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DOI:
[10.2308/API-2020-017](https://doi.org/10.2308/API-2020-017)

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Document Version
Peer reviewed version

Citation for published version (Harvard):
Beelitz, A, Cho, CH, Michelon, G & Patten, DM 2021, 'Measuring CSR disclosure when assessing stock market effects', *Accounting and the Public Interest*, vol. 21, no. 1, pp. 1-22. <https://doi.org/10.2308/API-2020-017>

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Publisher Rights Statement:

Annika Beelitz, Charles H. Cho, Giovanna Michelon, Dennis M. Patten; Measuring CSR Disclosure when Assessing Stock Market Effects. *Accounting and the Public Interest* 2021; doi: <https://doi.org/10.2308/API-2020-017>

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Accounting and the Public Interest

Measuring CSR Disclosure when Assessing Stock Market Effects

--Manuscript Draft--

Manuscript Number:	API-2020-017R2
Article Type:	Article
Full Title:	Measuring CSR Disclosure when Assessing Stock Market Effects
Short Title:	CSR Disclosure and Stock Market Effects
Section/Category:	Archival
Manuscript Classifications:	Accountability; CSR; Disclosure Issues; Environmental Issues
Keywords:	CSR Reporting Environmental Disclosure Market Reactions Catastrophic Events
Order of Authors:	Annika Beelitz Charles H. Cho Giovanna Michelin Dennis M. Patten
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Measuring CSR Disclosure when Assessing Stock Market Effects

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Abstract

A growing number of studies are using a dichotomous variable indicating the presence of a standalone CSR report to capture impacts of CSR disclosure. Our concern is that, without considering differences in the information provided, such an approach could lead to incorrect inferences regarding those impacts. Accordingly, we extend prior research by examining whether, similar to differences in environmental disclosure, the mere presence of a standalone CSR report also mitigates negative market reactions at times of regulatory cost exposure. We focus on the 2011 Fukushima Daiichi disaster and a sample of international utilities with nuclear power generation. Controlling for other factors related to social and regulatory cost exposures, we find only the environmental disclosures appear to reduce negative market effects. We thus argue that, in exploring the impacts of CSR disclosure, researchers need to carefully consider, beyond just the presence of a CSR report, differences in the extent of information being provided.

Measuring CSR Disclosure when Assessing Stock Market Effects

Introduction

Over the past decade, a growing body of research explores the impacts of corporate social responsibility (CSR) disclosure based on the existence of a standalone CSR report. These studies include examinations of CSR disclosure's impact on cost of capital (Dhaliwal et al. 2011; 2014), future earnings response coefficients (Dhaliwal et al. 2012; Birkey et al. 2017), aspects of firm reputation (Axjonow et al. 2018; Clarkson et al. 2020), and CSR ratings (Mahoney et al. 2013), among other items. Of particular interest to our study, three recent investigations (Christensen 2016; Du and Wu 2019; Li et al. 2017) examine whether the presence of a CSR report reduces negative market reactions to events triggering potential increases in regulatory cost concerns, and their results lack a consistent pattern. For example, Christensen (2016) focuses on high profile misconduct by U.S. firms and finds that CSR reports reduce negative market reactions to announcements of the events. In contrast, Du and Wu (2019), examining similar events in Taiwan, find that CSR reports similarly reduce negative market reactions, but only for sub-groups of firms with first-time offenses and events of an environmental nature. From a slightly different perspective, Li et al. (2017) focus on the early December 2013 haze crisis in China and find that CSR report issuance appeared to mitigate market concerns on the day the air quality index first moved into the 'hazardous' range, but was negatively related to market reactions for the subsequent period of high media coverage of the crisis.

One possible explanation for the somewhat inconsistent findings reported by Christensen (2016), Du and Wu (2019), and Li et al. (2017) is that none of the studies considers differences in the extent of information provided in the reports or through other means. This is important because numerous studies in the sustainability accounting domain (e.g., Cho et al. 2012b; Patten

and Zhao 2014; Parsa et al. 2018) document considerable differences in the extent of social and environmental information provided in CSR reports. Further, investors appear to value those differences. For example, both Guidry and Patten (2010), examining U.S. firms, and Wang and Li (2016), focusing on Chinese companies, report significantly more positive market reactions to first-time issuance of CSR reports of higher quality versus those with less extensive disclosure. Additionally, prior studies of environmental catastrophic events show more extensive environmental disclosures appeared to lead to less negative market reactions for intra-industry firms (Blacconiere and Patten 1994; Patten and Nance 1998; Heflin and Wallace 2017).¹ As such, our concern is that the failure to include assessments of differences in disclosure may lead to incorrect inferences about the effects of CSR disclosure, both with respect to the use of CSR reports, and more generally.

To shed light on this issue, we examine whether CSR disclosure, either as the existence of prior CSR reports or as the extent of firms' overall environmental disclosure, impacts market reactions to another catastrophic event raising regulatory cost concerns, the 2011 Fukushima Daiichi nuclear disaster. A major earthquake and tsunami on 11 March 2011 led to explosions and a partial nuclear meltdown at Tokyo Electric Power's (TEPCO) Fukushima nuclear power plant in Northeast Japan. Within days of the incident, more than 200,000 people had to be evacuated from the region due to concerns with radiation leakage, and the event triggered renewed questions on the safety of nuclear power generation (Hayashi and Hughes 2013; Vivoda and Graetz 2015). Early studies of the market impact of the disaster (e.g., Ferstl et al. 2012; Kawashima and Takeda 2012; Betzer et al. 2013) document significant negative reactions for

¹ Blacconiere and Patten (1984), Patten and Nance (1998), and Heflin and Wallace (2017) explore the market reaction to the 1984 Union Carbide chemical leak in Bhopal, India, the 1989 Alaskan oil spill, and the 2010 BP Deepwater Horizon disaster in the Gulf of Mexico, respectively.

