Investor Reactions to Information Disclosure: Can Providing Public Information About Firms' Pollution Improve Environmental Performance?

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Abstract

Information disclosure has been touted as a powerful tool to effect change in environmental quality. Nascent efforts to augment federal information disclosure have begun in Georgia. We conduct the first empirical analysis of investor reactions to a Pollutant Release and Transfer Register (PRTR) outside of the United States. In contrast to the U.S. studies, we find no evidence of negative investor reactions to firms listed on Japan's PRTR. We identify several institutional reasons for these contradictory results. Our results suggest that PRTRs may not have the same effect in all locations and thus further empirical studies of the burgeoning number of PRTRs being implemented globally are warranted.

Keywords:

Pollution Control, Information Disclosure, Toxics Release Inventory, Pollutant Release and Transfer Register, Event Study

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1. Introduction

In 2001, Georgia's Department of Natural Resources (DNR) Board debated and then passed a resolution to require public labeling of surface water point sources of pollution (amendments to Rules for Water Quality Control, Chapter 391-3-6, "Labeling of NPDES Outfalls"; DNR 2001a, 2001b). The labeling consists of signs two feet by two feet with the following information: (1) type of discharge (treated industrial water, treated municipal water, cooling water);, (2) facility name, (3) NPDES permit number and if there are multiple discharges from the facility, the outfall number, (4) the owner phone number, and (5) the Environmental Protection Division's (EPD) emergency phone number.

Alan Hallum, Chief of DNR's Water Protection Branch, stated that the purpose of labeling was to "give an individual who is recreating on a river or stream information that there is a permitted treated wastewater facility in the area" (DNR 2001a). However, many believed that the amendment would have more far-reaching effects than just transferring information. When asked his opinion at a sub-committee meeting of the DNR Board, the Director of the EPD at the time, Mr. Harold Reheis, stated that he believed that labeling outfalls would help improve water quality in the state (DNR 2001a). A clue to how such improvements might take place can be found in comments on the amendment by Randy Quintrell, representing the Georgia Pulp and Paper Association and the Georgia Mining Association. Mr. Quintrell believed the "the effect [of the amendment] will be punitive" and "the public will have negative impression when they see signs that have not been there before." The public's potentially "negative impression" was one reason that an earlier proposal to include on the sign the specific chemicals being discharge (legally) was not included in the final amendment.

Information disclosure strategies have been touted in many parts of the world as powerful and cost-effective tools to effect substantial change in environmental quality. Such strategies involve private or public attempts to provide environmental information about firms to consumers, stakeholders, and the public at large (Tietenberg and Wheeler 2001). Through their informed actions, these members of the public are assumed to pressure firms to improve their environmental performance. In a recent annual report, the U.S. Environmental Protection Agency

(EPA 2001) wrote that "[e]nvironmental information is one of EPA's most valuable tools for protecting human health and the environment."

One popular information disclosure strategy is the establishment of a Pollutant Release and Transfer Register (PRTR). A PRTR is a system that collects data, creates a database, and discloses information about potentially harmful chemical substances released to the environment or transferred off-site for treatment and disposal. The Toxics Release Inventory of the United States is the best known example of a PRTR, but many OECD nations, and an increasing number of developing nations, have also implemented PRTRs (OECD 2001; Tietenberg and Wheeler 2001). Georgia's outfall labeling initiative is simply one mechanism for disseminating to the public centralized information about known sources of pollution.

Governments establish PRTRs for a variety of reasons including communities' right-to-know and to allow stakeholders to bring pressure on pollution sources to curb their pollution. Investors are one important group of stakeholders that can affect the behavior of private firms that pollute. Past studies have hypothesized that the release of PRTR data creates investor reactions that lead to reduced demand for the shares of firms listed in a PRTR, thereby creating pressures on firms to reduce subsequent emissions (Hamilton 1995; Konar and Cohen 1997; Khanna et al. 1998). These studies have found that firms included in the PRTR experienced significantly negative abnormal returns to their stocks following the release of the PRTR data.

Despite the growing global popularity of PRTRs, however, previous studies on investor reactions have been limited to a single program: the Toxics Release Inventory (TRI) of the United States. We conduct the first empirical analysis of investor reactions to a PRTR outside of the United States. The next section presents the data. Section 3 describes the empirical method. Section 4 presents the results. Section 5 concludes the paper.

2. Data

Japan implemented its PRTR on a national-scale in fiscal year 2001 (April 2001 – March 2002). Facilities must report annually the amount of 354 chemicals released on-site to the air, water, and land, and the amount injected underground, discharged into the public sewage system or transferred off-site for treatment and disposal. A facility must file a report if it (1) operates within any of the 23 listed industry sectors, (2) has 21 or more full-time employees, and (3) handles more than 5,000 kg of any listed chemical during the fiscal year.[1] The 2001 reports were

due July 2002. The first public release of PRTR data was on 20 March 2003.

