.62)		(−1.87)*	
RRR	−84			−709	RRR	0.017			0.001
	(−0.33)			(−1.82)		(0.80)			(0.03)
SIZE	−75,108	−59,151	−22,165	−23,578	SIZE	−1.851	−2.008	−1.180	−1.628
	(−3.01)***	(−2.79)***	(−0.79)	(−0.67)		(−0.92)	(−1.21)	(−0.72)	(−0.91)
Pr > *F*	<.0001	<.0001	0.001	0.121	Pr > *F*	0.321	0.146	0.128	0.656
Adj. R^2	0.664	0.659	0.404	0.088	Adj. R^2	0.034	0.074	0.084	−0.044
R^2	0.714	0.684	0.448	0.155	R^2	0.178	0.143	0.152	0.033
Panel B: Dependent variable: Transformed EIS					*Panel D: Dependent variable: Transformed RSS*				
Intercept	10.821	16.170	16.774	5.662	Intercept	9.145	6.132	8.328	3.335
	(2.32)**	(3.54)***	(2.59)**	(0.85)		(2.13)**	(1.63)	(2.18)**	(0.85)
PBR	−1.445	−0.782			PBR	0.108	−0.214		
	(−5.71)***	(−6.07)***				(0.47)	(−2.01)*		
MHPR	0.578		−0.420		MHPR	−0.291		−0.208	
	(2.97)***		(−3.16)***			(−1.62)		(−2.64)**	
RRR	0.000			−0.012	RRR	0.001			−0.003
	(0.01)			(−1.46)		(0.25)			(−0.58)
SIZE	−1.596	−0.900	−0.252	−0.275	SIZE	0.931	0.612	0.850	0.773
	(−3.28)***	(−1.94)*	(−0.41)	(−0.39)		(2.08)**	(1.60)	(2.33)**	(1.85)*
Pr > *F*	<.0001	<.0001	0.012	0.277	Pr > *F*	0.061	0.036	0.011	0.199
Adj. R^2	0.714	0.604	0.300	0.026	Adj. R^2	0.194	0.172	0.248	0.051
R^2	0.664	0.572	0.244	0.098	R^2	0.313	0.233	0.303	0.121

Numbers in parentheses denote *t*-values of estimated coefficients.

***, **, and * indicate the statistically significant level at *p*-value = 0.01, 0.05, and 0.10, respectively.

Table 7. OLS Regression Results – Non-Utilities Sector.

Panel A: Dependent variable: Transformed GS					*Panel C: Dependent variable: Transformed GPS*				
Intercept	282,296	206,693	289,608	263,569	Intercept	19.211	15.546	19.852	19.316
	(2.72)***	(2.05)**	(2.80)	(2.58)***		(2.89)***	(2.51)**	(2.95)***	(3.07)***
PBR	8,692	10,155			PBR	0.823	0.657		
	(1.43)	(2.06)**				(2.11)**	(2.16)**		
MHPR	−3,707		−1,246		MHPR	−0.234		−0.023	
	(−1.20)		(−0.52)			(−1.18)		(−0.15)	
RRR	33			−0.414	RRR	0.001			0.000
	(0.27)			(−0.00)		(0.11)			(−0.06)
SIZE	11,022	8,557	8,661	7,987	SIZE	0.212	0.084	0.042	0.040
	(1.06)	(0.84)	(0.87)	(0.75)		(0.32)	(0.13)	(0.07)	(0.06)
Pr > *F*	0.560	0.094	0.631	0.746	Pr > *F*	0.352	0.101	0.988	0.995
Adj. R^2	−0.011	0.028	−0.011	−0.015	Adj. R^2	0.005	0.027	−0.021	−0.021
R^2	0.032	0.048	0.01	0.006	R^2	0.046	0.047	0.000	0.000
Panel B: Dependent variable: Transformed EIS					*Panel D: Dependent variable: Transformed RSS*				
Intercept	12.266	8.709	12.171	7.513	Intercept	3.760	4.351	3.836	5.254
	(4.13)***	(2.81)***	(4.04)***	(2.41)**		(2.07)**	(2.58)**	(2.11)**	(3.08)***
PBR	−0.282	−0.243			PBR	0.160	0.155		
	(−1.62)	(−1.60)				(1.50)	(1.87)		
MHPR	−0.233		−0.251		MHPR	0.055		0.075	
	(−2.63)**		(−3.65)***			(1.02)		(1.81)*	
RRR	0.005			−0.001	RRR	−0.002			0.000
	(1.44)			(−0.21)		(−0.89)			(−0.09)
SIZE	0.397	0.155	0.329	0.155	SIZE	0.457	0.537	0.473	0.525
	(1.34)	(0.49)	(1.14)	(0.48)		(2.51)**	(3.14)***	(2.71)***	(2.96)***
Pr > *F*	0.002	0.245	0.002	0.849	Pr > *F*	0.006	0.002	0.003	0.012
Adj. R^2	0.136	0.009	0.109	−0.017	Adj. R^2	0.108	0.101	0.097	0.069
R^2	0.172	0.029	0.127	0.003	R^2	0.145	0.120	0.116	0.088

Numbers in parentheses denote *t*-values of estimated coefficients.
***, **, and * indicate the statistically significant level at *p*-value = 0.01, 0.05, and 0.10, respectively.

CONCLUSIONS

In a time where there is a dearth of reliable information being provided by firms in accounting for their pollution performance, *Newsweek* attempted to fill this void by providing a ranking and analysis of the performance by the largest companies in the United States. In this study we compared *Newsweek*'s measures of pollution performance to TRI unadjusted and adjusted for risk.

We found that for some measures of TRI there is a significant association with the EIS provided by *Newsweek*. Specifically, the interaction between pollution release, toxicity, and exposed population is always captured in the EIS in the full sample and the dissected sample by industry. This finding indicates that the pollution performance component of the *Newsweek*'s ranking is reasonably effective. However, *Newsweek*'s GS is less informative than the EIS as a measure of pollution performance. First, in terms of industries, utilities seem to have been the one industry that is consistently ranked by *Newsweek* by the various measures of TRI. If the utility industry is eliminated from the sample then the GS for the other industries is not related to the various measures of TRI. Second, the *Newsweek*'s scores based on reputation do not seem to be a useful component in assessing pollution performance. *Newsweek*'s scores based on reputation (RSS) are directly related to size and but not related to TRI performance measures. Third, *Newsweek*'s scores based on green policy and procedure (GPS) also seem to be little useful in the assessment. The scores are disconnected from the pollution performance in pooled and cross-industry analysis.

When the component scores are aggregated into the GS, the information captured by the EIS is diluted by the other two components. The dilution effect suggests that the use of a composite index combining performance factors and soft/judgmental factors may not provide the most useful environmental disclosures.

For this study, we used only 2009 *Newsweek* Green Ranking because in 2010 *Newsweek* modified the methodology for Green Ranking in 2010. Thus, our finding is limited to only 2009 *Newsweek* Green Ranking. *Newsweek*'s change in methodology for Green Ranking might produce different test results, posing a question for future research.

Overall, we think *Newsweek* should be praised for their efforts in assessing pollution performance. In the future we believe that they should eliminate the reputational component and consider adding some measures of toxicity to their pollution measures. Although their measures

have flaws, people relying on them will probably be steered in the right direction.

From an accounting perspective, *Newsweek*'s efforts help provide a reporting model for firms to disclose information on their pollution performance. Providing this information and having it audited by an outside firm will enable users to have reliable pollution information and this will aid in decision making.

NOTES

1. The definitions for GS, EIS, GPS, and RSS are provided in the section '*Newsweek*'s Methodology' and Table 2.

2. TRI is a raw database which provides information on annual releases of hazardous chemicals. It is available on EPA website (EPA, 2010). The weight/volume of chemical releases, as measured by pounds, has been widely used in extant literature, prior to Cong and Freedman (2011). This measure overlooks the toxicity of each release or the population exposed to each release and thus is considered a rough and naïve measure.

3. This measure is identical to the TRI total pound metrics used in extant literature, for example, Freedman and Patten (2004) and Hamilton (1995). The TRI-based pollution performance metric in extant literature simply aggregate the pounds of the releases. This approach, in EPA terminology, is called pound-based results (EPA, 2013, Exhibit 2.2, p. 7).

4. By EPA definition, to calculate RRR, "The toxicity, surrogate dose, and population components are multiplied to obtain a risk score for the 'Indicator Element'. The surrogate dose is determined through pathway-specific modeling of the fate and transport of the chemical through the environment, combined with subpopulation-specific exposure factors" (EPA, 2013, p. 63). The modeling of RRR is theoretically appealing. However, the calculation of RRR uses a number of variables that may not be available, for example, fate, transport, and subpopulation-specific exposure factors. A value of zero is assigned when such data are not available (EPA, 2013, p. 63). To circumvent this issue, the three-way interaction term between pound release, toxicity weight, and population, namely MHPR, is adopted to simplify the model (Cong & Freedman, 2011).

5. Some data are collected by Trucost via the Trucost Environmental Register system. Essentially it is a voluntary disclosure system in which firms choose to respond to Trucost's request or not.

6. Using the Box-Cox transformation method, the most proper power transformation for each variable is as follows. For GS, lambda is 3.270 so the transformed GS is equal to $((GS)^{3.270}-1)/3.270$. For EIS, lambda is 0.546 so the transformed EIS is equal to $((EIS)^{0.546}-1)/0.546$). For GPS, lambda is 0.763 so the transformed GPS is equal to $((GPS)^{0.763}-1)/0.763$. For RSS, lambda is 0.515 so the transformed RSS is equal to $((RSS)^{0.515}-1)/0.515$).

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CORPORATE GOVERNANCE AND ENVIRONMENTAL ACTIVITY ☆

Martin Stuebs, Jr. and Li Sun

ABSTRACT

This chapter examines the association between corporate governance and environmental performance. The purpose of governance mechanisms is to build trust by ensuring that corporate responsibilities, including environmental responsibilities, are met. We obtain corporate governance data from the Investor Responsibility Research Center, Inc's (IRRC's) governance and director database and additional corporate governance and environmental performance data from Kinder, Lydenberg, and Domini's (KLD's) database. Our analyses document a significant positive association between corporate governance and environmental performance. Moreover, we find that corporate governance is positively related to environmental strengths, and negatively related to environmental concerns. Our findings contribute to and extend our understanding of the relationship between governance and performance and have important implications for policy makers, managers, investors, and others.

Keywords: Corporate governance; environmental performance; environmental strengths score; environmental concerns score

☆ Data availability: All data used in this study are available from public sources.

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INTRODUCTION

Environmental performance is a growing and critical dimension of corporate social responsibility (CSR) (Dixon-Fowler, Slater, Johnson, Ellstrand, & Romi, 2013). Since the 1990s, more and more firms have voluntarily (over)complied with environmental regulations and increased resources devoted to enhancing environmental quality. A growing body of empirical research supports the proposition that improving environmental quality can bring benefits to a firm (e.g., Christmann, 2000; Delmas, 2001; Hart & Ahuja, 1996; Konar & Cohen, 2002; McGuire, Sundgren, & Schneeweis, 1988; Melnyk, Sroufe, & Calantone, 2003; Porter & van der Linde, 1995; Russo & Fouts, 1997; U.S. EPA, 2000; Waddock & Graves, 1997). Given the benefits and growing importance of environmental performance (Dixon-Fowler et al., 2013), what factors are positively associated with environmental performance? Specifically, is corporate governance positively associated with environmental performance?

