DOES ENVIRONMENTAL DISCLOSURE INFLUENCE COST OF CAPITAL?

AN EMPIRICAL INVESTIGATION OF JAPANESE COMPANIES

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ABSTRACT

In this paper, we examine the economic consequences of corporate environmental disclosure commitment and environmental performance efforts in the Japanese context. More specifically, we investigate whether both commitment to voluntary environmental disclosure per se and efforts made to improve environmental performance through disclosure are related to a firm's cost of capital. Based on a sample of non-financial companies listed on the Tokyo Stock Exchange for the period 2003-2009, we report a negative relation between the issuance of a voluntary environmental report and firm cost of capital. Our results also indicate that long-term commitment to environmental disclosure is associated with a lower cost of capital. For a subset sample of firms that provide specific disclosure items, we finally find that both improvement in environmental performance and reported environmental efforts also decrease firm cost of capital. Overall, our results support the argument that, consistent with evidence found in some of the prior literature, capital market participants appear to value the existence and availability of voluntary corporate environmental information as well as firm commitment and efforts both in terms of environmental disclosure and environmental performance.

1. INTRODUCTION

Corporate environmental disclosure can be considered as an integral part of a firm's overall approach to reporting practices, which is "endogenously driven by both financial markets' and public interest considerations" (Aerts, Cormier and Magnan, 2008, p. 643). This study is motivated by the ongoing debate revolving about whether and how capital market participants capture and value the disclosure of environmental information. Although this question has been investigated in various contexts using different empirical approaches for more than four decades (see Barth and McNichols, 1994; Chan and Milne, 1999; Cho, Michelon, Patten and Roberts, 2012; Guidry and Patten, 2010; Ingram, 1978; Murray, Sinclair, Power and Gray, 2006), research findings seem to suggest that there is no overall consensus on the extent to which financial markets assess corporate risk and performance based on the disclosure of environmental information (Cho, Patten and Roberts, 2011). This seems to be true whether studies were conducted using experimental designs (e.g., Chan and Milne, 1999; Milne and Chan, 1999; Milne and Patten, 2002), standard market valuation models (e.g., Barth and McNichols, 1994; Clarkson, Li, and Richardson, 2004; Hughes, 2000), or market model methods, which help investigate the impact of released environmental information in stock market reactions and returns (e.g., Anderson and Frankle, 1980; Belakoui, 1976; Freedman and Jaggi, 1986; Ingram, 1978[1]). Most of these studies have, however, examined market valuations and reactions to environmental disclosure from a cross-sectional perspective—that is, the impact of such disclosure on a given year or period. We argue that while this measure, design and analysis provide some insights to how environmental information is perceived by financial market stakeholders and participants, it does not take into consideration any potential commitment of disclosing this information over time. Therefore, we add to this body of research by investigating whether continuity in environmental reporting practices

translates into greater consistency, or at least into higher perceived reliability of the information provided, which would in turn lead to a positive valuation or reaction from the market. In addition to environmental disclosure commitment, we also examine the effects of environmental performance improvement and efforts on the market. We focus on a specific context—Japan. While it exhibits some similarities with the U.S. such as a litigious type of society and strong legal enforcement, Japan is considered similar also to an insider economy with less-developed stock markets (Leuz, Nanda and Wysocki, 2003). Hence, the impacts of capital markets can be more significant in addressing potential selection and information asymmetry issues. Further, in contrast to most developed countries, Japan does not have any formal and comprehensive environmental disclosure regulation and environmental reporting is thus still considered a voluntary corporate activity.[2] However, Ho and Taylor (2007) note that guidance for disclosure provided by Japanese governmental departments (e.g., the "Environmental Report Creation Guideline" provided by the Ministry of the Environment) could possibly explain more extensive voluntary environmental disclosure from Japanese companies compared to their U.S. counterparts. This may also explain results of the KPMG International Survey of Corporate Social Responsibility Reporting indicating that almost all of Japan's largest companies report on corporate responsibility, including environmental issues (KPMG, 2008; 2011). In addition, societal concerns in Japan have sharply increased during the 1970s as several pollution incidents occurred at that time (and continue to exist), leading to both a demand from stakeholders and a quasi-obligation from corporations to provide accounts and information on their environmental impacts.

In this study, we examine the economic consequences (and potential benefits) of corporate environmental disclosure commitment and environmental performance efforts in the specific context of Japan. Based on a sample of non-financial companies listed on the

Tokyo Stock Exchange for the period 2003-2009, we first report a negative relation between the issuance of a voluntary environmental report and firm cost of capital. Our results also indicate that long-term commitment to environmental disclosure is associated with a lower cost of capital. Finally, for a subset sample of firms that provide specific disclosure items, we find that both a positive change in environmental performance (i.e., lower levels of reported pollution) and projected environmental efforts also have a negative impact on the cost of capital. Overall, our results support the argument that, consistent with evidence found in some of the prior literature (Anderson and Frankle, 1980; Guidry and Patten, 2010), capital market participants appear to value the existence and availability of voluntary corporate environmental information as well as firm commitment and efforts both in terms of environmental disclosure and environmental performance.

