

# **Revisiting the Relation Between Environmental Performance and Environmental Disclosure: An Empirical Analysis\***

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**April 5, 2006**

\* We are grateful for comments and suggestions from Walt Blacconiere, Denis Cormier, Gus De Franco, Kathy Herbohn, Ole-Kristian Hope, Hai Lu, Michel Magnan and seminar participants at Chinese University of Hong Kong, University of Queensland and University of Toronto. We acknowledge the financial support of the Canadian Academic Accounting Association, Canadian Institute of Chartered Accountants, and the AIC Institute for Corporate Citizenship at Rotman School of Management, University of Toronto. We thank Rod Lohin, Bill Swirsky, and Alan Willis for their support and encouragement for this project and Gauri Bhat for help in data collection.

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## **Abstract**

Previous empirical evidence provided mixed results on the relationship between corporate environmental performance and environmental disclosures. We revisit this relation by testing economics based theories of voluntary disclosure using a more rigorous research design. In particular, we improve on the prior literature by focusing on purely voluntary environmental disclosures and by developing two reliable environmental performance measures using actual toxic emissions and waste management data. We also develop a content analysis index based on the Global Reporting Initiative sustainability reporting guidelines to assess the extent of discretionary disclosures in environmental and social responsibility reports. This index better captures firm disclosures related to its commitment to protect the environment than the indices employed by prior studies. Using a sample of 191 firms from the five most polluting industries in the U.S., we find a positive association between environmental performance and the extent of discretionary environmental disclosures. The result is consistent with the predictions of the economics based voluntary disclosure theory.

**Keywords:** *environmental disclosures, environmental performance, voluntary disclosure theory, pollution propensity, content analysis, global reporting initiative.*

# **Revisiting the Relation Between Environmental Performance and Environmental Disclosure: An Empirical Analysis**

## **1. Introduction**

An unresolved research issue in environmental accounting is the extent to which corporate environmental disclosures are consistent with corporate environmental performance (Chen and Metcalf, 1980; Hughes et al., 2001, Al Tuwaijri et. al., 2004). Accounting standard setters and securities regulators are increasingly being made aware of deficiencies in corporate environmental disclosures (Beets and Souther, 1999; Franco, 2001; Chan-Fishel, 2002). The results of previous studies on the relation between corporate environmental performance and environmental disclosure in financial reports have been mixed. Patten (2002) attributes the failure to find a significant and consistent relation between environmental performance and environmental disclosure to problems in the research designs of existing research. These problems include failure to control for other factors associated with level of environmental disclosure, inadequate sample selection, and inadequate measures of environmental performance and disclosure (Patten, 2002, p. 765).

This study seeks to revisit the relation between environmental performance and environmental disclosure using a more rigorous research design. Voluntary disclosure theory (Verrecchia, 1983; Dye, 1985) predicts a positive association between environmental performance and the extent of discretionary environmental disclosures. The notion is that superior environmental performers will convey their “type” by pointing to objective environmental performance indicators which are difficult to mimic by inferior type firms. Inferior performers will choose to disclose less or to be “silent” on their environmental performance, thus being placed in a pool of firms where investors and other users ascribe the

“average type” to that pool. What sustain this partial disclosure equilibrium are proprietary costs associated with disclosure about environmental performance (Verrecchia, 1983) and uncertainty as to whether the firm is informed regarding its type (Dye, 1985).

In collaboration with an environmental disclosure expert, we develop a content analysis index to assess the level of discretionary environmental disclosures in environmental and social responsibility reports or similar disclosures as listed on the firm’s web site or sourced from its regulatory filings. This index differs from the Wiseman (1982) index, previously used in the literature, because we focus on firm disclosures related to its commitment to protect the environment. Our index potentially allows investors, regulators, and environmental stakeholder groups to infer environmental performance “type” from the disclosure score. This is valuable to users who seek to assess the firms’ true environmental commitment and related environmental exposures.

We focus on the 2003 environmental disclosures of 191 firms drawn from five industries: Pulp and Paper, Chemicals, Oil and Gas, Metals and Mining, and Utilities. These five industries are considered to have a high pollution propensity and have collectively been the subject of a whole range of environmental regulations in the U.S. in the past 30 or more years. The magnitude of the environmental spending by these industries to comply with the environmental regulations and the impact of their operations on the natural environment should be a major concern to investors and other environmental stakeholder groups. Thus, firms in these industries collectively form an ideal sample to test the predictions of voluntary disclosure theory.

Our results indicate a positive association between environmental performance and the overall level of discretionary disclosures in environmental and social reports or related web disclosures. In other words, superior environmental performers are more forthcoming in truly discretionary disclosure channels, as predicted by economics based voluntary disclosure theories.

The paper is organized as follows. Section two reviews the existing studies in this area and develops our research hypothesis. Section three describes our content analysis disclosure index and the measures of environmental performance which we use in the study. We present our econometric model and preliminary empirical evidence in Sections four and five, respectively. Section six contains the main results and Section 7 the sensitivity analysis. Section 8 concludes the paper.

## **2. Literature review and hypothesis developments**

### **2.1 Literature review**

The existing literature in environmental accounting research can be categorized into three broad groups. The first group of studies examines the valuation relevance of corporate environmental performance information and has found that such information is valuable to investors seeking to assess environmental liabilities in different settings.<sup>1</sup> The second line of literature examines factors affecting managerial decisions to disclose potential environmental liabilities. This group of studies finds that there are strategic factors affecting firms' decisions to disclose environmental liability information, especially when disclosures are discretionary.<sup>2</sup> A third line of studies, one which we discuss in the following paragraphs since it is most relevant to this study, explores the relation between environmental disclosures and environmental performance.

Ingram and Frazier (1980) examine the association between the content of corporate environmental disclosure and corporate environmental performance. The study was concerned with a lack of corporate social responsibility disclosures in annual reports due to their voluntary nature.

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<sup>1</sup> See Cormier, Magnan and Morard (1993), Blacconiere and Patten (1994), Barth and McNichols (1994), Cormier and Magnan (1997), Li and McConomy (1999), Hughes (2000), Richardson and Welker (2001), and Clarkson, Li and Richardson (2004),

<sup>2</sup> See Patten (1992), Li, Richardson, Thornton (1997), Barth, McNichols, and Wilson (1997), Li and McConomy (1999) and Aerts, Cormier and Magnan (2006).

The authors scored environmental disclosures in 20 pre-selected content categories along four dimensions; evidence, time, specificity, and theme. Ingram and Frazier (1980) proxied environmental performance by a performance index devised by the Council on Economic Priorities (CEP), a non-profit organization specializing in the analysis of corporate social activities. Forty firms were selected from the 50 firms that were monitored by the CEP. Regression results indicated no association between environmental disclosure and environmental performance, consistent with authors' prior expectation about an overall poor quality of environmental disclosures in annual reports.

Wiseman (1982) examines the extent of voluntary environmental disclosures made by corporations in their annual reports using a research design almost identical to Ingram and Frazier (1980). The study focuses on the 26 largest US companies that were monitored by the CEP for the 1972 to 1976 period. Wiseman designed an environmental disclosure index covering 18 items in four categories: economic factors (5 items), environmental litigation (2 items), pollution abatement activities (5 items), and environmental disclosures that do not fall into the other three (6 items). In addition, Wiseman assigned a score to each item based on whether the disclosure is quantitative or qualitative (3 for quantitative disclosure, 2 for non-quantitative disclosure, 1 for mentioning in general terms, 0 for no disclosure).<sup>3</sup> The CEP rankings were used as a proxy for environmental performance. Spearman rank order correlation indicates that there is no significant association between the CEP environmental performance rankings and the Wiseman environmental disclosure index rankings.

Freedman and Wasley (1990) examine the relationship between corporate pollution performance and pollution disclosures made in annual reports and 10-K reports filed with the SEC.

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<sup>3</sup> Many environmental disclosure studies since then rely on the Wiseman index in order to measure the extent of corporate environmental disclosures. Few recognize the fact that the Wiseman index places a heavy weight on the financial consequences of corporate environmental activities, most of which are required disclosures in 10-ks for public companies registered with the SEC.

Their sample consists of 50 US companies in four industries (Steel, Oil, Pulp and Paper, Electric Utilities). Again, the CEP rankings are used as a proxy for environmental performance. The authors measure environmental disclosures in both annual and 10-K reports using the same indexing procedure developed by Wiseman (1982). Spearman rank order correlation tests are conducted to examine the associations both between annual report disclosure indices and the CEP indices, and between 10-K disclosure indices and the CEP indices. The results indicate that neither annual report environmental disclosures nor the 10-K environmental disclosures are indicative of firms' actual environmental performance.