Stakeholder theory (Hill & Jones, 1992) and legitimacy theory (Suchman, 1995) are two socio-political theories that focus on the importance of building and maintaining stakeholder relationships. These stakeholder relationships are critical to a firm's success since they can profoundly influence performance regardless of whether those stakeholder groups share in ownership rights. Effective stakeholder relationships are based on trust. Trust is built and maintained by meeting and exceeding responsibilities. Environmental responsibilities are among these corporate social responsibilities that a firm must meet to build trust with various stakeholders. Corporate governance mechanisms play an important role in this process of building trust by assuring that corporate social responsibilities, including environmental responsibilities, are met. Improved corporate governance should be positively associated with improved environmental performance.

In this chapter, we investigate the relationship between corporate governance and environmental performance. We collect corporate governance and environmental performance data from the Investor Responsibility Research Center, Inc's (IRRC's) governance and director database and the Kinder, Lydenberg, and Domini's (KLD's) database. Our analyses document a significant positive association between corporate governance and environmental performance. This chapter contributes to research on the relationship between governance and performance by delivering new evidence on the link between governance and environmental performance,

another dimension of company performance. It adds to the corporate governance literature and emerging accounting literature on pro-environmental management. The results should interest managers who engage in behavior leading to or maintaining strong corporate governance mechanisms, financial analysts who conduct research on corporate governance and firm performance, and policy makers who design and implement guidelines on corporate governance mechanisms. Moreover, results in this study can increase "green" investors' confidence in investing in companies with stronger corporate governance.

The remainder of the chapter is organized as follows. The next section reviews prior research and develops our hypothesis. The section after this describes our research design, including measurement of primary variables and empirical specification. Following this sample selection and descriptive statistics are described, and the results from analyses are reported next. The next section reports results from additional supplemental tests, and the last section summarizes our study.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

A Socio-Political Theoretical Base

We rely on two socio-political theories – stakeholder theory (Freeman, 1984; Hill & Jones, 1992) and legitimacy theory (Suchman, 1995) – to provide our hypothesis theoretical foundation. Both theories employ a stakeholder perspective. Stakeholder theory and the conflict resolution literature (e.g., Calton & Payne, 2003; Jensen, 2002; Jo & Harjoto, 2011; Sherer, Palazzo, & Baumann, 2006) posit that the corporation's role extends to other non-investing stakeholder interests (Jo & Harjoto, 2011, p. 354). Recently, Moser and Martin (2012) recommended that CSR research in accounting adopt this broader stakeholder view and recognized that CSR accounting research "could benefit significantly if accounting researchers were more open to the possibility that CSR activities and related disclosures are driven by both shareholders and non-shareholder constituents" (p. 804). A stakeholder is a "group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984, p. 6). Since stakeholder relationships can affect achievement of organization objectives,

stakeholder theory recognizes the important impact of stakeholders on firm sustainability and success.

Successful stakeholder relationships are based on creating and maintaining trust, and trust is created and maintained by fulfilling corporate responsibilities. Environmental responsibilities are among the corporate social responsibilities firms must meet to build trust with various stakeholders. Several studies examine the relationship between social capital and trust building (La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1997a, 1997b) since building trust is one of the essential rationales behind CSR engagement. Firms must manage stakeholder relationships by meeting the needs and expectations of diverse stakeholder groups – including environmental, employee, and societal groups (Freeman & Evan, 1990; Marcus & Geffen, 1998; Sharma & Vredenburg, 1998) – to be successful. Environmental improvements and disclosures are made because they are demanded by stakeholders to satisfy their needs and expectations (Gray, Kouhy, & Lavers, 1995).

Ullmann (1985) developed a three-dimensional model for predicting levels of CSR activity and disclosure based on this stakeholder concept (Freeman, 1984). Stakeholder power is the first dimension and is viewed as a function of the stakeholder's degree of control over resources required by the corporation. A firm will be responsive to the intensity of stakeholder demands and to stakeholders with more power. Economic performance, the second factor, directly affects the financial capability of a firm to respond to stakeholder demands and institute social responsibility programs. The third factor, strategic posture, describes a firm's mode of response concerning social demands. Ullmann (1985) dichotomizes strategic posture as active or passive. The more active the strategic posture the greater the expected CSR activities and disclosures. Roberts (1992) finds that measures of stakeholder power, economic performance, and strategic posture are significantly related to levels of corporate social disclosure.

Given the importance of social posture, legitimacy theory (Suchman, 1995), based on the concept of the social contract (Patten, 1991, 1992), recognizes the importance of stakeholder expectations and has been used in social and environmental accounting research (e.g., Lindblom, 1994) as a mechanism for understanding voluntary social and environmental activities and disclosures. While many researchers have employed the term legitimacy, few define it (Suchman, 1995). Legitimacy is "a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions" (Suchman, 1995, p. 574). It is a process "by

which an organization seeks approval (or avoidance of sanction) from groups in society" (Kaplan & Ruland, 1991, p. 370) by establishing "congruence between the social values associated with or implied by their activities and the norms of acceptable behavior in the larger social system in which they are a part. In so far as these two value systems are congruent we can speak of organizational legitimacy" (Matthews, 1993, p. 350). Firms try to meet societal expectations and behave in a way that society wants them to behave (Dowling & Pfeffer, 1975; Patten, 2000) through socially responsible activities. This is a strong form of legitimacy – providing legitimacy with real, substantive social activities. A weak form of legitimacy also exists (Cong & Freedman, 2011) in which information is provided through CSR disclosures by management (Cho & Patten, 2007; Freedman & Patten, 2004; Patten, 2002) to manage stakeholders' corporate social perceptions even if this information does not reflect actual performance (i.e., providing legitimacy in communicated form even if lacking the underlying real substance). As a result, legitimacy is an operational resource that organizations extract – often competitively – from their cultural environments and employ in pursuit of their goals (Suchman, 1995, pp. 575–576).

Meeting the responsibilities created by stakeholder expectations determines legitimacy. Consequently, legitimacy is given reality by multiple actors – stakeholders – in the social environment. Preston and Post (1975) developed a process through which social issues develop in the social environment: issues are raised by society, analyzed through the public policy arena, and enacted into law if deemed necessary. The use of social activities and/or social disclosures represents strong form and weak form legitimacy methods, respectively, that firms can use to influence society, the public policy process, and the formal legal environment. The intended effect, in both cases, is to reduce what Miles (1987) refers to as the "exposure" of the company to the social, political, and legal environments.

Given the importance of the social environment, Hybels (1995) notes that good models in legitimacy theory must examine how relevant stakeholders influence the "flow of resources crucial to the organizations' establishment, growth and survival" (p. 243) and identifies four critical organizational stakeholders which control a number of resources summarized in Table 1.

Companies try to manage legitimacy with these stakeholder groups because it can provide benefits and help to ensure the continued flow of resources, capital, labor, and customers necessary for viability, sustainability, and success (Neu, Warsame, & Pedwell, 1998, p. 265). Increasing

Table 1. Critical Organizational Stakeholders.

Stakeholder	Resources Controlled
1. The state	Contracts, grants, legislation, regulation, taxes
2. The public	Patronage (as customers), support (as community interest), labor
3. The financial community	Investment
4. The media	Information resources that can influence other stakeholders

attention is being paid to the effects that social capital has on economic variables, growth, and financial development (Guiso, Sapienza, & Zingales, 2004).

Benefits of Meeting Corporate Social Responsibilities

Meeting corporate social responsibilities created by stakeholders' expectations builds trust and legitimacy which improves stakeholder relationships and leads to myriad other benefits. In other words, CSR can be employed as a strategic tool to maximize shareholder value by protecting stakeholders' interests (Malik, 2014). Malik (2014) presents a recent literature review of the many value-enhancing benefits of CSR including: enhanced operating efficiency (Brammer & Millington, 2005; Porter & Kramer, 2002; Saiia, Carroll, & Buchholtz, 2003), product market gains (Bloom, Hoeffler, Keller, & Meza, 2006; Menon & Kahn, 2003), improved employee productivity (Trevino & Nelson, 2004; Tuzzolino & Armandi, 1981; Valentine & Fleischman, 2008), and risk management (Cheng, Ioannou, & Serafeim, 2014; Dhaliwal, Li, Tsang, & Yang, 2011; Husted, 2005; Richardson & Welker, 2001).

The benefits of CSR can also lead to improved financial performance. Moser and Martin (2012) discuss a comprehensive meta-analysis of 251 studies by Margolis, Elfenbein, and Walsh (2009) that concludes an overall positive association between CSR and firm performance. Likewise, Margolis and Walsh (2003) summarize management studies and conclude a generally positive association between CSR and financial performance.

As a result of the financial performance benefits, firms can also realize earning quality (Chih, Shen, & Kang, 2008; Hong & Anderson, 2011; Kim, Park, & Wier, 2012) and capital market benefits (Dhaliwal, Radhakrishnan, Tsang, & Yang, 2012; Godfrey, 2005) from superior CSR performance. Firms with greater social responsibility have reduced earnings smoothing behavior (Chih et al., 2008), are less likely to manage earnings

through accruals and real activities, and are less likely to be subject to SEC investigations (Kim et al., 2012). These financial performance and earnings quality benefits from superior CSR lead to other capital market benefits which in turn lead to higher values for these firms. The capital market benefits include a lower cost of equity capital (Dhaliwal et al., 2011), a lower cost of debt (Ye & Zhang, 2011), improved risk management (Husted, 2005), and smaller analyst bid-ask spreads (Dhaliwal et al., 2012).

Benefits of Meeting Environmental Responsibilities

Environmental responsibilities are among the responsibilities firms must meet and can also lead to a number of benefits including meeting diverse stakeholders' needs (e.g., Freeman & Evan, 1990), improving operational efficiency (e.g., Porter & van der Linde, 1995), and enhancing legitimacy (e.g., Hart, 1995). Environmental performance can also lead to improved financial performance. Research has focused on the relationship between environmental performance and financial benefits in both the academic literature (e.g., Baker & Sinkula, 2005; Christmann, 2000; Clarkson, Li, Richardson, & Vasvari, 2008; Coombs & Gilley, 2005) and the business press (e.g., Engardio, Capell, Carey, & Hall, 2007; Spaeder, 2006; Tozzi, 2008). In fact, a number of narrative and meta-analytic reviews in the management literature (Ambec & Lanoie, 2008; Dixon-Fowler et al., 2013; Etzion, 2007; Orlitzky, Schmidt, & Rynes, 2003; Sharma & Starik, 2002) suggest a positive relationship between corporate environmental performance and corporate financial performance.

