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Accounting, Organizations and Society xxx (2007) xxx–xxx

Accounting,
Organizations
and Society

www.elsevier.com/locate/aos

Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis

Peter M. Clarkson ^{a,b}, Yue Li ^c, Gordon D. Richardson ^{c,*}, Florin P. Vasvari ^d^a *UQ Business School, The University of Queensland, Australia*^b *Faculty of Business Administration, Simon Fraser University, Canada*^c *Joseph Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, Ontario, Canada M5S 3E6*^d *London Business School, University of London, London, United Kingdom*

Abstract

Previous empirical evidence provides mixed results on the relationship between corporate environmental performance and the level of environmental disclosures. We revisit this relation by testing competing predictions from economics based and socio-political theories of voluntary disclosure using a more rigorous research design. In particular, we improve on the prior literature by focusing on purely discretionary environmental disclosures and by developing 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 US, we find a positive association between environmental performance and the level of discretionary environmental disclosures. The result is consistent with the predictions of the economics disclosure theory but inconsistent with the negative association predicted by socio-political theories. Nevertheless, we show that socio-political theories explain patterns in the data (“legitimization”) that cannot be explained by economics disclosure theories.

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Introduction

An unresolved research issue in environmental accounting is the empirical association between the level (i.e., amount) of corporate environmental disclosures and corporate environmental performance (Al-Tuwajiri, Christensen, & Hughes,

* Corresponding author. Tel.: +1 416 946 8601.

E-mail addresses: p.clarkson@business.uq.edu.au (P.M. Clarkson), yueli@rotman.utoronto.ca (Y. Li), gordon.richardson@rotman.utoronto.ca (G.D. Richardson), fvasvari@london.edu (F.P. Vasvari).

2004; Hughes, Anderson, & Golden, 2001; Patten, 2002). Accounting standard setters and securities regulators are increasingly being made aware of deficiencies in corporate environmental disclosures (Beets & Souther, 1999; Chan-Fishel, 2002; Franco, 2001). 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 the level of environmental disclosure, inadequate sample selection, and inadequate measures of environmental performance and disclosure.

This study seeks to revisit the relation between environmental performance and the level of environmental disclosure using a more rigorous research design. We test two competing predictions about the level of voluntary environmental disclosures. Voluntary disclosure theory (Dye, 1985; Verrecchia, 1983) predicts a positive association between environmental performance and the level of discretionary environmental disclosure. 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 sustains this partial disclosure equilibrium is proprietary costs associated with disclosure about environmental performance (Verrecchia, 1983) and uncertainty as to whether the firm is informed regarding its type (Dye, 1985).

Socio-political theories including political economy, legitimacy theory, and stakeholder theory (Patten, 2002), on the other hand, predict a negative association between environmental performance and the level of discretionary environmental disclosures. These overlapping theories suggest that social disclosure is a function of social and political pressures facing the corporation. To the extent that

poor environmental performers face more political and social pressures and threatened legitimacy, they will attempt to increase discretionary environmental disclosures to change stakeholder perceptions about their actual performance. Thus, we have competing directional predictions from alternative theories, and the observed direction of association between environmental performance and the level of discretionary disclosures will eliminate one of the two predictions.

The predictions of the above theories relate to discretionary, not mandatory, environmental disclosures. 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 (1982) 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 the inconclusive findings in the previous literature and why Patten (2002) finds a negative relation between environmental disclosure and a toxics release inventory (TRI) based environmental performance indicator.¹

In collaboration with an environmental disclosure expert, we develop a content analysis index based on the global reporting initiative guidelines (GRI) to assess the level of discretionary environmental disclosures in environmental and social responsibility reports or similar disclosures provided on the firm's web site. This index differs from 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

¹ 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).

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 US 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 competing predictions of voluntary disclosure and socio-political theories.

In brief, 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 the economics based voluntary disclosure theory. Our result is inconsistent with the prediction of a negative association arising from socio-political theories such as legitimacy theory and stakeholder theory. Further, using the Janis–Fadner coefficient of imbalance as a direct measure of perceived legitimacy, we fail to observe the negative association between legitimacy and the level of disclosures implied by socio-political theories.² Thus, our results suggest that socio-political theories are not robust in predicting the level of discretionary environmental disclosures.

We do, however, find that socio-political theories are helpful in predicting *what* is being said,

which moves the focus of enquiry beyond the simple level of discretionary disclosure. Using the ratio of soft disclosure scores to total awarded scores as a proxy for “legitimization”, we show that firms with unfavorable prior year media coverage are more likely to make soft claims to be committed to the environment which are not readily verifiable. This behavior is not predicted by economic disclosure theories, which assume truth-telling. Thus, socio-political theories do indeed explain additional patterns in the data.

The paper is organized as follows. Following literature review and hypothesis development, we describe our content analysis disclosure index and the measures of environmental performance which we use in the study. We then present our econometric model and preliminary empirical evidence. The sections ‘Empirical results involving the level of disclosure’ and ‘A revised role for socio-political theories’ contain the main results followed by sensitivity analysis. The final section summarizes the main findings of the study with a discussion of implications for future research.

Literature review and hypothesis development

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.³ 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

² The Janis–Fadner coefficient of imbalance measures the propensity of a firm’s prior year press articles pertaining to the environment to be unfavorable. See section ‘Other control variables specific to environmental disclosures’ for a detailed definition.