Japanese, French, and German utility companies with nuclear operations, but none explores the role that CSR disclosure may have played in these reactions.²

Based on a sample of 52 utilities with nuclear power generation representing 16 different countries,³ we first document a significant negative market reaction of 2.24 percent over the three-day period commencing with the Fukushima accident for our sample. This aligns with the prior studies of market reactions to the event and indicates investor concern, presumably due to potential regulatory impacts. In cross sectional analysis of the market reactions controlling for other factors likely impacting perceptions of regulatory cost exposures, we find that the presence of a standalone CSR report prior to the disaster is not significantly related to differences in investor response. In contrast, and consistent with the prior studies of catastrophic environmental events, higher levels of pre-event environmental disclosure appeared to mitigate the extent of negative reactions. Further analysis shows these findings are robust to a variety of additional controls.

Our results highlight a potential problem with using CSR report issuance as a measure of CSR disclosure. Without further analysis of the impact related to differences in environmental disclosure across firms, our findings would suggest that CSR reporting did not influence investor reactions to the Fukushima Daiichi event for our sample of firms. But the more specific focus on differences in environmental disclosure results in different conclusions. As such, we believe our analysis highlights the importance, when examining the impacts of CSR disclosure, to carefully assess differences in the specific aspects of the information being provided.

We begin with background on the motivation for our investigation.

² Bonetti et al. (2018) do consider the role of carbon emission disclosure in market reactions to the Fukushima event, but their focus is on a broad set of Japanese firms that is not restricted to utilities.

³ We exclude TEPCO from the analysis.

Background and Development of Hypotheses

Motivation for Our Study

Academic inquiry into market valuation of CSR disclosure dates back more than 40 years (see, e.g., Belkaoui 1976; Ingram 1978; Anderson and Frankle 1980), and one subset of this research focuses more specifically on whether CSR disclosure reduces investor concerns at times of increased regulatory cost exposures. Watts and Zimmerman (1986) identify the potential issues firms face with respect to political costs, and proponents of legitimacy theory (e.g., Warsame et al. 2002; Cho et al. 2015; Patten 2020) argue that companies use CSR disclosure to reduce these threats. As such, if investors perceive more extensive disclosure as a signal of firms' reduced exposure to the political process, market reactions for firms providing more extensive disclosure should be less negative at times of increased regulatory cost concerns (Blacconiere and Patten 1994).

Investigations of the market reaction to the Three Mile Island nuclear disaster (Bowen et al. 1983; Hill and Schneeweis 1983) and the 1982 Tylenol tampering incident (Dowdell et al. 1992) provide early evidence of investor concern with regulatory cost exposures, but none of these studies explores the potential mitigating impact of CSR disclosure for affected firms. The first study to consider this issue, Blacconiere and Patten (1994), examines the market reaction for U.S. chemical firms other than Union Carbide in response to that company's 1984 chemical leak at its Bhopal, India processing plant. They report a significant negative market reaction, on average, and they further find the impacts are negatively related to companies' involvement in chemical operations. However, Blacconiere and Patten also show that the market reactions are positively related to levels of prior environmental disclosure (companies with higher levels of

disclosure suffered less negative market reactions), and they attribute this to investors perceiving the disclosure as reducing exposures to the social and political process.

Patten and Nance (1998) similarly investigate whether prior levels of environmental disclosure appeared to mitigate investor concerns with potential regulatory costs arising from the 1989 *Exxon Valdez* oil spill off the coast of Alaska. Although, on average, their sample of 25 U.S. petroleum firms (Exxon was excluded) exhibited positive market reactions in the period immediately following the disaster,⁴ Patten and Nance document regulatory cost concerns in that firm size and having operations in Alaska were both negatively related to market impacts. Consistent with Blacconiere and Patten (1994), Patten and Nance also find that more extensive levels of prior environmental disclosure were positively related to market reactions.

More recently, Heflin and Wallace (2017) explore market effects related to BP's 2010 Deepwater Horizon platform explosion and subsequent oil spill in the Gulf of Mexico. Also focusing on U.S. oil and gas firms, they report significant negative intra-industry market reactions, but only for a sub-sample of companies with offshore oil exploration activities. Heflin and Wallace also find that higher levels of pre-event environmental disclosure reduced the severity of negative market reactions, but again only for firms with offshore exploration. Consistent with Blacconiere and Patten (1994) and Patten and Nance (1998), they argue investors perceive the disclosure as reducing exposures to social and political costs.

In sum, Blacconiere and Patten (1994), Patten and Nance (1998), and Heflin and Wallace (2017) all document that it is differences in the extent of disclosure that appear to mitigate investor concerns at times of catastrophic events that potentially increase companies' exposure to

⁴ Patten and Nance (1998) attribute the positive reactions to substantial increases in oil and gas prices in response to the threat of reduced petroleum supplies in the U.S.

social and regulatory costs.⁵ However, three recent studies (Christensen 2016; Li et al. 2017; Du and Wu 2019) explore the potential impacts of CSR disclosure at times of regulatory cost exposure focusing on the mere presence of a CSR report.

Building on a pair of prior studies focusing on financial impacts of the presence of a standalone CSR report (Dhaliwal et al. 2011; 2012), Christensen (2016) explores the relation between the reporting practice and incidents of high-profile misconduct, including those of an environmental nature. Christensen (2016, 378) proxies high-profile misconduct as “lawsuits related to CSR issues (e.g., bribery, kickbacks, discrimination) that appear in reputable international press articles.” He identifies (385) that about six percent of his 749 sample observations relate to environmental events. Noting that executives often cite a “desire to *protect* the firm’s brands and reputation” (Christensen 2016, 377, his emphasis) as the purpose for the reporting, Christensen documents less negative market reactions to high profile misconduct for firms having issued a standalone CSR report. Christensen’s (2016, 380) argument, or at least his evidence, seems to be that merely issuing a standalone CSR report is sufficient to generate “insurance-like protection that helps reduce negative consequences when bad events occur.”