The remainder of the paper is organized as follows. The next section provides a review of prior research and develops hypotheses to be tested in the study. Section three explains the methods used to conduct the analysis and is followed by the presentation of the results. Discussion, limitations and conclusions are provided in the last section.

2. PRIOR RESEARCH AND HYPOTHESES DEVELOPMENT

Much of prior and current empirical financial accounting research closely examines at the relationship between financial disclosure and the cost of capital (Core, 2001; Healy and Palepu, 2001; Leuz and Verrecchia, 2000; Leuz and Wysocki, 2008; Leuz and Schrand, 2011). In general, this literature presents evidence of a negative association between the quantity/quality of financial disclosure and the cost of capital. This body of research is primarily based on the argument that corporate disclosure mitigates the adverse selection problem by reducing both the probability of trading with a

better-informed counterpart (information asymmetry) and the advantage of better-informed investors (uncertainty) (Leuz and Wysocki, 2008). Moreover, disclosure improves the investor base (Merton, 1987), which in turn improves risk-sharing and decreases the cost of capital. More recently, analytical models show that the quality of disclosure has an effect on the estimation risk because it decreases the covariance of a firm's cash flow with the cash flows of other firms (Hughes, Liu and Liu, 2007; Lambert, Leuz and Verrecchia, 2007, 2012).

Parallel to financial disclosure studies, a relatively large number of investigations examining the market valuations and reactions to the disclosure of corporate non-financial information have been conducted as early as in the 1970s but generated mixed findings. While Belakoui (1976) found a positive market reaction for a sample of 50 pollution control disclosing firms vs. a control group of non-disclosing counterparts, Ingram (1978) found none when using a larger sample and differentiated disclosure across social and environmental areas.[3] Anderson and Frankle (1980) also examine the market reactions at the time of annual report issuance and, after controlling for differences in firm-specific market risk, report significant positive market reactions for companies disclosing CSR information vis-à-vis non-disclosers, but primarily only for the month preceding annual report releases. In contrast, Freedman and Jaggi (1996) report no significant differences in market reaction across companies when using a monthly return model for a sample of firms operating in four environmentally sensitive industries (chemicals, steel, pulp and paper, and oil). More recently, Guidry and Patten (2010) investigate whether a market reaction was triggered at the time of press releases announcing the first-time issuance of stand-alone CSR reports. Results indicate positive market reactions over a three-day event period centered on the press release date, but only for firms with more extensive disclosure.

Focusing more on differences in firm valuation (as opposed to one-time market effects), prior studies provide evidence indicating that financial markets seem to capture information about environmental performance made available through non-company sources and negatively value the exposures to potential future costs (Barth and McNichols, 1994; Clarkson et al., 2004; Hugues, 2000). In addition, two studies—Murray et al.(2006) and Jones, Frost, Loftus and Van Der Laan (2007), explore whether differences in social and environmental disclosure have longer-term effects. Based on a sample of firms from the United Kingdom, Murray et al. (2006) report no significant short-term associations between CSR disclosure and market valuation, but find that over a nine-year period, higher levels of disclosure appear to be associated with higher market valuation. On the other hand, Jones et al. (2007) document that CSR disclosure from their sample of Australian companies appears to be negatively, but only weakly associated with longer-term market valuation effects.

Therefore, we believe more empirical research about the economic consequences of environmental disclosure is needed.

2.1 Environmental reporting and cost of capital

Prior disclosure research findings generally indicate a negative correlation between the level of disclosure and the cost of capital.[4] There are several possible explanations for expecting a negative association between environmental disclosure and cost of capital.[5] First, investors gather information about corporate environmental risk—a company that provides information on its environmental programs and policies as well as its environmental impacts will also have the ability to respond quickly to potential environmental regulation, thus lowering its risk associated to future compliance. Information provided by the company should lower the uncertainty of the information environment for the disclosing company. Moreover, environmental disclosure may serve

as useful source of information when an investor estimates the role of environmental issues in driving competitive advantage, thus reducing uncertainty and leading to a decrease in the cost of capital.

However, previous evidence on this association is mixed. Richardson and Welker (2001) test the relation between financial and social disclosure and the cost of capital for a sample of Canadian firms. While they report a negative relation between the quantity and quality of financial disclosure and the cost of capital for firms with low analyst followings, they find that social disclosure and cost of capital are significantly and positively related. They note that this positive association is mitigated among firms with better financial performance and suggest that their findings might be explained by either potential biases in social disclosure or benefits on organizational stakeholders other than equity investors. Plumlee, Brown and Marshall (2010) examine how the quality of a firm's voluntary environmental disclosures is related to firm value by exploring the association between the components of firm value (cost of capital and future expected cash flows) and voluntary environmental disclosure quality. They find a positive association between environmental disclosure and firm value after controlling for environmental performance. Clarkson, Fang, Li and Richardson (2010) investigate 119 U.S. firms with environmental reports belonging to five environmentally sensitive industries (paper and pulp business, chemistry business, oil and gas business, steel industry, electric power and gas business). Their results indicate that voluntary environmental disclosure is incrementally informative for investors over current environmental performance. However, they do not find evidence that voluntary environmental disclosures affect firm's cost of capital.