Bewley and Li (2000) examine factors associated with the environmental disclosures in Canada from a voluntary disclosure theory perspective. The authors measure environmental disclosures by 188 Canadian manufacturing firms in their 1993 annual reports using the Wiseman index. A firm's pollution propensity (i.e., environmental performance) is proxied by their industry membership and by whether they report to the Ministry of Environment under the National Pollution Release Inventory program. The study finds that firms with more news media coverage of their environmental exposure, higher pollution propensity, and more political exposure are more likely to disclose general environmental information, suggesting a negative association between environmental disclosures and environmental performance.

Hughes, Anderson and Golden (2001) examine environmental disclosures made by 51 U.S. manufacturing firms for 1992 and 1993. Again, the authors use a slightly modified Wiseman index to measure environmental disclosures made within the President's letter, MD&A, and note section, and then assess whether environmental disclosures are consistent with environmental performance ratings (good, mixed, and poor) by the CEP. Although the study finds no difference in environmental disclosures between good and mixed groups, firms rated as poor environmental performers by the CEP tend to make substantially more environmental disclosures under the

Wiseman disclosure index. The authors attribute this finding to increased scrutiny in 1992 and 1993 by the FASB and SEC with respect to environmental disclosures, which forces poor performers to make more disclosure as they are subject to more remediation activities.

Patten (2002) identifies three issues in the previous studies in this area; (1) failure to control for other factors, (2) inadequate sample selection; and (3) inadequate measures of environmental performance. Since the CEP only followed a small group of firms in only four industries, reliance on the CEP for sample selection may be problematic. In addition, the CEP did not use the same criteria and consistent methodology to assess corporate environmental performance in different industries. To overcome this shortcoming, Patten uses the Toxic Release Inventory (TRI) data, normalized by sales, to proxy for environmental performance. Using a sample of 131 U.S. firms from 24 different industries, and a modified Wiseman index measure and line count of environmental disclosures in 1990 annual reports, Patten finds that TRI/sales are positively associated with both measures of environmental disclosures, suggesting a negative relation between environmental performance and environmental disclosures.

Al-Tuwaijri, Christensen, and Hughes (2004) explore the relations among environmental disclosure, environmental performance and economic performance using a simultaneous equations approach. Similar to Patten (2002), Al-Tuwaijri et al. (2004) use TRI based data to assess environmental performance. Specifically, they assess environmental performance as the percentage of total waste generated that is recycled. The authors measure environmental disclosure using a content analysis in four categories (potential responsible parties designation, toxic waste, oil and chemical spills, and environmental fines and penalties). These disclosures are largely non-discretionary, in contrast to the discretionary disclosures which we examine. They find a positive association between environmental performance and environmental disclosure.

In summary, the existing studies find mixed results on the relation between environmental disclosure and environmental performance. One reason for the inconclusive findings is due to the choice of non-discretionary disclosure channels and use of the Wiseman index. It is self evident that, as environmental problems and exposures increase, non-discretionary disclosures in regulated channels such as annual reports and 10-Ks should increase. Thus, a negative association between environmental performance and content analysis scores in annual reports and 10-Ks may be driven by non-discretionary disclosures.<sup>4</sup> Voluntary disclosure theories reviewed in the next section, on the other hand, apply to discretionary disclosures. Thus, inferences about the robustness of these theories are confounded when the disclosure media are formal channels like the annual report and 10-K. Adding to this problem is the heavy weight the Wiseman index places on disclosures about the financial consequences of environmental activities, whereas our index places more weight on disclosures that reveal true (but unobservable) environmental performance. By focusing primarily on environmental and social responsibility reports or similar disclosures on firms' web sites, locations where disclosures are purely discretionary, and with an index that aims at revealing performance "type," we enhance the reliability of inferences about the true direction of association between environmental performance and discretionary disclosure.

## **2.2 Hypothesis development**

The voluntary disclosure literature suggests that companies have incentives to disclose "good news" in order to differentiate themselves from companies with "bad news" and to avoid the adverse selection problem (Verrecchia, 1983; Dye, 1985; Li, Richardson, and Thornton, 1997). Companies with superior environmental performance due to their proactive environmental strategy have incentives to inform investors and other stakeholders of their

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<sup>4</sup> Patten (2002) was aware of the problem of non-discretionary disclosures in annual reports and dropped litigation disclosures as a partial attempt to deal with this (see p. 768).

strategy by voluntarily disclosing more environmental information. Put simply, they seek to reveal their performance type, something not directly observable to investors and other stakeholders, through direct voluntary disclosures that cannot be easily mimicked by poor environmental performers. In doing so, they potentially increase firm valuation since knowledgeable investors will infer that exposures and latent environmental liabilities are lower for good as opposed to poor environmental performers.<sup>5</sup> Thus, voluntary disclosure theory predicts the following hypothesis (stated in the alternate form):

*H1: Environmental performance and the extent of discretionary environmental disclosures are positively associated*

### **3. Research design**

#### **3.1 Environmental performance indicators**

A key research design issue in this study is to develop a reliable proxy for a firm's environmental performance. The difficulty in assessing environmental performance is well documented in the literature (see, for example, Ilinitch, Soderstrom, and Thomas, 1998). Since we seek to assess relative environmental performance in this study, we follow the existing literature and develop our relative environmental performance proxy using the actual pollution discharge data from the U. S. Environmental Protection Agency's (EPA) Toxic Release Inventory (TRI) database (King and Lenox, 2001). Specifically, we first aggregate the total toxic releases (in pounds) and the toxic waste treated or processed for each of our sample firms in

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<sup>5</sup> The assumption that environmental performance "type" is not readily observable to investors and other stakeholders is supported by the difficulties environmental researchers have had obtaining reliable measures of environmental performance that are comparable across companies in the same industry and comparable across industries (see Al-Tuwaijri et al, 2004 and Ilinitch et al, 1998). Furthermore, the EPA annually makes TRI data available with a two year lag, thus stakeholders are working with TRI data that is between two and three years out of date.

2003, as reported by the EPA in 2005 (EPA annually reports the data at the plant level, with a two year lag). To verify the accuracy of our aggregation procedure, we compared the TRI measures obtained at the firm level with those provided by the Investor Responsibility Research Center in their proprietary database. We found that the differences were minor.

Our first measure is the total toxic waste that is treated, recycled or processed as a percentage of the total toxic waste generated by each firm (% Recycled). This measure is similar to the one used by Al-Tuwaijri et al. (2004). We supplement our analysis with an alternative measure, the ratio of TRI to total firm sales. This gives us pounds of toxic releases per thousand dollars of sales for each of our sample firms (TRI/sales). However, if firms are not homogenous in terms of production processes within one of our five industries (Pulp and Paper, Chemicals, Oil and Gas, Metals and Mining, and Utilities), such that TRI/Sales is not directly comparable across firms in that industry, the recycling measure reduces this noise and facilitates pooling.

Since industry pollution propensity differs significantly, we alternatively rank the above two measures within each industry. Thus, the %Recycled ranks and TRI/sales ranks are our proxies for a firm's relative performance within its industry. Similar relative performance measures are also used in Clarkson, Li and Richardson (2004).

### **3.2 Environmental disclosure index**

As discussed in Section 2, from the economic theory perspective (H1), superior environmental performance (EP) types are hypothesized to seek credible direct disclosures to reveal their (unobservable) performance type. A crucial property of these disclosures is that they focus on objective, "hard" measures that cannot be easily mimicked by poor environmental performers. Thus, reliable inferences about theories like Verrecchia (1983) and Dye (1985) require a content analysis disclosure index that puts a heavy emphasis on objective measures of performance as opposed to soft (i.e., not easily verifiable) claims to be committed to the

environment.<sup>6</sup> As a simple example, consider a good and poor EP type firm in the same industry. The poor EP type firm will either be silent in purely discretionary channels such as the web, or make soft claims on the web about being committed to the environment. The good EP firm will voluntarily disclose objective measures of environmental impact (e.g., quantitative environmental performance indicators) and will benchmark its performance relative to the industry, something the poor EP firm will not want to do. Thus, the good EP firm will emphasize discretionary disclosures that are hard to mimic. We assume these hard disclosures are truthful, in that a firm would face litigation exposure if caught lying by informed stakeholders in social responsibility reports or web related disclosures.

What is striking in all this is that there is a demand by environmental stakeholders for precisely the same thing: hard, objective measures of environmental performance in social responsibility reports, so that poor EP performers cannot mimic (i.e., “greenwash”) good EP performers by soft, unverifiable claims to be committed to the environment. Indeed, good EP performers and environmental stakeholders have joined forces to develop standards for firms preparing social responsibility reports that put a premium on hard, objective measures.