Du and Wu (2019) build on Christensen (2016) and examine market reactions to CSR-related misconduct events in Taiwan. In addition to testing impacts of the presence of a CSR

⁵ Aside from catastrophic events, both Blacconiere and Northcut (1997) and Freedman and Patten (2004) also examine the role of environmental disclosures in mitigating market reactions to environmental legislation events and both document that differences in the extent of disclosure appear to mitigate negative market reactions. And, while not examining market use of the information, other studies similarly find impacts related to differences in overall environmental information disclosure. For example, Toms et al. (2005), focusing on a sample of UK firms, document that differences in both the quantity and the quality of environmental disclosure explain differences in environmental reputation. Similarly, Cho et al. (2012a) find that more extensive environmental disclosure is significantly associated with membership in the Dow Jones Sustainability Index as well as perceptions of corporations’ environmental reputation.

report, they also explore whether assurance on the report makes a difference. Focusing on a sample of 1,531 events, nearly half of which (47.81%) are related to environmental protection and safety issues, they find that neither factor is significantly associated with differences in market returns. However, in additional analyses they document that both factors become significant if it is a first-time offense, and, that for events of an environmental nature, the existence of a CSR report, with or without assurance, reduces negative market reactions.

More closely aligned to the prior studies of catastrophic events, Li et al. (2017) examine the market reaction to the 2013 ‘haze crisis’ in China. On December 2 of that year, the country’s air quality index moved into the hazardous zone for the first time ever, triggering production and other work stoppages and leading to substantial media coverage. Li et al. document that market reactions on the initial event day were less negative for companies having previously issued CSR reports. However, report issuance was negatively associated with market reactions over the days of increased media coverage of the crisis (trading days three through eight).

Overall, the results from Christensen (2016), Du and Wu (2019), and Li et al. (2017) do not provide consistent evidence that the mere existence of CSR reports serve to mitigate investor concerns at times of increased regulatory exposure. We believe the problem is that a dichotomous reporting variable fails to capture differences in the extent of information being provided, and this is important because, as documented in prior studies, such differences can be vast. To illustrate, Guidry and Patten (2010) analyze 37 first-time standalone CSR reports using a 55-item disclosure scale based on Global Reporting Initiative (GRI) guidelines. Following Wiseman’s (1982) weighting for differences in quantitative, specific, and general disclosures, they report scores ranging from a low of five points to a high of 74. Guidry and Patten also document substantial differences in the number of companies providing specific types of CSR

information. For example, while 31 of the sample reports included information on diversity or non-discrimination programs, only one disclosed indirect energy consumption, and there were numerous disclosure items recommended by the GRI not included in any of the reports. Similar variations in the extent of disclosure included in standalone CSR reports have been documented in a variety of other studies (e.g., Cho et al. 2012a, Habek and Wolniak 2016, and Odriozola and Baraibar-Diez 2017, among others). Importantly, Guidry and Patten (2010) document that investors appear to value the differences in disclosure as they show that market reactions to announcements of report issuance were significantly more positive for companies with more extensive disclosure versus those issuing lower quality reports. Wang and Li (2016) report similar findings for their sample of first-time CSR report issuing firms in China.

We believe that the substantial differences in the extent of information provided in CSR reports, in conjunction with the evidence from Blacconiere and Patten (1994), Patten and Nance (1998), and Heflin and Wallace (2017) that it is more extensive information provision that appears to drive market reactions at times of environmental disasters, calls into question whether reliance on a dichotomous reporting variable can adequately identify the value of CSR disclosure at times of regulatory cost-inducing events. However, we concede that, while Christensen (2016), Du and Wu (2019), and Li et al. (2017) do not include assessments of the extensiveness of disclosure, none of the environmental disaster studies explores whether the existence of CSR reports might similarly explain reduced negative market reactions. Accordingly, we extend both of these streams of research and examine whether the existence of a CSR report and the extent of environmental disclosure similarly explain differences in investor response to catastrophic events that likely increase the social and political exposure of firms in the affected industry. We test these issues relative to the market reactions to the 2011 Fukushima nuclear disaster.

The Fukushima Event

An earthquake off North Japan's coast at approximately 2:46pm (JST) on 11 March 2011 led the Fukushima Daiichi nuclear power plant to automatically shut down. The tsunami that resulted from the earthquake struck the plant about an hour later, causing a failure in the backup cooling system on the same day and a series of fires and explosions in the ensuing days. Further, radiation levels around the site and in the bordering seawater rose above the norm, resulting in the evacuation of local residents within a radius of 30 kilometres. Those living nearest the plant were allowed to return only recently. Soon after the incident, news broke of a possible partial meltdown in the plant. This was later confirmed by the Japanese government, as well as by TEPCO, the operator of the Fukushima Daiichi nuclear power plant. The disaster was classed as a level 7 event on the International Nuclear and Radiological Event Scale⁶ (INES) (major accident), which is the highest level on the index, putting it on par with the Chernobyl disaster in 1986. Figure 1 presents a timeline of events over the first five days (three trading days) of the disaster. The catastrophe represented a threat to the legitimacy of the nuclear industry worldwide, as the event made the dangers and risks inherent in the technology apparent (see, e.g., Hayashi and Hughes 2013; Vivoda and Graetz 2015).

----- Figure 1 about here -----

Several studies already investigate the market reaction following the Fukushima disaster, examining the share price movements for utilities in different geographic contexts and for different utility sub-sectors.⁷

⁶ See <https://www.iaea.org/sites/default/files/ines.pdf>

⁷ Bonetti et al. (2018), as part of their analysis of the impact of the Fukushima event on the cost of capital for Japanese firms (not restricted to utilities), also examine market reactions. They find a negative response, in general, but find it is less pronounced for those Japanese firms disclosing carbon emission information prior to the disaster.

