



Corporate Environmental Performance, Disclosure and Leverage: An Integrated Approach

Elizabeth Connors^a, Lucia S. Gao^b

^a Northeastern University

^b University of Massachusetts Boston

Abstract: Corporate capital financing decisions are an integral part of overall corporate strategy. This study analyses the effect of environmental performance and disclosure on the capital structure of U.S. firms in the electric utility industry. The hypothesized relationships account for endogeneity in the three factors of strategy and are estimated using a simultaneous equations model. Our results suggest that firms with lower toxics emissions exhibit higher leverage and voluntary disclosure and that leverage is negatively associated with disclosure.

Keywords: corporate environmental strategy, environmental performance, environmental disclosure, leverage, capital structure.

1. Introduction

Capital structure decisions are fundamental for the firm's financial strategy and have important implications for risk-taking and investment behavior of the firm, research and development, innovation, competition, costs, and relationships with non-financial stakeholders such as customers and employees.¹ In practice, capital structure decisions and corporate strategy are interrelated (Parsons and Titman, 2008) and the question of how to finance the firm should support and be consistent with its long-term strategy (Andrews, 1980; Barton and Gordon, 1987).

Parsons and Titman (2008) argue that empirical studies that attempt to shed light on the connection between capital structure and a firm's corporate strategy potentially suffer from endogeneity problems. For example, studies of the effect of debt on a

¹ See for example Titman (1984), Titman and Wessels (1988), Hall et al. (1990), Bronars and Deere (1991), Opler and Titman (1994), Chevalier (1995), Kale and Noe (1995), Zingales (1998), Khanna and Tice (2000), Myers (2001), Campello (2002), Mauer and Sarkar (2005).

firm's sales and market share need to also incorporate the effect of shocks to sales on observed debt ratios (Opler and Titman, 1994; Zingales, 1998; Parsons and Titman, 2008).

In the environmental management literature, Al-Tuwarijri et al. (2004) argue that environmental strategy, financial performance, and environmental reporting transparency must be examined simultaneously. They propose a framework that explicitly treats these variables as endogenous variables jointly determined by the firm's strategic management process.

The purpose of our study is to analyze the relationship between environmental performance, voluntary environmental disclosure, and capital structure measured as leverage. Our model reflects theoretical literature and empirical support for the contention that these factors are influenced by a complex strategic relationship. Specifically, we hypothesize that environmental performance has a significant association with both leverage and voluntary environmental disclosures. We also hypothesize that there is a significant relationship between disclosure and leverage in that disclosure affects debt capacity and equity financing, and leverage requires disclosure in order to reduce agency and information asymmetry costs.

Environmental performance may impact leverage through an increase on firms' risk. The trade-off theory suggests that firms with volatile cash flows utilize less debt financing in the capital structure in order to avoid potential bankruptcy costs. Poor environmental performance also implies uncertainty of future cash flows relating to potential regulatory changes and potential cleanup costs. These contingent liabilities are not necessarily reflected in the liabilities recorded by firms due to the discretionary choice allowed by accounting rules (Cormier and Magnan, 1997). However, previous studies have shown that managers and stakeholders consider these to be undisclosed liabilities when estimating firm value (Barth and McNichols, 1994; Clarkson and Li, 2004). Therefore, firms with poor environmental performance should have lower disclosed leverage relative to their better performing peers.

In addition to environmental performance, our model introduces environmental disclosure to determine the impact of the firm's environmental strategy on leverage. Finance theory suggests that agency costs of debt are higher for firms with a larger proportion of debt in the capital structure (Jensen and Meckling, 1976) and the

monitoring demand for information increases as firm debt increases (Leftwich, 1981). Sengupta (1998) provides evidence that firms with higher quality disclosure benefit from a lower cost of debt. Therefore, environmental disclosure may be associated with higher leverage.

A competing argument is that disclosure of environmental performance is likely to provide additional information that allows equity investors to better estimate the firm's future cash flows and reduce uncertainty. Several studies in the accounting literature show that disclosure quality has an impact on the cost of equity capital that, in turn, reduces estimation or information risk (e.g. Barry and Brown, 1985; Coles et al., 1995; Diamond and Verrecchia, 1991; Leuz and Verrecchia, 2000, Lambert et al., 2007). Following this argument, environmental disclosure may be associated with more reliance on equity financing and lower leverage.

For a sample of electric utility companies, our results show that poor environmental performance has a significant and negative impact on leverage and disclosure when controlling for endogeneity. The results also show a negative relationship between environmental disclosure and leverage. While we could expect disclosure to play a role in decreasing agency costs of debt and increase debt capacity, our results suggest that the reduction in estimation or information risk and consequential decrease in the cost of equity may contribute to higher equity financing. This result may also be explained by the fact that our disclosure variable is based on the release of discretionary environmental reports that may be targeted to the equity investors of companies.

This study contributes to the accounting and finance literature in that it extends the work of Sharfman and Fernando (2008) by including the effects of disclosure in addition to the effects of environmental performance on leverage and by incorporating simultaneity of the explanatory variables in the model. Our analysis introduces the Clarkson et al. (2008) measure of voluntary environmental disclosure as a more detailed and comprehensive measure than has been previously used in much of the economics, finance, or management literature. The analysis also incorporates seven years of data. This provides some assurance that our results are not unduly influenced by events of a single year or small set of years. Our results provide evidence that environmental performance affects both environmental disclosure and leverage, and leverage is associated with environmental disclosure.