The Global Reporting Initiative (GRI) was launched in 1997 as a joint initiative of Coalition for Environmentally Responsible Economies, a US non-government organization and the United Nations Environmental Program. The overall goal of the initiative is to develop a globally accepted reporting framework to enhance the quality, rigor, and utility of sustainability reporting (GRI, 2002). The GRI Guidelines follow 11 principles (Transparency, Inclusiveness, Auditability, Completeness, Relevance, Sustainability Context, Accuracy, Neutrality, Comparability, Clarity, and Timeliness) to ensure that sustainability reports (1) present a

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<sup>6</sup> For a related discussion on the need for objective and verifiable disclosures to achieve the separation predicted by Verrecchia (1983) see Hutton, Miller and Skinner (2003).

reasonable and balanced account of economic, environmental, and social performance, (2) facilitate comparison over time and across organizations, and (3) credibly address issues of concerns to stakeholders. The first set of GRI Guidelines was published in 1999 as an Exposure Draft and several revisions have followed since then. For the purpose of this study, we rely on the GRI Sustainability Reporting Guidelines published in 2002.

We engaged an expert in the field of environmental reporting to help us develop a content analysis index suitable for firms' sustainability reports or the corresponding sections of a broad social responsibility report or equivalent discussions on the web.<sup>7</sup> From the outset, we agreed that the construct we seek to measure is the extent of a firm's disclosure in their sustainability report. With this aim established, the expert convinced us that the GRI reporting guidelines are consistent with that purpose. Thus, the expert helped us develop a scoring model containing 95 line items that reflect the spirit of the GRI guidelines. Table 1 contains the scoring model with a reference to the corresponding section in the GRI guidelines.

Our disclosure index follows closely the reporting requirements of the GRI guidelines for the following reasons. Firms do not have to prepare social responsibility reports or related web based disclosures discussing their environmental impacts, and if they voluntarily do so, they do not have to adopt the GRI guidelines. The voluntary decision by a firm to both prepare a social responsibility report and use the GRI guidelines means that the firm has opted for a format (the GRI format) that, by the intent of the GRI guidelines, will result in hard disclosures not easily mimicked by the poor EP types. Thus, a firm making a sincere attempt to use the GRI guidelines will score high using our content analysis index, which is precisely the result we seek (i.e., the poor EP types will not want to conform to GRI guidelines that place a premium, for example, on

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<sup>7</sup> Alan Willis, CA, Project Director – Performance Reporting Initiatives, The Canadian Institute of Chartered Accountants. He was a member of the GRI Steering Committee since its inception, and has been a member of the GRI Guidelines development and revision working groups from 1998 to date. He is also a judge for the Canadian Institute for Chartered Accountants' Corporate Reporting Awards.

objective environmental performance indicators). Of the 95 equally weighted items in our disclosure index, 79 relate to “hard” disclosure measures compared to only 16 for “soft” disclosure items, a proportion which (according to the expert who helped us developing the index) reflects the spirit of the GRI guidelines.

We now turn to discuss our disclosure index in more detail. Our disclosure index consists of seven broad categories, A1 to A7, of environmental disclosures (see Table 1). We consider A1 to A4 and A5 to A7 to represent “hard” and “soft” environmental disclosures, respectively.

To score environmental disclosures in discretionary channels and web related disclosures, we accessed the internet web site of each sample firm and identified their environmental reports, if any, and any web based environmental disclosures. We saved all such disclosures as of September 2004. We choose September 2004 as a cutoff point because we wanted to line up with discretionary disclosures about environmental performance contained in the firm’s fiscal 2003 annual report and 10K’s. If firms choose to use discretionary channels (other than 10-ks and annual reports) to update their environmental reports/web related disclosures based on their 2003 environmental performance, they typically will have done so by September of 2004. This arbitrary choice of timing worked out well for us as we did not find any firms that did not file 2003 AR or 10-ks by then, and all firms discussed their fiscal 2003 environmental performance in their environmental reports and related web based disclosures (when reported).

### **3.2.1 “Hard” Disclosure Items**

Category A1 focuses on disclosures pertaining to a firm’s governance structure and management systems put in place with respect to environmental protection. For instance, firms whose Board of Directors have an environmental committee or have implemented ISO 14001 will inform their stakeholders of such commitments. A2 focuses on the credibility of a firm’s disclosures in its environmental report. Firms that obtained independent verification of their

environmental reports, and firms with their products and environmental programs certified by independent agencies and third parties will receive higher scores in this category. In A3, we assess the extent to which firms disclose specific environmental performance indicators, both about their actual pollution emissions and their conservation and recycling efforts. These are the “hard” data that firms can disclose to convince stakeholders about their environmental commitments. In addition, we also award scores when firms disclose performance indicators with respect to historical trends, the firms’ own emission reduction targets, and the industry average. Disclosing actual performance indicators in the above context can convey critical information for stakeholders to assess the firm’s long-term environmental performance (and commitments).

The final category in the “hard” disclosure group is A4, which reflects a firm’s environmental spending. We do not score disclosures pertaining to environmental spending as a result of complying with the existing environmental regulations, as such disclosures are largely non-discretionary and appear in mandatory disclosure channels such as 10-ks and annual reports. Rather, we focus on disclosures of dollar savings from existing environmental programs and efforts and discretionary spending to further enhance future environmental performance such as investing in new environmental technologies or environmentally related R&D and innovations. We also include disclosures of fines related to environmental issues. Such penalties are usually immaterial thus their reporting is not mandatory. Nevertheless, the dollar amount of fines is important to environmental stakeholders to assess the level of true commitment to the environment. In summary, our index design in the A1 to A4 “hard” disclosure categories makes it relatively difficult for poor environmental performers to mimic the environmental disclosures of good environmental performers.

### 3.2.2 “Soft” Disclosure Items

We measure a firm’s disclosures of vision and environmental strategy claims in A5. For instance, firms often disclose broadly that they have an environmental policy, that management is committed to protecting the environment, etc. Such disclosures can be genuine when put in the specific context but they can also be deceiving as they lack credibility and substantiation, and can be easily mimicked. A6 assesses the disclosure of a firm’s environmental profile given the existing and forthcoming environmental regulations. Finally, we code a firm’s disclosures of its environmental initiatives in A7. Items coded here include employee training in environmental management, existence of response plans for environmental accidents, internal environmental awards and audit, and community involvement through scholarship and donations. Again, these kinds of initiatives can represent true commitment but they can also be imitated by companies with no real commitments to protecting the environment.

## 4. Econometric model

### 4.1 Model and Variable Descriptions

In order to test the hypothesis H1, we employ the following econometric model:

$$\begin{aligned} \text{VED} = & \beta_0 + \beta_1 \text{EP} + \beta_2 \text{Tobin Q} + \beta_3 \text{VOLAT} + \beta_4 \text{ROA} + \beta_5 \text{LEV} + \beta_6 \text{SIZE} + \beta_7 \text{NEW} + \\ & + \beta_8 \text{CAPIN} + \varepsilon \end{aligned}$$

The variables in the regression above are defined as follows:<sup>8</sup>

*VED* - is a score of voluntary environmental disclosures using web disclosures as of September, 2004 and discretionary disclosures in the firm’s fiscal 2003 annual report and 10K’s. We perform a content analysis using our disclosure index (see Table 1). In an initial logit analysis, we code *VED* as an indicator variable that takes the value 1 if firms provide disclosures in discretionary channels and 0 otherwise.

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<sup>8</sup> Numbers in brackets represent data items in the Compustat Annual File.

*EP* – is an environmental performance proxy. We use two alternative proxies to capture the environmental performance of each firm. The first is the Toxic Release Inventory (TRI) emission scaled by total sales revenue. To facilitate the interpretation of the results, we reverse the sign of this variable. In other words, the larger this measure is, the better the environmental performance of the firm. The second measure is the percentage of toxic waste treated, recycled or processed in the production. Large recycling percentages imply environmentally proactive firms. Both measures are computed using the public database made available by the U.S. Environmental and Protection Agency (EPA). We aggregate the plant specific data at the firm level.

*FIN* - is the amount of debt or equity capital raised by the firm in the fiscal year 2004. It is the sale of common stock and preferred shares minus the purchase of common stock and preferred shares (#108 - #115) plus long term debt issuance minus the long term debt reduction (#111 - #114). The amount is scaled by the size of total assets at the end of the fiscal year 2002.

*Tobin Q* - is Tobin's Q, measured as market value of common equity (#25 \* #199) plus book value of preferred stock (#10), book value of long term debt (#9) and current liabilities (#5), divided by book value of total assets (#6).

*VOLAT* - is stock price volatility, measured as standard deviation of market adjusted monthly stock return during fiscal year 2003.

*ROA* - is total return on assets measured as the ratio of income before extraordinary items (#18) at the end of fiscal year 2004 and total assets (#6) at the end of fiscal year 2003.

*LEV* – is the leverage ratio, measured as the ratio of total debt (#9 + #34) divided by total assets (#6) at the end of fiscal year 2003.

*SIZE* – is the natural logarithm of the total asset value measured as of the end of fiscal year 2003.