Finally, in their recent paper, Dhaliwal et al. (2011) argue that CSR disclosures related to the environment and employee morale can reduce information asymmetry and uncertainty, hence decrease cost of capital. As such, they conduct an international study

looking at 31 countries—including Japan, to investigate whether the initiation of stand-alone CSR reports has an effect on disclosing firms' cost of capital and find a negative relation between first-time issue of CSR reports and subsequent cost of capital (in the year following the issuance of the report).[6] In line with these prior findings, we state the hypothesis as:

H1: Firm cost of capital is negatively associated with environmental reporting.

2.2 Commitment to environmental reporting and cost of capital

While extant research focused on whether a company issued an environmental report or not, we argue that one aspect of corporate environmental reporting that need to be explored is commitment to environmental disclosure. One concern with Dhaliwal et al.'s (2011) findings is that their measure of CSR disclosure (initial issuance of a stand-alone CSR report) can be reversed and thus might not necessarily represent a commitment to disclosure in the future (Leuz and Verrecchia, 2000). A continuous commitment to environmental disclosure instead captures whether the firm decides what it will disclose before it knows the content of the information (i.e., ex ante) rather than after it observes the content and any potential consequences (i.e., ex post). Indeed, while there is an increase in the number of companies that issue environmental reports, little is known about the effect that continuous and long-lasting disclosure have on the cost of capital. The number of years of commitment to environmental reporting might be relevant because long-lasting commitment to disclosure might increase the perception of reliability over the information provided, thus inducing an additional decrease in the cost of capital because only a commitment to disclosure requires that information be disclosed regardless its content (e.g. Diamond and Verrecchia, 1991). Therefore, we formally state the following hypothesis as:

H2: Firm cost of capital is negatively associated with commitment to environmental reporting.

2.3 Disclosure of environmental efforts and cost of capital

The net economic benefits of environment disclosure for Japanese firms have become increasingly a relevant issue to examine, especially as societal concerns about the environmental have been rising. Survey results from the Ministry of Economy, Trade and Industry of Japan (METI) and an investigation by *Nikkei-Ecology*—one of the major Japanese magazines about environmental issues, revealed that most business people are more and more concerned with the economic consequences of environmental disclosure. In particular, concerns are raised about the relatively vague or trivial overall results after spending a significant amount of time and efforts in environmental activities (METI, 2007; Nikkei-Ecology, 2009).

Hence, two avenues of investigation can be pursued to address these issues. The first one—which is previously explored and discussed in the development of the first two hypotheses, is based on the assumption that environmental information can be indeed useful for decision-making by outside stakeholders, mainly investors and creditors. The other suggests that environmental disclosure is expected to change firms' actions and activities as their commitment to disclosure implies, in theory, an improvement of their environmental performance disclosed to the market. We thus focus on the information included as part of firm environmental disclosure (i.e., self-reported efforts to improve environmental performance) to assess whether it leads to any changes in investors' perceptions and beliefs after controlling for the underlying improvement in environmental performance. We thus posit the following two hypotheses:

H3: Firm cost of capital is negatively associated with improvements in environmental performance.

H4: Firms cost of capital is negatively associated with disclosure of environmental effort.

3. RESEARCH METHODS

3.1 Sample selection

We focus our analysis on firms listed on the Tokyo Stock Exchange for the period 2003-2009. More specifically, to be included in the study, sample firms had to meet the following criteria:

1. They had to be listed on the First Section of the Tokyo Stock Exchange with a fiscal year-end of March 31, 2003 to 2009.

2. They had to operate in a non-financial industry.

3. They had to have data available to compute the implied cost of capital (from the "Tokyo Keizai Shinpo-Sha" database) and other financial information (from NEEDS-FinancialQUEST).

In addition, two additional criteria were set to generate our sub-sample of firms to test the association between firm cost of capital and commitment to environmental reporting (H2) as well as improvements in environmental performance (H3) and disclosure of environmental effort (H4):

1. They had to have an environmental report and the announcement date available.

2. They had to have environmental performance data available in their voluntary environmental reports.

Figure 1 shows the number of Japanese companies issuing environmental reports during the period 1999-2009.

[Insert Figure 1 about here]

3.2 Measurement of variables

3.2.1 Implied cost of capital

We measure the implied cost of capital (ICC) for each firm as the internal rate of return that equates the present value of expected future cash flows to current stock price, as in Gebhardt, Lee and Swaminathan (2001). We estimate ICC using the residual income

valuation model by Ohlson (1995). It is equivalent to a divided-discount model that assumes a clean surplus relation. The share price can be written as in formula (1).

$$P_t = PBS_t + \sum_{\tau=1}^{\infty} \frac{E_t(EPS_{t+\tau} - r \times BPS_{t+\tau-1})}{(1+r)^{\tau}} \quad (1)$$

, where Pt is the share price, BPS_t is the book value of equity per share, EPS_t is the earnings per share, r is the cost of capital and $EPS_{t+\tau} - r \times BPS_{t+\tau-1}$ represents the abnormal earnings per share (residual income). Thus, price at t is described as the reported book value of equity per share and an infinite sum of future abnormal earnings per share (discounted residual income).