³ See Cormier, Magnan, and Morard (1993), Blacconiere and Patten (1994), Barth and McNichols (1994), Cormier and Magnan (1997), Li and McConomy (1999), Richardson and Welker (2001), & Clarkson, Li, and Richardson (2004).

are discretionary.⁴ 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. 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 1972–1976 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).⁵ 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. 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 dis-

⁴ See Patten (1992), Li, Richardson, and Thornton (1997), Barth, McNichols, and Wilson (1997), Li and McConomy (1999), & Aerts, Cormier, and Magnan (2006).

⁵ 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.

close general environmental information, suggesting a negative association between environmental disclosures and environmental performance.

Hughes et al. (2001) examine environmental disclosures made by 51 US 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 issue, Patten uses TRI data, normalized by sales, to proxy for environmental performance. Using a sample of 131 US 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.

More recently, Al-Tuwajri et al. (2004) explore the relations among environmental disclosure, environmental performance and economic performance using a simultaneous equations approach. Similar to Patten (2002) and Al-Tuwajri 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 (1982) 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. The 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 the 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 exclusively 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.

Hypothesis development

The voluntary disclosure literature suggests that companies have incentives to disclose "good

news” to differentiate themselves from companies with “bad news” in order to avoid the adverse selection problem (Dye, 1985; Verrecchia, 1983). While these theories do not pertain to environmental performance per se, they are applied to this setting by Bewley and Li (2000) and Li et al. (1997). Companies with superior environmental performance due to their proactive environmental strategy have incentives to inform investors and other stakeholders of their 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.⁶ Thus, voluntary disclosure theory predicts a positive association between environmental performance and the level of discretionary environmental disclosure.

Turning to the predictions of socio-political theories, Gray, Kouhy, and Lavers (1995) and Lindblom (1994) argue that companies whose social legitimacy is threatened have incentives to increase environmental disclosures to: (1) educate and inform relevant publics about (actual) changes in their performance, (2) change perceptions about their performance, (3) deflect attention from the issue of concern by highlighting other accomplishments, and (4) seek to change public expectations of their performance.⁷ According to Patten (2000, 2002), socio-political theories predict a negative

association between corporate environmental performance and level of discretionary environmental disclosure. Thus, the two competing theories provide opposite predictions on how environmental performance may affect discretionary environmental disclosure strategies. Our hypotheses now follow (stated in the alternate form):

- H1a: Environmental performance and the level of discretionary environmental disclosures are positively associated, as implied by economics based voluntary disclosure theories.
- H1b: Environmental performance and the level of discretionary environmental disclosures are negatively associated, as implied by the socio-political theories.

Research design

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 et al., 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 US Environmental Protection Agency’s (EPA) TRI database (King & 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 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

⁶ 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 across industries (see Al-Tuwajri et al., 2004 & Ilinitch, Soderstrom, & Thomas, 1998).

⁷ Socio-political theories include political economy, legitimacy theory and stakeholder theory (see Patten, 2002). We do not differentiate them in this study as they have the same prediction with respect to the relation between environmental performance and environmental disclosure.

by Al-Tuwajjri 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 et al. (2004).

Environmental disclosure index

As discussed in section 'Literature review and hypothesis development', from the economic theory perspective, 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.⁸ As a simple example, consider a good and a poor EP type firm in the same industry. 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.⁹

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 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 (Global Reporting Initiative, 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 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.

⁸ 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).

⁹ As anecdotal evidence in support of this argument, Greenpeace issued a press release on October 14, 1994 accusing MacMillan Bloedel of deliberately lying to the public by claiming that, in 25 years, the company had been convicted of only 15 environmental offenses. Greenpeace identified 26 convictions in the last four years.

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.¹⁰ 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 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.

¹⁰ 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.

We now turn to discuss our disclosure index in more detail. Our disclosure index consists of seven broad categories, A1–A7, of environmental disclosures (see Table 1). We consider A1–A4 and A5–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 its environmental report, if any, and any web based environmental disclosures. We saved all such disclosures as of September 2004. This arbitrary choice of timing worked out well for us as all firms discussed their fiscal 2003 environmental performance in the environmental reports and related web based disclosures which we obtained.

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

Table 1

Index assessing the quality of discretionary disclosures about environmental policies, performance and inputs

Hard disclosure items	Map to GRI	Percentage of firms attaining the item (%)	Average score	
			Good EP firms (N = 61)	Poor EP firms (N = 61)
(A1) Governance structure and management systems (max score is 6)				
1. Existence of a Department for pollution control and/or management positions for env. management (0–1)	3.1	37.70	0.44	0.31
2. Existence of an environmental and/or a public issues committee in the board (0–1)	3.1	31.15	0.38	0.25
3. Existence of terms and conditions applicable to suppliers and/or customers regarding env. practices (0–1)	3.16	21.31	0.31	0.11***
4. Stakeholder involvement in setting corporate environmental policies (0–1)	1.1, 3.10	27.05	0.36	0.18**
5. Implementation of ISO14001 at the plant and/or firm level (0–1)	3.14, 3.20	45.90	0.51	0.41
6. Executive compensation is linked to environmental performance (0–1)	3.5	4.92	0.08	0.02*
(A2) Credibility (max score is 10)				
1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report (0–1)	3.14	12.30	0.21	0.03**
2. Independent verification/assurance about environmental information disclosed in the EP report/web (0–1)	2.20, 2.21	1.64	0.03	0.00
3. Periodic independent verifications/audits on environmental performance and/or systems (0–1)	3.19	17.21	0.18	0.16
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)		51.64	0.52	0.51
7. Stakeholder involvement in the environmental disclosure process (0–1)	1.1, 3.10	4.92	0.08	0.02*
8. Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy (0–1)	3.15	33.61	0.31	0.36
9. Participation in industry specific associations/initiatives to improve environmental practices (0–1)	3.15	54.10	0.71	0.38***
10. Participation in other environmental organizations/assoc. to improve environmental practices (if not awarded under 8 or 9 above) (0–1)	3.15	40.98	0.52	0.30***
(A3) Environmental performance indicators (EPI) (max score is 60)^a				
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	33.61%	1.05	0.65*
6. EPI on other discharges, releases and/or spills (not TRI) (0–6)	EN12, 13	28.69	1.15	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	0.00*
10. EPI on compliance performance (e.g., exceedances, reportable incidents) (0–6)	EN16	25.41	0.64	0.48