*NEW* – is the asset newness, measured as a ratio of net properties, plant and equipment (#8) divided by the gross properties, plant and equipment (#7) at the end of fiscal year 2003.

*CAPIN* – is the capital intensity, measured as a ratio of capital spending (#128) divided by total sales revenues (#12) at the end of fiscal year 2003.

The control variables included in the multivariate regression model besides our environmental performance (EP) measures have been documented to be causes of voluntary disclosures in the disclosure literature. We include them to avoid a correlated omitted variables threat that EP is standing in for some other well known determinants of disclosure in other disclosure channels. We divide the control variables in three groups: variables the proxy for the benefits of voluntary disclosures, variables that measure costs of voluntary disclosures and other control variables.

#### **4.2 Benefits of Voluntary Disclosure**

*Financing:* It is well known that firms that raise financing in debt and equity markets have a higher propensity for disclosures in voluntary channels (Frankel, McNichols and Wilson, 1995) to lower their cost of capital. We use the amount of debt and equity financing raised by the firm in the fiscal year following the measurement of the environmental performance (FIN).

*Information Asymmetry:* It is generally asserted in the voluntary disclosure literature that managers seek to lower information asymmetry through voluntary disclosures in order to lower the cost of capital (Healy and Palepu, 2001). Our chosen proxies for information asymmetry are: monthly stock return volatility measured (VOLAT) over the 12 month period represented by fiscal 2003 (Lim, 2001) and Tobin's Q, based on the argument that firms with greater unbooked intangibles and a positive NPV investment opportunity set enjoy larger Tobin's Q (Smith and Watts, 1992; Barth and Kasznik, 1999) .

*Firm Performance:* Lang and Lundholm (1993) and others have shown that firms with superior upcoming earnings performance have a higher disclosure propensity to reveal their “good news” to financial markets. At the time of observing web disclosures (September 2004), markets would know fiscal year 2003 ROA so earnings for the upcoming year would be fiscal 2004 ROA.

*Leverage:* A number of disclosure studies (e.g., Leftwich, Watts and Zimmerman, 1981) have argued that the monitoring demand for information increases as firm debt increases, and empirical evidence is consistent with managers being more forthcoming, generally to facilitate the contracting demand for information. Agency costs of debt are higher for firms with relatively more debt in their capital structure (Jensen and Meckling, 1976), thus voluntary disclosures are expected to increase with leverage.

### **4.3 Costs of Voluntary Disclosures**

*Firm Size:* Most voluntary disclosure studies control for firm size (see, for example, Lang and Lundholm, 1993) based on the assumption of economies of scale with respect to information production costs.

*Proprietary Costs:* In Verrecchia (1983), a key friction sustaining a partial disclosure equilibrium is the existence of proprietary costs associated with being forthcoming. In our setting, proprietary costs pertain to the manager revealing information to environmental regulators and other environmental activist groups that increase the probability of criticism, sanction or attack (see Li, Richardson and Thornton, 1997). We assume that industry serves as a measure of proprietary costs, since pollution propensity and related monitoring by opponents is well known to vary by industry. In our inter-industry regressions, we control for industry fixed effects in

order to control for differing proprietary costs and other unidentified factors that might vary by industry.

#### **4.4 Other Control Variables Specific to Environmental Disclosures**

*Equipment Age and Annual Capital Spending:* Healy and Palepu (2001) describe a common criticism in the voluntary disclosure literature involving endogeneity. EP and sustainability disclosures might be joint endogenous variables driven by some underlying exogenous variables such as the level of investments in clean technologies, thus representing a threat to causal inferences. Firms with newer, cleaner technologies are likely to have a superior environmental performance measure and it is reasonable to assume that they will want stakeholders to know about this superior environmental performance in discretionary disclosure channels. To address this omitted variables threat, we control for the average age of a firm's equipment (NEW) based on the argument that newer equipment is expected to employ newer and less polluting technologies. For similar reasons, firms with higher sustaining capital expenditures, as proxied by CAPIN, are expected to have newer equipment and may want to signal their environmental type through more discretionary disclosures regarding their environmental performance.

### **5. Sample selection, summary statistics and univariate empirical results**

As mentioned in Section 1, the sample of this study consists of public U.S. companies from five polluting industries that report toxic release data to the U.S. Environmental Protection Agency and have financial and stock price data in the Compustat and CRSP database. The final sample contains 191 firms covered by the EPA-TRI database for 2003 with adequate variables available in Compustat and CRSP. All these firms are selected such that their activity is

concentrated in the industry in which they are classified (i.e., they are “pure players”).<sup>9</sup> The distribution across the five industries is as follows: 27 firms in the Pulp and Paper industry (14.14% of the sample), 63 firms in the Chemical industry (32.98% of the sample), 18 firms in the Oil and Gas industry (9.42% of the sample), 42 firms in the Metals and Mining industry (21.99% of the sample) and 41 firms in the Utilities industry (21.47% of the sample). Among these firms, 122 firms (63.87% of the sample) chose to provide discretionary disclosures about the environment in the sense that they have compiled an environmental report or a social responsibility report in fiscal year 2003 and/or they set up a website with a section on environmental matters. If a firm has no environmental report or related discretionary web disclosures, we classify such a firm as being “silent” and do not examine the annual report or 10K for that firm. The disclosure score is set to zero for such firms. We allow silent firms in the sample since non-disclosure is a choice in a partial disclosure equilibrium setting.

For firms providing discretionary environmental disclosures, Table 1 presents our scoring model along with descriptive statistics as to the percentage of firms obtaining a particular item and the difference in average disclosure scores across good and poor EP firms. The table also shows the GRI reference for each line item. A crucial assumption of our scoring approach is that the disclosures are discretionary. In support of that assumption, untabulated analysis indicates that for the total number of awarded “hits”, in which a hit is an award of one mark for a given line item, 96.50 % came from firm environmental reports (hereafter EP reports) or web based disclosures other than firm annual reports or 10ks. We assume that EP reports /web disclosures are purely discretionary, i.e. silence is always an option. It is possible for discretionary disclosures to appear in firm annual reports and 10ks, though these are more formal disclosure channels (see Lang and Lundholm, 1993). We assume that a score awarded in the annual report

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<sup>9</sup> We have eliminated firms that operate in multiple industries to facilitate our intra-industry analysis.

or 10k reflected a discretionary disclosure choice by the firm management. As a sensitivity test, in Section 7 we repeat all analyses dropping scores awarded in annual reports and 10ks to address the possibility that such disclosures contain non-discretionary components.

In Table 1, A1 to A4 summarize the separation in average awarded scores across good and poor EP performers, using the %Recycled as the measure of environmental performance. We use the median %Recycled in a given industry to classify firms as good versus poor EP performers. Recall that, according to H1, good EP performers should have higher scores for hard disclosure items that are difficult to mimic by poor EP performers. The results in Table 1 confirm that prediction for the A1 category (Governance Structure and Management Systems). The average score for good (poor) EP performers is 2.08 (1.37). Using a two-tailed t-test the difference is significant at the 1% level. For the A2 category (Credibility), the average score for good (poor) EP performers 2.89 (2.04), and the difference is again significant at the 5% level. Not surprisingly, good EP firms are more likely to disclose that they adopt GRI guidelines. The difference in average scores 0.21 versus 0.05 is statistically significant at the 1% level. It is apparent from these scores for A2.2 that 2 (61 X 0.033) good EP firms obtained independent assurance for their ER report/ web disclosures compared to zero poor EP firms. While this is consistent with an attempt by good EP firms to signal their type, the difference between the two types of firms is not statistically significant.

Of special interest is category A3 (EPI indicators), since this type of hard disclosure is not one that poor EP firms will want to mimic. The average score for Good EP performers of 10.19 is well in excess of the corresponding average score for poor EP performers, 6.08 (the difference is significant at the 1% level). Each item has a total score of 6 based on the dimensions indicated in Table 1. The low scores for both good and poor EP performers suggest that disclosures in this area are less than ideal given the GRI guidelines. In untabulated analyses,

we analyzed the contribution of each of the 6 dimensions to the total scores (i.e. “hits”) awarded in A3, for good versus poor EP firms : performance data presented represents 43.50% (48.44%) of total A3 scores awarded for good (poor) EP firms, respectively; performance data presented relative to peers represents only 1.06% (2.44%) of total A3 scores awarded for good (poor) EP firms, respectively; trend analysis represents 28.86% (26.33%) of total A3 scores awarded for good (poor) EP firms, respectively; performance relative to targets represents 8.76% (7.31%) of total A3 scores awarded, for good (poor) EP firms, respectively; performance data presented in both absolute and normalized form represents 7.87% (8.63%) of total A3 scores awarded, for good (poor) EP firms, respectively; and, finally, performance data presented at the disaggregated level represents 9.64% (6.68%) of total A3 scores awarded, for good (poor) EP firms, respectively. Thus, it is apparent that GRI guidelines with respect to performance relative to peers are not being followed by either good or poor EP performers. This is not surprising, as it is difficult for both types of firms to decide on appropriate “peers” given differences in production processes across firms within a given industry. It is precisely this dilemma that makes relative environmental performance “unobservable” to the typical investor or stakeholder, creating the potential for the setting of a partial disclosure equilibrium where some firms are more transparent than others in their report/web disclosures, and some firms are entirely silent.