In order to estimate ICC from (1), we first estimate the future BPS_t ($FBPS_t$) from formula (2).

$$FBPS_{t+\tau} = BPS_{t+\tau-1} \times (1 - k_{t+\tau}) \times EPS_{t+\tau} \quad (2)$$

, where k_t is the payout ratio and the other variables are defined as above. Because Japanese companies are likely to set a constant dividend per share, we transform (2) by DOE_t (equity dividend rate) to estimate $FBPS_t$ as follows:

$$\begin{aligned} FBPS_{t+\tau} &= BPS_{t+\tau-1} \times (1 - DOE_{t+\tau} / ROE_{t+\tau}) \times EPS_{t+\tau} \\ &= (1 + ROE_{t+\tau} - DOE_{t+\tau}) \times BPS_{t+\tau-1} \end{aligned} \quad (3)$$

where: $EPS_{t+\tau}$ is $BPS_{t+\tau-1} \times RPE_{t+\tau}$.

Next, we estimate future $ROE_{t+\tau}$ ($FROE_{t+\tau}$) in order to estimate future earnings per share $FEPS_{t+\tau}$. Following Gebhardt et al. (2001), we assume that ROE converges to the industry median in the long term, thus we calculate the median ROE for each industry, using data from the past eight years of profitable companies in each industry.

$$FROE_{t+\tau} = ROE_{t+\tau} \pm \frac{(ROE_{t+\tau} - medianINDROE_{t+\tau-2})}{10} \quad (4)$$

$$P_t = BPS_t + \frac{FROE_{t+1} - r}{(1+r)} \times BPS_t + \frac{FROE_{t+2} - r}{(1+r)^2} \times BPS_{t+1} + TV \quad (5)$$

,where: TV is terminal value.

$$TV = \sum_{\tau=3}^{12} \frac{FROE_{t+\tau} - r}{(1+r)^{\tau}} \times FBPS_{t+\tau-1} + \frac{FROE_{t+12} - r}{r(1+r)^{11}} \times FBPS_{t+11} \quad (6)$$

In order to reconcile the differences between years, instead of directly used r to satisfy the equation (5), we use r after deducting the risk-free rate as a cost of equity. We use the 10-year government bond as a risk-free rate. In addition, we use analyst forecast earnings per share (one period ahead and two periods ahead of the current fiscal year) from the database "Toyo Keizai".

3.2.2 Environmental reporting and commitment

Similar to Dhaliwal et al. (2011), we employ a dummy variable equal to 1 if the company issues an environmental report, 0 otherwise. This data was hand-collected mainly from the Ministry of Economy, Trade and Industry and the companies' website. For environmental reporting commitment, we take the natural log of the number of times environmental reports are issued.

3.2.3 Self-reported environmental performance

We look at whether companies provide information on their level of CO_2 emissions in their voluntary environmental reports. According to an investigation by the Ministry of Environment, 75.9% of companies report on green house gas emissions, 75.7% on paper use and 74.1% on total waste. Because of its practical availability, we hand collected data on CO_2 emissions and we use it as our proxy of the company's self-reported environmental performance. However, rather than only scaling CO_2 emissions on unit of sales, we benchmarked the self-reported measure in the industry, assuming that investors would evaluate self-reported performance measures by benchmarking them with industry peers. Hence, we first scale the amount of CO_2 emissions per unit of sales, and we then

standardize them according to the total amount in the same industry and year. Figure 2 shows the most commonly reported measures of environmental performance.

[Insert Figure 2 about here]

3.2.4 Disclosure of environmental effort

We employ two measures for disclosure of environmental effort. First, we consider the growth rate of CO_2 emissions level as the relationship between current year CO_2 emissions level and previous year CO_2 emission level. Second, we include a dummy variable equal to 1 if the company provides a quantitative target for reduction of CO2 emissions in the future, 0 otherwise. The data was hand-collected from corporate environmental reports.

3.3 Multivariate models

We use multiple regressions to identify the relation between cost of capital and environmental reporting and commitment to environmental reporting. Our models to estimate are stated as:

$$ICC - Rf_{i,t} = \alpha_0 + \alpha_1 \ln(ME)_{i,t} + \alpha_2 BM_{i,t} + \alpha_3 \beta_{i,t} + \alpha_3 EREPORT_{i,t} + \sum_{i=2003}^{2008} \gamma_i year_i + IND + \varepsilon_{i,t} \quad (1)$$

$$ICC - Rf_{i,t} = \alpha_0 + \alpha_1 \ln(ME)_{i,t} + \alpha_2 BM_{i,t} + \alpha_3 \beta_{i,t} + \alpha_3 \ln(TIMES)_{i,t} + \sum_{i=2003}^{2008} \gamma_i year_i + IND + \varepsilon_{i,t} \quad (2)$$

, where:

ICC-Rf	= Cost of Capital
Rf	= Risk free rate, the interest rate of 10-year Japanese government bond
ln(ME)	= Natural log of Market Equity
BM	= Book-Market Ratio
β	= Historical beta (with TOPIX, for 60 months)
EREPORT	= One if a voluntary environmental report is issues, zero otherwise
ln(TIMES)	= Natural log of number of times of disclosing

Following Fama and French (1993; 1997), we adopt ln(ME), BM and β as control variables. According to H1 and H2, we expect both α3 and α4 to be significant and negative.

