



The Wealth Effect of Corporate Water Actions: How Past Corporate Responsibility and Irresponsibility Influence Stock Market Reactions

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Abstract

Ensuring access to clean water is one of the most important development and health challenges of the twenty-first century. Given the manifold impacts of business activities on water resources, corporate water actions should be of central concern to business ethics researchers. Yet so far we know too little about whether business activities that impact on water resources are noticed or how corporate water actions are valued by a firm's stakeholders, including by financial markets. In response, we conduct an event study to investigate the shareholder wealth effect of reports of corporate water actions. We explore stock market reactions to water actions by S&P 500 firms from 2005 to 2017, showing that the market reacts positively to reports of responsible water actions and negatively to irresponsible actions. We further explain that these abnormal returns to water actions are associated with a firm's past performance on ethical issues, arguing that the reputational effects from prior corporate social responsibility and irresponsibility influence market reactions. Our analysis provides evidence that there are diminishing marginal returns to responsible water actions for firms with records of past responsibility and an offsetting effect for those with past irresponsibility. Similarly, we demonstrate an insurance effect that limits punishment for irresponsible water actions for firms with responsible performance records and diminishing negative marginal returns for those already seen to be irresponsible. This study is the first to show that shareholders recognize market value in corporate water actions and are prepared to award or punish firms in stock markets based on their impacts on water.

Keywords Corporate social responsibility/irresponsibility (CSR/CSiR) · Water · Financial returns · Shareholder wealth effect

Introduction

By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, posing risks for energy production, food security, human health, economic development and poverty reduction (UN-Water, 2020). By 2030, water supplies are predicted to satisfy only 60% of global demand on average (Boccaletti et al., 2009), raising ethical

questions about the unequal distribution of water stress. While business activities in the developed world are responsible for many drivers of climate change and other factors subsequently leading to water problems (Dong et al., 2019; IPCC, 2018), many of the impacts manifest in the developing world, which have lower capacity, structure, and resources to deal with the problem (UN-Water, 2020). Thus, researchers in this area identify “valuing water” as one of the most critical steps toward achieving water sustainability, including the value of human right to water as well as economic valuation (Garrick et al., 2017).

However, it is difficult to quantify the value of water and there is no consensus on how to measure it. As one of the biggest users of fresh water and with manifold impacts of business activities on water resources (UN-Water, 2020), business organizations have a big role to play in managing the environmental, social, and ethical impacts of water. But corporate water actions are difficult to motivate without valuing their impacts. With increasing awareness, a growing

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number of institutional investors (CDP, 2016) and varied stakeholder base (Bowen et al., 2018; Lambooy, 2011) today demand that business organizations carefully control and minimize pollution, water resource consumption and depletion, and other water impacts of business activities (Bowen et al., 2018; Lambooy, 2011). Initial estimates suggest that the social and environmental cost of global business water use add up to around \$1.9 trillion per year and some of these external costs have already started being internalized and hitting firm bottom lines (Trucost, 2013). Internalizing water risks could have serious impacts on corporate growth, market valuation, corporate creditworthiness, and bond rating (Burritt et al., 2016; Larson et al., 2012).

Despite all these arguments, the fact remains that water is not usually a directly traded asset like oil, and tends to be an underpriced resource with mostly unrestricted access (Trucost, 2013). This has led to calls for research to add monetary or financial data to measure the impacts of corporate water actions and making this ethical issue more tangible for firms. Evaluating the financial impact of corporate water actions has barely been touched on yet, with most of the research focus concentrating on physical water use (Christ & Burritt, 2017). Empirical work from the field of water is limited (Kurland & Zell, 2010; Whiteman et al., 2013). Business ethics approaches to water management have primarily adopted case studies or other qualitative approaches, mostly analyzing the extent and quality of water disclosure by firms (Burritt et al., 2016; Kleinman et al., 2017; Leong et al., 2014; Linneman et al., 2015; Money, 2014). A few quantitative studies have explored the quantity of water used (Jeswani & Azapagic, 2011), water footprint assessment (Hoekstra et al., 2016), and water management accounting (Christ & Burritt, 2017). To the best of our knowledge, there is no prior large sample empirical research to systematically investigate the direct financial impacts brought about by firms' responsible or irresponsible water actions.