The final hard category is A4 (disclosures pertaining to discretionary environmental spending). For that category, the average score for good (poor) EP performers is 0.84 (0.45). The difference between the good and poor groups is significant at 5%. In this category, we find that, on average, good EP firms disclose significantly more often amounts spent on fines than the poor firms. Although these amounts are not material, they are useful to the firm’s stakeholders because they signal a firm’s commitment to the environment.

Table 1 contains corresponding statistics for the soft disclosure categories A5 to A7. Consistent with H1, good EP performers have significantly greater soft discretionary disclosures for A5 (Vision and Strategy) and A7 (Environmental Initiatives) relative to poor EP performers. The result is not surprising in that truly committed firms will claim that they are committed. However, there is no significant difference for A6 (Environmental Profile).

In Table 2, Panel A we present descriptive statistics on environmental disclosure scores by industry. The lowest average score (out of 95) is 10.46 and is obtained by the Metals and Mining Industry while the highest score, 25.21, is obtained by the Pulp and Paper Industry. In Table 2, Panel B we show that the average ratios of TRI/Sales for Pulp and Paper and Metals and Mining are 2.34 (i.e., 2.34 pounds of toxic emissions per thousand dollar sales) and 1.72, respectively. Thus, it appears that industries with a high (low) pollution propensity are more (less) likely to provide discretionary environmental disclosures to firm stakeholders. This is by no means inconsistent with H1 which conditions disclosure predictions by environmental type at the firm level relative to industry peers. Table 2 does confirm differences across sectors in both environmental disclosure and pollution propensities suggesting the need for industry controls.

Untabulated analysis for our 69 firms with zero disclosure scores indicates that these firms have an average TRI/Sales (Percent Recycled) measure of 2.97 (59.01%) compared to 1.82 (65.61%) for the 122 firms with non-zero disclosure scores. The differences in both EP measures across the two groups are significant at the 5% level. This is generally consistent with H1, i.e. poor EP firms are more likely to opt for silence.

In Table 3, Panel A we present descriptive statistics for independent variables used in the estimation. The average firm has a negative financing variable (FIN) meaning that it reduces debt or repurchases shares more than it raises new financing. Also, on average, the ROA is about 5% and the average leverage (LEV) is 33% of total assets. The firm size measured by the

logarithm of total assets (SIZE) is 8.01 implying average total assets in dollar terms of \$3.01bn, thus our sample consists of relatively larger firms. The mean (and median) firm size is comparable with the median firm size reported by Patten (2002) for his sample.

We present in Panel B of Table 3 Pearson correlations between the independent variables used in the regressions. The Pearson correlation between the negative of TRI/Sales and Percent Recycled is equal to 0.29 and is statistically significant at 1%, implying that (minus) TRI/Sales and Percent recycled both measure environmental performance but the overlap is modest.

## **6. Multivariate empirical results**

### **6.2 Inter-Industry Analysis**

We present in Table 4 the results of inter-industry multivariate regressions of disclosure scores on the environmental performance measures and the control variables. We estimate the regressions using a Tobit analysis to account for the censoring of the dependent variable at zero.<sup>10</sup> We estimate the Tobit regressions by maximum likelihood using a Newton-Raphson algorithm.<sup>11</sup> We run three sets of equations based on the different disclosure scores used on the dependent side. All regressions are inter-industry analyses using industry fixed effects. We estimate the regressions using each environmental performance variable separately and then include both variables at the same time.

The first three columns present the results for the total disclosure scores. As predicted by H1, the estimated coefficients for our environmental performance proxies are positive and significant (recall, we reverse the sign of TRI/Sales to facilitate the interpretation). This result is consistent with the discretionary disclosure theories of Verrecchia (1983) and Dye (1985). Firms

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<sup>10</sup> As an alternative, we have re-run our regressions using simple OLS and the inferences are unchanged.

<sup>11</sup> In the Tobit model, the marginal effect of a change in an independent variable on the dependent variable (i.e., disclosure score) is the estimated coefficient times the probability that the firm provides discretionary environmental disclosures (Verbeek, 2004).

with better environmental performance have more voluntary disclosures about their environmental impact. Furthermore, when we introduce both scaled TRI and Percent Recycled in the regression we find that they are significant and positive suggesting that each provides incremental information to the other with respect to voluntary environmental disclosures.

While we do not hypothesize the sign of the coefficients for our control variables, Table 4 indicates the predicted sign of association given prior general disclosure literature and intuition. For the total disclosures as well as hard versus soft disclosures, the forward looking financing proxy is positive (consistent with the prior literature) but is statistically significant only for the soft disclosure category. The information asymmetry proxies (Tobin's Q and Stock Volatility) are insignificant. Similarly, firm profitability (ROA) in the following year is insignificant. One interpretation of this result is that firms resort to other disclosure channels to reduce the information asymmetry and convey their good news about future ROA, and do not use ER reports/web disclosures for this purpose. Turning to our agency proxy, we find that the leverage variable is significantly positive, suggesting that debtholders exercise pressure on firms to disclose environmental related matters to assess potential future liabilities. Also, large firms disclose more, consistent with their lower production costs. Similarly, firms with greater capital expenditures disclose more: the coefficient of the capital intensity control variable is significantly positive. In contrast to our intuition, firms with newer equipment (NEW) are less likely to provide discretionary environmental disclosures.

We also split our disclosure scores in two parts: hard disclosures and soft disclosures. Hard disclosures are closest in spirit to the assumed truthful disclosures in the voluntary disclosure theories discussed in Section 2. However, we find similar results for both hard and soft disclosure scores: the estimated coefficients for our two EP measures are positive and

significant for both hard and soft disclosures as predicted by H1. For soft disclosures, (minus) TRI/Sales is redundant once % Recycled is in the model (see the third column).

## **6.2 Intra-Industry Analysis**

Following Lang and Lundholm (1993, 1996) and Healy, Hutton and Palepu (1999) we supplement the above tests with an intra-industry approach which seeks to explain the within-industry variation in the ranks of disclosure scores using the within-industry variation in the ranks of our independent variables. There are two reasons justifying this approach: (1) some of our variables (i.e. TRI/Sales) can be compared within an industry but cannot be meaningfully compared across industries due to differences in production processes; (2) the distribution of our disclosure scores for the Metal and Mining sector are quite low, so taking intra-industry ranks and then pooling facilitates the i.i.d assumption requirement of our OLS regression model.

We rank the dependent and the independent variables within industry and then we pool the corresponding percentiles across the five sectors. The regression results are presented in Table 5. They are generally the same as in Table 4 and indicate a positive association between the environmental performance measures and the discretionary environmental disclosures (total scores). Both (minus) TRI/Sales and % Recycled complement each other and neither is redundant for the total sample and for the hard and soft groups considered separately. We find similar results when we split the total scores into hard and soft disclosure scores: the estimated coefficients for our two environmental performance measures are positive and significant as predicted by H1. The results for the control variables are also generally comparable to Table 4.

## **7. Sensitivity analysis**

For each disclosure item in the index presented in Table 1, we have replicated the difference tests across the two EP groups using Wilcoxon rank tests. Non-parametric Wilcoxon

rank tests are robust to the possibility that the data does not follow a normal distribution. In addition, we have bootstrapped the p-values of the two-sample parametric t-tests by re-sampling the data with replacement.<sup>12</sup> Both approaches result in the same levels of significance as the ones reported for the parametric t-tests.

We verify whether the difference tests in disclosure scores reported in Table 1 are robust to the classification of sample firms as good and poor environmental performers, using the % Recycled measure. We split the firms in the two groups based on the level of the alternative environmental performance measure, TRI/sales. We still find significant differences between the good and the poor groups across all main categories in the index.

In a separate sensitivity analysis (unreported) we drop out the marks in the disclosure scores awarded from annual reports and 10ks (about 4% of the total). The reason is that environmental disclosures made in these channels may not be purely discretionary. The results presented in Table 4 as well as those in Table 5 remain the same.

Finally, we run a Logit model to investigate whether the decision to provide any discretionary environmental disclosures is affected by the environmental performance of the sample firms. We perform an inter-industry analysis using the same control variables as discussed in Section 4. Results are presented in Table 6 and are consistent with the main results from Table 4. Environmental performance is found to be one of the main drivers of the probability that the firm provides environmental disclosures in discretionary channels. % Recycled and (minus) TRI/Sales are significantly positive at 1% when introduced separately. When both are in the model, the significance level increases to 10%. All models show a good fit

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<sup>12</sup> We implement the bootstrap procedure by drawing with replacement 20,000 samples from each EP group. Prior to resampling, the procedure mean-centers the data within each group (for details, see Westfall and Young, 1993).