Focusing specifically on Japanese utilities, Kawashima and Takeda (2012) investigate the market reaction for 11 companies excluding TEPCO. They divide the sample according to whether companies were directly affected by the earthquake and tsunami (Tohoku Electric Power was the only other company affected in the sample), whether they own nuclear power plants, and whether they are larger nuclear utilities (≥ 20 percent of total power generation is nuclear), as well as according to the age of nuclear power plants, and reactor design. Using daily returns, they report a significant negative market reaction for all Japanese utility companies over a three-day event period, as well as over longer event windows of 31 and 138 days. The reaction was more pronounced for Tohoku Electric Power, the only other utility directly struck by the earthquake and the tsunami, and for those utilities with nuclear power plants.⁸

Both Ferstl *et al.* (2012) and Betzer *et al.* (2013) investigate the market reaction to the Fukushima disaster using international samples of utility companies. Ferstl *et al.* examine the market reaction of French, German, Japanese and U.S. utility firms and compare the reactions for nuclear utilities ($\geq 1,000$ megawatt of installed nuclear capacity) and alternative energy companies. Using daily returns and Fama-French's three-factor model, they find a significant negative share price reaction for Japanese, German, and French nuclear utilities over a five-day event period (14-18 March 2011). Japanese, German, and French alternative energy companies, on the other hand, experienced positive market reactions over the event window. The market reactions of U.S. utilities were insignificant for both sub-samples. Consistent with Kawashima and Takeda (2012), Ferstl *et al.* report that Japanese nuclear utilities suffered a prolonged and significant negative market reaction over a five week period following the event. They conclude that investors in Japanese nuclear utility companies appeared to be uncertain about future

⁸ We delete Tohoku Electric Power from our analysis as its three-day CAR falls more than three standard deviations from the overall sample mean (see discussion below).

regulatory changes, while investors in French and German nuclear firms appeared to anticipate a shift towards the use of alternative energy generation. They argue that in the U.S., on the other hand, no regulatory changes of energy policies were expected, explaining their differing results. The findings suggest that investor perceptions are influenced by the regulatory environment and anticipated changes thereof following environmental disasters.

Similar to Ferstl *et al.* (2012), Betzer *et al.* (2013) examine the post-Fukushima market reaction for a sample of 38 German and 38 European utilities and compare these for nuclear and conventional utilities in comparison to renewable energy companies. They find no significant market reactions on the day of the Fukushima disaster for German or European nuclear and conventional utilities. On Monday, 14 March 2011, however, German nuclear and conventional utilities suffered significantly negative abnormal returns of -3.27 percent, while their European counterparts did not experience a significant market reaction. German renewable energy companies, on the other hand, experienced significantly positive abnormal returns of 11.07 percent on that day. The authors explain the negative market reaction for German nuclear and conventional utilities on 14 March 2011 as being due to the German government announcing an immediate and final shutdown of their oldest nuclear reactors and a 3-month moratorium for all other reactors for the purpose of safety inspections. In contrast, their European counterparts did not face any immediate policy changes. Betzer *et al.* conclude that market reactions depend more strongly on anticipated policy changes and potential regulatory costs than on the environmental disaster itself.

Hypotheses

None of the prior studies of market reactions to the Fukushima disaster examines whether differences in CSR disclosure, either through the existence of a CSR report or differences in the

extent of environmental information being provided, potentially impacted investor reactions for utility companies facing increased regulatory exposures related to nuclear power generation. Accordingly, we use this event to explore whether the alternate CSR reporting measures similarly impact market reactions to the disaster. Although argued to potentially reduce investor concerns, the evidence on CSR report impacts across Christensen (2016), Du and Wu (2019), and Li et al. (2017) yield, at best, mixed evidence of such an effect. We thus offer our hypothesis regarding the presence of CSR reports on the market reaction to the Fukushima event in null form:

H1: The market reaction to the Fukushima nuclear disaster will not be related to the existence of a CSR report in the period prior to the event.

In contrast, based on the consistent evidence from Blacconiere and Patten (1994), Patten and Nance (1998), and Heflin and Wallace (2017) regarding differences in environmental disclosure and investor reactions to catastrophic events, we expect differences in the extent of environmental disclosure similarly to mitigate the market reactions to the Fukushima disaster. As such, we state our second hypothesis (in directional form) as:

H2: The market reaction to the Fukushima nuclear disaster will be positively related to the extent of pre-event environmental disclosure.

Methods

Sample

Our sample differs from those used in the prior investigations of the market reaction to the Fukushima event in that we include utilities from across the globe and we focus exclusively on companies with nuclear power generation.⁹ To be included in the sample, companies had to:

⁹ Studies of the market reaction to earlier nuclear disasters at Three Mile Island in the U.S. (Bowen *et al.* 1983; Hill and Schneeweis 1983) and Chernobyl in the U.S.S.R. (Fields and Janjigian 1989; Kalra *et al.* 1993) indicate the disasters appear only to have impacted utilities with nuclear power generation, suggesting it is these firms that face increased regulatory cost exposure arising from such an event. To assure this holds in our setting, we identified a

- (1) be a publicly traded utility (other than TEPCO) with market price data available on the Thomson One Banker database,
- (2) have information on power generation available on their website or in company or other reports indicating the company had nuclear power generation at the time of the Fukushima event,¹⁰
- (3) not have confounding financial news announcements in the period of investigation, and
- (4) have CSR disclosure data for 2010 on the Bloomberg database.

In total, we identified 53 firms meeting these criteria. However, examination of the abnormal returns over the event period (discussed below) revealed one company with abnormal returns falling more than three standard deviations from the mean.¹¹ We deleted this outlier observation, leaving a sample of 52 firms. The companies represent 16 different countries, with the highest representation (26 firms) coming from the U.S. The sample also includes seven Japanese utilities. Table 1 identifies the sample distribution by country location.

----- Table 1 about here -----

Dependent Variable – 3-day CARs

The earthquake and resulting tsunami leading to the disaster at the Fukushima Daiichi nuclear power plant were unanticipated events, and as such, we expect share price movements to occur on the day of the accident and thereafter. Therefore, we designate 11 March 2011 as event day 0, and consistent with Kawashima and Takeda (2012), we calculate the market reaction over a three trading-day window (day 0 through day +2, inclusive).¹² Hillman *et al.* (1999, 73) note

sample of 260 international utilities without nuclear power generation and calculated three-day cumulative abnormal returns as described below. The mean reaction for this group was a minus 0.45 percent and it was not statistically significant at conventional levels.