Extant literature already indicates a positive relationship between corporate social responsibility (CSR) in general and corporate financial performance (Friede et al., 2015; Margolis & Walsh, 2003; Margolis et al., 2009; Orlitzky et al., 2003). We extend the same logics in the specific ethical issue of access to water, expecting corporate water actions to associate positively to corporate financial performance given the potentially significant implications for business risk and return. We specifically focus on the shareholder wealth effect in the uncharted territory of corporate water actions. We take a sample of S&P 500 firms during 2005 to 2017 and manually construct a sample of responsible and irresponsible water actions by these firms as published in leading news outlets. We follow an event study approach and investigate if these firms experience any abnormal returns following the release of new information regarding water actions. Our findings provide the first evidence that shareholders recognize value in corporate

water actions: the market reacts positively to responsible water actions, and negatively to irresponsible water actions by firms.

Establishing this shareholder wealth effect of corporate water actions is extremely important as one of the main problems in the field of water is that the value of this resource and related actions are not clearly visible, which can dampen business incentives (Trucost, 2013). Our study of stock market reactions would help practitioners and policy-makers understand investor sentiment and their evaluation of water actions in this new business ethics domain. Since water assets are overexploited and undervalued in many countries, establishing financial market consequences from corporate water actions could help raise awareness of this emerging business ethics issue and ultimately support the protection and fairer distribution of water resources.

We also explore what prior factors influence these market reactions to water actions and propose that these actions are interpreted by shareholders within the broader context of prior overall corporate social responsibility (CSR) and corporate social irresponsibility (CSiR) performance by firms. We propose a matrix relating a firm's CSR and CSiR performance to the abnormal returns from subsequent responsible and irresponsible water actions. Specifically, when a firm with prior responsible performance engages in a further responsible action, it experiences diminishing positive marginal returns. This suggests that the returns to responsible actions increase at a decreasing rate because of growing market expectations and indifference. A similar market indifference effect manifests when prior irresponsible performance is followed by a further irresponsible action, and we term the effect as diminishing negative marginal returns. However, the market provides tolerance through a less negative reaction whenever prior responsible performance is followed by an irresponsible action, in which case prior positive responsibility provides an insurance effect. In a similar spirit, the market shows encouragement when prior irresponsibility is followed by a responsible action, a form of offsetting present for past performance.

We provide detailed conceptual framework behind each of these four proposed effects in the next section on theory and hypotheses, followed by section on data and methodology. We then go on to provide evidence in favor of all our hypotheses, and we conclude with the theoretical and practical implications of our findings in the final discussion section.

Theory and Hypothesis Development

Investor Reaction to Responsible and Irresponsible Corporate Water Actions

As with many ethical issues affecting businesses, water issues can be expected to affect corporate financial

performance through impacting profit potential and corporate risk profiles. The World Economic Forum has ranked water crises as the second most severe risk that the business community faces in terms of impact (Howell, 2013). What makes water risk so critical is that it is not just a subset of environmental concern, but also a critical resource for carrying out business (Money, 2014). Burton (2010) separated water risk into four components: physical, reputational, regulatory and litigation risk. Similarly, the World Business Council for Sustainable Development (2012) grouped business threats related to water into five main groups: *financial*, resulting from increasing investor awareness and preference that may lead to restricted access to capital, higher interest rates, etc.; *operational*, resulting from increase in production costs and disruptions because of lack in smooth supply of water resources; *product*, resulting from loss of customers because of increasing awareness and preference against water unfriendly products and companies; *reputational*, resulting from negative impacts on communities or society owing to business water-related actions; and *regulatory*, resulting from fees, fines and lawsuits resulting in regulation violations. A 2012 report by Trucost has claimed that external costs of water have started hitting the bottom lines of firms. A number of stakeholders—including suppliers, investors, rating agencies, creditors, customers, communities, government, regulatory agencies, and NGOs, have started to take interest in water-related actions and disclosure by firms (Burritt et al., 2016), and firms can be expected to be rewarded or punished accordingly by financial markets for their responsible and irresponsible water actions.