(significant likelihood ratios and almost 90% concordant observations) suggesting a good model specification.

## **8. Conclusions**

The study extends the existing environmental accounting literature in two important ways. First, the predictions of voluntary disclosure theory relate to discretionary, not mandatory, environmental disclosures. This study focuses on purely voluntary disclosure media such as corporate Internet web sites and independent environmental reports. Previous studies assessed environmental disclosures mainly from annual reports and other regulatory filings such as 10-ks and many of those studies rely on a Wiseman based content analysis index to measure the extent of environmental disclosures. The Wiseman index focuses on the financial consequences of corporate environmental activities and puts more weight on quantitative disclosures. Using this measure, poor environmental performers may actually have higher disclosure scores than good performers because they have greater exposures and must discuss any material financial information in their regulatory filings such as annual reports and 10-ks. This may partially explain inconclusive findings in the previous literature and why Patten (2002) finds a negative relation between environmental disclosure and a TRI based environmental performance indicator. Second, in collaboration with an environmental reporting expert, we develop a content analysis index to assess the level of environmental disclosure in environmental and social responsibility reports or similar disclosures in the firm's web site. The index, which follows closely the Global Reporting Initiative (GRI) sustainability reporting guidelines, differs from the Wiseman index in that we focus on firm disclosures related to its commitment to protect the environment. Our index potentially allows investors, regulators, and environmental stakeholder groups to infer

environmental performance “type” from the disclosure score. This is valuable to users who seek to assess the firms’ true environmental commitment and related environmental exposures.

Our results are as follows. We find a positive association between environmental performance and the level of discretionary disclosures in environmental and social reports or related web disclosures. In other words, superior environmental performers are more forthcoming in truly discretionary disclosure channels, as predicted by economics based voluntary disclosure theories. Our findings are robust to two reliable environmental performance measures that use actual toxic emission and waste management data. The first one is based on TRI/Sales data at firm level, normalized by firm’s operational scale and the second one is percentage of total toxic wastes that were treated or processed by each firm. In addition, our findings are not affected when we assess the relative environment performance within each industry in order to control for industry differences in pollution propensity.

Finally, our results suggest an important direction for future research. Our study has focused on the determinants (i.e., causes) of discretionary environmental disclosures but not on the consequences. We document that good environmental performers are more forthcoming. The interesting question is whether this disclosure strategy is successful i.e., does the environmental disclosure have the intended valuation consequences? We leave an answer to this question to subsequent research.

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**Table 1: Index assessing the quality of discretionary disclosures about environmental policies, performance and inputs**

This table presents the index used to assess the quality of discretionary disclosures about environmental policies, performance and inputs. Index items are classified in two categories: “hard” and “soft” disclosures. The second column presents the mapping of items in the index to the Global Initiative Reporting (GRI) guidelines. The third column presents the percentage of firms which made disclosures on that item (discretionary channels considered are Environmental and/or Social Responsibility Reports, Website, the Annual Report and the 10k). Good environmental performance (EP) firms are firms that have the environmental performance measure (% recycled) above the industry median. The last two columns present the average score on each item for each group of firms. The significance levels presented in the last column are from two-sample t-statistics that test the difference between the good and the poor group. \*\*\*, \*\*, \* represent significance levels at 1%, 5% and 10%, respectively. Wilcoxon Rank tests and t-tests with Bootstrap Resampling provided similar results. Sample size is 122 firms.

HARD DISCLOSURE ITEMS	Map to GRI	% of firms attaining the item	Average Score	
			Good EP Firms (N=61)	Poor EP Firms (N=61)
<b>A1) Governance Structure and Management Systems ( max score is 6)</b>		<b>72.13%</b>	<b>2.08</b>	<b>1.37***</b>
1. Existence of a Department for pollution control and/or management positions for env. management (0-1)	3.1	39.34%	0.44	0.34
2. Existence of an Environmental and/or a Public Issues Committee in the board (0-1)	3.1	31.97%	0.38	0.26
3. Existence of terms and conditions applicable to suppliers and/or customers regarding env. practices (0-1)		21.31%	0.31	0.11***
4. Stakeholder involvement in setting corporate environmental policies (0-1)	1.1, 3.10	28.69%	0.36	0.21*
5. Implementation of ISO14001 at the plant and/or firm level (0-1)	3.14, 3.20	46.72%	0.51	0.42
6. Executive compensation is linked to environmental performance (0-1)	3.5	4.92%	0.08	0.01*
<b>A2) Credibility ( max score is 10)</b>		<b>84.43%</b>	<b>2.89</b>	<b>2.04**</b>
1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report (0-1)	3.14	13.11%	0.21	0.05***
2. Independent verification/assurance about environmental information disclosed in the EP report/Web.(0-1)		1.64%	0.03	0.00
3. Periodic independent verifications/audits on environmental performance and/or systems (0-1)	3.19, 2.20,21	18.03%	0.18	0.18
4. Certification of environmental programs by independent agencies (0-1)	3.20	15.57%	0.23	0.08**
5. Product Certification with respect to environmental impact (0-1)	3.16	9.84%	0.08	0.11
6. External Environmental Performance Awards and/or inclusion in a Sustainability Index (0-1)		52.46%	0.52	0.52
7. Stakeholder involvement in the environmental disclosure process (0-1)	1.1, 3.10	4.92%	0.09	0.02*
8. Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy (0-1)	3.15	34.43%	0.31	0.37
9. Participation in industry specific associations/initiatives to improve environmental practices (0-1)	3.15	54.92%	0.71	0.39***
10. Participation in other environmental organizations/assoc. to improve environmental practices (if not awarded under 8 or 9 above) (0-1)	3.15	41.80%	0.52	0.31**

HARD DISCLOSURE ITEMS	Map to GRI	% of firms attaining the item	Average Score	
			Good EP Firms (N=61)	Poor EP Firms (N=61)
<b>A3) Environmental Performance Indicators (EPI) ( max score is 60) *</b>		<b>74.59%</b>	<b>10.19</b>	<b>6.08***</b>
1. EPI on energy use and/or energy efficiency (0-6)	EN3,4,17	41.80%	1.46	0.75***
2. EPI on water use and/or water use efficiency (0-6)	EN5,17	30.33%	1.07	0.49**
3. EPI on green house gas emissions (0-6)	EN8	31.97%	1.10	0.59**
4. EPI on other air emissions (0-6)	EN9,10	43.44%	1.45	1.08
5. EPI on TRI (land, water, air) (0-6)	EN11	34.43%	1.04	0.72
6. EPI on other discharges, releases and/or spills (not TRI) (0-6)	EN12,13	28.69%	1.14	0.43***
7. EPI on waste generation and/or management (recycling, re-use, reducing, treatment and disposal) (0-6)	EN11	50.00%	1.44	1.04
8. EPI on land and resources use, biodiversity and conservation (0-6)	EN6,7	36.89%	0.71	0.47
9. EPI on environmental impacts of products and services (0-6)	EN14	4.10%	0.13	0.01**
10. EPI on compliance performance (e.g. exceedances, reportable incidents) (0-6)	EN16	26.23%	0.64	0.49
<b>A4) Environmental Spending ( max score is 3)</b>		<b>44.26%</b>	<b>0.84</b>	<b>0.45**</b>
1. Summary of dollar savings arising from environment initiatives to the company (0-1)		23.77%	0.30	0.18*
2. Amount spent on technologies, R&D and/or innovations to enhance environ. perf. and/or efficiency (0-1)	EN35	20.49%	0.21	0.19
3. Amount spent on fines related to environmental issues (0-1)	EN16	25.41%	0.33	0.18**

\* The scoring scale of environmental performance data is from 0 to 6. A point is awarded for each of the following items:

- 1) Performance data is presented
- 2) Performance data is presented relative to peers/rivals or industry
- 3) Performance data is presented relative to previous periods (trend analysis)
- 4) Performance data is presented relative to targets
- 5) Performance data is presented both in absolute and normalized form
- 6) Performance data is presented at disaggregate level (i.e. plant, business unit, geographic segment).