¹⁰ We hand collected data on power generation by source from company websites, financial reports, and standalone sustainability reports. If we could not definitively identify the breakdown of power generation sources, companies were excluded from the sample.

¹¹ The outlier company, Tohoku Electric Power of Japan, had been identified by Kawashima and Takeda (2012) as also impacted by the tsunami.

¹² Christensen (2016) and Du and Wu (2019) similarly use three-day CARs. However, there is variation in the windows used in the studies of catastrophic events. Both Kawashima and Takeda (2012) and Fields and Janjigian

that the use of a short event window allows researchers “to attribute any abnormal return to the event of interest as it minimizes the potential for confounding events during the same window that may affect firm performance.”

We use standard market model methods (see, e.g., Brown and Warner, 1985) to isolate the abnormal market reaction. Based on a 100-day pre-event period (days -110 to -11), we estimate market parameters using the basic market model:

$$(1) \quad R_{jt} = a_1 + B_i R_{mt} + e_{jt}$$

where R_{mt} represents the stock index average on which the sample company’s shares are primarily listed. We then calculate daily abnormal returns as:

$$(2) \quad AR_{jt} = R_{jt} - E(R_{jt})$$

where $E(R_{jt})$ is based on each company’s market parameters and relevant stock index average return for each day of the test period. Finally, we cumulate the abnormal returns over the three-day period and calculate significance adjusting for potential clustering effects (see Edwards and Shevlin, 2011).

CSR Reporting Measures

We separately include two distinct CSR reporting metrics, one identifying the existence of standalone CSR reports (as in Christensen 2016, Li et al. 2017, and Du and Wu 2019), and one focusing specifically on environmental disclosure (as in Blacconiere and Patten 1994, Patten and Nance 1998, and Heflin and Wallace 2017). Similar to Michelin *et al.* (2019), we rely on searches of the Global Reporting Initiative database, CorporateRegister.com, and individual company websites to identify the existence of standalone CSR reporting, and we identify that 38

(1989) also use a three-day window, but Kalra *et al.* (1993) report two-day CARs, and both Bowen *et al.* (1983) and Blacconiere and Patten (1994) use longer five-day windows. We repeat all tests using the alternative windows and results remain qualitatively similar to those we report using the three-day CARs.

sample companies had issued a 2009 or 2010 standalone CSR report.¹³ We use a one/zero indicator variable, ‘CSR Report’, to designate the report-issuing firms.

To identify differences in the provision of environmental information, we rely on the Bloomberg disclosure scores. Bloomberg reports the extensiveness of environmental reporting on a scale ranging from 0 to 100 percent based on the number of environmental information items each firm reports in various corporate documents (including stand-alone CSR reports, annual reports and websites) (Eccles et al. 2014). The Bloomberg scores are being increasingly used in disclosure research (see, e.g., Birkey *et al.* 2016; Tamini and Sebastianelli 2017; Michelin *et al.* 2020). Consistent with Blacconiere and Patten (1994), Patten and Nance (1998), and Heflin and Wallace (2017), we focus on disclosure from the year prior to the event of interest, in our case, 2010, and we designate the disclosure metric as ‘Env Disc’. Our Env Disc scores range from 1.38 to 73.64 with a mean of 35.33.¹⁴

Control Variables

We separately test the relation between the CSR reporting measures and company-specific CARs using multiple regression analysis controlling for other factors potentially influencing investors’ perceptions of regulatory cost exposure.¹⁵ Because the immediate physical effects of the Fukushima accident are limited to Japan, we anticipate that social and

¹³ The percentage of companies issuing standalone reports is considerably higher than for the samples examined in Christensen (2016), Li et al. (2017), and Du and Wu (2019). This is likely a function of our sample companies being much larger, on average, than those in the other studies. Simnett et al. (2009) document that firm size is a major factor explaining the choice to issue a standalone report. They also find that utilities are one of the industry groups statistically more likely to issue a report, a factor also likely helping to explain our sample’s higher percentage of reporting. We have no basis to expect the differing sample percentages to influence interpretation of our analysis.

¹⁴ Both the range and mean of the scores is consistent with findings from other studies of environmental disclosure by companies in environmentally sensitive industries (see, e.g., Cho et al. 2012a; Clarkson et al. 2008; Dobler et al. 2015).

¹⁵ Controlling for other potential regulatory exposure factors is consistent with Blacconiere and Patten (1994), Patten and Nance (1998), Heflin and Wallace (2017), and Li et al. (2017).

political cost exposure would likely be more prevalent for the Japanese firms in our sample. Accordingly, we include a one/zero indicator variable, Japan, to designate the seven Japanese firms in the sample. Next, we control for firm size. Watts and Zimmerman (1986) argue that larger firms face greater exposures to the political process, and Patten and Nance (1998) document firm size effects related to market reactions to catastrophic events. We measure firm size as the level of market capitalization as of 11 March 2011 and obtain this data from the Thomson One Banker database. We adjust for heteroskedasticity by taking the natural log of the size measure. Our Firm Size measure ranges from 19.53 to 25.08 with a mean of 23.19.¹⁶ Finally, Bowen *et al.* (1983) report more negative reactions to the Three Mile Island nuclear disaster for firms with more than ten percent of operating capacity coming from nuclear sources. Accordingly, we include a one/zero indicator variable, Nuc10, to designate sample companies with larger nuclear reliance, that is, greater than 10 percent reliance on nuclear operations.¹⁷ Thirty-four of the sample firms fall into this classification. We expect market reactions to be negatively related to each of the control variables, and we state our primary regression model as:

$$CAR_i = a_1 + b_1Japan_i + b_2Firm\ Size_i + b_3Nuc10_i + b_4Reporting_i + e_i \quad (1)$$

where Reporting is alternately the CSR Report and Env Disc measures. If the alternative aspects of CSR reporting mitigate the market reactions, we expect a positive relation between the respective metrics and the CARs. As we discuss in more detail below, we also conduct a series of robustness tests including additional factors. The appendix summarizes all variable definitions.