Corporate Governance and Corporate Social Responsibilities

Given the benefits of meeting corporate and environmental responsibilities, what factors influence a company's ability to meet responsibilities? Does corporate governance influence a company's ability to meet responsibilities? Community expectations can change across time thereby requiring organizations to be responsive to the environment in which they operate (Deegan, Rankin, & Tobin, 2002, pp. 319–320) to maintain legitimacy. Corporate governance is important in responsively meeting responsibilities created by changing social expectations. The purpose of governance mechanisms is to build trust by ensuring that corporate responsibilities – including environmental responsibilities – are accountably met.

There has been a tremendous acceleration of corporate governance activities over the last few years (Hermalin, 2005). In response to the numerous financial reporting failures, much of the corporate governance research focuses on how corporate governance affects dimensions of financial reporting and performance and can repair public trust. Research has documented a positive association between corporate governance and fulfilling financial reporting responsibilities. Abdel-Khalik (2002) proposed post-Enron governance reforms to, among other financial reporting reforms, improve auditor selection, retention, and compensation. Improved governance provides documented financial reporting benefits. Good governance is associated with less information asymmetry around quarterly earnings announcements (Kanagaretnam, Lobo, & Whalen, 2007) and an increased quality of information available to financial analysts (Byard, Li, & Weintrop, 2006). Given these documented reporting benefits, research has also investigated the determinants of good financial reporting governance. Research shows that characteristics of the Board of Directors and the audit committee like independence (Bronson, Carcello, Hollingsworth, & Neal, 2009; Jaggi, Leung, & Gul, 2009) and expertise (DeZoort, Hermanson, & Houston, 2003; Gul & Leung, 2004; Kelton & Yang, 2008) provide good governance and high-quality financial reporting.

Corporate governance is also positively linked with other dimensions of firm performance in addition to financial reporting. Good corporate governance can protect shareholder interests and reduce principal-agent problems (Riyanto & Toolseman, 2007). Brown and Caylor (2006, 2009) posit that good corporate governance creates a system of greater controls over managerial actions, which in turn reduces principal-agent problems. Reduced principal-agent problems improve operating performance. Brown and Caylor (2009) document a significant positive relationship between governance and operating performance measured by return on assets (ROA) and return on equity (ROE). Better governance is associated with better operating performance.

Riyanto and Toolseman (2007) suggest a positive association between corporate governance and CSR activities. Stuebs and Sun (2014) document a positive relationship between corporate governance and measures of CSR performance. Jo and Harjoto (2011) document a positive association between corporate governance and firms' CSR engagement. Jo and Harjoto (2012) extend this work and document a positive causal relationship that corporate governance leads to CSR engagement – the lag of CSR does not affect corporate governance variables, but a lag in corporate

governance variables positively affects firms' CSR engagement. Other governance variables are also associated with CSR performance. For example, Bear, Rahman, and Post (2010) explored how board diversity and gender composition (i.e., the number of women on boards) affect CSR ratings. The robustness of the relationship between governance and CSR has also been explored internationally. For example, Li and Zhang (2010) document that corporate ownership dispersion is positively associated with CSR activities in China. Haniffa and Cooke (2005) also find that boards play an important role in CSR disclosures in Malaysian markets.

Corporate Governance and Environmental Responsibilities

Is corporate governance also positively associated with environmental performance? Environmental responsibilities are among a firm's critical corporate social responsibilities. Researchers have examined how environmental performance and disclosure are related to specific aspects of corporate governance, such as board composition (Brammer & Pavelin, 2006), board size, outside directorships, and inside ownerships (Kassinis & Vafeas, 2002). Although there is evidence that positive environmental performance reflects strong organizational and management capabilities (e.g., Aragon-Correa, 1998), there is also mixed evidence in the literature. For example, Cong and Freedman (2011) find that while good governance is positively related to pollution disclosure, there is no relationship between good governance and pollution performance among a restricted sample of major toxic-emitting U.S. firms. Rupley, Brown, and Marshall (2012) find that voluntary environmental disclosure is positively associated with board independence, diversity, and expertise. Stuebs and Sun (2010) also document a positive relationship between governance and certain environmental strengths. We add to and extend this initial work in multiple ways with a more expansive and comprehensive investigation of the corporate governance–environmental performance relationship. We use a larger sample over an expanded time period of multiple years. We include additional and different measures of overall environmental performance and environmental concerns in addition to environmental strengths. We also use multiple and different measures of corporate governance from different data sources. We also expand our model and control for environmental differences across industries. Our work contributes to our knowledge of the relationship between corporate governance and environmental performance.

This study posits that corporate governance is positively associated with environmental performance. Our hypothesis is as follows:

H1. Corporate governance is positively associated with environmental performance.

RESEARCH DESIGN AND VARIABLE DESCRIPTION

Fig. 1 provides an overview of the research design we use to test this study's hypothesis.

The Gompers Index governance scores (Gompers, Ishii, & Metrick, 2003) and KLD's net governance score and environmental scores are used

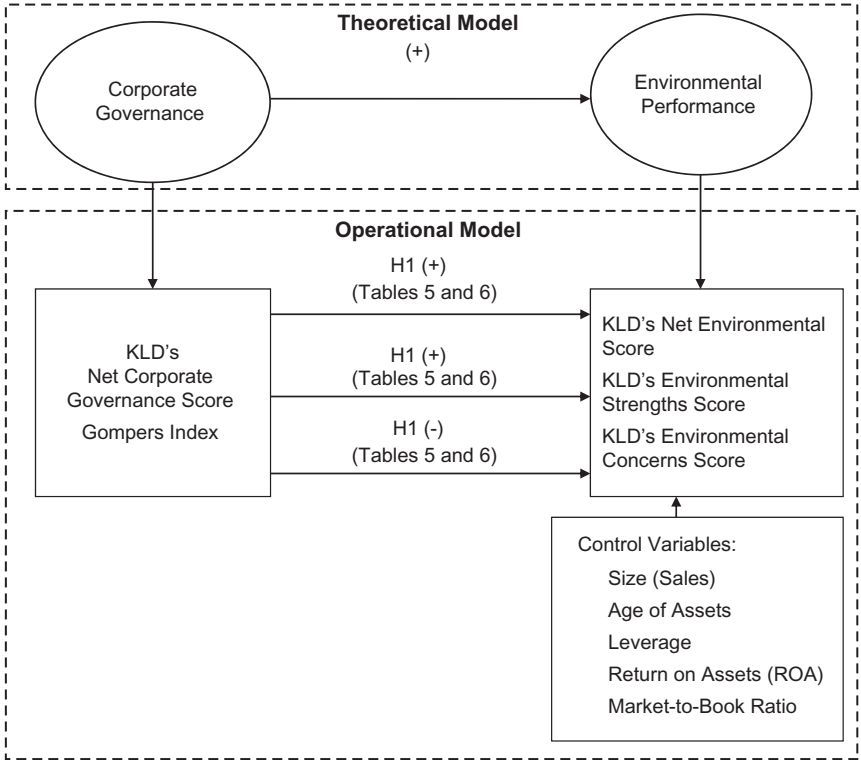

Fig. 1. Research Design.

to investigate the relationship between corporate governance and environmental performance. We also include seven control variables to control for size, age of assets, leverage, ROA, the market-to-book ratio, time, and industry.[1]

Measurement of the Primary Independent Variable – Corporate Governance

We use two primary measures of corporate governance. First, we use the Gompers Index, a commonly accepted and used corporate governance score (Cong & Freedman, 2011).[2] It uses data from the IRRC's governance and director database. We are only able to include sample years 2004 and 2006 in our models when we use the Gompers Index since the IRRC does not publish volumes every year but only in the years 2004 and 2006 during our sample period.

Second, we use KLD net governance scores as another primary measure of corporate governance. KLD has been actively providing rating data on CSR since 1991. It is a strong example of a great source of consistent CSR measurements for archival researchers (Malik, 2014) because it is "the largest multidimensional corporate social performance database available to the public and is used extensively in research on corporate social performance" (Deckop, Merriman, & Gupta, 2006, p. 334). KLD accumulates CSR information for more firms than other CSR data sources.[3] It has become "the de facto corporate social performance research standard at the moment" (Waddock, 2003, p. 369). KLD provides rating data for approximately 80 variables in seven qualitative areas. Strengths and concerns are reported in each of these seven qualitative areas, and the net score aggregates strengths less concerns in each area. Measures of corporate governance comprise one of the seven qualitative areas.

Consistent with prior research (e.g., Graves & Waddock, 1994; Griffin & Mahon, 1997; Johnson & Greening, 1999; Ruf, Muralidhar, Brown, Janney, & Paul, 2001; Waddock & Graves, 1997), we use KLD's net corporate governance score to measure corporate governance.[4] Net corporate governance is an aggregated measure of corporate governance strengths less corporate governance concerns. The corporate governance strengths score measures a company's strengths in transparency of financial reporting, compensation, ownership, public policy, and political accountability. The governance concerns score measures the external concerns over a company's accounting practices, transparency of financial reporting, compensation, ownership, and public policy.[5] A larger governance strengths score

suggests stronger governance, while a larger corporate governance concerns score suggests weaker corporate governance. KLD scores are relative measures that can be both positive and negative. In fact, a net governance score of 0 does not necessarily mean that a firm has no governance strengths or concerns. Strengths and concerns can offset each other when aggregated.

Measurement of the Primary Dependent Variable – Environmental Performance

Measures of environmental performance comprise another of KLD's seven qualitative areas. Since KLD is a common and recognized measure of environmental performance (Dixon-Fowler et al., 2013), we use KLD's net environmental score[6] as a measure of environmental performance since use of the net score is consistent with prior research (e.g., Graves & Waddock, 1994; Griffin & Mahon, 1997; Johnson & Greening, 1999; Ruf et al., 2001; Waddock & Graves, 1997). Additionally, we use the separate environmental strengths and environmental concerns scores to further investigate governance's relationship with environmental performance. The environmental strengths score measures and aggregates strengths in the following areas: beneficial products, pollution prevention, recycling, alternative fuels, communications, and property (plant and equipment). The environmental concerns score measures and aggregates concerns in the following areas: hazardous waste, regulatory problems, ozone depleting chemicals, substantial emissions, agricultural chemicals, and climate change. We use these measures of environmental performance and corporate governance in our analyses to test our hypothesis.

Empirical Specification

We use the following general regression model to test the relationship between corporate governance and environmental performance:

$$\begin{aligned} \mathrm{ENV}_{it} = {} & \alpha_0 + \alpha_1 \times \mathrm{GOVSCORE}_{it} + \alpha_2 \times \mathrm{SALES}_{it} + \alpha_3 \times \mathrm{ASSETAGE}_{it} \\ & + \alpha_4 \times \mathrm{LEV}_{it} + \alpha_5 \times \mathrm{ROA}_{it} + \alpha_6 \times \mathrm{MTB}_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

where:

ENV_{it} = An environmental score measure for firm i in year t;
$ENVNET_{it}$ = KLD's net environmental score for firm i in year t;
$ENVSTR_{it}$ = KLD's net environmental strengths score for firm i in year t;
$ENVCON_{it}$ = KLD's net environmental concerns score for firm i in year t;
$GOVSCORE_{it}$ = A governance score measure for firm i in year t:
$GOVNET_{it}$ = KLD's net corporate governance score for firm i in year t;
$GINDEX_{it}$ = Gompers corporate governance score of firm i in year t;
$SALES_{it}$ = Net sales (Compustat Item #12) for firm i in year t;
$ASSETAGE_{it}$ = Net property, plant and equipment (Compustat Item #8)/Gross property, plant and equipment (Compustat Item #7) for firm i in year t;
LEV_{it} = Leverage ratio [total liabilities (Compustat Item #9 + #34)/total assets (Compustat Item #6)] for firm i in year t;
ROA_{it} = Return on assets [income before extraordinary items – available for common equity (Compustat Item #237)/total assets (Compustat Item #6)] for firm i in year t;
MTB_{it} = Market to book ratio {[common shares outstanding (Compustat Item #25) × stock price – fiscal year-end (Compustat Item #199)]/total common equity (Compustat Item #60)} for firm i in year t.