SOFT DISCLOSURE ITEMS	Map to GRI	% of firms attaining the item	Average Score	
			Good EP Firms (N=61)	Poor EP Firms (N=61)
<b>A5) Vision and Strategy Claims ( max score is 6)</b>		<b>96.72%</b>	<b>3.71</b>	<b>3.04**</b>
1. CEO statement on environmental performance in letter to shareholders and/or stakeholders (0-1)		63.93%	0.73	0.54**
2. A statement of corporate environmental policy, values and principles, environ. codes of conduct (0-1)	1.1, 1.2, 3.7	90.98%	0.92	0.90
3. A statement about formal management systems regarding environmental risk and performance (0-1)	3.19	60.66%	0.62	0.59
4. A statement that the firm undertakes periodic <i>reviews and evaluations</i> of its environ. performance (0-1)	3.19	38.52%	0.49	0.27**
5. A statement of <i>measurable goals</i> in terms of future env. performance (if not awarded under A3) (0-1)	1.1	28.69%	0.34	0.22
6. A statement about specific environmental innovations and/or new technologies (0-1)	1.1	55.74%	0.59	0.52
<b>A6) Environmental Profile ( max score is 4)</b>		<b>70.49%</b>	<b>1.52</b>	<b>1.23</b>
1. A statement about the firm's compliance (or lack thereof) with specific environmental standards (0-1)	GN 8	33.61%	0.39	0.28
2. An overview of environmental impact of the industry (0-1)	GN 8	22.95%	0.26	0.20
3. An overview of how the business operations and/or products and services impact the environment. (0-1)	GN 8	56.56%	0.61	0.52
4. An overview of corporate environmental performance relative to industry peers (0-1)	GN 8	24.59%	0.26	0.23
<b>A7) Environmental Initiatives ( max score is 6)</b>		<b>74.59%</b>	<b>1.98</b>	<b>1.34**</b>
1. A substantive description of employee training in environmental management and operations (0-1)	3.19	30.33%	0.39	0.21**
2. Existence of response plans in case of environmental accidents (0-1)		23.77%	0.31	0.16**
3. Internal Environmental Awards (0-1)		13.11%	0.18	0.08*
4. Internal Environmental Audits (0-1)	3.19 3.20	34.43%	0.38	0.31
5. Internal certification of environmental programs (0-1)	3.19	9.84%	0.15	0.05*
6. Community involvement and/or donations related to environ. (if not awarded under A1.4 or A2.7 ) (0-1)	SO1, EC10	54.92%	0.57	0.52

**Table 2: Descriptive Statistics**

This table presents descriptive statistics on environmental disclosure scores and environmental performance measures by industry. Descriptive statistics present means (medians) and ranges (min-max) below. *Panel A* presents disclosures scores for firms that chose to provide discretionary disclosures (i.e., “disclosing” firms) on their environmental performance (N=122 firms). The scale for each category of disclosure items is presented in brackets. *Panel B* presents Environmental Performance measures for the full sample, i.e. “disclosing” firms and “silent” firms (N=191 firms). TRI/Sales is Toxic Release Inventory data (in pounds) divided by total sales (in thousands). Percent recycled is toxic waste treated or recycled divided by total waste generated by firm.

**PANEL A: Environmental Disclosures**

	<b>Overall</b> <b>(n=122)</b>	<b>Pulp &amp; Paper</b> <b>(n=24)</b>	<b>Chemicals</b> <b>(n=41)</b>	<b>Metals &amp; Mining</b> <b>(n=13)</b>	<b>Oil &amp; Gas</b> <b>(n=13)</b>	<b>Utilities</b> <b>(n=31)</b>
<b><i>Hard Disclosures (0-79)</i></b>						
A1) Governance Structure and Manag. Systems (0-6)	1.72 (1.00) 0-5	2.04 (2.00) 0-5	2.05 (2.00) 0-5	1.38 (1.00) 0-5	2.00 (2.00) 0-5	1.10 (1.00) 0-5
A2) Credibility (0-10)	2.47 (2.00) 0-9	3.75 (3.00) 0-9	2.24 (2.00) 0-6	1.23 (1.00) 0-6	2.77 (3.00) 0-5	2.16 (2.00) 0-6
A3) Environmental Performance Indicators (0-60)	8.14 (7.00) 0-36	10.13 (6.00) 0-36	7.61 (7.00) 0-27	3.00 (0.00) 0-29	8.69 (4.00) 0-21	9.23 (9.00) 0-23
A4) Environmental Spending (0-3)	0.70 (0.00) 0-3	1.17 (1.00) 0-3	0.59 (0.00) 0-3	0.23 (0.00) 0-2	0.85 (1.00) 0-3	0.61 (0.00) 0-3
<b><i>Soft Disclosures (0-16)</i></b>						
A5) Vision and Strategy (0-6)	3.38 (3.00) 0-6	3.83 (4.00) 1-6	3.37 (3.00) 0-6	2.69 (3.00) 0-6	3.92 (4.00) 1-6	3.10 (3.00) 1-6
A6) Environmental Profile (0-4)	1.38 (1.00) 0-4	2.17 (2.00) 0-4	1.19 (1.00) 0-3	1.08 (1.00) 0-3	1.38 (1.00) 0-3	1.13 (1.00) 0-3
A7) Environmental Initiatives (0-6)	1.66 (1.00) 0-6	2.13 (2.00) 0-6	1.90 (1.00) 0-4	0.85 (0.00) 0-4	1.85 (2.00) 0-4	1.26 (1.00) 0-5
<b><i>Total (0-95)</i></b>	<b>19.45 (15.50)</b> 1-68	<b>25.21 (19.00)</b> 3-68	<b>18.95 (17.00)</b> 1-50	<b>10.46 (4.00)</b> 1-55	<b>21.46 (22.00)</b> 4-43	<b>18.58 (15.00)</b> 1-42

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**PANEL B: Environmental Performance**

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	<b>Overall</b>	<b>Pulp &amp; Paper</b>	<b>Chemicals</b>	<b>Metals &amp; Mining</b>	<b>Oil &amp; Gas</b>	<b>Utilities</b>
Percent Recycled	63.12% (81.67%) 0%-99.85%	68.41% (83.22%) 1.80%-99.01%	76.72% (93.92%) 0.01%-99.50%	70.47% (84.52%) 0%-99.85%	77.70% (87.46%) 0%-99.28%	25.32% (24.69%) 0%-68.54%
TRI/Sales	2.24 (0.62) 0.01-23.19	2.34 (1.49) 0.09-12.02	2.16 (0.58) 0.01-18.99	1.72 (0.27) 0.01-21.19	0.89 (0.13) 0.01-8.02	3.45 (2.07) 0.01-14.92

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**Table 3: Descriptive and Correlation Statistics for Independent Variables Used in the Estimation**

This table presents descriptive and correlation statistics for independent variables used in multivariate tests. Statistics are presented for the full sample of 191 firms. % recycled is toxic waste treated or recycled divided by total waste generated by firm. -TRI/Sales is the negative of Toxic Release Inventory data (in pounds) divided by total sales in thousands. SIZE is the logarithm of market value. FIN is the amount of debt or equity capital raised in fiscal year 2004 divided by total assets. Tobin Q is the sum of market value of equity, book value of preferred stock and book value of debt divided by total assets. VOLAT is stock price volatility (standard deviation of monthly returns during 2003). ROA is return on assets. LEV is the leverage ratio. NEW is asset newness measured as the ratio of net PPE to gross PPE. CAPIN is capital intensity measured as the ratio of capital spending to total sales. Spearman Correlation statistics provide similar results. \*\*\*, \*\*, \* represent significance levels at 1%, 5% and 10%, respectively.

**Panel A: Descriptive statistics**

Variable	Mean	Median	Q1	Q3	Std Dev
% Recycled	0.63	0.82	0.30	0.95	0.35
-TRI/Sales	-2.24	-0.62	-2.50	-0.13	3.68
SIZE	8.01	7.89	6.70	9.28	1.70
FIN	-0.02	-0.01	-0.03	0.01	0.31
Tobin Q	1.13	1.04	0.81	1.35	0.75
VOLAT	0.09	0.07	0.05	0.10	0.08
ROA	0.05	0.03	0.00	0.08	0.07
LEV	0.33	0.31	0.23	0.41	0.16
NEW	0.54	0.54	0.45	0.62	0.14
CAPIN	0.07	0.04	0.02	0.09	0.08

**Panel B: Pearson Correlation statistics**

	% Recycled	-TRI/Sales	SIZE	FIN	TOBIN Q	VOLAT	ROA	LEV	AGE	CAPIN
% Recycled	-	0.29***	-0.06	0.15**	0.28***	0.07	0.14**	0.02	-0.26***	-0.30***
-TRI/Sales		-	-0.04	-0.01	0.11	-0.16**	0.08	0.01	-0.03	-0.01
SIZE			-	0.07	0.17**	-0.09	0.01	0.01	0.33***	0.21***
FIN				-	-0.03	0.03	0.05	0.02	0.05	0.03
TOBIN Q					-	-0.01	0.47***	-0.04	-0.15**	-0.06
VOLAT						-	-0.11	0.03	-0.15**	-0.06
ROA							-	-0.11	-0.10	-0.07
LEV								-	0.14*	0.01
NEW									-	0.18**
CAPIN										-

**Table 4: Inter-Industry Regressions with Industry Fixed Effects (Tobit Analysis)**

Dependent variables are disclosures scores as indicated by the columns. The expected signs for the control variables are presented in brackets. Coefficients are estimated by maximum likelihood (Tobit Regressions). The significance levels are based on Chi-Squared statistics (presented in parentheses). All control variables are defined in Table 3. \*\*\*, \*\*, \* represent significance levels at 1%, 5% and 10%, respectively.