(continued on next page)

Table 1 (continued)

Hard disclosure items	Map to GRI	Percentage of firms attaining the item (%)	Average score	
			Good EP firms (N = 61)	Poor EP firms (N = 61)
(A4) Environmental spending (max score is 3)				
1. Summary of dollar savings arising from environment initiatives to the company (0-1)		44.26	0.84	0.45**
2. Amount spent on technologies, R&D and/or innovations to enhance environ. perf. and/or efficiency (0-1)	EN35	23.77	0.30	0.18*
3. Amount spent on fines related to environmental issues (0-1)	EN16	20.49	0.21	0.19
		25.41	0.33	0.18**
Soft disclosure items				
	Map to GRI	Percentage of firms attaining the item (%)	Average score	
			Good EP firms (N = 61)	Poor EP firms (N = 61)
(A5) Vision and strategy claims (max score is 6)				
1. CEO statement on environmental performance in letter to shareholders and/or stakeholders (0-1)	1.1, 1.2	95.90	3.48	3.04
2. A statement of corporate environmental policy, values and principles, environ. codes of conduct (0-1)	1.1, 1.2, 3.7	61.48	0.69	0.54*
3. A statement about formal management systems regarding environmental risk and performance (0-1)	3.19	87.70	0.85	0.90
4. A statement that the firm undertakes periodic reviews and evaluations of its environ. performance (0-1)	3.19	58.20	0.57	0.59
5. A statement of measurable goals in terms of future env. performance (if not awarded under A3) (0-1)	3.19	37.70	0.47	0.27**
6. A statement about specific environmental innovations and/or new technologies (0-1)	1.1, 1.2	27.05	0.31	0.22
	1.1, 1.2	54.92	0.58	0.52
(A6) Environmental profile (max score is 4)				
1. A statement about the firm's compliance (or lack thereof) with specific environmental standards (0-1)	GN 8	70.49	1.49	1.23
2. An overview of environmental impact of the industry (0-1)	GN 8	32.79	0.38	0.28
3. An overview of how the business operations and/or products and services impact the environment. (0-1)	GN 8	22.13	0.26	0.20
4. An overview of corporate environmental performance relative to industry peers (0-1)	GN 8	56.56	0.61	0.52
	GN 8	24.59	0.26	0.23
(A7) Environmental initiatives (max score is 6)				
1. A substantive description of employee training in environmental management and operations (0-1)	3.19	72.95	1.93	1.34**
2. Existence of response plans in case of environmental accidents (0-1)		30.33	0.39	0.21**
3. Internal environmental awards (0-1)		22.95	0.30	0.16*
4. Internal environmental audits (0-1)	3.19 3.20	13.11	0.18	0.08
5. Internal certification of environmental programs (0-1)	3.19	34.43	0.38	0.31
6. Community involvement and/or donations related to environ. (if not awarded under A1.4 or A2.7) (0-1)	SO1, EC10	9.84	0.15	0.05*
		53.28	0.54	0.52

This table presents the index used to assess the 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, or similar disclosures in firms' web site). 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 (two-tailed) at 1%, 5% and 10%, respectively. Wilcoxon Rank tests and *t*-tests with Bootstrap Resampling provided similar results. Sample size is 122 firms.

Table 1 (continued)

^a 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).

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–A4 “hard” disclosure categories makes it relatively difficult for poor environmental performers to mimic the environmental disclosures of good environmental performers.

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.¹¹ 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.

Econometric model

Model and variable descriptions

In order to test our hypotheses, we employ the following econometric model:

$$\begin{aligned} \text{VED} = & \beta_0 + \beta_1 \text{EP} + \beta_2 \text{J-F coefficient} + \beta_3 \text{FIN} \\ & + \beta_4 \text{TOBIN } Q + \beta_5 \text{VOLAT} + \beta_6 \text{ROA} \\ & + \beta_7 \text{LEV} + \beta_8 \text{SIZE} + \beta_9 \text{NEW} \\ & + \beta_{10} \text{CAPIN} + \varepsilon \end{aligned}$$

The variables in the regression above are defined as follows:

VED – is a score of voluntary environmental disclosures using web based disclosures as of September, 2004. We perform a content analysis using our disclosure index (see Table 1).

EP – is an environmental performance proxy. We use two alternative proxies to capture the environmental performance of each firm. The first is the 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,

¹¹ Consider, for example, items A5-2, 3 and 5. We classify these statements as soft because they involve claims about environmental management control systems without details or substantiation. In contrast, the corresponding items in A1-1 and 2 are hard because they provide specific information about the existence of the department, management positions or board committees responsible for monitoring pollution control.

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 US Environmental and Protection Agency (EPA). We aggregate the plant specific data at the firm level.

J–F coefficient – the Janis–Fadner coefficient of imbalance, measured for the firm’s 2002 fiscal year and defined in greater detail below.

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).¹² 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 that proxy for the benefits of voluntary disclosures, variables that measure costs of voluntary disclosures and other control variables.