Seven control variables are included to control for size, the age of long-term assets, leverage, ROA, the market-to-book ratio, time, and industry. Indicator variables are also used to control for time in years and industry based on two-digit SIC codes although they have been left out of Eq. (1) for parsimony. Controlling for industry is important given that environmental issues and concerns can vary dramatically between industries. Similar to Jo and Harjoto (2011, 2012) we include variables in our model to control for firm characteristics that theoretically could influence environmental performance: firm size (SALES), capital investment and expenditure (ASSETAGE), financial leverage and risk (LEV), firm operating performance (ROA), and firm value (MTB).

SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

KLD contains approximately 3,000 firm observations each year because the KLD database uses firms from the Russell 3000 Index. Our sample

period is from 2004 to 2007. After matching KLD observations with Compustat financial data, the final sample consists of 7,551 firm-year observations. Panel A of Table 2 reconciles the observations in our sample, and Panel B of Table 2 presents the industry distribution for our sample firms.

Table 2. Industry Distribution of Sample Firms.

Panel A: Observation Reconciliation

	Number of Firms Total	Number of Firms 2007	Number of Firms 2006	Number of Firms 2005	Number of Firms 2004
Observations with KLD data	11,946	2,935	2,960	3,015	3,036
Less: Observations missing Compustat Data	4,395	992	1,072	1,156	1,175
Net sample observations	7,551	1,943	1,888	1,859	1,861

Panel B: Observation Industry Distribution

Industry	Number of Firms Total	Number of Firms 2007	Number of Firms 2006	Number of Firms 2005	Number of Firms 2004
Agriculture, forestry and fisheries (SIC 01-09)	25	6	6	6	7
Mineral industries (SIC 10-14)	411	119	111	99	82
Construction industries (SIC 15-17)	115	30	31	27	27
Manufacturing industries (SIC 20-39)	3,768	944	941	935	948
Transportation, communication and utilities (SIC 40-49)	490	142	126	116	106
Wholesale (SIC 50-51)	267	69	70	67	61
Retail (SIC 52-59)		175	181	181	184
Financial industries (SIC 60-69)	237	69	58	56	54
Service (SIC 70-89)	1,497	383	360	368	386
Public administration (SIC 90-99)	20	6	4	4	6
Total	7,551	1,943	1,888	1,859	1,861

Table 3 summarizes the sample's descriptive statistics. Information including mean and median of selected variables is provided. For instance, the mean value of the net governance (GOVNET) score is −0.24, while the mean value of the net environment (ENVNET) score is −0.09. The

Table 3. Descriptive Statistics for the Sample Firms ($n = 7{,}551$) (2004−2007).

Variable	Mean	Std. Dev.	25th Percentile	Median	75% Percentile
GOVNET	−0.24	0.74	−1.00	0.00	0.00
ENVNET	−0.09	0.64	0.00	0.00	0.00
ENVSTR	0.12	0.46	0.00	0.00	0.00
ENVCON	0.21	0.63	0.00	0.00	0.00
SALES	4109.16	15932.57	276.63	787.69	2388.81
COGS	2742.75	11765.15	125.85	449.03	1538.32
XSGA	721.73	2622.21	62.28	151.70	433.30
OCF	479.50	2153.64	22.89	72.99	245.18
ASSETS	4658.05	23477.64	335.20	836.86	2485.74
ASSETAGE	0.51	0.17	0.39	0.49	0.62
LEV	0.19	0.18	0.01	0.16	0.31
ROA	3.91	14.50	1.77	5.35	9.40
ROE	7.31	260.46	3.99	11.07	18.08
MTB	4.90	33.17	1.73	2.61	4.07

Variable definitions:
$GOVNET_{it}$ = KLD's net corporate governance score of firm i in year t;
$ENVNET_{it}$ = New environmental score ($ENVSTR_{it}$−$ENVCON_{it}$) of firm i in year t;
$ENVSTR_{it}$ = Environmental strength score of firm i in year t;
$ENVCON_{it}$ = Environmental concern score of firm i in year t;
$SALES_{it}$ = Net sales (Compustat Item #12) of firm i in year t;
$COGS_{it}$ = Cost of goods sold (Compustat Item #41) of firm i in year t;
$XSGA_{it}$ = Selling, general and administrative expenses (Compustat Item #189) of firm i in year t;
OCF_{it} = Net cash flows from operating activities (Compustat Item #308) of firm i in year t;
$ASSET_{it}$ = Total assets (Compustat Item #6) of firm i in year t;
$ASSETAGE_{it}$ = Net property, plant and equipment (Compustat Item #8)/Gross property, plant and equipment (Compustat Item #7) of firm i in year t;
LEV_{it} = Leverage ratio [total liabilities (Compustat Item #9 + #34)/total assets (Compustat Item #6)] of firm i in year t;
ROA_{it} = Return on assets [income before extraordinary items−available for common equity (Compustat Item #237)]/total assets (Compustat Item #6) of firm i in year t;
ROE_{it} = Return on equity ratio [income before extraordinary items−available for common equity (Compustat Item #237)/common shareholders' interest in the company (Compustat Item #60)] of firm i in year t;
MTB_{it} = Market to book ratio {[common shares outstanding (Compustat Item #25) × stock price−fiscal year-end (Compustat Item #199]/total common equity (Compustat Item #60)} of firm i in year t.

descriptive statistics of environmental strengths and concerns scores are also provided in Table 3. The mean value of the environmental strengths (ENVSTR) score is 0.12, while the mean value of the mean value of the environmental concerns (ENVCON) score is 0.21.

Table 4 reports the Pearson correlation matrices for selected variables. For each pair of variables, the Pearson correlation coefficient and related *p*-value are provided. Panel A reports correlation results for the sample using KLD's GOVNET as the governance measure. In general, the results indicate that ENVNET is significantly positively correlated with GOVNET and significantly negatively correlated with SALES, AGE, LEV, and ROA. Of particular interest to this study, GOVNET is significantly ($p < 0.0001$) positively (0.7977) correlated with ENVNET. The significant correlation between GOVNET and ENVNET provides initial support for our hypothesis of a positive relationship between corporate governance and environmental performance. In addition, GOVNET is significantly ($p = 0.0014$) positively (0.0368) associated with ENVSTR, and is significantly ($p < 0.0001$) negatively (−0.1081) associated with ENVCON. Panel B reports correlation results for the sample using the Gompers governance score (GINDEX) as the governance measure. The results are similar to Panel A and provide initial support for our hypothesis. GINDEX is strongly ($p < 0.0001$) positively (0.0860) correlated with ENVNET, strongly ($p = 0.0009$) positively (0.0697) correlated with ENVSTR, and strongly ($p = 0.0007$) negatively (−0.0714) correlated with ENVCON. Overall, results in Table 4 provide initial evidence supporting our hypothesis.

RESULTS

We run the regression model in Eq. (1) to test the relationship between corporate governance and environmental performance and include annual and industry dummy variables to control for time and industry differences. Table 5 reports results using KLD's GOVNET score as the primary independent governance variable in Eq. (1). Panel A of Table 5 reports the primary results testing our hypothesis using KLD's net environmental score (ENVNET) as the dependent variable. The net corporate governance coefficient (α_1) is positive (0.0384) and significant ($p < 0.0001$) indicating a positive association between corporate governance and environmental performance and supporting our hypothesis. Results from Panel A also report a significant negative association between KLD's net environment

Table 4. Pearson Correlation among Selected Variables.

Panel A: KLD's Net Governance Score (GOVNET) as Key Independent Variable ($n = 7{,}551$)

	GOVNET	ENVNET	ENVSTR	ENVCON	SALES	ASSETAGE	LEV	ROA	ROE
ENVNET	0.7977								
(*p*-value, two-tailed)	<0.0001								
ENVSTR	0.0368	0.3834							
(*p*-value, two-tailed)	0.0014	<0.0001							
ENVCON	−0.1081	−0.7389	−0.3391						
(*p*-value, two-tailed)	<0.0001	<0.0001	<0.0001						
SALES	−0.1952	−0.2229	0.2606	0.4172					
(*p*-value, two-tailed)	<0.0001	<0.0001	<0.0001	<0.0001					
ASSETAGE	0.0296	−0.0928	−0.0459	0.0611	0.045				
(*p*-value, two-tailed)	0.0103	<0.0001	<0.0001	<0.0001	<0.0001				
LEV	−0.1034	−0.0647	0.0521	0.1039	0.0424	0.282			
(*p*-value, two-tailed)	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001			
ROA	−0.0525	−0.0301	0.0389	0.0591	0.0549	0.0113	−0.1036		
(*p*-value, two-tailed)	<0.0001	0.0088	0.0007	<0.0001	<0.0001	0.3274	<0.0001		
ROE	−0.0211	−0.0194	0.01	0.0271	0.0114	0.0095	−0.0108	0.2071	
(*p*-value, two-tailed)	0.0664	0.0916	0.3865	0.0188	0.3207	0.4097	0.3461	<0.0001	
MTB	−0.0016	0.001	−0.007	−0.0061	−0.0082	−0.0202	0.1023	−0.0474	−0.1174
(*p*-value, two-tailed)	0.8906	0.9325	0.5461	0.5984	0.4755	0.0794	<0.0001	<0.0001	<0.0001

Panel B: Gompers Governance Score (GIndex) as Key Independent Variable ($n = 2{,}268$)

	GINDEX	ENVNET	ENVSTR	ENVCON	SALES	ASSETAGE	LEV	ROA	ROE
ENVNET	0.0860								
(*p*-value, two-tailed)	<0.0001								
ENVSTR	0.0697	0.7351							
(*p*-value, two-tailed)	0.0009	<0.0001							
ENVCON	−0.0714	−0.8880	−0.3409						

Table 4. (*Continued*)

Panel B: Gompers Governance Score (GIndex) as Key Independent Variable ($n = 2{,}268$)