As for H3 and H4, we estimate the following equation:

$$ICC_{i,t} = \alpha_0 + \alpha_1 \ln(ME) + \alpha_2 BM_{i.t} + \alpha_3 \beta_{i,t} + \alpha_4 adj\_CO2_{i,t} + \alpha_5 \Delta adj\_CO2_{i,t} + \alpha_6 Target_{i,t} + IND + \sum_{i=2005}^{2008} \gamma_i year_i + \varepsilon_{i.t} \quad (3)$$

, where:

ICC-Rf	= Cost of Capital
Rf	= Risk free rate, the interest rate of 10-year Japanese government bond
ln(ME)	= Natural log of Market Equity
BM	= Book-Market Ratio
β	= Historical beta (with TOPIX, for 60 months)
EREPORT	= One if a voluntary environmental report is issues, zero otherwise
adj_CO2	= CO_2 emissions level compared with other companies in the same industry and same fiscal year
Δadj_CO2	= Growth rate of CO_2 emissions level (Δadj_CO2_t / Δadj_CO2_{t-1}
Target	= One if a numerical reduction target about CO_2 emissions is disclosed, zero otherwise

If H3 is supported, we expect α_5 to be significant and positive. If H4 is supported, we expect α_6 to be significant and negative.

4. RESULTS

Table 1 panel A shows the sampling procedure and the total number of firm-year observations (5,915). Approximately 50% of the firms for which we are able to obtain data on the ICC also provide an environmental report. Table 1 Panel B shows the distribution of observations over the time period analyzed.

[Insert Table 1 about here]

Descriptive statistics are provided in Table 2 Panel A. The mean (median) implied cost of capital (net of the risk free rate) is 4.3% (3.98%) and the standard deviation is 2.1%. The mean (median) book to market ratio is 1.7 (1.4) and the mean (median) beta is equal to 0.96 (0.91). On average, companies have been disclosing an environmental report for about two years although the maximum period is almost 18 years. Table 2 Panel B shows the correlation coefficients.

[Insert Table 2 about here]

Table 3 reports the results of for our analysis on the relationship between environmental reporting and cost of capital, and commitment to environmental reporting and cost of capital. The first three columns report the regression results (coefficient, t-test and p-value) for the Fama-French three factors model. The results are in line with the predictions and all coefficients are significant at 1% level. This suggests that our measure for the implied cost of capital is valid.

For equation (1), the coefficient for EREPORT (α_3) is significant and negative at the 1% level, which is consistent with our expectations. This finding implies that companies providing an environmental report present a lower cost of capital than those not providing one.

For equation (2) we find a significant and negative relationship between ln(TIME) and ICC. The evidence supports our hypothesis as it indicates a negative association between commitment to disclosure and the cost of capital.

Overall, the findings are in line with previous evidence in the literature of a negative relationship between CSR-related stand-alone reports and the cost of capital. Moreover, commitment to environmental reporting, measured in terms of number of years of continuous reporting, seem to induce an additional decrease in the cost of capital. This

negative relation could be interpreted as a superior reliability of the information provided for firms that continue to report on environmental performance. While the issuance of an environmental report per se may reflect self-serving choices, the continuous and long-lasting commitment to reporting implies that managers cannot condition their disclosure choice on its realization, i.e., whether it is good or bad news.

[Insert Table 3 about here]

In order to test H3 and H4, we use of a sample of 1,625 companies as shown in Table 4, primarily due to the fact that not all companies in the previous sample report on CO2 emissions. The mean (median) adjusted level of CO2 emissions is 0.27 (0.15). CO2 emissions seem to be on average stable or increasing (mean of Δadj_CO2 is equal to 1,027). Finally, almost 50% of the companies providing the level of CO2 emissions also disclose a numerical reduction target (the target mean is equal to 0.493 and the median value is equal to 0).

[Insert Table 4 about here]

Table 5 Panel B shows the correlation coefficients.

[Insert Table 5 about here]

Table 6 shows the test results of the relation between disclosure of environmental performance and of environmental effort and cost of capital. H3 would be supported id we find a positive relationship between our measure of reduction levels of CO_2 emissions and cost of capital (α_5, the coefficient for Δadj_CO2). In addition, a negative relationship between the disclosure of a numerical reduction target about CO_2 emissions and the cost of capital would provide supporting evidence for H4.

All coefficients in our model are significant at the 5% level or better. The coefficient between adj_CO2 and ICC is positive as expected, which suggests that companies with negative environmental performance (high CO_2 emissions) experience a

higher cost of capital. Furthermore, α_5 is positive and α_6 is negative at the 1% level, which is aligned with our expectations. This suggests that a company that reduces its CO_2 emissions level experiences a lower cost of capital than other their other counterparts. Finally, the disclosure of an environmental effort (target) is also negatively related to the cost of capital. Our evidence suggests that firms disclosing their efforts to improve as well as the actual improvement of their environmental performance experience a lower cost of capital.