¹⁶ In non-tabulated sensitivity tests, we alternately use the natural log of 2010 total assets and the natural log of 2010 revenues as a firm size measure. Results, in both cases, remain qualitatively similar to those using the market capitalization measure.

¹⁷ In non-tabulated sensitivity tests, we repeat all analyses using the individual company nuclear percentages. Results on our primary test variables remain qualitatively unchanged.

Results

Table 2 provides descriptive statistics and frequencies for the variables used in our analyses. As reported in the table, the mean three-day CAR for the sample was a minus 2.24 percent. This is statistically significant at $p < .001$, two-tailed, and the finding is consistent with the market reactions for utilities with nuclear power generation to the previous nuclear disasters. Pearson product-moment correlations, presented in Table 3, indicate that the CSR Report and Env Disc variables are highly correlated. Interestingly, at the univariate level, neither is significantly related to the market reactions for the nuclear firms.

----- Tables 2 and 3 about here -----

We present the results of the regression analyses of the impact of our CSR reporting metrics on market reactions to the Fukushima disaster controlling for other regulatory cost exposure factors in Table 4.¹⁸ Column 1 reports results for the model using the presence of a standalone CSR report variable, while column 2 provides results for the model using the environmental disclosure metric. In both estimations, each of the exposure factors, Japan, Firm Size, and Nuc10, is negatively signed and each is significant at the $p = .05$ level or better, one-tailed. This indicates market reactions were more negative for companies facing greater regulatory cost exposures. As highlighted in Column 1, we first find that the CSR Report variable, although positively signed, is not statistically significant at conventional levels. In contrast, and consistent with the prior studies of environmental disclosure impacts on market reactions, our Env Disc metric is positively signed and statistically significant (at $p < .05$, one-tailed) (see column 2 of Table 3).¹⁹ Overall, the results of our primary analyses indicate that it is

¹⁸ Variance inflation factors, not reported in the table, range from 1.108 to 1.636 suggesting multi-collinearity is not an issue with the regression.

¹⁹ Due to the high correlation between the separate reporting metrics (Pearson product-moment correlation = .503, $p < .01$, two-tailed), models including both measures at the same time are prone to potential multicollinearity

only differences in environmental information provision that appear to explain differences in the investor response to the Fukushima disaster.

----- Table 4 about here -----

Robustness Tests

We conduct a series of additional analyses to assure the robustness of our primary results. First, we note that the prior studies of the mitigating impacts of environmental disclosure at times of catastrophic events are limited to the U.S. setting. Because our sample of nuclear utilities is dominated by U.S. firms (26 of the 52 companies), it is possible that the relations we report are being driven by the U.S. factor. To explore this possibility, we include a one/zero indicator variable (US) to designate the U.S. firms and, alternately, US*CSR Report and US*Env Disc interaction variables to capture any differing relations for that sub-group of firms. This enhanced model is thus stated as:

$$CAR_i = a_1 + b_1Japan_i + b_2Firm\ Size_i + b_3Nuc10_i + b_4Reporting_i + b_5US_i + b_6US*Reporting_i + e_i \quad (2)$$

We present the results of these additional analyses in Table 5. As reflected in the table, in neither case is the US nor either of the interaction terms statistically significant. Further, results on the CSR Report and Env Disc variables remain consistent with the primary tests. These findings further support that only environmental disclosure appears to mitigate the investor concerns at the time of the Fukushima event.

----- Table 5 about here -----

We next examine whether the documented disclosure effects are driven by the Japanese firms in the sample. Non-tabulated tests indicate that those utilities had significantly higher

problems. Keeping these concerns in mind, when both metrics are included in the same estimation, Env Disc continues to show a positive statistically significant relation with the CARs, whereas CSR Report remains statistically insignificant. These results (non-tabulated) are thus consistent with the primary analyses.

levels of pre-event environmental disclosures and significantly more negative market reactions to Fukushima relative to the other nuclear utilities. Accordingly, we alternately include Japan*CSR Report and Japan*Env Disc interaction terms and re-estimate the primary regressions. We state this model as:

$$CAR_i = a_1 + b_1Japan_i + b_2Firm\ Size_i + b_3Nuc10_i + b_4Reporting_i + b_5Japan*Reporting_i + e_i$$

(3)

We present these results in Table 6. As documented in Column 1 of the table, the Japan*CSR Report variable is marginally significant ($p < .10$, one-tailed). However, it is also negatively signed, suggesting the existence of a CSR report for the Japanese companies in the sample is associated with more negative market reactions than is the case for other firms with standalone reports. This fails to support the claims for reporting as argued by Christensen (2016), Li et al. (2017), and Du and Wu (2019). Further, the CSR Report variable remains insignificant overall in this further analysis. In contrast, the mitigating effect of environmental disclosure continues to hold in the presence of the Japan*Env Disc interaction variable (see Column 2), as it remains positively signed and statistically significant (at $p < .05$, one-tailed). Finally, results indicate no significant difference in environmental disclosure impacts across Japanese sample firms as the Japan*Env Disc variable is not statistically significant.

----- Table 6 about here -----

Lastly, we run a series of tests including controls for a variety of other factors. We first estimate models including financial performance (ROA) and leverage (Lev) metrics as firm financial characteristics could potentially lead to variations in market returns (Grewal *et al.*, 2019). We use fiscal year 2010 data to calculate these measures. We then control for differences in the business culture at the country level. Simnett *et al.* (2009, 944) argue that in

shareholder-oriented countries, “companies are primarily seen as instruments for the creation of shareholder value,” and that other stakeholder groups are less likely to be able to influence corporate activities. As such, investors may consider social pressure to be less of a factor in such countries potentially reducing the market effects of social and political cost-inducing events. Following Simnett *et al.* (2009), we classify common law countries as being more shareholder-oriented, and we run models including a one/zero indicator variable designating the 31 observations in the nuclear sample originating from common law countries as an additional control. Finally, we examine whether the choice to respond to Carbon Disclosure Project (CDP) solicitations influence the market reactions. A review of CDP data indicates that 49 of the 52 sample companies were solicited for response by the organization in 2010, with 39 of those providing a response. We use a one/zero indicator variable to designate those responders (and exclude the three non-contacted firms).