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, & 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 & 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 (Barth & Kasznik, 1999; Smith & Watts, 1992).

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, & 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

¹² Numbers in brackets represent data items in the Compustat Annual File.

demand for information. Agency costs of debt are higher for firms with relatively more debt in their capital structure (Jensen & Meckling, 1976), thus voluntary disclosures are expected to increase with leverage.

Costs of voluntary disclosures

Firm Size: Most voluntary disclosure studies control for firm size (see, for example, Lang & Lundholm, 1993) based on the assumption of economies of scale with respect to information production costs.¹³

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 et al., 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.

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 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.

Favorable media coverage: Following Aerts and Cormier (2006), Bansal and Clelland (2004) and Janis et al. (1965), we measure lagged environmental legitimacy as the propensity for unfavorable press articles using the Janis–Fadner coefficient of imbalance. This coefficient ranges from -1 (unfavorable) to $+1$ (favorable), with zero implying neutral perceptions about the firm's environmental legitimacy. Following Aerts and Cormier (2006) and Patten (2002), legitimacy theory predicts a negative association between lagged environmental legitimacy and the level of voluntary environmental disclosures.¹⁴ The Janis–Fadner coefficient is measured as follows:

Janis–Fadner coefficient

$$\begin{aligned} &= \frac{(e^2 - ec)}{t^2} \quad \text{if } e > c, \\ &= \frac{(ec - e^2)}{t^2} \quad \text{if } c > e, \\ &= 0 \quad \text{if } e = c, \end{aligned}$$

¹³ Firm size has been regularly established as a determinant of voluntary disclosure in the literature, so its effects must be controlled for. Firm size is marginally significant and positively correlated with % recycled in the Chemical and Pulp and Paper industries, but is insignificant for our other three industries. In Table 4, we control for firm size as a covariate to ensure that our EP measures are not standing in for size. In Table 5, firm size is once again a covariate in our model. Thus, the role played by firm size in environmental disclosure is controlled for in both tables when we isolate effects due to EP.

¹⁴ In our sample of 191 firms, 126 have at least one article in Factiva database related to the environment in fiscal 2002. The 126 firms generate 770 total articles related to the environment during fiscal 2002. Of these, 393, 207, and 170 are coded by us as unfavorable, neutral and favorable, respectively. For the 65 firms with no environmental articles, the Janis–Fadner coefficient is set to a default measure of zero. Thus, silence in the media is interpreted to imply neutrality of perceptions about environmental legitimacy.

where e is the number of favorable environmental articles, c is the number of unfavorable articles, and t is $e + c$.

Sample selection, summary statistics and univariate empirical results

As mentioned in section ‘Introduction’, the sample of this study consists of public US companies from five polluting industries that report toxic release data to the US Environmental Protection Agency and have financial and stock price data in the Compustat and CRSP database.¹⁵ The final sample contains 191 firms covered by the EPA-TRI database for 2003 with adequate variables available in Compustat and CRSP. 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 fiscal 2003: 55 of those firms had stand alone environmental reports and invariably also had supplementary web disclosures, while the remaining 67 firms had discretionary web disclosures but no stand alone environmental reports. If a firm has no environmental report or related discretionary web disclosures, we classify such a firm as being “silent”, with the disclosure score set to zero for these 69 firms.¹⁶ We allow silent firms in the sample since non-disclosure is a choice in a partial disclosure equilibrium setting.

¹⁵ We identify all firms with available TRI data and two-digit SIC codes: 26 (pulp and papers), 28 (chemicals), 29 (oil and gas), 33 (metals and mining), and 49 (utilities). For these companies, we read the firm’s business descriptions and dropped companies that identify material business operations in industries outside of their primary two-digit SIC code.

¹⁶ We contacted the 69 firms with zero disclosures first by email and then by phone. None of them indicated that they published a stand alone environmental report in 2003.

For firms providing discretionary environmental disclosures, Table 1 presents our scoring model along with descriptive statistics as to the percentage of firms disclosing 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, we use only disclosures that came from firm environmental reports (hereafter EP reports) or web based disclosures other than firm annual reports or 10 Ks. We assume that EP reports/web disclosures are purely discretionary, i.e., silence is always an option.

In Table 1, A1–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.¹⁷ Recall that, according to H1a, 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 (1.27). 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 is 2.88 (1.95), 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 0.03 is statistically significant at the 1% level. It is apparent from the scores for A2-2 that 2 (61×0.03) 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.

¹⁷ Our results in Table 1 are qualitatively unaffected when we partitioned the sample using the mean % recycled.

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, 6.00 (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. Economics based voluntary disclosure theories predict that good EP firms will be more forthcoming about the dollar amount spent on fines because this amount will be lower than the corresponding amount for poor EP firms, consistent with superior environmental performance within the industry. To validate that disclosing the amount spent on fines signals a firm’s commitment to the environment, we examine the dollar amount spent on fines and the number of environmental violations in fiscal year 2000 for the 100 of our sample firms (56 good EP firms and 44 poor EP firms) covered in the Corporate Environmental Profile Database developed by the Investor Responsibility and Research Center. In untabulated results, we find that the fifty-six good EP firms had an average of 1.13 violations per firm and 0.17 cents of fines per thousand of dollars of sales. In comparison, the forty four poor EP firms had an average of 2.63 violations per firm and 0.42 cents of fines per thousand dollars of sales. Using a two-tailed *t*-test, the difference in the number of violations (scaled dollar fines) between the two groups is statistically significant at 0.02 (0.01) level.¹⁸

Table 1 contains corresponding statistics for the soft disclosure categories A5–A7. Consistent with H1a, good EP performers have significantly greater soft discretionary disclosures for A7 (environmental initiatives) relative to poor EP performers. However, there is no significant difference for A5 (vision and strategy) and A6 (environmental profile). Overall, the results for our soft disclosure scores suggest less separation between good and poor EP firms, a finding which we explore in more depth in section ‘A revised role for socio-political theories’ below.