[Insert Table 6 about here]

5. DISCUSSION AND CONCLUSION

In this study, we examined the cost of capital effect of corporate environmental disclosure commitment and environmental performance efforts in the specific context of Japan. Based on a sample of non-financial companies listed on the Tokyo Stock Exchange for the period 2003-2009, we found a negative relation between the issuance of a voluntary environmental report and firm cost of capital. Moreover, our results show that long-term commitment to environmental disclosure is associated with a lower cost of capital. We also explored the cost of capital effect of specific disclosure items, namely the reported change in environmental performance as well as the projected environmental efforts. We found that self-reported disclosures on improvement of environmental performance as well as targets of CO_2 emission reductions are beneficial to the firms as they are associated with lower cost of capital. Overall, the evidence suggests that Japanese capital markets perceive information contained in the environmental reports of our sample firms as reliable and credible. Thus, our results support the argument that, consistent with evidence found in some of the prior literature (Anderson and Frankle, 1980; Guidry and Patten, 2010), capital market participants appear to value the existence and availability of

voluntary corporate environmental information, but more importantly firm commitment and efforts both in terms of environmental disclosure and environmental performance.

We contribute to the debate on the capital market effects of environmental disclosure by investigating whether commitment (continuity) in environmental reporting practices and specific content of environmental disclosure (performance improvements and targeted pollution reductions) translate into additional cost of capital effects thanks to a higher perceived reliability and credibility of the information provided.

Like all studies, our investigation has some limitations. We examine the economic consequences (and potential benefits) of corporate environmental disclosure commitment and environmental performance efforts for firms listed on the First Section of the Tokyo Stock Exchange, hence only for large and publicly traded companies and as such, we cannot generalize findings to organizations of different type or size. Similarly, we focus only on companies in Japan. Interest in CSR and environmental reporting is argued to vary across regions (see, e.g., Simnett, Vanstraelen and Chua, 2009; Dhaliwal, Radhakrishnan, Tsang and Yang, 2012) and as such, the reported relations may not hold in other countries. Finally, our environmental performance metrics (improvement in emissions and targets) are self-reported and limited by the availability of firm-specific information provided in the reports. Richer and better measures may indicate some other patterns that we are not able to capture. Future research along any of these lines, therefore, would appear to be warranted.

[1] In contrast to the mixed results in market reactions to social and/or environmental disclosure, studies of the mitigating effect of such prior disclosure at times of social-cost-inducing events (e.g., Blacconiere and Northcut, 1997; Blacconiere and Patten, 1994; Freedman and Patten, 2004; Freedman and Stagliano, 1991) are more consistent and indicate a significant positive association with market impact (Cho et al., 2011).

[2] Based on a recommendation from the OECD, the Japanese Ministry of the Environment had introduced a Pollutant Release and Transfer Register (PRTR) in 1999 as part of the Act on Promotion of Global Warming Countermeasures. Under this Act, companies of only certain industries that use more fuel that 1500 kiloliter of crude oil yearly or that emits more than 3000 tons of CO2 are required to report the CO2 emissions to the PRTR. However, there are no requirements to provide any additional information on environmental legal risk, environmental measure, or environmental opportunity. Therefore, for this scope of this study, we do not take into consideration this Act and primarily focus on voluntary environmental reporting practices.

[3] However, controlling for the sign of unexpected earnings and partitioning across industry subsets, results indicate some limited positive market reactions associated with aspects of CSR disclosure.

[4] In line with analytical models, disclosure transforms private information into public information. Easly and O'Hara (2004) show that if the degree of private information on a firm is relative large to the other firms, such a firm's cost of capital is relatively higher.

[5] Dhaliwal, Zhen, Tsang and Yong. (2011) note that this type of specific investigation (i.e., whether voluntary CSR disclosure reduces a firm's cost of capital) is an empirical question because of non-comparability and potential credibility issues as well as opportunistic behaviors of firms. We suggest that this may explain, at least in part, the mixed results found in prior research examining the capital market effects of CSR disclosure.

[6] Endogeneity and self-selection issues are addressed by employing a lead-lag approach to disentangle the contemporaneous relation between CSR disclosure and the cost of capital. However, this finding applies only to companies with superior CSR performance. Moreover, and in contrast to Guidry and Patten (2010), they did not examine take into account the quality or the extensiveness of disclosures included in CSR reports.

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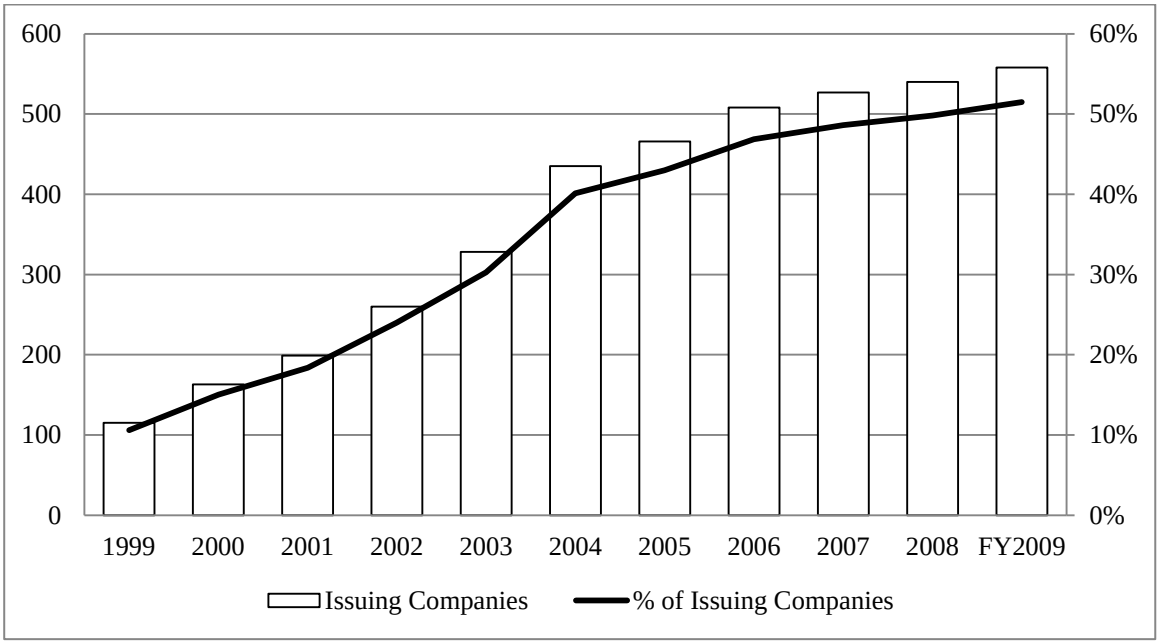
Figure 1