	GINDEX	ENVNET	ENVSTR	ENVCON	SALES	ASSETAGE	LEV	ROA	ROE
(*p*-value, two-tailed)	0.0007	<0.0001	<0.0001						
SALES	−0.0033	0.4111	0.2294	−0.4144					
(*p*-value, two-tailed)	0.1140	<0.0001	<0.0001	<0.0001					
ASSETAGE	−0.0621	0.0249	−0.0507	−0.0690	0.0952				
(*p*-value, two-tailed)	0.0031	0.2358	0.0157	0.0010	<0.0001				
LEV	0.0818	0.1055	0.0535	−0.1099	0.0368	0.2372			
(*p*-value, two-tailed)	<0.0001	<0.0001	0.0108	<0.0001	0.0798	<0.0001			
ROA	0.0081	0.0699	0.0602	−0.0560	0.0621	0.1045	−0.2445		
(*p*-value, two-tailed)	0.6997	0.0009	0.0041	0.0076	0.0031	<0.0001	<0.0001		
ROE	0.0010	0.0336	0.0023	−0.0450	0.0032	0.0190	0.0802	0.2121	
(*p*-value, two-tailed)	0.9626	0.1095	0.9118	0.0320	0.8782	0.3673	0.0001	<0.0001	
MTB	0.0020	0.0098	−0.0063	−0.0179	−0.0091	0.0080	0.1429	0.0697	0.9156
(*p*-value, two-tailed)	0.9238	0.6417	0.7631	0.3955	0.6651	0.7036	<0.0001	0.0009	<0.0001

Variable definitions:

$GOVNET_{it}$ = KLD's net corporate governance score of firm i in year t;

$GINDEX_{it}$ = Gompers corporate governance score of firm i in year t;

$ENVNET_{it}$ = New environmental score ($ENVSTR_{it}$−$ENVCON_{it}$) of firm i in year t;

$ENVSTR_{it}$ = Environmental strength score of firm i in year t;

$ENVCON_{it}$ = Environmental concern score of firm i in year t;

$SALES_{it}$ = Net sales (Compustat Item #12) of firm i in year t;

$ASSETAGE_{it}$ = Net property, plant and equipment (Compustat Item #8)/Gross property, plant and equipment (Compustat Item #7) of firm i in year t;

LEV_{it} = Leverage ratio [total liabilities (Compustat Item #9 + #34)/total assets (Compustat Item #6)] of firm i in year t;

ROA_{it} =Return on assets [income before extraordinary items−available for common equity (Compustat Item #237)]/total assets (Compustat Item #6) of firm i in year t;

ROE_{it} = Return on equity ratio [income before extraordinary items−available for common equity (Compustat Item #237)/common shareholders' interest in the company (Compustat Item #60)] of firm i in year t;

MTB_{it} = Market to book ratio {[common shares outstanding (Compustat Item #25) × stock price−fiscal year-end (Compustat Item #199]/total common equity (Compustat Item #60)} of firm i in year t.

score (ENVNET) and the control variable SALES. In other words, larger firms in terms of sales are negatively associated with environmental performance.

We further investigate the relationship between corporate governance and environmental performance by using the environmental strengths score (ENVSTR) and environmental concerns score (ENVCON) as dependent variables in separate additional regressions reported in Panels B and C of Table 5, respectively. We expect a significantly positive relation between GOVNET and ENVSTR, and a significantly negative relation between GOVNET and ENVCON. Panel B reports that the corporate governance coefficient (α_1) is positive (0.0160) and significant ($p = 0.0204$), while Panel C reports that the corporate governance coefficient (α_1) is negative (−0.2247) and significant ($p = 0.0055$). Thus, the regression results provide evidence supporting a significantly positive association between corporate governance and environmental strengths and a significantly negatively association between corporate governance and environmental concerns.

Table 6 reports results using Gompers governance score (GINDEX) as the primary independent governance variable in Eq. (1). Panel A of Table 6 reports the primary results testing our hypothesis using KLD's net environmental score (ENVNET) as the dependent variable. The GINDEX coefficient (α_1) is positive (0.0352) and significant ($p < 0.0001$) indicating a positive association between corporate governance and environmental performance and supporting our hypothesis. Results from Panel A also report a significant positive association between KLD's net environment score (ENVNET) and the control variables SALES, LEV, and ROA. In other words, larger firms with more financial leverage and better operating performance are positively associated with environmental performance. Also, there is a significant negative association between ENVNET and ASSETAGE. In other words, firms that keep newer assets are negatively associated with environmental performance. Perhaps these firms are replacing assets too early and not efficiently maximizing the effective environmental use of their assets lives.

We further investigate the relationship between corporate governance (GINDEX) and environmental performance by using the environmental strengths score (ENVSTR) and environmental concerns score (ENVCON) as dependent variables in separate additional regressions reported in Panels B and C of Table 6, respectively. As expected, Panel B reports that the GINDEX governance coefficient (α_1) is positive (0.0127) and significant ($p = 0.0019$), while Panel C reports that the GINDEX governance coefficient (α_1) is negative (−0.0225) and significant ($p < 0.0001$). Thus, the

Table 5. Regression Analysis (2004−2007).

Panel A: ($n = 7{,}551$; Adjusted $R = 0.2093$)				
Model: $ENVNET_{it} = \alpha_0 + \alpha_1 \times GOVNET_{it} + \alpha_2 \times SALES_{it} + \alpha_3 \times ASSETAGE_{it} + \alpha_4 \times LEV_{it} + \alpha_5 \times ROA_{it} + \alpha_6 \times MTB_{it} + \varepsilon_i$				
Variable	Parameter estimate	Standard error	t-value	$p > \|t\|$
Intercept	−0.2839	0.1175	−2.42	0.0157
GOVNET	0.0384	0.0092	4.17	<0.0001***
SALES	−5.69E-06	4.57E-07	−12.44	<0.0001***
ASSETAGE	0.0585	0.0463	1.26	0.2066
LEV	−0.0079	0.0418	−0.19	0.8508
ROA	−0.0005	0.0005	−1.09	0.2743
MTB	9.04E-05	0.0002	0.45	0.6532
Panel B: ($n = 7{,}551$; Adjusted $R = 0.1434$)				
Model: $ENVSTR_{it} = \alpha_0 + \alpha_1 \times GOVNET_{it} + \alpha_2 \times SALES_{it} + \alpha_3 \times ASSETAGE_{it} + \alpha_4 \times LEV_{it} + \alpha_5 \times ROA_{it} + \alpha_6 \times MTB_{it} + \varepsilon_{it}$				
Intercept	0.2379	0.0876	2.72	0.0066
GOVNET	0.0160	0.0069	2.32	0.0204**
SALES	8.13E-06	3.41E-07	12.85	<0.0001***
ASSETAGE	−0.1247	0.0346	−3.61	0.0003***
LEV	0.1413	0.0312	4.53	<0.0001***
ROA	0.0014	0.0003	4.10	<0.0001***
MTB	−1.59E-04	0.0001	−1.06	0.2888

Panel C: ($n = 7{,}551$; Adjusted $R = 0.3676$)

Model: $ENVCON_{it} = \alpha_0 + \alpha_1 \times GOVNET_{it} + \alpha_2 \times SALES_{it} + \alpha_3 \times ASSETAGE_{it} + \alpha_4 \times LEV_{it} + \alpha_5 \times ROA_{it} + \alpha_6 \times MTB_{it} + \varepsilon_{it}$				
Intercept	0.5219	0.1031	5.06	<0.0001
GOVNET	−0.2247	0.0081	−2.77	0.0055***
SALES	1.38E-05	4.01E-07	34.42	<0.0001***
ASSETAGE	−0.1833	0.0407	−4.50	<0.0001***
LEV	0.1492	0.0367	4.06	<0.0001***
ROA	0.0019	0.0004	4.73	<0.0001***
MTB	−2.49E-04	0.0002	−1.41	0.1578

Variable definitions:

$GOVNET_{it}$ = KLD's net corporate governance score of firm i in year t;

$ENVNET_{it}$ = New environmental score ($ENVSTR_{it} - ENVCON_{it}$) of firm i in year t;

$ENVSTR_{it}$ = Environmental strength score of firm i in year t;

$ENVCON_{it}$ = Environmental concern score of firm i in year t;

$SALES_{it}$ = Net sales (Compustat Item #12) of firm i in year t;

$ASSETAGE_{it}$ = Net property, plant and equipment (Compustat Item #8)/Gross property, plant and equipment (Compustat Item #7) of firm i in year t;

LEV_{it} = Leverage ratio [total liabilities (Compustat Item #9 + #34)/total assets (Compustat Item #6)] of firm i in year t;

ROA_{it} =Return on assets [income before extraordinary items−available for common equity (Compustat Item #237)]/total assets (Compustat Item #6) of firm i in year t;

MTB_{it} = Market to book ratio {[common shares outstanding (Compustat Item #25) × stock price−fiscal year-end (Compustat Item #199]/total common equity (Compustat Item #60)} of firm i in year t.

Note: Significance level: *$p \leq 0.1$, **$p \leq 0.05$, ***$p \leq 0.01$.

Table 6. Regression Analysis (2004 and 2006).

Panel A: ($n = 2{,}268$; Adjusted $R = 0.1895$)

Model: $\text{ENVNET}_{it} = \alpha_0 + \alpha_1 \times \text{GINDEX}_{it} + \alpha_2 \times \text{SALES}_{it} + \alpha_3 \times \text{ASSETAGE}_{it} + \alpha_4 \times \text{LEV}_{it} + \alpha_5 \times \text{ROA}_{it} + \alpha_6 \times \text{MTB}_{it} + \varepsilon_{it}$

Variable	Parameter estimate	Standard error	*t*-value	$p > \|t\|$
Intercept	−0.0610	0.1008	−0.60	0.5453
GINDEX	0.0352	0.0078	4.51	<0.0001***
SALES	2.20E-05	1.03E-06	21.47	<0.0001***
ASSETAGE	−0.3061	0.1399	−2.19	0.0287**
LEV	0.7135	0.1301	5.48	<0.0001***
ROA	0.0088	0.0023	3.84	0.0001***
MTB	−3.38E-04	0.0008	−0.41	0.6794

Panel B: ($n = 2{,}268$; Adjusted $R = 0.0696$)

Model: $\text{ENVSTR}_{it} = \alpha_0 + \alpha_1 \times \text{GINDEX}_{it} + \alpha_2 \times \text{SALES}_{it} + \alpha_3 \times \text{ASSETAGE}_{it} + \alpha_4 \times \text{LEV}_{it} + \alpha_5 \times \text{ROA}_{it} + \alpha_6 \times \text{MTB}_{it} + \varepsilon_{it}$

Intercept	0.0870	0.0528	1.65	0.0998
GINDEX	0.0127	0.0041	3.11	0.0019***
SALES	6.12E-06	5.37E-07	11.39	<0.0001***
ASSETAGE	−0.3331	0.0733	−4.54	<0.0001***
LEV	0.2604	0.0682	3.82	0.0001***
ROA	0.0044	0.0012	3.63	0.0003***
MTB	−4.39E-04	0.0004	−1.02	0.3058

Panel C: ($n = 2{,}268$; Adjusted $R = 0.1874$)

Model: $ENVCON_{it} = \alpha_0 + \alpha_1 \times GINDEX_{it} + \alpha_2 \times SALES_{it} + \alpha_3 \times ASSETAGE_{it} + \alpha_4 \times LEV_{it} + \alpha_5 \times ROA_{it} + \alpha_6 \times MTB_{it} + \varepsilon_{it}$