¹⁸ An alternative interpretation of our results for fines disclosures is that the firms disclosing such fines are seeking to legitimize the violation of environmental regulation and requirements. This pattern of disclosure behaviour is predicted by legitimacy theory (Patten, 2000). We leave the validation of this alternative explanation to future research.

In Table 2, Panel A we present descriptive statistics on environmental disclosure scores by industry. The lowest average score (out of 95) is 10.08 and is obtained by the Metals and Mining Industry while the highest score, 25.21, is obtained by the Pulp and Paper Industry.¹⁹ 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 H1a 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 (% 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 H1a, 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.

¹⁹ While our scoring scheme has 95 available points to allow for rich variety of disclosures from one sustainability report to the next, and from one industry to another, the attainable score is lower than this, even for an excellent sustainability report. For example, our top scoring firm, Weyerhaeuser, obtained 68 of the 95 available points, suggesting an effective maximum of 71%. This is comparable to the effective maximum in similar scoring scheme used in “Risk and Opportunity: the Best Practice in Non-financial Reporting” by Standard and Poor’s (2004). Nonetheless, the low average scores (out of 95) for each of the four industries point to an overall need for improvement in sustainability reporting in the years beyond 2003.

The firm size measured by the logarithm of total assets (SIZE) is 8.01 implying average total assets in dollar terms of \$3.01 bn, 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. The average J–F coefficient is -0.08 .

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 % recycled is equal to 0.29 and is statistically significant at 1%, implying that (minus) TRI/Sales and % recycled both measure environmental performance but the overlap is modest.

Empirical results involving the level of disclosure

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.²⁰ We estimate the Tobit regressions by maximum likelihood using a Newton–Raphson algorithm.²¹ We run three sets of equations based on the different disclosure scores (total, hard and soft) used on the dependent side. All regressions are inter-industry analyses using dummy variables to control for 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 H1a, the estimated coefficients for our environmental

²⁰ As an alternative, we have re-run our regressions using simple OLS and the inferences are unchanged.

²¹ 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).

Table 2
Descriptive Statistics for variables of interest

Panel A: Environmental disclosures (N = 122 firms)

	Overall (n = 122)	Pulp and paper (n = 24)	Chemicals (n = 41)	Metals and mining (n = 13)	Oil and gas (n = 13)	Utilities (n = 31)
Hard disclosures (0–79)	12.88 (10.00) 0–53	16.95 (13.00) 0–53	12.19 (10.00) 0–39	5.76 (2.00) 0–42	14.31 (11.00) 1–33	13.00 (11.00) 0–31
(A1) Governance structure and manage. systems (0–6)	1.68 (1.00) 0–5	1.95 (2.00) 0–5	1.95 (2.00) 0–5	1.31 (1.00) 0–5	2.00 (2.00) 0–5	1.10 (1.00) 0–5
(A2) Credibility (0–10)	2.42 (2.00) 0–9	3.71 (3.00) 0–9	2.14 (2.00) 0–6	1.23 (1.00) 0–6	2.77 (3.00) 0–5	2.13 (2.00) 0–6
(A3) Environmental performance Indicators (0–60)	8.09 (6.50) 0–36	10.13 (6.00) 0–36	7.49 (5.00) 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	0.58 (0.00) 0–3	0.23 (0.00) 0–2	0.85 (1.00) 0–3	0.61 (0.00) 0–3
Soft Disclosures (0–16)	6.26 (6.00) 0–15	7.91 (8.50) 2–15	6.39 (6.00) 0–13	4.31 (3.00) 0–13	6.69 (7.00) 0–12	5.45 (5.00) 1–11
(A5) Vision and strategy (0–6)	3.26 (3.00) 0–6	3.71 (4.00) 1–6	3.27 (3.00) 0–6	2.53 (3.00) 0–6	3.61 (4.00) 1–6	3.06 (3.00) 1–6
(A6) Environmental profile (0–4)	1.36 (1.00) 0–4	2.08 (2.00) 0–4	1.19 (1.00) 0–3	1.08 (1.00) 0–3	1.38 (1.00) 0–3	1.12 (1.00) 0–3
(A7) Environmental initiatives (0–6)	1.64 (1.00) 0–6	2.13 (2.00) 0–6	1.90 (1.00) 0–4	0.69 (0.00) 0–4	1.77 (2.00) 0–4	1.26 (1.00) 0–5
Total (0–95)	19.13 (15.00) 1–68	25.21 (19.00) 3–68	18.59 (15.00) 1–50	10.08 (4.00) 1–55	21.00 (22.00) 2–43	18.45 (15.00) 1–42

Panel B: Environmental performance (N = 191 firms)

	Overall	Pulp and paper	Chemicals	Metals and mining	Oil and gas	Utilities
% 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

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 toxics 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.