Table 7 provides the results of our final sets of robustness tests with models including the presence of a CSR report summarized in Panel A, and those using environmental disclosure in Panel B. As reflected in the table, the only additional control exhibiting statistical significance is leverage. It is positively signed and statistically significant in the models for each of the CSR disclosure metrics. More importantly, the relations for the two disclosure metrics remain consistent with the primary results in all additional estimations. Env Disc continues to be positively related to market reactions, although in the model controlling for CDP response the significance level is slightly reduced. In no estimations is the CSR Report variable statistically significant. Results thus continue to suggest that it is only environmental disclosure that serves to mitigate the market response to the Fukushima disaster.

Conclusion

Our study is motivated by the concern that studies examining the impact of CSR reporting without considering differences in the nature and extent of information provided may lead to incorrect inferences about the impact of CSR disclosure. To illustrate this potential problem, we investigate whether the mere presence of a standalone CSR report plays the same mitigating role as environmental disclosure on market reactions to events increasing the social and political exposure of affected firms. We explore this issue relative to the 2011 Fukushima nuclear disaster in Japan. Our results document differing effects across the two reporting measures. Based on a sample of 52 international utility companies with nuclear power generating capacity and controlling for other factors potentially influencing regulatory cost exposure, we document a positive and significant association between levels of pre-event environmental disclosure and market reactions. In contrast, our results also show that the mere presence of a standalone CSR report did not similarly reduce market effects for the sample companies. If only the latter reporting metric had been used, the results would suggest CSR disclosure had no impact in the situation examined, when the results on environmental disclosure show that was not the case. And while both Christensen (2016) and Du and Wu (2019) report less negative market reactions to misconduct of an environmental nature in the presence of a CSR report, our results suggest the results may instead be a function of differences in overall environmental information associated with those firms. Overall, our results suggest that in examining the impacts of corporate social responsibility reporting, a careful assessment of the nature and extent of the information being provided appears to be warranted.

Like all studies, ours is subject to limitations. We explore an event that is, arguably, environmental in nature, and similar to the prior studies of such catastrophes, we focus on an

industry that is commonly considered to be sensitive to environmental exposures. As such, we cannot assess whether the presence of a standalone CSR report is sufficient to mitigate market impacts for events of a non-environmental nature, or make inferences regarding whether the positive associations reported by Christensen (2016) for those types of events are potentially also driven by differences in other types of CSR information. Extensions along these lines of research would clearly add to our understanding of the impacts of corporate social reporting, and could add further support for the need to carefully consider both the nature and the extent of CSR disclosure when assessing its potential impacts, particularly given substantial evidence that both the quantity and quality of the disclosure in the reports varies dramatically (see, e.g. Michelon et al. 2015).

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Figure 1: Timeline of events following the earthquake and tsunami on 11 March 2011

Date	Events
11 March 2011 t = 0	Earthquake off of North Japan's coast at 2:46 pm (JST). Fukushima nuclear power plant shuts down. Tsunami approximately an hour afterwards. Fukushima nuclear power plant swept by tsunami. Failure of cooling system. Radiation levels 1,000 times normal. Japanese government declares state of emergency at a reactor of Fukushima nuclear power plant because of the possibility of radiation leak. Evacuation of 2,800 residents.
12 March 2011	TEPCO reports failure of cooling system in a second reactor. Japanese government declares state of emergency at a second reactor of Fukushima nuclear power plant. Comparison to Three Mile Island and Chernobyl incidents. Explosion at Fukushima. 20km evacuation radius.
13 March 2011	Attempt to cool down reactors in Fukushima 1 using seawater. Evacuation of over 200,000 residents.
14 March 2011 t = 1	Second explosion at Fukushima. Drop in water levels in all three reactors in Fukushima 1. Danger of meltdown.
15 March 2011 t = 2	Third explosion at Fukushima. TEPCO admits possibility of partial meltdown. Fire breaks out at Fukushima. Staff evacuated from plant; only 50-70 workers left. Evacuation radius extended to 30km.

Table 1 – Sample distribution by country.

Country	# of Firms	% of Sample
Brazil	1	1.9%
Czech Republic	1	1.9%
Finland	1	1.9%
France	1	1.9%
Germany	3	5.8%
Hong Kong	1	1.9%
India	2	3.8%
Italy	1	1.9%
Japan	7	13.5%
Portugal	1	1.9%
Russia	1	1.9%
South Korea	1	1.9%
Spain	3	5.8%
Switzerland	1	1.9%
United Kingdom	1	1.9%
United States	26	50.0%

Table 2 – Descriptive statistics and frequencies for variables examining disclosure effects on the market reaction for nuclear utility companies to the Fukushima disaster (n = 52).

Descriptive Statistics				
<i>Variable</i>	Minimum	Maximum	Mean	Std. Dev.
CAR	-0.0796	0.0576	-0.0224 ^a	0.0292
Env Disc	1.38	73.64	35.33	20.75
Firm Size	19.53	25.08	23.19	1.05
Frequencies				
<i>Variable</i>	Number of Observations	Percentage of Sample		
CSR Report	38	73.1%		
Japan	7	13.5%		
Nuc10	34	65.4%		
^a Significant at $p < .001$, two-tailed. See Appendix for variable definitions.				

Table 3 – Pearson product-moment correlations (n = 52).

	<i>CAR</i>	<i>Env Disc</i>	<i>CSR Report</i>	<i>Japan</i>	<i>Firm Size</i>	<i>Nuc10</i>
<i>CAR</i>	1	-.133	-.108	-.410	-.349	-.385
<i>Env Disc</i>		1	.503	.288	.488	.117
<i>CSR Report</i>			1	-.142	.531	.105
<i>Japan</i>				1	-.080	.287
<i>Firm Size</i>					1	.098
<i>Nuc10</i>						1

Significance at $p < .05$, two-tailed indicated in bold.
See Appendix for variable definitions.