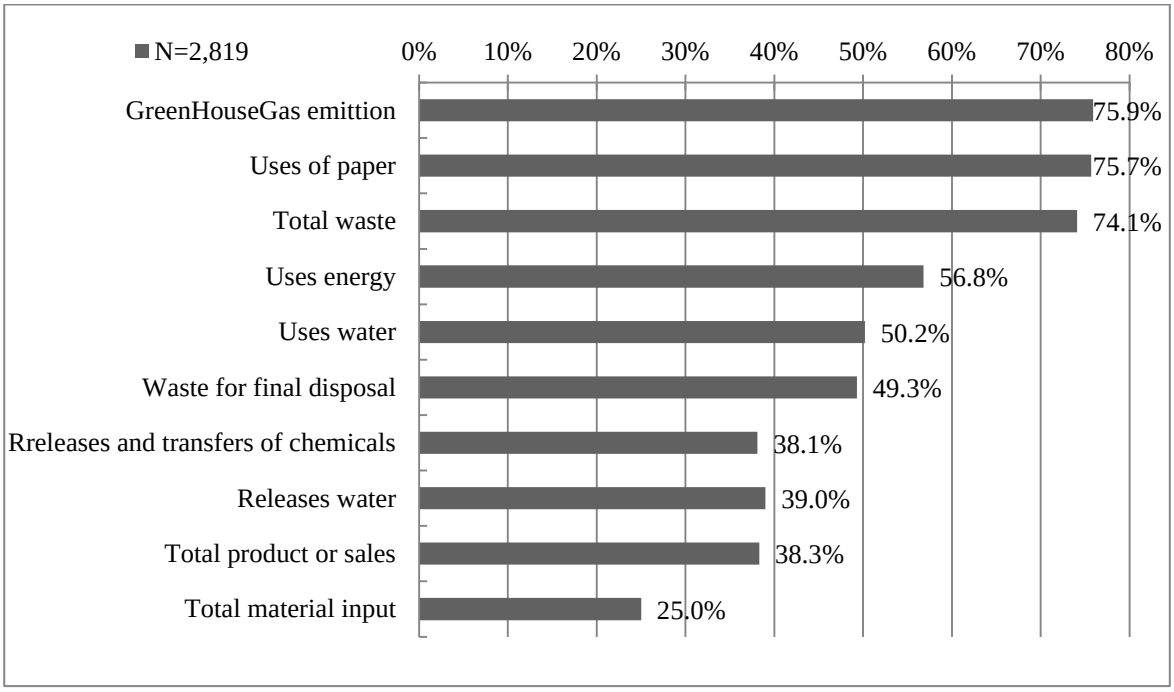
Number of Japanese companies issuing environmental reports during 1999-2009



Note: Data from Ministry of the Environment (2005), "Edition 2004 behavioral survey environmentally friendly company", Ministry of the Environment (2010), "Edition 2009 behavioral survey environmentally friendly company".

Figure 2

Types of environmental data in environmental reporting



Note: Ministry of the Environment (2010), “Edition 2009 behavioral survey environmentally friendly company”

Table 1

Sample selection and sample size for H1 and H2

Panel A - Sample selection	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Listed on the First Section of Tokyo Stock Exchange	1,452	1,470	1,529	1,586	1,631	1,654	1,702	7,870
Except the finance business and business year ending in March	1,285	1,288	1,297	1,300	1,309	1,318	1,183	6,512
Data available for ICC	798	831	832	861	869	841	883	5,915
Disclosing of environmental report	319	380	400	434	463	459	502	2,957

Panel B - Sample size classified by fiscal year

fiscal year	**Full sample**	**disclosing companies**	**Non-disclosing companies**
2003	798	319(40.0%)	479(60.0%)
2004	831	380(45.7%)	451(54.3%)
2005	832	400(48.1%)	432(51.9%)
2006	861	434(50.4%)	427(49.6%)
2007	869	463(53.3%)	406(46.7%)
2008	841	459(54.6%)	382(45.4%)
2009	883	502(56.9%)	381(43.1%)