Table 3
Descriptive and correlation statistics for variables used in the estimation

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
J–F coefficient	–0.08	0.00	0.00	0.37	0.81
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

	TRI/Sales	Size	FIN	TOBIN Q	VOLAT	ROA	LEV	AGE	CAPIN	Total disclosure	J–F coefficient
% Recycled	0.29***	–0.06	0.15**	0.28***	0.07	0.14**	0.02	–0.26***	–0.30***	0.23***	–0.05
–TRI/Sales	–	–0.04	–0.01	0.11	–0.16**	0.08	0.01	–0.03	–0.01	0.17***	0.13*
SIZE	–	–	0.07	0.17**	–0.09	0.01	0.01	0.33***	0.21***	0.46***	0.05
FIN	–	–	–	–0.03	0.03	0.05	0.02	0.05	0.03	0.03	0.01
TOBIN Q	–	–	–	–	–0.01	0.47***	–0.04	–0.15**	–0.06	0.14	0.03
VOLAT	–	–	–	–	–	–0.11	0.03	–0.15**	–0.06	–0.16**	–0.15**
ROA	–	–	–	–	–	–	–0.11	–0.10	–0.07	0.04	0.03
LEV	–	–	–	–	–	–	–	0.14*	0.01	0.19***	0.10
NEW	–	–	–	–	–	–	–	–	0.18**	–0.12**	–0.02
CAPIN	–	–	–	–	–	–	–	–	–	0.34***	0.09
Total disclosure	–	–	–	–	–	–	–	–	–	–	0.09*

This table presents descriptive and correlation statistics for independent variables used in multivariate tests. Statistics are presented for the full sample of 191 firms. *Percent recycled* is toxic waste treated or recycled divided by total waste generated by firm. *TRI/Sales* is the negative of Toxics 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. *Total Disclosure* is total environmental disclosure score achieved using the disclosure index presented in Table 1. *J–F coefficient* is the Janis–Fadner Coefficient (see Bansal and Clelland, 2004 for details). Spearman Correlation statistics provide similar results. ***, **, * represent significance levels (two-tailed) at 1%, 5% and 10%, respectively.

performance proxies are all 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), but inconsistent with the negative association (H1b) predicted by socio-political theories. Firms with better environmental performance have more voluntary disclosures about their environmental impact. Furthermore, when we introduce both scaled TRI and % 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.

Table 4 indicates the predicted sign of association for our control variables 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 cate-

Table 4
Inter-industry regressions with industry fixed effects (Tobit analysis)

	Dependent variables								
	Total disclosures			Hard disclosures			Soft disclosures		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	−81.2*** (122.45)	−74.72*** (103.76)	−78.67*** (115.87)	−70.65*** (115.51)	−64.00*** (105.64)	−68.01*** (112.24)	−20.65*** (75.46)	−19.03*** (63.87)	−19.85*** (69.60)
% Recycled (±)	11.48*** (10.31)		9.81*** (7.41)	8.83*** (7.62)		8.02*** (6.53)	2.40** (5.68)		2.11** (4.35)
−TRI/Sales (±)		0.84*** (6.67)	0.65** (4.07)		0.77*** (7.90)	0.72*** (6.99)		0.21** (4.43)	0.18* (3.20)
J–F coefficient (−)	2.21 (2.02)	1.76 (1.23)	1.83 (1.40)	2.00 (2.43)	1.59 (1.52)	1.56 (1.52)	0.60 (1.33)	0.47 (0.79)	0.49 (0.90)
FIN (+)	18.82* (2.79)	21.20* (3.47)	18.05* (2.65)	13.17 (2.02)	14.41* (2.48)	11.73 (1.70)	9.42*** (6.32)	9.94*** (6.99)	9.13*** (6.07)
TOBIN <i>Q</i> (+)	−1.54 (0.86)	−1.88 (1.22)	−1.83 (1.24)	−2.18 (2.49)	−2.05 (2.24)	−2.45 (3.25)	−0.44 (0.64)	−0.48 (0.75)	−0.51 (0.85)
VOLAT (+)	−4.69 (0.17)	4.05 (0.11)	3.56 (0.09)	−1.44 (0.02)	7.45 (0.55)	8.39 (0.72)	−1.93 (0.26)	−0.05 (0.01)	−0.08 (0.01)
ROA (+)	−2.56 (0.02)	−1.31 (0.00)	0.85 (0.01)	9.49 (0.36)	11.32 (0.51)	13.73 (0.81)	−5.01 (0.62)	−5.57 (0.74)	−4.54 (0.52)
LEV (+)	27.27*** (21.38)	26.58*** (19.77)	27.63*** (20.98)	23.80*** (21.76)	23.01*** (21.04)	22.67*** (20.89)	7.29*** (13.99)	7.13*** (13.20)	7.16*** (13.71)
SIZE (+)	9.70*** (152.17)	10.06*** (160.43)	9.67*** (155.71)	7.90*** (140.36)	8.05*** (148.80)	7.81*** (145.05)	2.61*** (101.38)	2.68*** (106.75)	2.57*** (100.57)
NEW (+)	−17.57** (5.00)	−17.63** (4.81)	−18.22** (5.40)	−12.16* (3.38)	−13.09** (3.96)	−12.73** (3.86)	−5.62** (4.55)	−5.64** (4.45)	−5.73** (4.76)
CAPIN (+)	33.38*** (8.33)	26.96** (5.26)	30.32*** (6.97)	28.22*** (8.62)	21.26** (5.06)	24.96*** (7.06)	9.67** (5.18)	8.04** (3.54)	8.82** (4.34)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	−497.98	−499.55	−495.88	−435.27	−434.96	−431.62	−359.50	−360.01	−357.84
<i>N</i> = no of firms	191	191	191	191	191	191	191	191	191

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 (two-tailed) at 1%, 5% and 10%, respectively.

gory. 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 information

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. The lagged Janis–Fadner coefficient is not associated with the level of disclosure, which is consistent with the results of Aerts and Cormier (2006).