The facility-level data were available to the public on a compact disc upon request (same day) from the Japanese Ministry of the Environment. Firm-level emissions data were constructed by manually matching, for each facility, the company name, the headquarters address, and the name of the company president. The data comprise 4,124 facilities owned by 1,072 publicly traded companies. These companies make up 31% of public companies in Japan, including 42% of the "First Section" of the Tokyo Stock Exchange (the vast majority of the volume traded on the Tokyo Stock Exchange is in the First Section).

Stock price data come from the *Kabuka* Chart (Stock Price Chart) compiled by Toyo Keizai Inc. As an indicator of the return to the market portfolio, we use the TOPIX (Tokyo Stock Price Index), which is a value-weighted index of all companies listed in the First Section of the Tokyo Stock Exchange. After selecting those companies trading in the First and Second Sections for which complete stock price data existed for the estimation window (see next section) and for which there were no confounding events (e.g., stock split), we have a sample of 564 PRTR-listed firms.

3. Model

The three studies of investor reactions to the release of TRI data in the U.S. used the event study methodology (MacKinley 1997) to test whether firms reporting to the TRI incurred statistically significant abnormal returns following the release of the TRI data. We use the same methodology. The theoretical basis of the event study methodology is the efficient market hypothesis. The hypothesis predicts that in a well-functioning capital market, a firm's stock price reflects all available information about the firm's future profits. Pollution data provided by a PRTR may change investors' expectations of the firm's future profitability and create abnormal returns.

The event study starts with estimating the following linear relationship between the returns of each security and the market portfolio:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{1}$$

$$E(\varepsilon_{it}) = 0 \qquad \text{var}(\varepsilon_{it}) = \sigma_i^2$$

where R_{it} is the individual firm return at time t and R_{mt} is the market return at time t. Equation (1) is estimated using daily returns during the estimation window, which is defined as a 250-trading day period beginning with 259 trading days and ending 10 trading days prior to the event day. The event day is defined as the day the PRTR data were released: 20 March 2003. The government began accepting requests for facility-level data at 2 pm on March 20. Investors may not have had time to analyze the data before the market closed at 3 pm, and thus we estimate abnormal returns on both the event day and the following trading day, March 24 (Friday the 21st was a national holiday).

The abnormal return for firm *i* on day *t* is defined as the difference between the actual return and the predicted return: $AR_{it} = R_i - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$. The test statistic for abnormal returns is the aggregated cumulative abnormal return during the event window.[2] We test for significant abnormal returns in three event windows. The first window is the event day (denoted as window 0) and the second window is the following trading day (window 1). To examine if abnormal returns persisted, we use a 6-day window that includes the release day (denoted as window 0-5).

4. Results and Discussion

Table I presents estimates of abnormal returns and their significance. The first column shows the aggregate abnormal returns of all firms included in the PRTR. We find evidence of significantly *positive* abnormal returns on the event day. In fact, for 0-5 day window, we find large, significantly positive abnormal returns.

The distribution of emissions across publicly-traded firms, however, is highly skewed, with few very large polluters. These large polluters may have been the only firms to experience significantly negative abnormal returns. To test this hypothesis, we selected the top 50 firms in terms of total emissions (on-site emissions plus off-site transfers) and estimated their abnormal returns. We further hypothesized that investors might have found it cumbersome to calculate and compare total emissions across firms and thus may have compared the number of chemicals reported instead. We thus estimated the abnormal returns of the top 50 firms in terms of the number of chemicals reported. These results are shown in the second and third columns of Table I. In both cases, abnormal returns on the event day are neither negative nor statistically different from zero. The abnormal returns on the following day are negative as hypothesized, but these

returns are not statistically different from zero. Thus, we observe no evidence that investors reacted negatively to the PRTR data release.[3]

Table I. Abnormal Returns for Firms Listed in the PRTR

Window	All firms	Top 50 firms in total emissions	Top 50 firms in number of chemicals
0	0.00215	0.00309	0.00246
	(2.114)**	(1.040)	(0.926)
1	0.00179	-0.00330	-0.00028
	(1.767)	(-1.111)	(-0.106)
0-5	0.0239	0.00115	0.0139
	(9.612)***	(0.158)	(2.136)**
Number of observations	564	50	52

Note: Z statistics are shown in parentheses.
Because of ties, there are 52 observations in the top 50 firms in number of chemicals.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

To explain the difference between the results from past TRI studies, which found significantly negative reactions, and this study, which found either no reaction or a significantly positive one, we identify two important, and related, differences in the institutional environments of the two programs. First, King and Lenox (2001) point out that investors may react to the negative media coverage rather than the release of PRTR data itself. After the TRI data were first released, there was media coverage that focused attention on firms with large emissions of chemicals in TRI data (Hamilton 1995). In contrast, there was no firm-level media coverage related to Japan's PRTR in the week after the data were released. In fact, in a search for PRTR-related articles in the *Nikkei Goo* database[4] between March 20, 2003 and January 31, 2004, only 63 articles were found within which only two firms and their emissions were mentioned. The other articles simply mentioned aggregate PRTR emissions data or covered another topic not directly related to emissions.