The remainder of the paper is organized as follows. In Section 2 we expand on the relevant literature and formally present our hypotheses. In Section 3, we present the empirical design and Section 4 we discuss our sample and descriptive statistics. Section 5 presents our results and our conclusions are discussed in Section 6.

2. Hypothesis Development

The theory of the capital structure of firms is generally framed in terms of agency conflicts, asymmetric information, tax benefits, bankruptcy costs, or behavioral considerations. Within this theoretical context, we next discuss how environmental performance and disclosure may impact leverage.

2.1 Environmental Performance

Poor environmental performance is associated with latent environmental liabilities and potential future lawsuits related to accidental spills and other uncontrollable events (Barth and McNichols, 1994). Firm's with higher levels of pollution emissions are also more likely to see their operations and financial performance affected by changes in environmental legislation and regulation, due to high relative compliance costs. Poor environmental performance is also associated with inefficiencies in the manufacturing process (Nehrt, 1996) and less innovation and product differentiation (Porter and van der Linde, 1995; Reinhardt, 1998). Therefore, poor environmental performance may increase the uncertainty of the future cash flows of the company.

According to the trade-off theory, higher risk should be associated with less debt, because future cash flows may not be high enough to repay the debt. This potential bankruptcy cost increases the cost of debt and reduces the firm's ability to raise debt capital (Kraus and Litzenberger, 1973). Uncertainty in future cash flows also reduces the probability that tax shields will be fully utilized through consistently positive taxable income, thereby reducing the tax benefit of debt financing (Frank and Goyal, 2009).

Several studies investigate the impact of environmental risk and performance on the cost of equity and on the cost of debt. For example, Garber and Hammitt (1998) examined the effect of Superfund liabilities on the costs of equity, based on the capital

asset pricing model and beta, and found a significant positive relationship for large firms. Connors and Gao (2009) find that firms with high levels of Toxics Release Inventory (TRI) emissions have higher cost of equity capital. Sharfman and Fernando (2008) found a positive and significant relationship between environmental risk management and the cost of equity, but their results show that the cost of debt increases with environmental risk management. They attribute this increase to an increase in debt financing in the capital structure of the firm. Conversely, Schneider (2010) finds that the cost of debt increases with poor environmental performance measured as TRI emissions. He explains that poor environmental performance represents potential liabilities related to compliance and clean-up costs due to increasingly strict environmental laws and regulations. These potential liabilities may entail future fixed payments which entail a risk of insolvency.

Another explanation of the effect of environmental performance on leverage is the view that poor relative environmental performance proxies for latent environmental liabilities which affects the debt capacity of firms (Barth and McNichols, 1994). Rogers (2005) defines environmental liabilities as “probable and measurable estimates of future environmental cleanup, closure, and disposal costs.” Some environmental liabilities result from pollution remediation laws such as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). SEC's Regulation S-K mandates that all companies publicly traded on U.S. stock exchanges disclose significant corporate environmental liabilities and debt exposure in incidences of violation of U.S. environmental laws. Superfund sites information and disclosures regarding compliance investigations and litigation are made publicly available by the EPA. Financial statement reporting requirements for environmental liabilities fall under the rules of SFAS No. 5, which requires that contingent liabilities be booked when it is probable that the liability will arise and the amount can be reasonably estimated. The ultimate loss to an entity from environmental liabilities is contingent on the outcome of future events which causes considerable estimation error (Ulph and Valentini, 2004). In the context of this uncertainty, accounting standards provide considerable latitude and discretion regarding disclosure and recognition of contingent liabilities (Rogers, 2009). The general result is that liabilities are unrecorded due to estimation difficulties or because the dollar values are considered to be immaterial.

Even though environmental liabilities are not fully recorded or disclosed in the financial statements of companies, they may be accounted for by the stakeholders. Several studies in the accounting literature find that environmental liabilities have market valuation implications not reflected in book values (Barth and McNichols, 1994; Cormier and Magnan, 1997; Campbell et al., 1998; Clarkson and Li, 2004). The estimation risk associated with contingent Superfund liability estimates is particularly important to valuation (Barry and Brown, 1985; Coles and Loewenstein, 1988; Clarkson and Thompson, 1990; Botosan 1997). Thus the combination of uncertain future outcomes and accounting rules relating to contingent liabilities may result in possibly substantial unrecorded environmental liabilities. However, it has been shown that stakeholders and management recognize and adjust capital structure choices accordingly.

All else equal, we expect firms with better environmental performance to carry more debt in their capital structure than their poorly performing peers. Formally, our first hypothesis is stated as follows:

Hypothesis 1: Firms with better environmental performance maintain a capital structures with higher leverage than those with poor environmental performance.