Our baseline hypothesis, consistent with previous studies on market reactions to CSR events (e.g., Flammer, 2013; Hamilton, 1995; Konar & Cohen, 1997; Kruger, 2015), is that shareholders associate responsible water actions with better risk management and potential returns. For example, due to responsible water actions, the firm might gain greater profitability arising from lower production costs and/or higher sales to a more committed customer base. From a risk perspective, responsible water actions might strengthen creditors' confidence in the firm's future potential, allowing the firm better access to creditor capital and/or more favorable rates, reducing the financial risk. Consequently, shareholders are expected to react positively to responsible water actions. This prediction has been supported in a variety of ethical business contexts, but no previous study examines how the market reacts to corporate water action announcements in particular. We summarize our first hypothesis as follows:

Hypothesis 1 (H1) Shareholders react positively to the announcement of a responsible water action.

On the contrary, an irresponsible water action, for example, water pollution, can lead to loss in reputation, brand equity, employee morale, and customer loyalty, and cause other forms of negative effects on stakeholders. Furthermore, legal costs might be involved. All of these imply an induced competitive disadvantage to a firm. Therefore, we predict a negative reaction from the stock market to irresponsible water actions:

Hypothesis 2 (H2) Shareholders react negatively to the announcement of an irresponsible water action.

The Effects of Past Responsible or Irresponsible Performance

There is an important theoretical distinction between CSR actions, that is individual acts of CSR, and corporate social performance, that is an aggregation of all CSR actions by a firm over a period that provides a measure of the firm's CSR performance over that period (Barnett, 2007). Barnett (2007) pointed out that most papers use these CSR action and performance terms interchangeably, and that the majority of the studies trying to establish the financial impacts of CSR actions have actually worked with CSR performance captured through some periodic measure. In this study, we recognize and accommodate this difference between individual responsible or irresponsible actions and the prior positive or negative responsibility performance of a firm. We define corporate social responsibility (CSR) as a firm's comprehensive approach to ethical issues delivering economic, social, and environmental good to stakeholders, and corporate social irresponsibility (CSiR) as a firm's actions causing harm or damaging welfare across these parameters (Riera & Iborra, 2017; Lin-Hi and Müller, 2013). We propose that performance measures based on the prior accumulation of CSR/CSiR actions by a firm help create positive/negative reputation that can influence the way the market reacts to a subsequent CSR or CSiR action by the firm. This is in accordance with Barnett's (2007) proposition that "stakeholders draw from their prior knowledge of a firm when they assess the implications of new information generated by that firm's CSR activities" (p. 803).

Based on a firm's responsible and/or irresponsible past CSR performance, stakeholders form distinctive perceptions about the firm (Lange & Washburn, 2012). Stakeholders can be expected to act on this perception in allocating their resources and shaping their relationship with the firm. This perception by stakeholders has been identified as an important component of firm reputation (Fombrun & Shanley, 1990; Fombrun et al., 2000; Rindova et al., 2005), and CSR investment in different stakeholder areas has been considered as a form of reputation building and maintenance activity (Brammer & Pavelin, 2004; Mahon & Wartick,

Table 1 Effects of past performance on market reaction to corporate water actions

	Market reaction to responsible water actions	Market reaction to irresponsible water actions
Past responsible performance (CSR)	Diminishing positive returns (H3)	Insurance effect (H4)
Past irresponsible performance (CSiR)	Offsetting effect (H5)	Diminishing negative returns (H6)

2003; McWilliams et al., 2006). Therefore, we propose that whenever a new CSR or CSiR action by a firm takes place, shareholders evaluate the action in the light of firm reputation set by prior CSR/CSiR performance and market reaction is toned accordingly. The reputation created through prior CSR/CSiR performance moderates the way the market reacts to a subsequent CSR/CSiR action.