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 'Literature review and hypothesis

development'. 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 H1a.

Intra-industry analysis

Following Lang and Lundholm (1993, 1996) and Healy et al. (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

Table 5
Intra-industry rank regressions (OLS analysis)

	Dependent variables								
	Total disclosures			Hard disclosures			Soft disclosures		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	13.91* (1.84)	15.30** (2.03)	11.08 (1.48)	20.03*** (2.65)	19.03*** (2.53)	16.20*** (2.18)	15.38** (1.96)	16.42*** (2.09)	13.65*** (3.41)
% Recycled (\pm)	0.17*** (3.56)		0.15*** (3.19)	0.15*** (3.05)		0.14*** (2.98)	0.11** (2.34)		0.11** (2.24)
–TRI/Sales (\pm)		0.16*** (3.32)	0.14*** (2.93)		0.17*** (3.48)	0.16*** (3.42)		0.09* (1.93)	0.09* (1.73)
J–F coefficient (–)	0.07 (1.57)	0.05 (1.07)	0.05 (1.19)	0.05 (1.09)	0.04 (0.84)	0.03 (0.66)	0.18*** (3.74)	0.17*** (3.51)	0.17*** (3.46)
FIN (+)	0.06 (1.24)	0.07 (1.45)	0.06 (1.38)	0.06 (1.35)	0.07 (1.50)	0.07 (1.51)	0.03 (0.69)	0.04 (0.79)	0.04 (0.75)
TOBIN Q (+)	–0.04 (–0.67)	–0.05 (–0.89)	–0.06 (–1.07)	–0.04 (–0.72)	–0.06 (–0.98)	–0.07 (–1.21)	–0.02 (–0.36)	–0.03 (–0.50)	–0.04 (–0.62)
VOLAT (+)	–0.06 (–1.15)	–0.04 (–0.83)	–0.05 (–0.99)	–0.06 (–1.15)	–0.03 (–0.54)	–0.05 (–0.97)	–0.04 (–0.84)	–0.03 (–0.60)	–0.04 (–0.76)
ROA (+)	0.06 (1.09)	0.06 (1.01)	0.06 (0.97)	0.06 (1.09)	0.08 (1.33)	0.06 (0.94)	0.03 (0.44)	0.02 (0.37)	0.02 (0.36)
LEV (+)	0.17*** (3.51)	0.17*** (3.40)	0.17*** (3.44)	0.15*** (3.15)	0.15*** (3.02)	0.15*** (3.07)	0.16*** (3.12)	0.15*** (2.98)	0.15*** (3.04)
SIZE (+)	0.43*** (8.39)	0.44*** (8.55)	0.43*** (8.53)	0.40*** (7.67)	0.41*** (8.03)	0.39*** (7.84)	0.36*** (6.77)	0.37*** (6.94)	0.36*** (6.81)
NEW (+)	–0.11** (–2.34)	–0.11** (–2.26)	–0.11** (–2.42)	–0.09* (–1.92)	–0.09** (–1.99)	–0.09** (–2.03)	–0.08* (–1.65)	–0.08* (–1.64)	–0.08* (–1.68)
CAPIN (+)	0.11** (2.20)	0.10** (2.13)	0.10** (1.97)	0.10** (2.07)	0.08* (1.75)	0.09* (1.79)	0.13** (2.54)	0.13** (2.54)	0.12** (2.39)
Adj. R^2	40.83%	40.33%	43.22%	36.38%	37.32%	39.94%	34.98%	34.36%	35.69%
$N = \text{no of firms}$	191	191	191	191	191	191	191	191	191

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 (two-tailed) at 1%, 5% and 10%, respectively.

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 or 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 H1a. The results for the control variables are also generally comparable to Table 4. The Janis–Fadner coefficient is now positively associated with the level of soft disclosures, which is opposite to the negative association predicted by the socio-political theories.

A revised role for socio-political theories

Overall, the results in the previous sections point to economic disclosure theory and not socio-political theory as being robust in predicting the level of discretionary environmental disclosure. If the focus of enquiry is switched to disclosure strategies, it may be that socio-political theories explain interesting patterns in the data. While we leave this possibility to future research, we offer in this section some preliminary evidence on the question.

Legitimacy theory predicts that firms with threatened legitimacy are likely to make self-serving disclosures referred to as “legitimization” (see, for example, Adams, 2004; Gray et al., 1995, p. 54 & Hughes et al., 2001, p. 219). One example of legitimization is for a poor environmental performer to make soft claims to be committed to the environment which are not readily verifiable. In fact, it is apparent from an inspection of Table 1 that many poor EP firms do make soft claims to be committed to the environment. Focusing on A5, Vision and Strategy Claims, over 90% of our poor EP firms make a claim which is awarded at least one mark in category A5. For example, 55 of 61 poor EP firms (i.e., $0.90 * 61$) make a claim that is awarded a score of 1 for item A5-2 which is a statement of corporate environmental policy and/or commitment. Further, 33 of our 61 poor EP firms are awarded a score under

A5-1 which involves a CEO statement on environmental performance to stakeholders.²²

More formally, using the ratio of soft disclosure scores to total awarded scores as a proxy for legitimization, we would expect to find a negative relation between prior perceived legitimacy and this ratio. Our tests based on the conditional sample of firms with scored sustainability/web disclosures appear in Table 6. We measure threats to legitimacy in two ways: group EP membership based on the median % recycled and group media coverage based on the median Janis–Fadner Coefficient. There are 122 (95) firms with scored sustainability/web disclosures (at least one environmental press article in 2002) and available EP. As indicated in Table 6, the ratio of soft/total scores is 50.95% for poor EP firms, compared to 34.23% for good EP firms. Similarly, the ratio of soft/total scores is 47.54% for unfavorable media coverage firms, compared to 32.58% for firms with favorable media coverage. In both instances, the difference is statistically significant at the 1% level. Both results are consistent with firms whose environmental legitimacy is threatened to make soft claims to be committed to the environment. This result is predicted by legitimacy theory but cannot be explained by economic disclosure theories, which assume truth-telling and thus offer no predictions about biased disclosures.