Intercept	0.1479	0.0728	2.03	0.0422
GINDEX	−0.0225	0.0056	−4.00	<0.0001***
SALES	−1.59E-05	7.40E-07	−21.46	<0.0001***
ASSETAGE	−0.0270	0.1010	−0.27	0.7892
LEV	−0.4531	0.0939	−4.82	<0.0001***
ROA	−0.0045	0.0017	−2.68	0.0073***
MTB	−0.0001	0.0006	−0.17	0.8641

Variable definitions:

$GINDEX_{it}$ = Gompers corporate governance score of firm i in year t;

$ENVNET_{it}$ = New environmental score ($ENVSTR_{it} - ENVCON_{it}$) of firm i in year t;

$ENVSTR_{it}$ = Environmental strength score of firm i in year t;

$ENVCON_{it}$ = Environmental concern score of firm i in year t;

$SALES_{it}$ = Net sales (Compustat Item #12) of firm i in year t;

$ASSETAGE_{it}$ = Net property, plant and equipment (Compustat Item #8)/Gross property, plant and equipment (Compustat Item #7) of firm i in year t;

LEV_{it} = Leverage ratio [total liabilities (Compustat Item #9 + #34)/total assets (Compustat Item #6)] of firm i in year t;

ROA_{it} =Return on assets [income before extraordinary items−available for common equity (Compustat Item #237)]/total assets (Compustat Item #6) of firm i in year t;

MTB_{it} = Market to book ratio {[common shares outstanding (Compustat Item #25) × stock price−fiscal year-end (Compustat Item #199]/total common equity (Compustat Item #60)} of firm i in year t.

GINDEX regression results provide evidence supporting a significantly positive association between corporate governance and environmental strengths and a significantly negative association between corporate governance and environmental concerns.

ADDITIONAL SUPPLEMENTAL TESTS

Descriptive statistics in Table 3 report that there is not much variation in the values of GOVNET, ENVNET, ENVSTR, and ENVCON. As an additional supplemental test, we remove observations with a value of zero for either the corporate governance or environmental performance variables, and run the three regression models in Table 5 again. These additional results are reported in Table 5. Panel A reports the results from regressing ENVNET on GOVNET and removes observations where either GOVNET = 0 or ENVNET = 0. Results are unchanged. The net corporate governance coefficient (α_1) is positive (0.2011) and significant ($p = 0.0007$) indicating a positive association between corporate governance and environmental performance and adding additional support to our hypothesis. Additional results from Panel A report that two control variables, SALES and AGE, are significantly negatively associated with the net environmental performance score. Panel B of Table 7 contains results from regressing ENVSTR on GOVNET and removing observations from our sample where ENVSTR = 0 or GOVNET = 0. The net corporate governance coefficient (α_1) is positive (0.1800) and significant ($p < 0.0001$) indicating a positive association between corporate governance and environmental strengths and supporting our hypothesis. Lastly, the regression of ENVCON on GOVNET after removing sample observations where ENVCON = 0 or GOVNET = 0 is reported in Panel C of Table 7. There is an insignificantly positive association between ENVCON and GOVNET. In other words, corporate governance is not associated with a reduction in environmental concerns. Perhaps one possible explanation for this result is that environmental concerns are more prevalently externally present at, for example, the industry level regardless of a company's idiosyncratic corporate governance mechanisms. Environmental strengths gauge a company's individual proactive response and strategy to environmental threats and concerns that may be common in an industry.[7] In this case, corporate governance mechanisms would more easily influence and have a stronger relationship with environmental strengths, as our results demonstrate.

Table 7. Additional Regression Analysis (2004–2007).

Panel A: ($n = 638$; Adjusted $R = 0.4475$)

Model: $\text{ENVNET}_{it} = \alpha_0 + \alpha_1 \times \text{GOVNET}_{it} + \alpha_2 \times \text{SALES}_{it} + \alpha_3 \times \text{ASSETAGE}_{it} + \alpha_4 \times \text{LEV}_{it} + \alpha_5 \times \text{ROA}_{it} + \alpha_6 \times \text{MTB}_{it} + \varepsilon_{it}$

Variable	Parameter estimate	Standard error	*t*-value	$p > \|t\|$
Intercept	−0.2783	0.5673	−0.49	0.6239
GOVNET	0.2011	0.0590	3.41	0.0007***
SALES	−3.25E-06	1.58E-06	−2.06	0.0395**
ASSETAGE	−0.8231	0.4353	−1.89	0.0591*
LEV	−0.4479	0.4060	−1.10	0.2704
ROA	−0.0017	0.0055	−0.30	0.7625
MTB	3.26E-04	0.0017	0.20	0.8434

Panel B: ($n = 348$; Adjusted $R = 0.2672$)

Model: $\text{ENVSTR}_{it} = \alpha_0 + \alpha_1 \times \text{GOVNET}_{it} + \alpha_2 \times \text{SALES}_{it} + \alpha_3 \times \text{ASSETAGE}_{it} + \alpha_4 \times \text{LEV}_{it} + \alpha_5 \times \text{ROA}_{it} + \alpha_6 \times \text{MTB}_{it} + \varepsilon_{it}$

Intercept	1.3938	0.3718	3.75	0.0002
GOVNET	0.1800	0.0419	4.30	<0.0001***
SALES	8.49E-06	1.55E-06	5.47	<0.0001***
ASSETAGE	−1.1453	0.3673	−3.12	0.0020***
LEV	0.0192	0.3132	0.61	0.5394
ROA	0.0058	0.0048	1.22	0.2215
MTB	1.57E-03	0.0072	0.22	0.8263

Table 7. (*Continued*)

Panel C: (n=512; Adjusted R=0.3915)				
Model: $ENVCON_{it}=\alpha_0+\alpha_1\times GOVNET_{it}+\alpha_2\times SALES_{it}+\alpha_3\times ASSETAGE_{it}+\alpha_4\times LEV_{it}+\alpha_5\times ROA_{it}+\varepsilon_{it}$				
Intercept	3.1744	0.4824	6.58	<0.0001
GOVNET	0.0039	0.0424	0.09	0.9273
SALES	7.67E-06	1.04E-06	7.34	<0.0001***
ASSETAGE	0.2043	0.3233	0.63	0.5277
LEV	0.1144	0.3067	0.37	0.7093
ROA	0.0019	0.0045	0.43	0.6698
MTB	−0.0004	0.0011	−0.38	0.7058

Variable definitions:
$GOVNET_{it}$ = KLD's net corporate governance score of firm i in year t;
$ENVNET_{it}$ = New environmental score ($ENVSTR_{it}-ENVCON_{it}$) of firm i in year t;
$ENVSTR_{it}$ = Environmental strength score of firm i in year t;
$ENVCON_{it}$ = Environmental concern score of firm i in year t;
$SALES_{it}$ = Net sales (Compustat Item #12) of firm i in year t;
$ASSETAGE_{it}$ = Net property, plant and equipment (Compustat Item #8)/Gross property, plant and equipment (Compustat Item #7) of firm i in year t;
LEV_{it} = Leverage ratio [total liabilities (Compustat Item #9+#34)]/total assets (Compustat Item #6)] of firm i in year i;
ROA_{it} =Return on assets [income before extraordinary items−available for common equity (Compustat Item #237)]/total assets (Compustat Item #6) of firm i in year t;
MTB_{it} = Market to book ratio {[common shares outstanding (Compustat Item #25) × stock price−fiscal year-end (Compustat Item #199]/total common equity (Compustat Item #60)} of firm i in year t.
Note: Significance level: *$p\leq0.1$, **$p\leq0.05$, ***$p\leq0.01$.

CONCLUSION

In this study, we explore the relationship between corporate governance and environmental performance, a critical component of CSR and another important dimension of overall firm performance. We find that corporate governance is positively associated with environmental performance. Our results are robust to different governance and environmental performance measures. The results suggest that, in general, business entities with stronger corporate governance mechanisms have better environmental performance. Corporate governance is associated with better performance in other areas beyond financial reporting and performance. This research further supports the efforts toward improving corporate governance in U.S. corporations.

The IRRC and KLD measures used in our study, although widely accepted and used, have limitations. IRRC data are only available in certain years (e.g., 2004 and 2006 for our sample data). KLD's measures are aggregate, general measures. Future research could gather and use more accurate measures of governance and environmental performance. Also, KLD data are gathered on firms in the Russell 3000 Index. These are usually larger firms. Caution is needed when generalizing our findings. These limitations open the door for future research possibilities.

Future work can further investigate specific environmental performance benefits from other specific corporate governance efforts by, for example, using additional measures and collecting additional data on corporate governance and environmental performance. This is consistent with the recommendation of Moser and Martin (2012, p. 802) that it is "important to isolate individual components of CSR performance." Future research can also continue to explore other performance benefits from improved governance or improved environmental performance. For example, what is the relationship between corporate governance and other dimensions of social responsibility and performance? Measuring and documenting additional benefits from corporate governance or environmental performance can continue to provide incentives for corporate governance or environmental performance improvement initiatives.

NOTES

1. Based on two-digit SIC code.
2. The Gompers Index is one of three indices published in the academic literature and widely adopted in academia and industries (E-index: Bebchuk,

Alma, & Allen, 2009; Gov-Score index: Brown & Caylor, 2006; G-index: Gompers et al., 2003).

3. KLD provides CSR information for more than 3,000 firms, which accounts for 98 percent of the total market value of all public firms in the United States (Barnea & Rubin, 2010).

4. Measurement and use of the net or composite score is done in research using KLD data. For example, Jo and Harjoto (2012, 2011), Baron, Harjoto, and Jo (2011), and Hillman and Keim (2001) use net or composite scores for certain KLD data in their models.

5. http://www.kld.com/research/ratings_indicators.html

6. Net environmental score = environmental strengths − environmental concerns.

7. We recognize that our possible explanation for these results is based on conjecture. Although the explanation is possible, it could also be reasonable to expect environmental strengths to be an industry-wide phenomenon.

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SEC GUIDANCE ON CLIMATE CHANGE RISK DISCLOSURES: AN ASSESSMENT OF FIRM AND MARKET RESPONSES

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ABSTRACT

This study investigates the reaction to the Securities and Exchange Commission's (SEC) 2010 interpretative guidance on climate risk disclosures. Issued on February 8, 2010, the release represents one of the few examples of authoritative requirements for environmental disclosure in filers' 10-K reports. As such, we attempt to determine the effect of the new requirement on companies' disclosures as well as how the market reacted to the guidance announcement. Based on a sample of 155 large companies drawn randomly from the Fortune 500, we find first, that, as expected, climate change disclosures increased significantly following the release, but overall, the information provision remained quite limited. We further find that, presumably as intended, companies from industries facing greater climate change exposures exhibited significantly larger increases in disclosure (controlling for prior levels of information provision). Finally, we document that the market reaction to the release of

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the SEC guidance was significantly positive and driven by more positive returns from firms in climate risk industries. We interpret these unexpected findings as potentially being due to investors believing the new requirements were less demanding than might have been anticipated or that they believe firms facing climate risks were in a better position to respond than other companies.