Clarkson et al. (2008) find support for the prediction that good environmental performers will provide more environmental information to the market in the form of substantive voluntary environmental reports. Delmas and Blass (2010) find contradictory results to those in Clarkson et al. (2008). However, their sample size is relatively small and they use a substantially less detailed measure of disclosure. The Clarkson et al. (2008) results provide empirical support for disclosure theory which argues that companies with better performance have more incentives to disclose in order to differentiate themselves from poorer performers (Dye, 1985; Verrechia, 1983). Consistent with this theory, our second hypothesis is the following:

Hypothesis 2: Firms with better environmental performance provide more voluntary environmental disclosures than those with poor environmental performance.

2.2 Environmental Disclosure

Highly leveraged firms have higher agency costs of debt and incur more monitoring costs (Jensen and Meckling, 1976). In order to manage agency and

monitoring costs, firms with high leverage will voluntarily disclose more information (Fama and Miller, 1972; Alsaeed, 2006).

Leftwich (1981) also hypothesizes that monitoring demand for information increases as a firm's debt increases, but their empirical results do not show a higher reporting frequency for companies with higher leverage. Schipper (1981) discusses the Leftwich (1981) results. She argues that agency conflicts between bondholders and stockholders can be resolved by explicit contracts, and as such, leverage and frequency of reporting will not necessarily show a positive relationship.

Malone et al. (1993) and Hossain et al. (1994) empirically identified leverage as a factor with a positive association with the extent of voluntary disclosure. However, several other papers have not found a significant relationship between leverage and disclosure (Chow and Wong-Boren, 1987; Wallace et al., 1994; Wallace and Naser, 1995; Hossain et al., 1995; Raffournier, 1995).

In a study of disclosure practices across different countries, Zazerski (1996) finds a negative relationship between leverage and disclosure and concludes that firms with more debt are likely to disclose less public information. He argues that companies with higher debt ratios share more private information with creditors in countries with high uncertainty avoidance and where firms developed special banking relationships. Conversely, there is an increased demand for public information from companies with higher level of equity.

Healy and Palepu (2001) argue that demand for financial reporting and disclosure arises from information asymmetry and agency conflicts between managers and outside investors. Information asymmetry results from managers having superior information relative to investors regarding the firm's future prospects (Milgrom, 1981; Diamond and Verrecchia, 1991). According to Myers and Majluf (1984), equity and debt is costly for companies that cannot resolve information asymmetry. Other studies provide evidence that higher disclosure quality reduces information asymmetry, increases the certainty of future returns and lowers transaction costs for investors (Lev, 1988; Lang and Lundholm, 2000).

Forecasting risk is also higher for firms with lower disclosure (Barry and Brown, 1986). Firms with more disclosure, and hence lower information risk, are more likely to have a lower cost of capital than firms with a low level of disclosure (Healy and

Palepu, 2001). Several studies provide evidence that disclosure quality has an impact on the cost of equity capital (e.g. Barry and Brown, 1985; Coles et al., 1995; Diamond and Verrecchia, 1991; Botoson, 1997; Leuz and Verrecchia, 2000; Lambert et al., 2007). Therefore, disclosure may increase the level of equity financing.

There is also evidence that managers who anticipate equity financing have incentives to provide voluntary disclosure and reduce the information asymmetry problem (Healy and Palepu, 1993, 1995). For example, Lang and Lundholm (1993) find that firms issuing securities in the current or future periods benefit from higher analysts' ratings. Lang and Lundholm (2000) find that there is a significant increase in disclosure beginning six months before for firms making equity offerings.

We study the impact of environmental performance and disclosure on leverage. As we have discussed, leverage may be a determinant of voluntary disclosure, as firms may need to resolve asymmetric information and agency problems with the stakeholders. However, following the argument that managers who anticipate external financing have incentives to provide voluntary disclosure (Healy and Palepu, 1993, 1995) and the aforementioned effects of disclosure on the cost of equity capital, we could also expect higher levels of disclosure for firms that rely on external financing. Therefore, the direction of causality between leverage and environmental disclosure is not clear.

Given the conflicting theories and evidence relating to the effect of disclosure on debt capacity (numerator) and on equity financing (denominator) components of leverage, there is no consensus expectation for the sign of the relationship either. Therefore we propose the following non-directional hypothesis:

Hypothesis 3: There is a significant relationship between leverage and the level of environmental disclosure.

3. Empirical Design

Parsons and Titman (2008) consider that endogeneity is one of the biggest challenges in empirical corporate finance research. Statistically, endogeneity means that the model's errors are not random because they are partially predictable from information contained in the explanatory variables. Regression models may be

misspecified in a way that makes identifying a causal effect between two economic variables difficult.

Al-Tuwarijri et al. (2004) show that statistical mishandling of endogeneity affected prior research into the relationship between environmental disclosure, environmental performance and economic performance. They provide analyses using simultaneous equations models in various forms to show that these factors are jointly determined and have a positive relationship.

Healey and Palepu (2001) also point out potential endogeneity bias in disclosure studies. As an example, they mention that firms with the highest disclosure ratings tend to also have high contemporaneous earnings performance (Lang and Lundholm, 1993) and that this phenomenon may be caused by a self-selection bias. In other words, firms may increase disclosure when they have better performance.