	Disclosure Scores								
	Total Disclosures			Hard Disclosures			Soft Disclosures		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	-80.6*** (121.54)	-72.45*** (94.26)	-77.21*** (112.24)	-71.52*** (128.75)	-62.27*** (98.41)	-68.57*** (119.94)	-20.83*** (75.16)	-18.91*** (61.27)	-19.98*** (68.55)
% Recycled	14.77*** (16.87)		13.01*** (13.00)	15.06*** (23.18)		13.54*** (18.68)	3.26*** (7.63)		2.86** (5.77)
- TRI/Sales		0.93*** (8.55)	0.71** (5.20)		0.82*** (9.43)	0.61** (5.45)		0.22** (4.61)	0.17* (2.91)
FIN (+)	11.62 (1.10)	15.23 (1.78)	11.06 (1.03)	5.48 (0.39)	8.82 (0.94)	4.87 (0.32)	8.12** (4.74)	8.91** (5.59)	7.96** (4.65)
TOBIN Q (+)	-1.52 (0.83)	-1.84 (1.13)	-1.76 (1.14)	-1.91 (2.07)	-2.16 (2.40)	-2.16 (2.68)	-0.32 (0.33)	-0.37 (0.41)	-0.37 (0.45)
VOLAT (+)	-7.40 (0.43)	2.69 (0.05)	1.68 (0.02)	-1.50 (0.03)	6.26 (0.39)	6.56 (0.48)	-3.23 (0.72)	-0.89 (0.05)	-1.07 (0.07)
ROA (+)	-4.78 (0.07)	-3.66 (0.03)	-2.14 (0.01)	12.12 (0.66)	10.93 (0.47)	14.19 (0.95)	-7.73 (1.45)	-7.68 (1.36)	-7.18 (1.27)
LEV (+)	27.66*** (22.09)	27.61*** (20.86)	26.76*** (21.27)	23.16*** (22.53)	23.10*** (20.99)	22.04*** (21.05)	7.84*** (16.00)	7.86*** (15.72)	7.66*** (15.54)
SIZE (+)	9.44*** (143.23)	9.92*** (149.48)	9.34*** (144.21)	7.43*** (134.77)	7.90*** (139.65)	7.36*** (136.43)	2.62*** (100.08)	2.71*** (106.09)	2.59*** (99.55)
NEW (+)	-18.13** (5.28)	-19.38** (5.59)	-19.02** (5.91)	-12.07* (3.61)	-13.45** (4.10)	-12.75** (4.13)	-5.87** (4.91)	-6.25** (5.33)	-6.13** (5.38)
CAPIN (+)	35.35*** (9.42)	26.84** (5.06)	31.43*** (7.55)	31.01*** (11.46)	21.63** (5.16)	27.56*** (9.21)	9.43** (4.71)	7.53* (2.94)	8.54** (3.88)
<i>Industry Fixed Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Log-Likelihood</i>	-498.54	-502.25	-498.84	-433.51	-440.27	-430.65	-363.53	-364.89	-362.03
<i>N=no of firms</i>	191	191	191	191	191	191	191	191	191

**Table 5: Intra-Industry Rank Regressions (OLS Analysis)**

Dependent variables are disclosures scores as indicated by the columns. The expected signs for the control variables are presented in brackets. All variables are ranked within industry. Coefficients are estimated by OLS regressions using the ranked variables. The significance levels are based on t statistics (presented in parentheses). All control variables are defined in Table 3. \*\*\*, \*\*, \* represent significance levels at 1%, 5% and 10%, respectively.

	Disclosure Scores								
	Total Disclosures			Hard Disclosures			Soft Disclosures		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	22.61*** (3.31)	21.47*** (3.10)	17.44** (2.55)	24.91*** (3.63)	23.88*** (3.42)	19.76*** (2.87)	30.45*** (4.19)	29.46*** (4.00)	26.53*** (3.59)
% Recycled	0.17*** (3.68)		0.16*** (3.42)	0.18*** (3.73)		0.16*** (3.47)	0.13** (2.53)		0.11** (2.31)
-TRI/Sales		0.17*** (3.52)	0.15*** (3.25)		0.17*** (3.49)	0.15*** (3.22)		0.13** (2.51)	0.12** (2.28)
FIN (+)	0.01 (0.27)	0.04 (0.75)	0.02 (0.53)	0.01 (0.18)	0.03 (0.66)	0.02 (0.44)	-0.01 (-0.22)	0.01 (0.12)	0.00 (-0.04)
TOBIN Q (+)	-0.04 (-0.66)	-0.05 (-0.87)	-0.07 (-1.12)	-0.04 (-0.73)	-0.06 (-0.93)	-0.07 (-1.19)	-0.02 (-0.28)	-0.03 (-0.44)	-0.04 (-0.6)
VOLAT (+)	-0.07 (-1.52)	-0.05 (-1.00)	-0.06 (-1.28)	-0.06 (-1.19)	-0.03 (-0.66)	-0.05 (-0.94)	-0.09 (-1.64)	-0.07 (-1.28)	-0.08 (-1.46)
ROA (+)	0.05 (0.89)	0.05 (0.83)	0.05 (0.77)	0.07 (1.20)	0.07 (1.15)	0.06 (1.09)	0.03 (0.41)	0.02 (0.37)	0.02 (0.32)
LEV (+)	0.17*** (3.49)	0.17*** (3.48)	0.16*** (3.41)	0.15*** (2.98)	0.15*** (2.97)	0.14*** (2.89)	0.17*** (3.27)	0.17*** (3.27)	0.16*** (3.19)
SIZE (+)	0.41*** (7.86)	0.43*** (8.21)	0.41*** (8.11)	0.39*** (7.39)	0.41*** (7.73)	0.39*** (7.62)	0.36*** (6.43)	0.37*** (6.69)	0.36*** (6.54)
NEW (+)	-0.10** (-2.07)	-0.11** (-2.29)	-0.10** (-2.23)	-0.08 (-1.59)	-0.09* (-1.81)	-0.08* (-1.74)	-0.08 (-1.63)	-0.09* (-1.79)	-0.09* (-1.73)
CAPIN (+)	0.12** (2.38)	0.10** (2.07)	0.1** (2.13)	0.11** (2.11)	0.09* (1.81)	0.09* (1.86)	0.13** (2.45)	0.12** (2.23)	0.12** (2.25)
Adj. R <sup>2</sup>	39.89%	39.52%	42.90%	37.06%	36.49%	40.15%	31.50%	31.46%	33.06%
<i>N=no of firms</i>	191	191	191	191	191	191	191	191	191

**Table 6: Logit Analysis**

The dependent variable is the probability that firms provide disclosures in discretionary disclosure channels. The expected signs for the control variables are presented in brackets. Coefficients are estimated by maximum likelihood (Logit Regressions). The significance levels are based on Wald Chi-Square statistics (presented in parentheses). All control variables are defined in Table 3. \*\*\*, \*\*, \* represent significance levels at 1%, 5% and 10%, respectively.

	<b>Probability to Disclose</b>		
	Total	Hard	Soft
Intercept	-9.16*** (26.39)	-7.73*** (22.80)	-8.78*** (24.02)
% Recycled	1.49*** (5.68)		1.11* (2.86)
- TRI/Sales		0.13*** (5.81)	0.11* (3.17)
FIN (+)	1.24 (0.30)	1.45 (0.44)	1.06 (0.24)
TOBIN Q (+)	-0.16 (0.17)	-0.07 (0.04)	-0.13 (0.13)
VOLAT (+)	-2.18 (0.91)	-0.81 (0.13)	-1.32 (0.35)
ROA (+)	-5.27 (1.89)	-5.67 (2.19)	-5.70 (2.15)
LEV (+)	5.75*** (13.00)	5.45*** (12.53)	5.58*** (12.25)
SIZE (+)	1.18*** (34.68)	1.18*** (34.97)	1.21*** (34.52)
NEW (+)	-3.49** (4.21)	-3.85*** (5.36)	-3.66** (4.55)
CAPIN (+)	5.28** (4.25)	3.89 (2.49)	4.86* (3.54)
<i>Industry fixed effects</i>	Yes	Yes	Yes
Likelihood Ratio (p-value)	93.29 (<.001)	93.73 (<.001)	96.65 (<.001)
%Concordant Observations	87.60%	87.80%	88.40%
<i>N=no of firms</i>	191	191	191