Keywords: Climate and environmental risk; firm disclosure and performance; industry sensitivity; mandatory disclosure

INTRODUCTION

In response to numerous petitions from large institutional investors and other investor groups,[1] the Securities and Exchange Commission (SEC) on February 8, 2010 issued interpretative guidance that applies existing federal securities laws and regulations to climate risk disclosures. In its pronouncement, the SEC specifically identified areas where climate change risks could trigger disclosures required under Regulation S-K, and the guidance was meant to improve the provision of information on these risks. The federal securities rules require "such further material information, if any, as may be necessary to make the required statements, in light of the circumstances under which they are made, not misleading."[2] Because prior to the SEC's release, few companies were providing information about how climate change impacts their business, the interpretative guidance was desperately needed for enforcement and clarity.[3] In this study, we attempt to determine the impacts of the SEC's guidance release.

We first assess the impact of the new SEC requirements on company filings by examining 10-K reports issued before and after the guidance release for climate risk disclosures. Using a content analysis scheme based on the guidance and a sample of 155 firms drawn from the Fortune 500, we find that while the extent of climate change risk disclosure increased significantly under the new guidance, it continued to be very limited in scope. We also find that, controlling for other factors potentially influencing the change, companies from industries facing greater climate change exposures exhibited larger changes in disclosure, suggesting the SEC was at least partially successful in its quest for better information. In addition to our analysis of disclosures, however, we also examine whether investors interpreted the new requirements as being potentially costly for firms by identifying the

market reaction to the guidance release. We unexpectedly find a significantly positive market reaction at the time of the SEC guidance release, and we document that this is more pronounced for firms from industries facing greater climate change risk. We argue this may be due to the pronouncement being less restrictive than investors believed was likely or a belief that firms in industries facing climate risks were in a better position to deal with the new requirements *vis-à-vis* other companies. We leave exploration of this issue to future studies.

BACKGROUND AND HYPOTHESIS DEVELOPMENT

As noted by Larrinaga (2014, p. 1), mounting evidence indicates that "human-induced emissions of greenhouse gases (GHG) have a clear influence on the climate," and the issue of climate change is recognized as one of the greatest challenges facing society today (Dietz, Hope, Stern, & Zhengalis, 2007; Solomon, Solomon, Norton, & Joseph, 2011). Jones and Levy (2007, p. 430) identify a number of risks accruing to businesses as a result of the crisis, and these include potentially "higher costs for fuels and other inputs, and lower demand for energy-intense products," as well as competitive risk due to "changes in prices, technologies, and demand patterns." In theory, publicly listed companies in the United States are required through Regulation S-K to disclose the material risks and impacts of environmental concerns in their filings with the SEC (see, e.g., Johnson, 1993). However, as reported by, for example, Doran and Quinn (2009) a vast majority of companies included no disclosure of climate change risks up through 2008, and Freedman and Park (2014) document that even utility firms, companies potentially at the greatest risk of impacts from climate change threats, were providing very limited information in their reports as of the late 2000s. Facing pressures from institutional investors and other groups, the SEC, on February 8, 2010 issued *Commission Guidance Regarding Disclosure Related to Climate Change* (SEC, 2010).

Applicable to disclosures included in Sections 1, 3, and 7 of Form 10-K, the SEC's new guidance identified four topics where climate change may trigger disclosures required under Regulation S-K. These are (1) the impact of climate change legislation and regulation, (2) the impact of international accords related to climate change, (3) the indirect consequences or opportunities of climate change regulation on business trends, and (4) the physical impacts of climate change. As noted by Freedman and Park (2014, p. 31),

under the new guidance, publicly traded firms are required "to assess the impact of climate change on their financial conditions or operating performances and to disclose the information" in reports filed with the SEC. Given that, as argued by Li, Richardson, and Thornton (1997), companies are hesitant to disclose environmental information out of concerns with potentially increased proprietary costs, we seek in this investigation to identify the impacts of the SEC's new guidance with respect to company disclosures. In addition, however, we also explore how investors responded to the change in potential regulatory cost exposures.

With respect to the first aim of our examination, we note that a number of prior studies investigate the impact of new disclosure regulation and guidance on corporate reporting, and evidence to date has been mixed. For example, Larrinaga, Carrasco, Llena, and Moneva (2002) document that an overwhelming percentage of Spanish companies failed to provide environmental disclosure in spite of that country's adoption of mandatory reporting requirements. Similarly, Delbard (2008) reports that French firms' initial compliance with the social and environmental information requirements under the *Nouvelles Régulations Économiques* (NRE) #2001-420, passed in 2001 was quite limited. In contrast, Frost (2007) finds that, in Australia, the introduction of mandatory environmental disclosure requirements led to increased provision of information. And while only focusing on general government guidance as opposed to formal reporting regulations, both Ho and Taylor (2007) and Cho, Choi, Kwak, and Patten (2013) present evidence consistent with the guidance leading to more extensive environmental disclosure in Japan and South Korea, respectively.

In the U.S. context, both Barth, McNichols, and Wilson (1997) and Patten (2000) explore the impact of accounting guidance related to environmental liability disclosures associated with hazardous waste remediation. Patten notes that both the SEC, through Staff Accounting Bulletin 92 (SAB 92), and the Financial Accounting Standards Board via pronouncements issued through its Emerging Issues Task Force,[4] provided guidance related to corporate environmental disclosure over the early 1990s, and both Barth et al. (1997) and Patten (2000) document significant increases in Superfund-related information disclosure subsequent to the issuances from the authoritative bodies. Similarly, Alciatore, Dee, and Easton (2004) find that petroleum companies increased their disclosure of dismantlement environmental liabilities over the 1990s, presumably in response to guidance in SAB 92.

While acknowledging that exceptions exist, we believe the preponderance of the evidence on corporate responses to environmental disclosure

guidance and regulation, particularly in the U.S. setting, suggests companies would be likely to respond to the SEC guidance on climate change risk disclosures by providing more detailed information in their 10-K reports. We thus state our first hypothesis as:

H1. Ceteris paribus, climate change risk disclosures will be more extensive following the issuance of the SEC guidance on disclosure.

Turning to the second phase of our investigation, we note that, while several prior studies document negative market reactions to increases in regulatory cost exposures, almost all of these focus on the impact of catastrophic events. For example, both Bowen, Castanias, and Daley (1983) and Hill and Schneeweis (1983) examine the market reaction for publicly traded utilities following the Three Mile Island nuclear accident in 1979, and both document significant negative abnormal returns for companies with nuclear power reliance. Similarly, Blacconiere and Patten (1994) investigate investor reaction to Union Carbide's disastrous 1984 chemical leak in Bhopal, India and find significantly negative returns for a sample of U.S. chemical companies. Almost no studies to date, however, focus on potential regulatory cost changes arising from governmental actions. One exception is Blacconiere and Northcut (1997).

Focusing on investor perceptions of the impact of the legislative debate regarding the passage of the Superfund Amendments and Reauthorization Act of 1986, Blacconiere and Northcut (1997) examine the market reaction for a sample of chemical companies with respect to 26 different events with implications for the likelihood of the bill's success. While the overall reaction to the events was not statistically significant, a more narrow focus on specific legislative events (17 of the 26 overall events) revealed a significant negative market reaction. Because Blacconiere and Northcut further document that differences in exposure to Superfund costs and prior environmental disclosure are associated with the extent of individual firm reaction, the study suggests that investors negatively valued the potential increase in regulatory costs arising from the legislation.

While the SEC guidance on climate change risk disclosures is, in contrast to the issue studied in Blacconiere and Northcut (1997), not a legislative action, the release could still be expected to impact investor perceptions of companies' value. If market participants believed the need to assess the climate change risks (and implement reporting on those) as required by the SEC guidance would materially affect firms' cash flows, a negative market reaction would be anticipated. Similarly, if investors believed the disclosure of the climate change risks would increase

proprietary costs for the companies, again, negative market adjustments would be expected. Given these potential impacts, we state our second hypothesis as:

H2. Ceteris paribus, market reactions to the SEC release of guidance on climate risk disclosures will be negative.

METHODS

Sample

We base our sample on a random selection of companies listed in the 2009 Fortune 500 focusing on firms filing their fiscal year 2009 Form 10-K subsequent to the SEC's release of reporting guidance (February 8, 2010). Companies also had to have a fiscal year 2008 Form 10-K available for review. Our final sample consists of 155 firms spread across 43 different industry classifications. We classify sensitive industries based on prior studies of environmental disclosure (e.g., Barth & McNichols, 1994; Deegan & Gordon, 1996; Frost, 2007) with the exception that we also include the insurance, food, and auto repair industries as sensitive due to the unique risks posed by climate change. The sample distribution across industries is presented in Table 1.

Disclosure

The first intent of our study is to identify the extent to which companies changed their climate risk disclosures in response to the SEC's new guidance. We use content analysis to assess the extent of climate change risk disclosure in the 10-K reports immediately preceding and immediately following the release of the SEC guidance on disclosure. Content analysis has been used in a variety of environmental disclosure studies (e.g., Blacconiere & Patten, 1994; Clarkson, Li, Richardson, & Vasvari, 2008; Patten, 2000) and involves assessing the reports for the presence or absence of disclosure related to specific items of information. We base our content scheme on the requirements specified in the SEC release and examine for disclosure across Sections 1, 3, and 7 of the sample companies' 10-K reports. The appendix identifies the nine items of disclosure we examined

Table 1. Industry Breakdown of Sample Companies.

Sensitive Industries	No.	Not Sensitive Industries	No.
Metal mining	1	Communications	7
Coal mining	1	Wholesale trade – durable goods	4
Oil and gas extraction	5	Wholesale trade – nondurable goods	2
Heavy construction	1	Building materials and garden supplies	1
Food and kindred products	3	Food stores	2
Tobacco products	3	Apparel and accessory stores	3
Lumber and wood products	1	Furniture and home furnishings stores	1
Paper and allied products	2	Eating and drinking places	1
Chemicals and allied products	10	General merchandise stores	4
Petroleum and coal products	8	Miscellaneous retail	3
Rubber and miscellaneous plastics products	1	Depository institutions	7
Stone clay and glass products	1	Nondepository institutions	1
Primary metal industries	3	Security and commodity brokers	2
Fabricated metal products	2	Hotels and other lodging places	1
Industrial machinery and equipment	6	Business services	18
Electronic and other equipment	1	Engineering and management services	1
Transportation equipment	8	Miscellaneous	1
Instruments and related products	7		
Railroad transportation	1		
Trucking and warehousing	2		
Transportation by air	3	Total not sensitive industries	59
Electric, gas, & sanitary services	17		
Automotive dealers and service stations	2	Total observations	155
Auto repair, services, and parking	1		
Health services	3		
Insurance agents, brokers and services	3		
Total sensitive industries	96		

The table presents the industries that are sensitive to climate change and their distribution within the sample. Industry classification is consistent with Barth and McNichols (1994), Frost (2007), and Deegan and Gordon (1996) except insurance, food, and auto repair are also classified as sensitive due to their increased risk of carbon footprint, and climate change effects.

for. Each area of disclosure included is awarded one point, and as such, disclosure scores could range from zero to nine.