Second, national non-profit conservation organizations were an important force in the U.S. in publicizing TRI data to the larger population, thereby affecting investor behaviors directly through information interpretation and indirectly by affecting consumer behaviors. For example, on the day the TRI data were released, the Natural Resources Defense Council published a report

of the release of carcinogenic chemicals (a subset of the TRI chemicals), which spurred media coverage that reported on large emitters of TRI chemicals (Konar and Cohen 1997). In contrast, such leadership was not observed in Japan when the PRTR data were released. In Japan, non-profit groups are few in comparison to the U.S. and are typically operating at the level of the neighborhood or town (Pekkanen 2001). Custom and regulations have lead to a situation in which there are few large professional non-profit organizations capable of affecting the behaviors of investors, journalists, and the general public.

The absence of any evidence of negative investor reactions is also consistent with a recent study of the factors that affect the development of Environmental Management Systems (EMSs) among Japanese firms (Uchida and Ferraro 2003). Although consumer and regulatory pressures were found to significantly affect the development of firms' EMSs, investor pressures had no discernable effect. Thus investors in the Japanese stock market may care less about environmental performance than do investors on the U.S. stock market.

One may wonder, however, why this study detected *positive* investor reactions in the full sample. When we examined the abnormal returns to PRTR firms in the days leading up to the event date, we detected significantly *negative* abnormal returns.[5] We hypothesize that, based on analyses of investor reactions in the United States after the release of TRI data, investors in Japan anticipated negative abnormal returns from the release of PRTR data and acted before the release day. However, the release provided no new relevant information and thus those who had exited the market before the event date re-entered and bid prices back up.

5. Conclusion

In their review of information disclosure strategies for environmental protection, Tietenberg and Wheeler (2001) write that, "[p]ublic announcements do seem to affect stock market valuations of firms" (p. 112). We tested whether firms listed in Japan's PRTR incurred significantly negative abnormal returns to their stocks following the release of the PRTR data. We find no compelling evidence of such negative investor reactions.

Our results stand in stark contrast to results from analyses of the United States Toxics Release Inventory (TRI), the best known PRTR in the world. We attribute these differences to (1) the absence of firm-level media coverage after the release of Japan's PRTR data, and (2)

weaker social pressures from non-profit conservation organizations. Related work on the environmental managements systems of Japanese firms also suggests that investors in the Japanese stock market may care less about environmental performance than do investors in the U.S. stock market. Future analyses of changes in firm emissions after subsequent releases of the PRTR data may help shed further light on the PRTR's role in achieving environmental objectives in Japan.

As noted in the Introduction, governments may implement PRTRs for a variety of reasons, including the rights of communities to know about what chemicals are emitted in their environments. Thus the absence of evidence of negative investor reactions to the release of PRTR data does not imply that the PRTR in Japan is a failure (nor does it imply that investor reactions will not be observed in the future). It does, however, suggest that the U.S. TRI experience may not be replicated in every detail in other nations or even within states in the U.S. Institutions and cultural norms and preferences matter for most economic outcomes, and thus one should not be surprised that they may also matter in environmental policy. Empirical analyses of information disclosure efforts in other nations and across states within the U.S. are thus clearly warranted.

Notes

1. There are other minor conditions. For details, English translation of the PRTR Law can be accessed at http://www.env.go.jp/chemi/prtr/e-low.html and http://www.env.go.jp/chemi/prtr/e-co.html.

2. See MacKinley (1997) for more details on the test statistic. We also tested the significance using a method suggested by Dodd and Warner (1983), but our conclusions were unchanged. We replicated Hamilton's (1995) results to confirm that our methodology is correct. We thank Professor Hamilton for sharing his data with us.

3. Further breakdowns of the sample (e.g., by industry, removing the top polluters, etc.) also failed to generate any evidence of negative investor reactions.

4. The *Nikkei Goo* is a database administered by the Nikkei Newspaper, which is Japan's equivalent of the Wall Street Journal. The database covers major magazines and daily newspapers in Japan.

5. For example, on the day prior to the event day, abnormal returns = -0.00761 (z = -7.495). For the window of 1 to 3 trading days prior to the event day, abnormal returns = -0.00907 (z = -5.156).

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