These results hold when we repeat the tests (untabulated) in a multivariate fashion using all other control variables in Tables 4 and 5 and employ the ratio of soft/total as the dependent variable. There is a significant negative association between the lagged Janis–Fadner Coefficient and the ratio of soft/total scores, after including all control variables. Similar results hold for our two EP measures. This result is robust to the Tobit analysis approach (Table 4) and the rank regression analyses approach (Table 5) and implies a greater propensity for “legitimization” behavior

²² As anecdotal evidence, consider the following soft environmental commitment claim made by one of our sample chemical firms in the bottom quartile of our environmental performance ranking: “Senior management leads the industry with respect to responsible care.”

Table 6
Comparisons of soft to total disclosure scores

Panel A: Group membership is based on median % recycled (N = 122 firms)

Disclosure categories	Average score		Difference (<i>t</i> -stat)
	Good EP firms (<i>N</i> = 61)	Poor EP firms (<i>N</i> = 61)	
Soft/total (%)	34.23%	50.95%	–16.72%*** (3.99)

*Panel B: Group membership is based on median Janis–Fadner coefficient (N = 95 firms)**

Disclosure categories	Average score		Difference (<i>t</i> -stat)
	Favorable media coverage (<i>N</i> = 48)	Unfavourable media coverage (<i>N</i> = 47)	
Soft/total (%)	32.58%	47.54%	–14.96%*** (3.22)

This table presents average ratios of soft to total disclosure scores. *Panel A* presents differences in soft to total disclosure ratios across good environmental performance (EP) firms and poor environmental performance firms. Good environmental performance (EP) firms are firms that have the environmental performance measure (% recycled) above the industry median. *Panel B* presents differences in soft to total disclosure ratios across favorable media coverage firms and unfavorable media coverage firms. Firms with favorable media coverage are firms that have a Janis–Fadner Coefficient above the sample median (see Bansal and Clelland, 2004 for details). Only firms that have at least one article in Factiva are included. The significance levels presented in the last column are from two-sample *t*-statistics that test the difference between the groups. ***, **, * represent significance levels (two-tailed) at 1%, 5% and 10%, respectively. Wilcoxon Rank tests and *t*-tests with Bootstrap Resampling provided similar results. Groupings based on mean values also provide similar results.

for firms whose environmental legitimacy is threatened.

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.²³ 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.

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 ‘Econometric model’. Results (unreported) 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. *Percent recycled* and (minus) *TRI/Sales* are significantly positive at the 1% level when introduced separately. When both are in the model, the significance level decreases to 10%. The J–F coefficient is not significant. All models show a good fit (significant likelihood ratios and almost 90% concordant observations) suggesting a good model specification.

²³ We implement the bootstrap procedure by drawing with replacement 20000 samples from each EP group. Prior to resampling, the procedure mean-centers the data within each group (for details, see Westfall & Young, 1993).

Conclusions

Previous empirical evidence provides mixed results on the relationship between corporate environmental performance and the level of environmental disclosures. We revisit this relation by testing competing predictions from economics based and socio-political theories of voluntary disclosure using a more rigorous research design. In particular, we improve the prior 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 stand-alone 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 (1982) based content analysis index to measure the extent of environmental disclosures.

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 (2002) sustainability reporting guidelines, differs from the Wiseman index in that we focus on firm disclosures related to its commitment to protect the environment.

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 Toxics Release Inventory scaled by sales data at firm level (i.e., TRI 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. Our results are inconsistent with the prediction of a negative association from socio-political theories, suggesting that these theories are not robust in predicting the level of discretionary disclosure.

Although there is separation in scores and good EP firms disclose more, the scores of good EP firms are low relative to the expectation implied by the 2002 GRI reporting guidelines and point to the need for improvement in the years beyond 2003. Specific areas where improvement is required include obtaining independent assurance of sustainability reports and the disclosure of environmental performance indicators.

Finally, our results suggest important directions for future research. Specifically, we provide preliminary evidence that socio-political theories are robust in predicting what is being said. In particular, we find that firms whose environmental legitimacy is threatened make soft claims to be committed to the environment. This behavior is predicted by legitimacy theory but cannot be explained by economics disclosure theory. Thus, we argue that future environmental disclosure research should move the focus of enquiry beyond the level of disclosure.

Acknowledgements

We are grateful for comments and suggestions from the Editor (Anthony G. Hopwood), two anonymous reviewers and from Kate Bewley, Walt Blacconiere, Denis Cormier, Gus De Franco, Kathy Herbohn, Ole-Kristian Hope, Hai Lu, Michel Magnan, Naomi Soderstrom 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 also thank concurrent session participants and discussants at the June 2006, July 2006 and August 2006 meetings of the CAAA, AFAANZ (a Best Paper Award) and AAA,

respectively. We thank Rod Lohin, Bill Swirsky, and Alan Willis for their support and encouragement for this project and Gauri Bhat, Grace Jin and Dushyantkumar Vyas for help in data collection. Gordon Richardson thanks KPMG for their generous financial support.

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