In addition to examining descriptively the change in climate change disclosures following the release of the SEC guidance, we also attempt to determine whether changes are related to factors expected to influence the reporting. We use multiple regression analysis to assess these impacts and include three explanatory variables. First, we anticipate that companies

facing greater climate change risks will exhibit larger increases in disclosure. As identified in Table 1, 96 of our sample companies are classified as being climate change sensitive, and we code these using a one/zero indicator variable. Our second explanatory variable is firm size. Watts and Zimmerman (1986) argue larger firms face greater political exposures and numerous studies of environmental disclosure (e.g., Brammer & Pavelin, 2006; Gray, Kouhy & Lavers 1995; Patten, 2002) document that larger companies tend to make more extensive environmental disclosures. Prado-Lorenzo, Rodriguez, Gellego-Alvarez, and Garcia-Sanchez (2009) and Freedman and Jaggi (2005) more specifically report a firm size effect related to greenhouse gas emission disclosures. We use 1st quarter 2010 sales as our size measure and take the natural logarithm of the amount to control for heteroscedasticity concerns. Our final explanatory variable is the extent of disclosure included in the 2008 10-K. Patten (2000), in his study of changing Superfund disclosures, notes that companies with higher levels of prior disclosure have less room for improved reporting and as such, posits a negative relation between the prior disclosure levels and changes in the extent of disclosure.

Market Reaction

In addition to identifying changes in disclosure in response to the 2010 SEC guidance release, we also investigate whether investors appeared to value the change in regulation requirements. Using standard market model methods (see, e.g., Blacconiere & Patten, 1994; Watts & Zimmerman, 1986) and an estimation period from −300 through −46 trading days prior to the date of the guidance issuance, we were able to isolate the abnormal returns for the sample companies on the date of the release. However, due to confounding information events (see, e.g., Lev, 1979), eight firms were eliminated from this stage of the analysis. We anticipate that companies facing greater climate change risks would be more negatively affected by the new reporting requirements, and to test this we again use multiple regression analysis controlling for other potential impact factors. As with our disclosure model, we include a one/zero indicator variable to identify sample companies from industries facing greater climate change risks. Based on Patten and Nance's (1998) findings that company size was negatively related to the market reaction for petroleum companies in response to the presumed increase in regulatory costs associated with the Alaskan oil spill, we control for company size again using the natural logarithm of

2010 1st quarter sales. Finally, Blacconiere and Patten (1994), Blacconiere and Northcut (1997), and Patten and Nance (1998) all show that prior levels of environmental disclosure tended to mitigate market reactions to regulatory cost events, and as such, we control for prior disclosure using the 2008 10-K report content scores.

RESULTS

Panel A of Table 2 presents the results of tests for differences in climate risk disclosure across the 2008 (prior disclosures) and 2009 (post disclosures) 10-K reports. As shown in the table, and in support of our first hypothesis, the mean disclosure scores rose from 0.52 in 2008 to 2.14 the following year, and the difference is statistically significant. However, it must be noted that while disclosure clearly improved, the average score of just over two (out of a possible nine) suggests that our sample of companies was still not being very transparent about climate change risks. In order to better identify whether firms facing greater climate change risks were more forthcoming following the SEC guidance than companies with lesser exposures, we compared the 2009 disclosures across the two industry groupings. As shown in Panel B of Table 2, the higher risk firms did make significantly more extensive disclosures, on average, than companies with lower climate change risks (a mean of 2.77 in comparison to an average score of 1.12), but the disclosure score for the high-risk companies remains very low overall.

Table 2. Mean Climate Change Risk Disclosures.

Panel A – Comparison of Climate Risk Disclosure Scores 2008 versus 2009 ($n = 155$)				
Period	Mean	SD	*t*-stat	Significance
Prior	0.52	0.825		
Post	2.14	1.560	11.470	0.000
Panel B – Comparison of 2009 Climate Risk Disclosure Scores across Higher and Lower Risk Companies ($n = 155$)				
Period	Mean	SD	*t*-stat	Significance
Higher risk	2.77	1.447		
Lower risk	1.12	1.146	7.448	0.000

In Table 3 we present the results of our regression analysis on changes in climate risk disclosures. As highlighted in the table, the model is highly significant (based on the mode *F*-statistic) and explains almost 36 percent of the variation in changes in disclosure.[5] We find, as expected, that classification as a member of a high climate risk industry is significantly and positively related to changes in disclosure when we control for other possible factors influencing the change. Our results also indicate that prior disclosure is negatively, and significantly, related to changes in climate risk disclosures. However, while positively signed, as expected, the firm size variable is not statistically significant at conventional levels. Overall, the results on changes in disclosure suggest that the SEC guidance appears to have induced better climate risk disclosures by our sample of firms, and that the effect was more pronounced for companies facing higher exposures.

Turning to our tests of investor reactions to the issuance of the SEC guidance on climate risk disclosure, we find, in contrast to expectations, that market adjusted excess returns for the sample companies are a *positive* 0.89 percent, on average, and this is statistically different from zero at $p = .053$, two-tailed. Results of the regression analysis on differences in the market reactions, presented in Table 4, indicate little relation between the explanatory variables and differences in the market returns. As highlighted in the table, only one variable – Industry – is statistically significant, and the model explains a very modest 0.8 percent of the variation in the return observations. To further examine the extent of differences in market reaction across firms from industries facing higher climate change exposures relative to those with less exposure, we test for differences in the mean reaction across groups. As summarized in Table 5, the average abnormal return on the day of the SEC guidance issuance was a positive 1.55 percent for the firms in the climate risk group, compared to a mean market reaction of minus 0.22 percent for other companies. Overall, these market reactions

Table 3. Regression Analysis of Factors Impacting the Change in Climate Risk Disclosures ($n = 155$).

Model *F*-statistic = 29.570 (Significance = 0.000)
Adj. $R^2 = 0.358$

Variable	Parameter estimate	*t*-stat	Significance
Constant	0.161	0.176	0.861
Industry	1.686	7.307	0.000
Firm size	0.104	1.026	0.306
Prior disclosure	−0.901	−6.796	0.000

Table 4. Regression Analysis on Abnormal Returns for SEC Guidance Issuance ($n = 147$).

F-Statistic = 1.370 (Significance = 0.254)
Adj. $R^2 = 0.008$

Variable	Parameter estimate	t-stat	Significance
Constant	−0.010	−0.248	0.804
Industry	0.020	1.995	0.041
Firm size	0.001	0.227	0.821
Prior disclosure	−0.004	−0.719	0.473

Table 5. Difference in Market Reaction across Industry Groupings.

Period	Mean	SD	t-Stat	Significance
Climate risk ($n = 92$)	0.0155	0.06135		
Others ($n = 55$)	−0.0022	0.04267	2.061	0.041

are contrary to expectations, and we discuss this unexpected finding in more detail in the conclusion section that follows.[6]

CONCLUSION

Responding to calls from large institutional investors and other investor groups, the SEC, in February of 2010 issued new guidance for filers regarding disclosures of climate change risks. In this study, we document that, for a sample of 155 large firms, the first 10-K reports issued following the release of the guidance included a statistically significant increase in climate risk information disclosures relative to reports filed prior to the SEC's promulgation. Further, we find that companies in industries classified as having higher risks to climate change exposures exhibit both higher levels of disclosure than lower risk firms and larger changes in climate risk disclosure (controlling for other factors influencing the change). On the surface, these results suggest the SEC guidance appears, as presumably intended, to have increased the provision of climate risk information. However, while the disclosure increased significantly, it remains very limited. On average, our sample of companies averaged only 2.14 disclosure points out of a possible nine, and with a mean of 2.77 points, even the companies in high-risk industries exhibit low scores. These low levels of disclosure, while an

improvement, suggest more may need to be done to improve the reporting of climate risks. Of course, as companies adapt to the requirements it is possible that disclosure will become more extensive, and as such, investigating 10-K report climate change disclosure in subsequent years would make for an interesting extension of our study.

In addition to examining the change in climate risk disclosures, we also investigated investor perceptions of the SEC guidance by identifying the market reaction to the SEC release. In contrast to our expectations, we find a significantly positive market reaction of 0.89 percent for our overall sample. Further, we document that the reaction is driven by the effect on companies from high-risk industries, in that these firms, on average, experienced abnormal returns at the time of the release of a positive 1.55 percent. Although we cannot definitively identify the cause of the unexpected positive reaction, one logical explanation is that the SEC guidance, when released, was less restrictive than investors had anticipated it would be. In support of this claim, we note that during 2009 the Carbon Disclosure Project, one of the major organizations bringing pressures for improved climate change disclosure (Kolk, Levy, & Pinkse, 2008), appeared to believe the SEC was going to require filers to specifically report on GHG emissions, something not included in the actual guidance. As such, the positive reaction to the SEC release may have reflected the belief that proprietary cost exposures would not increase as anticipated. An alternative possibility for the difference in market returns across the sample groups is that investors believed companies facing higher climate risks were already in better shape for meeting the new requirements, and as such, were at a competitive advantage relative to the incurrence of future costs. We leave exploration of these explanations to future research.

NOTES

1. Securities and Exchange Commission, Commission Guidance Regarding Disclosure Related to Climate Change, Release Nos. 33-9106; 34-61469; FR−82, Footnote 20.

2. Securities Act Rule 408 and Exchange Act Rule 12b-20.

3. This is the conclusion reached by the Corporate Library in their report, "Climate Risk Disclosure in SEC Filings," June 2009.

4. Patten (2000) notes that both EITF Issue No. 90-8, *Capitalization of Costs to Treat Environmental Contamination*, and EITF Issue No. 93-5, *Accounting for Environmental Liabilities*, provided guidance related to reporting on environmental concerns.

5. Examination of variance inflation factors indicated no multicollinearity concerns.

6. In non-tabulated tests we also calculated abnormal returns for our sample companies at the time of filing of their 2009 Form 10-K. We found no statistically significant reaction for either the total sample or for firms from higher risk industries. Similarly, we found no significant differences in abnormal returns relative to either the level of, or the change in climate risk disclosures.

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APPENDIX: CLIMATE CHANGE RISK DISCLOSURE METRIC

We examined Items 1, 3, and 7 of Form 10-K for climate risk disclosures. Using word search strings "climate," "risk," and "climate change," disclosures were initially identified and each disclosure was further analyzed in terms of the SEC Interpretative guidance. We used the following coding scheme and disclosure of each item was scored one point.

Item 1: Description of Business

Disclosure of climate risk factors
Disclosure of current year financial impact
Disclosure of accounting policy
Disclosure of projected compliance costs with environmental laws

Item 3: Legal Proceedings

Reference to additional climate risk disclosures in Form 10-K other than footnotes to the financial statements
Reference to additional climate risk disclosures in the footnotes to the financial statements
Discussion of materiality of legal costs associated with climate risk

Item 7: Management Discussion and Analysis (MD&A)

Disclosure of climate risk impact on financial condition and results of operations
Disclosure of the monetary impact of climate risk on the financial condition and results of operations