Our theoretical discussions lead us to the conclusion that our analysis of the effects of disclosure and environmental performance on leverage must account for the possible effect of endogeneity. We posit that managers jointly determine leverage, environmental performance and environmental disclosure. Following Al-Tuwarijri et al. (2004) we specify leverage as a function of environmental disclosure and performance, and environmental disclosure as a function of leverage and environmental performance. Our model takes the following structural form:

$$\begin{aligned} \text{Leverage}_{it} = & \beta_0 + \beta_1 \text{Environmental Performance}_{it} + \beta_2 \text{Environmental Disclosure}_{it} + \\ & \beta_3 \text{Market to Book}_{it} + \beta_4 \text{Return on Assets}_{it} + \beta_5 \log(\text{Total Assets})_{it} + \\ & \beta_6 \text{Tangibility}_{it} + \beta_7 \text{Non Debt Tax Shields}_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{Environmental Disclosure}_{it} = & \gamma_0 + \gamma_1 \text{Environmental Performance}_{it} \\ & + \gamma_2 \text{Market to Book}_{it} + \gamma_3 \text{Leverage}_{it} \\ & + \gamma_4 \text{Return on Assets}_{it} + \gamma_5 \log(\text{Total Assets})_{it} \\ & + \gamma_6 \text{Newness}_{it} + \gamma_7 \text{Capital Intensity}_{it} \\ & + \gamma_8 \text{Financing}_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

Equation (1) in our model follows the standard literature in capital structure. Harris and Raviv (1991), and more recently Frank and Goyal (2010), surveyed the literature and propose factors that explain leverage. We control for the proportion of fixed assets, non-debt tax shields, growth opportunities, profitability and firm size.

Equation (2) is based on the model proposed in Clarkson et al. (2008). The control variables included in the model have been documented to be determinants of

voluntary disclosures in the disclosure literature. In Table 1 we present the description of the variables used in both equations.

Table 1.
Variable Definitions

Variable	Definition
<i>Leverage</i>	Ratio of total debt to the sum of total debt, market value of equity and liquidating value of preferred stock at the end of the fiscal year.
<i>Environmental Performance</i>	Annual TRI emissions in pounds scaled by sales.
<i>Environmental Disclosure-CRLV</i>	Environmental Disclosure Index proposed in Clarkson et al. (2008), constructed based on discretionary environmental reports released during the year.
<i>Environmental Disclosure-Hard</i>	Clarkson et al. (2008) Index categories (A1) – (A4).
<i>Environmental Disclosure-Soft</i>	Clarkson et al. (2008) Index categories (A5) – (A7).
<i>Market to Book</i>	Ratio of market value of equity to book value of equity at the end of the fiscal year.
<i>Return on Assets</i>	Ratio of earnings before extraordinary items to total assets at the end of the fiscal year.
<i>log(Total Assets)</i>	Logarithm of total assets at the end of the fiscal year.
<i>Tangibility</i>	Ratio of net plant and equipment to total assets at the end of the fiscal year.
<i>Non-Debt Tax Shields</i>	Ratio of depreciation and amortization to total assets at the end of the fiscal year.
<i>Newness</i>	Ratio of net property, plant and equipment divided by the gross property, plant and equipment at the end of the fiscal year.
<i>Capital Intensity</i>	Ratio of capital spending to total sales revenues.
<i>Financing</i>	Sale of common stock and preferred shares minus the purchase of common stock and preferred shares plus long term debt issuance minus long term debt reduction, scaled by the value of total assets at the end of the previous fiscal year.

3.2 Leverage and Environmental Variables

Leverage

Leverage is computed as total debt over the sum of total debt, market value of equity and liquidating value of preferred stock. We follow Welch (2008), who argues that in the leverage ratios financial debt should be divided by financial capital and not total assets.

Environmental Performance

Consistent with several prior studies (for example, Clarkson et al., 2008; King and

Lenox, 2002; Konar and Cohen, 2001) we measure environmental performance as annual Toxics Release Inventory (TRI) emissions in pounds scaled by U.S. sales. A higher value on this variable indicates poorer environmental performance. For the purposes of this study, annual emissions have been aggregated across chemicals and across the various methods of release. We have aggregated the TRI reports to the parent company level. Facility ownership has been determined by the review of SEC filed forms 10-K, corporate and facility websites, and through public announcements of acquisitions and disposals of subsidiaries and facilities.*Environmental Disclosure*

Our measure of environmental disclosure is the index proposed in Clarkson et al. (2008) to assess the discretionary disclosures about environmental policies, performance and corporate governance and initiatives in environmental reports. This index is based on the Global Reporting Initiative (GRI) Sustainability Guidelines of 2002. We include the Clarkson index as three separate measures of disclosure. Consistent with Clarkson et al. (2008), we utilize a measure of total disclosures. We also separate total disclosures in to “hard” disclosures and “soft” disclosure in accordance with Clarkson et al. (2008) methodology. Clarkson et al. (2008) define “hard” disclosures as those that are objective, not easily mimicked, and potentially litigable. The authors define “soft” disclosures as less verifiable, general commitments to environmental performance.

To varying degrees companies choose to issue their own Environmental/Sustainability Reports in order to convey primarily non-financial information. There is no standard reporting format for Environmental/Sustainability Reports and the types of actual disclosures vary from company to company and year to year. We examined discretionary environmental disclosure in corporate social responsibility reports, stand-alone environmental reports and sustainability reports. The reports were accessed at socialfunds.com, CorporateRegister.com and on individual corporate websites. We then classified the information according to the index items proposed by Clarkson et al. (2008) consistent with their described coding rules. Table 2 provides descriptive statistics for the scores on each of the index items for our sample.