Table 4 – Regression analysis of impact of pre-event CSR disclosure on the market reaction (3-day CARs) to the Fukushima event for utilities with nuclear power generation (n = 52).

	(1)	(2)
Constant	.298 (3.599)***	.243 (2.864)***
Japan	-.039 (-3.369)***	-.030 (-2.924)***
Firm Size	-.014 (-3.697)***	-.001 (-2.893)***
Nuc10	-.014 (-2.018)**	-.015 (-2.065)**
Env Disc	.001 (1.940)**	
CSR Report		.005 (0.566)
Adj. R ²	.366	.320

We report t-statistics in parentheses below parameter estimates.
 , * indicate significance at .05 and .01 levels, respectively.
 See Appendix for variable definitions.

Table 5 – Regression analyses of the market reaction (3-day CARs) to the Fukushima event for utilities with nuclear power generation (n = 52) controlling for potentially differing effects for U.S. utilities.

	(1)	(2)
Constant	.270 (3.022)***	.252 (2.650)**
Japan	-.037 (-3.184)***	-.032 (-2.647)***
Firm Size	-.013 (-3.328)***	-.011 (-2.718)***
Nuc10	-.015 (-2.006)**	-.015 (-1.883)**
Env Disc	.001 (2.021)**	
CSR Report		.002 (0.135)
US	.013 (0.875)	-.006 (-0.374)
US*Env Disc	-.000 (-0.644)	
US*CSR Rpt		.006 (0.368)
Adj. R ²	.351	.292

We report t-statistics in parentheses below parameter estimates.
 *, **, *** indicate significance at .10, .05 and .01 levels, respectively.
 See Appendix for variable definitions.

Table 6 – Regression analyses of the market reaction (3-day CARs) to the Fukushima event for utilities with nuclear power generation (n = 52) controlling for potentially differing effects for Japanese utilities.

	(1)	(2)
Constant	.295 (3.549)***	.250 (3.016)***
Japan	-.148 (-1.196)	-.535 (-0.535)
Firm Size	-.014 (-3.642)***	-.012 (-3.091)***
Nuc10	-.014 (-2.016)**	-.016 (-2.229)**
Env Disc	.001 (1.855)**	
CSR Report		.012 (1.249)
Japan*Env Disc	.002 (1.289)	
Japan*CSR Rpt		-.036 (-1.798)*
Adj. R2	.363	.351

We report t-statistics in parentheses below parameter estimates.
 *, **, *** indicate significance at .10, .05 and .01 levels, respectively.
 See Appendix for variable definitions.

Table 7 – Regression analyses of the market reaction (3-day CARs) to the Fukushima event for utilities with nuclear power generation (n = 52) controlling for other potential factors.

Panel A – CSR Report

	(1)	(2)	(3)
Constant	.162 (1.881)*	.239 (2.603)**	.241 (2.458)**
Japan	-.054 (-4.018)***	-.030 (-2.435)***	-.030 (-2.796)***
Firm Size	-.010 (-2.642)***	-.011 (-2.710)***	-.011 (-2.552)***
Nuc10	-.009 (-1.286)	-.015 (-2.042)**	-.017 (-2.102)**
CSR Report	.008 (0.925)	.005 (0.566)	-.001 (-0.134)
ROA	.063 (0.452)		
LEV	.149 (2.782)***		
Common Law		.001 (0.111)	
CDP			.015 (1.430)
n	52	52	49
Adj. R2	.395	.306	.305

We report t-statistics in parentheses below parameter estimates.
 *, **, *** indicate significance at .10, .05 and .01 levels, respectively.
 See Appendix for variable definitions.

Table 7 – Regression analyses of the market reaction (3-day CARs) to the Fukushima event for utilities with nuclear power generation (n = 52) controlling for other potential factors.

Panel B – Environmental Disclosures

	(1)	(2)	(3)
Constant	.210 (2.479)**	.279 (3.276)***	.313 (3.313)***
Japan	-.063 (-4.648)***	-.035 (-2.973)***	-.037 (-3.198)***
Firm Size	-.012 (-3.347)***	-.013 (-3.542)***	-.015 (-3.456)***
Nuc10	-.008 (-1.193)	-.014 (-1.986)**	-.016 (-1.974)**
Env Disc	.001 (2.119)**	.001 (2.135)**	.001 (1.434)*
ROA	.077 (0.575)		
LEV	.45 (2.826)***		
Common Law		.008 (0.904)	
CDP			.009 (0.989)
n	52	52	49
Adj. R2	.439	.364	.336

We report t-statistics in parentheses below parameter estimates.
 *, **, *** indicate significance at .10, .05 and .01 levels, respectively.
 See Appendix for variable definitions.

Appendix – Variable definitions.

Variable	Definition
CAR	The three-day cumulative abnormal return for each sample company commencing on the day of the Fukushima disaster (11 March 2011).
Env Disc	The 2010 environmental disclosure score for each sample company as reported in the Bloomberg ESG database.
CSR Report	A one/zero indicator variable designating sample utility companies having issued a 2009 or 2010 standalone CSR report.
Japan	A one/zero indicator variable designating sample utility companies headquartered in Japan.
Firm Size	The natural log of each sample company's market value of equity as of 11 March 2011 as reported in the Thomas One Banker database.
Nuc10	A one/zero indicator variable designating sample utility companies with ten percent or more of capacity generated by nuclear power plants.
US	A one/zero indicator variable designating sample utility companies headquartered in the United States.
ROA	Each sample utility company's fiscal year 2010 reported net income divided by beginning of the year total assets.
LEV	Each sample utility company's 2010 total long-term debt divided by 2010 total assets.
Common Law	A one/zero indicator variable designating sample utility companies headquartered in a common law country.
CDP	A one/zero indicator variable designating sample utility companies providing a response to the CDP request in 2010.