Table 2

Descriptive statistics for H1 and H2

Panel A - Descriptive statistics

	Mean	SD	Minimum	1Q	Median	3Q	Max	N
ICC-Rf	4.286	2.150	0.304	2.824	3.976	5.370	13.691	5,915
ln(ME)	25.012	1.572	22.116	23.790	24.754	26.054	29.359	5,915
BM	1.655	1.065	0.175	0.885	1.364	2.161	5.613	5,915
B	0.963	0.486	-0.055	0.621	0.916	1.282	2.593	5,915
EREPORT	0.500	0.500	0.000	0.000	0.000	1.000	1.000	5,915
ln(TIME)	0.679	0.867	0.000	0.000	0.000	1.609	2.890	5,915

Panel B - Correlation between variables

	ICC	*ln(ME)*	*BM*	*β*	*EREPORT*	*ln(TIME)*
ICC	1.000	-0.262	0.136	0.002	-0.168	-0.119
ln(ME)	-0.262	1.000	-0.294	-0.004	0.480	0.487
BM	0.136	-0.294	1.000	-0.148	-0.151	-0.219
B	0.002	-0.004	-0.148	1.000	-0.026	-0.018
EREPORT	-0.168	0.480	-0.151	-0.026	1.000	0.781
ln(TIME)	-0.119	0.487	-0.219	-0.018	0.781	1.000

Table 3

Test results for H1 and H2

		Three factors model			Equation(1)			Equation(2)		
		Full sample (N=5,915)			Full sample (N=5,915)			disclosing-Companies only (N=2,957)		
		Coef.	**t-value**	**p-value**	**Coef.**	**t-value**	**p-value**	**Coef.**	**t-value**	**p-value**
	?	5.762	12.254		3.393	6.624	0.000	3.239	5.506	0.000
ln(ME)	(-)	-0.170	-10.103	0.000	-0.068	-3.566	0.000	-0.016	-0.738	0.460
BM	(+)	0.661	20.953	0.000	0.687	21.940	0.000	0.685	15.820	0.000
β	(+)	0.162	3.170	0.000	0.155	3.066	0.002	0.101	1.677	0.094
EREPORT	(+)			0.002	-0.613	-11.067	0.000			
ln(TIME)	(-)							-0.173	-3.907	0.000
IND		Yes			Yes			Yes		
Year		Yes			Yes			Yes		
adj.R2		0.255			0.270			0.253		

Table 4

Sample selection and sample size for H3 and H4

	2004	2005	2006	2007	2008	2009	Total
Listed on the First Section of Tokyo Stock Exchange	1,470	1,529	1,586	1,631	1,654	1,702	9,572
Except the finance business and business year ending in March	1,288	1,297	1,300	1,309	1,318	1,183	7,695
Data available for ICC	831	832	861	869	841	883	5,117
Disclosing of environmental report	380	400	434	463	459	502	2,638
Dada available CO2	341	346	355	388	401	402	2,233
Dada available for Δadj_CO2		321	326	316	348	314	1,625

Table 5

Descriptive statistics for H3 and H4

Panel A - Descriptive statistics

	Mean	*SD*	*Minimum*	*1Q*	*Median*	*3Q*	*Max*	*N*
ICC	3.790	1.666	0.381	2.626	3.628	6.734	9.840	1,625
ln(ME)	25.964	1.471	22.793	24.851	25.920	27.8235	29.727	1,625
BM	1.386	0.838	0.265	0.785	1.147	2.878	4.609	1,625
β	0.962	0.478	-0.008	0.626	0.949	1.6345	2.320	1,625
adj_CO2	0.265	0.283	0.000	0.047	0.153	0.5765	1.000	1,625
Δadj_CO2	1.027	0.299	0.251	0.865	0.998	1.636	2.274	1,625
Target	0.493	0.500	0.000	0.000	0.000	1.000	1.000	1,625

Panel B - Correlation between variables

	ICC	*ln(ME)*	*BM*	*β*	*adj_CO2*	*Δadj_CO2*	*Target*
ICC	1.000	-0.224	0.292	-0.009	0.010	0.018	-0.100
ln(ME)	-0.187	1.000	-0.277	-0.018	0.168	-0.019	0.011
BM	0.226	-0.258	1.000	-0.023	-0.028	0.002	-0.016
β	0.013	-0.037	-0.041	1.000	-0.088	-0.013	-0.075
adj_CO2	0.065	0.163	-0.024	-0.117	1.000	0.144	-0.003
Δadj_CO2	0.017	-0.036	-0.030	-0.021	0.088	1.000	0.047
Target	-0.105	0.012	-0.014	-0.069	-0.057	0.042	1.000

Table 6

Test results for H3 and H4

	Equation (3)		
	Sample which is data available (N=1,625)		
		Coef.	***t-value***	***p-value***
	?	7.262	10.080	0.000
ln(ME)	(-)	-0.145	-5.730	0.000
BM	(+)	0.529	9.820	0.000
β	(+)	0.147	1.980	0.048
adj_CO2	(+)	0.535	3.550	0.000
Δadj_CO2	(+)	0.337	2.980	0.003
Target	(-)	-0.329	-4.750	0.000
IND		Yes		
Year		Yes		
adj_R2=0.239				