It should be noted that the Clarkson (2008) measure, and by extension the GRI framework, assumes that more disclosure indicates greater transparency and does not attempt to determine whether the disclosures represent either “good” or “bad” news.

Table 2.
Environmental disclosure scores according to the classification items for the index of quality of discretionary disclosure proposed in Clarkson et al. (2008)

	Mean	Median	SD
Hard disclosures			
(A1) Governance structure and management systems			
1. Existence of a Department for pollution control and/or management positions for env. management (0–1)	0.698	1	0.46
2. Existence of an environmental and/or a public issues committee in the board (0–1)	0.108	0	0.31
3. Existence of terms and conditions applicable to suppliers and/or customers regarding env. practices (0–1)	0.145	0	0.35
4. Stakeholder involvement in setting corporate environmental policies (0–1)	0.108	0	0.31
5. Implementation of ISO14001 at the plant and/or firm level (0–1)	0.181	0	0.38
6. Executive compensation is linked to environmental performance (0–1)	0.012	0	0.11
(A2) Credibility			
1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report (0–1)	0.325	0	0.47
2. Independent verification/assurance about environmental information disclosed in the EP report/web (0–1)	0.012	0	0.11
3. Periodic independent verifications/audits on environmental performance and/or systems (0–1)	0.217	0	0.41
4. Certification of environmental programs by independent agencies (0–1)	0	0	0
5. Product Certification with respect to environmental impact (0–1)	0	0	0
6. External environmental performance awards and/or inclusion in a sustainability index (0–1)	0.493	0	0.5
7. Stakeholder involvement in the environmental disclosure process (0–1)	0.024	0	0.15
8. Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy (0–1)	0.578	1	0.5
9. Participation in industry specific associations/initiatives to improve environmental practices (0–1)	0.421	0	0.49
10. Participation in other environmental organizations/assoc. to improve. environmental practices (0–1)	0.204	0	0.4
(A3) Environmental performance indicators			
1. EPI on energy use and/or energy efficiency (0–6)	0.37	0	0.98
2. EPI on water use and/or water use efficiency (0–6)	0.795	0	1.41
3. EPI on green house gas emissions (0–6)	3.12	3	1.17
4. EPI on other air emissions (0–6)	3.21	3	0.98
5. EPI on TRI (land, water, air) (0–6)	1.53	2	1.49
6. EPI on other discharges, releases and/or spills (not TRI) (0–6)	0.91	0	1.34
7. EPI on waste generation and/or management (0–6)	1.86	2	1.42
8. EPI on land and resources use, biodiversity and conservation (0–6)	0.12	0	0.45
9. EPI on environmental impacts of products and services (0–6)	0	0	0
10. EPI on compliance performance (e.g., exceedances, reportable incidents) (0–6)	1.66	2	1.41

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(A4) Environmental spending

1. Summary of dollar savings arising from environment initiatives to the company (0-1)\	0.12	0	0.33
2. Amount spent on technologies, R& D and/or innovations to enhance environ. perf. and/or efficiency (0-1)	0.45	0	0.5
3. Amount spent on fines related to environmental issues (0-1)	0.33	0	0.47

Soft Disclosures

(A5) Vision and strategy

1. CEO statement on environmental performance in letter to shareholders and/or stakeholders (0-1)	0.759	1	0.43
2. A statement of corporate environmental policy, values and principles, environ. codes of conduct (0-1)	0.566	1	0.49
3. A statement about formal management systems regarding environmental risk and performance (0-1)	0.518	1	0.5
4. A statement that the firm undertakes periodic reviews and evaluations of its environ. performance (0-1)	0.349	0	0.48
5. A statement of measurable goals in terms of future env. Performance (if not awarded under A3) (0-1)	0.108	0	0.31
6. A statement about specific environmental innovations and/or new technologies (0-1)	0.325	0	0.47

(A6) Environmental profile

1. A statement about the firm's compliance (or lack thereof) with specific environmental standards (0-1)	0.24	0	0.43
2. An overview of environmental impact of the industry (0-1)	0.108	0	0.31
3. An overview of how the business operations and/or products and services impact the environment. (0-1)	0.49	1	0.5
4. An overview of corporate environmental performance relative to industry peers (0-1)	0.048	0	0.21 5

(A7) Environmental initiatives

1. A substantive description of employee training in environmental management and operations (0-1)	0.133	0	0.34
2. Existence of response plans in case of environmental accidents (0-1)	0.156	0	0.37
3. Internal environmental awards (0-1)	0.108	0	0.32
4. Internal environmental audits (0-1)	0.373	0	0.49
5. Internal certification of environmental programs (0-1)	0.036	0	0.19
6. Community involvement and/or donations related to environ. (if not awarded under A1.4 or A2.7) (0-1)	0.99	1	0.11

The mean, median and standard deviation pertain to the observations in our sample.

3.3 Control Variables in Equation (1)

Market to Book

The market-to-book ratio is a proxy for the firm's growth opportunities. It also provides a measure of the agency costs of debt because of the higher potential agency costs of debt in high growth firms (Myers, 1977). Therefore, firms expecting high future growth should use a greater amount of equity finance. There is also the possibility that the correlations may stem from perceived mispricing. If firms typically issue stock when their price is high relative to book value we might observe a negative correlation between the market-to-book ratio and leverage (Korajczk et al.,

1990; Jung et al., 1994).

Non-Debt Tax Shields

This variable is expected to be negatively related to leverage. The tax benefit of additional debt financing declines with the increase in non-debt tax shields (DeAngelo and Masulis, 1980).

Tangibility

Prior studies document a positive relation between asset tangibility and firm leverage (Titman and Wessels, 1988). If a large fraction of a firm's assets are tangible, then assets should serve as collateral and reduce the risk and agency costs of debt. Tangible assets should also retain value in liquidation. Therefore, the greater the proportion of tangible assets on the balance sheet the more willing lenders should be to supply loans, and leverage should be higher.

log(Total Assets)

The effect of size on leverage is ambiguous. Larger firms tend to be more diversified and fail less often, so size may be an inverse proxy for the probability of bankruptcy and consequently should have a positive impact on the supply of debt. However, size may also be a proxy for the information available to outside investors, which should increase their preference for equity relative to debt (Frank and Goyal, 2009).

Return on Assets

Return on assets measures profitability. There are conflicting theoretical predictions on the effects of profitability on leverage. Myers and Majluf (1984) predict a negative relationship, because more profitable firms will prefer to finance with internal funds rather than debt. Jensen (1986) predicts a positive relationship if the market for corporate control is effective and forces firms to commit to paying out cash to stockholders by raising more debt, but the relationship would be negative if managers of profitable firms prefer to avoid the disciplinary role of debt.

3.4 Control Variables in Equation (2)

Return on Assets

Firms with superior earnings performance are more likely to disclose “good news” to financial markets (Lang and Lundholm, 1993; Clarkson et al., 2008).

Leverage

Agency costs of debt are higher for firms with a larger proportion of debt in their capital structure, and these firms incur more monitoring costs (Jensen and Meckling (1976). Thus voluntary disclosure is expected to increase with debt.

log(Total Assets)

Larger firms benefit from economies of scale with respect to information and production costs and are likely to disclose more information (Lang and Lundholm, 1993; Clarkson et al., 2008).

Newness

Firms with newer equipment, with newer and less polluting technologies, are likely to have a superior environmental performance relatively to their industry peers. Accordingly, the firms will want to communicate that information to stakeholders through discretionary disclosures (Clarkson et al., 2008).

Capital Intensity

Firms with higher capital expenditures are investing in new equipment. These upgrades and investments should improve environmental efficiency, compelling increased voluntary disclosures (Clarkson et al., 2008).

Financing

Firms that raise debt and equity capital have additional incentives to undertake voluntary disclosures to reduce the information asymmetry problem and lower their cost of capital (Healy and Palepu, 1993, 1995, Frankel et al., 1995, Clarkson et al., 2008).

4. Sample and Descriptive Statistics

Our sample is comprised of companies in the electric utility (SIC 49) industry that file with reportable TRI emissions and have information available in the Compustat database between 2001 and 2007. This industry has been chosen for study for several reasons. First, electric companies are fairly homogeneous in terms of operations and the toxicity of chemicals emitted is comparable. Second, during the time period of interest, the electric industry has the second highest total TRI emissions

and the highest air emissions and releases to on-site landfills. Third, U.S. electric companies have operations sited almost entirely in the United States. Finally, U.S. electric utilities are exposed to high environmental regulatory risks related to emissions. As such, their operations are subject to TRI reporting requirements and management strategy is influenced by a similar set of regulations, risks and disclosure requirements. Our final sample includes a total of 324 company/year observations and 47 companies.

Table 2 presents the mean and median scores of our sample on the Clarkson et al. (2008) index items. The scores are similar to those obtained in their sample. Mean scores are highest for Category (A3) which represent “hard” disclosures relating to various types of emissions and resource usage. Table 3 presents descriptive statistics for our sample. Companies in our sample have an average market value of equity of \$7.9 billion and average sales of \$6.5 billion. *Market-to-book* varies between 1.33 (1st quartile) and 1.91 (3rd quartile) and *Return on Assets* varies between 1.8% (1st quartile) and 3.6% (3rd quartile), providing evidence of homogeneity between the companies in our sample.

Table 3
Descriptive statistics

	Mean	Standard Deviation	25th Perc.	Median	75th Perc.
Leverage	0.539	0.161	0.442	0.524	0.626
Market to Book	1.747	0.924	1.335	1.591	1.906
Return on Assets	0.024	0.026	0.018	0.028	0.036
Log(Total Assets)	3.996	0.467	3.648	4.053	4.376
Tangibility	0.951	0.058	0.918	0.976	1.000
Non-Debt Tax Shields	0.034	0.008	0.029	0.033	0.039
Newness	0.642	0.083	0.586	0.628	0.690
Capital Intensity	0.148	0.079	0.094	0.133	0.186
Financing	0.005	0.048	-0.019	0.006	0.033

5. Results

Table 4 shows the correlation coefficients between the variables included in our model. *Leverage* is negatively correlated with *Market to Book*, *Non-Debt Tax Shield* and *Return on Assets*, and positively correlated with *log(Total Assets)*. As predicted, *Leverage* is positively correlated with *Environmental Performance*. The correlation coefficient between *Leverage* and *Environmental Disclosure* is negative.

Table 5 presents the results of the multivariate regression analyses of disclosure on environmental performance and leverage (Equation 2) using OLS pooled cross-sectional time-series regressions with robust standard errors clustered at the firm level. In support of Hypothesis 2, the results show a significant relationship between *CRLV* and *Environmental Performance* in models 1 (t-stat.=-2.93, p<0.01), 2 (t-stat=-2.69, p<0.01) and 3 (t-stat=-2.58,p<0.05) indicating that firms with better environmental performance provide more voluntary environmental information. These results are consistent with Clarkson et al. (2008). Models 4 and 5 indicate that this significant relationship holds for both “hard” and “soft” disclosures. This indicates that companies with better environmental performance disclose more objective and subjective information in their voluntary environmental reports.

Table 4
Correlation coefficients

	1	2	3	4	5	6	7	8	9	10
1. Environmental Performance	1.000	0.131	0.104	-0.190	-0.101	0.045	-0.067	-0.127	0.188	-0.166
2. Environmental Disclosure	0.131	1.000	-0.159	0.095	0.112	0.192	0.067	-0.069	0.119	0.182
3. Leverage	0.104	-0.159	1.000	-0.408	-0.579	0.212	-0.004	-0.253	-0.047	-0.120
4. Market to Book	-0.190	0.095	-0.408	1.000	0.327	0.096	0.063	0.045	0.014	0.052
5. Return on Assets	-0.101	0.112	-0.579	0.327	1.000	-0.098	-0.011	0.247	-0.158	0.169
6. Log (Total Assets)	0.045	0.192	0.212	0.096	-0.098	1.000	-0.258	-0.256	0.231	-0.050
7. Tangibility	-0.067	0.067	-0.004	0.063	-0.011	-0.258	1.000	-0.115	0.011	0.222
8. Non-debt Tax Shields	-0.127	-0.069	-0.253	0.045	0.247	-0.256	-0.115	1.000	-0.322	0.069
9. Newness	0.188	0.119	-0.047	0.014	-0.158	0.231	0.011	-0.322	1.000	0.044
10.Capital Intensity	-0.166	0.182	-0.120	0.052	0.169	-0.050	0.222	0.069	0.044	1.000

In all models, the coefficients on *Leverage* are negative and significant. This does not support the agency cost theory of Jensen and Meckling (1976) and lends support to the argument of Schipper (1981) that firms maintain other, non-public avenues of disclosure with bondholders. Schipper (1981) is further supported by the significant and negative coefficients on *Debt Financing* in models 3, 4, and 5. Firms that are issuing debt in the current reporting year provide less public environmental performance information. The coefficients on *Log(Total Assets)* and *Capital Intensity* are significant and positive in all models, as expected. Larger firms and those investing in new capital assets provide more performance information.

Table 5
Regressions of environmental disclosure on environmental performance and leverage

	Model 1 CRLV	Model 2 CRLV	Model 3 CRLV	Model 4 Hard	Model 5 Soft
Intercept	2.424 0.230	1.882 0.180	0.390 0.040	-8.838 -0.870	-1.689 -0.600
Environmental Performance	-1.839 <i>-2.930***</i>	-1.730 <i>-2.680***</i>	-1.692 <i>-2.580**</i>	-0.858 <i>-1.670*</i>	-0.400 <i>-2.550**</i>
Leverage	-13.615 <i>-3.090***</i>	-14.154 <i>-3.230***</i>	-12.250 <i>-2.810***</i>	-12.236 <i>-3.100***</i>	-3.509 <i>-2.700***</i>
Market to Book	0.160 0.240	0.086 0.120	0.329 0.480	-0.683 -1.360	-0.018 -0.080
Return on Assets	-4.978 -0.250	-0.059 0.000	-1.820 -0.090	-4.095 -0.200	-0.136 -0.020
Log(Total Assets)	4.977 <i>2.990***</i>	4.846 <i>2.920***</i>	5.092 <i>3.090***</i>	6.817 <i>4.310***</i>	1.953 <i>5.070***</i>
Newness	-2.274 -0.270	-1.031 -0.120	-2.246 -0.270	-1.958 -0.250	-0.717 -0.310
Capital Intensity	30.980 <i>2.100**</i>	31.590 <i>2.220**</i>	32.460 <i>2.240**</i>	22.809 <i>2.030**</i>	7.449 <i>2.150**</i>
Financing	5.191 0.680				
Equity Financing		-35.756 -0.980			
Debt Financing			-15.892 <i>-1.620*</i>	-21.530 <i>-2.700***</i>	-6.104 <i>-2.600***</i>
R ²	0.168	0.167	0.169	0.198	0.195
F-STAT	4.200	3.860	3.480	5.190	6.700
N	324	324	324	324	324

t-statistics are reported below each coefficient in italic. The significance levels for the independent variables are given by: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.10$. All models are estimated using pooled cross-sectional time-series regressions with robust standard errors clustered at the firm level. See Table 1 for variable definitions.

Table 6
Two-stage Least Squares regressions. (Dependent variable = Leverage)

	Predicted Sign	Model 1 OLS	Model 2 OLS	Model 3 OLS	Model 4 2SLS	Model 5 2SLS	Model 6 2SLS
Intercept		0.271 1.080	0.199 0.810	0.233 0.940	-0.443 -0.820	-1.112 -1.720*	-0.997 -1.910*
Environmental Performance	(+)	0.002 0.400	0.003 0.430	0.002 0.340	-0.035 -1.820*	-0.025 -1.460	-0.039 -1.990*
CRLV Index	(±)	-0.002 -2.590**			-0.025 -2.950***		
CRLV Hard			-0.003 -3.110***			-0.034 -3.650***	
CRLV Soft				-0.008 -2.680**			-0.110 -3.510***
Market to Book	(-)	-0.054 -1.790*	-0.057 -1.880*	-0.055 -1.830*	-0.035 -1.390	-0.070 -2.650**	-0.045 -1.440
Return on Assets	(±)	-2.634 -3.930***	-2.568 -3.840***	-2.613 -3.910***	-1.103 -1.650	-0.732 -1.020	-0.869 -1.230
Log(Total Assets)	(+)	0.075 2.460**	0.087 2.930***	0.082 2.690***	0.194 3.410***	0.300 4.060***	0.286 4.360***
Tangibility	(+)	0.175 0.980	0.210 1.210	0.190 1.100	0.787 2.040**	1.049 2.350**	1.008 2.770***
Non-Debt Tax Shields	(-)	-1.590 -1.140	-1.521 -1.090	-1.455 -1.040	-2.610 -0.930	-1.662 -0.550	-0.487 -0.150
R ²		0.450	0.463	0.454			
F-statistic		11.69	12.1	11.82	7.67	6.7	7.58
N		324	324	324	324	324	324

t-statistics are reported below each coefficient in italic. The significance levels for the independent variables are given by: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.10$. All models are estimated using pooled cross-sectional time-series regressions with robust standard errors clustered at the firm level. See Table 1 for variable definitions.

In Table 6, in models 1 to 3 we present the results of the multivariate regression analyses of leverage on environmental performance and disclosure (Equation 1) using OLS pooled cross-sectional time-series regressions with robust standard errors clustered at the firm level. We present the estimated two-stage least squares (2SLS) simultaneous equation models defined by the structural equations (1) and (2) in

models 4 - 6. The 2SLS equations were also estimated using pooled cross-sectional time-series regressions with robust standard errors clustered at the firm level. The OLS models 1 -3 show no significant relationship between *Leverage* and *Environmental Performance*. However, the results reveal a positive and significant relationship between *Leverage* and *Environmental Performance* in the 2SLS models 4 (t-stat=-1.82, p<.10) and 6 (t-stat=-1.99, p<.10). These results support H1. Firms with better environmental performance have higher relative debt financing than firms with poorer performance when controlling for endogeneity. The results also show a negative and significant relationship between *Leverage* and *Environmental Disclosure* for all models. This result supports H3 and shows that, for our sample, firms with greater voluntary disclosure have lower debt financing. This result holds true for total disclosures as well as “hard” and “soft” disclosures.

6. Conclusion

This study investigates the effect of environmental performance and environmental disclosure on the capital structure of a company. Better environmental performance reduces the volatility of the firm's cash flows, decreases potential bankruptcy costs and increases debt capacity. Environmental disclosure may decrease the agency costs of debt and reduce estimation or information risk.

Using a sample of electric utility companies, our results show that environmental performance has a significant impact on leverage, after controlling for endogeneity. This result is consistent with the argument presented by Al-Tuwarijri et al. (2004) that environmental strategy is jointly determined by firms, and environmental performance and environmental reporting transparency must be examined simultaneously. Allowing for the potential endogeneity in the model makes a statistically significant difference in the results. The significance of the relationship between leverage and disclosure increased in the simultaneous equations models, when compared with the results obtained in the OLS models.

We conclude that superior environmental performance has a positive impact on the proportion of debt financing in firms. The results also show a negative relationship between environmental disclosure and leverage. While voluntary disclosure may decrease agency costs of debt and increase debt capacity, our results suggest that the

reduction in estimation or information risk appears to result in more reliance on equity financing. The relationship between leverage and environmental disclosure may also result from the construct used to measure disclosure. The Clarkson et al. (2008) index is based on discretionary environmental reports that may be targeted to the equity investors of the company. This result is also consistent with managers sharing private information with creditors (Zazerski, 1996) and writing explicit contracts (Schipper, 1981) as a means of reducing agency costs relating to debt.

While previous papers have addressed the relationship between financial performance and environmental performance, or environmental performance and environmental disclosure, our paper uses an integrated approach to study the relationship between leverage and environmental performance and disclosure. This research furthers our understanding of how corporate environmental strategy is related to the firm's financial strategy.

Extensions to this study could include testing the model on samples in other industries with less exposure to regulatory risk and a lower proportion of U.S. based operations. In addition, the TRI is a single measure of environmental performance and may be more or less important to stakeholders depending on the industry (Connors et al., 2010). Future research should also consider alternative measures of environmental performance such as deforestation, greenhouse gas emissions, water use, and compliance with European Union REACH regulations.

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