In order to understand these moderating effects in full, it is very important not to conflate the positive (CSR) and negative (CSiR) performance of firms into a composite measure, but rather maintain positive and negative performance as separate and independent constructs. Eckert (2017) placed negative reputation as a separate parallel construct to positive reputation, and established that prior good performance and prior bad performance across different stakeholder domains (customer, investor, regulator, supplier) can work as indicators of good and bad reputation. Mattingly and Berman (2006) provided evidence that good and bad CSR performance are not the natural reciprocals of each other but rather are two conceptually distinct and empirically independent constructs that should not be aggregated. Bad CSR performance does not imply the absence of prior good actions, but rather signals the presence of prior unethical or harmful actions. A firm may have positive performance across some parameters, but negative performance in others, even from the same CSR domain (Walker, 2010). For example, in the CSR domain of environment, a firm may have positive reputation for controlling its carbon footprint, but a negative reputation for water contamination.

Prior CSR performance can indicate a good reputation arising from CSR and underpin “reputational capital” (Fombrun et al., 2000) or “moral capital” (Godfrey, 2005) as a strategic asset for the firm. We take this idea forward and propose, just as CSR performance can be a strategic asset, prior CSiR performance can be a strategic liability and create negative reputation. Along similar lines, other papers have theorized that negative CSR performance can damage firm reputation (Eckert, 2017; Sirsly & Lvina, 2019), terming this as “reputational risk” or “reputational loss”, which can be defined as negative perceptions by a firm’s stakeholders causing a change in their behavior that can potentially

lead to financial loss by the firm (Eckert, 2017; Gatzert, 2015; Shiu & Yang, 2017). We draw these streams on positive and negative reputation together, and propose that these CSR/CSiR-related positive/negative reputations run parallel for a firm, with separate influences on the way the market reacts to a subsequent CSR/CSiR action and varying extents of financial gain and loss.

Contemporary research has explored the effects of positive CSR reputation in a variety of CSR domains beyond water (Lii & Lee, 2011; Godfrey et al., 2009; Pirsch et al., 2007; Fombrun et al., 2000). For example, Muthuri et al. (2009) showed that employee involvement in community programs enhances a firm’s reputation among all stakeholders. Lijun et al. (2014) demonstrated that charitable donations by firms enhance its goodwill among suppliers. The most important effect of positive CSR reputation is perhaps the insurance-like benefit it provides in case of a subsequent negative event faced by a firm. Godfrey et al. (2009) provided evidence supporting an insurance effect for institutional CSR from the fields of diversity and community. Similar evidence has been revealed in other CSR areas (for example, Shui and Yang, 2017; Minor & Morgan, 2011; Peloza, 2006). However, effects of negative reputation from prior irresponsible performance have received much less attention (Lange & Washburn, 2012).

Our study completes these studies by simultaneously testing the effects of prior positive and negative CSR performance. We introduce a two-by-two matrix to summarize the four effects of prior CSR and CSiR performance on market reaction to a subsequent responsible or irresponsible water action, as shown in Table 1, using the positive/negative reputation created through prior CSR/CSiR performance to help explain these associations. Past responsible performance can support positive reactions to responsible water actions at a diminishing rate (H3), and also provide an insurance effect in the case of irresponsible actions (H4). In contrast, past irresponsible performance can be offset by subsequent responsible actions (H5) that stimulate positive market reactions, and the negative market reactions to irresponsible actions are diminished by conformity with expectations set by prior irresponsible performance (H6). Details of each

effect proposed in our matrix and corresponding hypothesis are provided in the next section.

Prior Corporate Socially Responsible (CSR) performance

When a firm with a prior record of CSR performance engages in one more responsible action, it adds to the firm's existing base of reputational capital. However, this addition happens at a diminishing rate. The neo-classical principle of diminishing marginal returns for productive assets like financial capital or labor, can also be expected to apply in case of the reputational capital of CSR. Diminishing return is the decrease in the marginal output (not total output) as the amount of a single resource input increases, while all other inputs stay constant (Samuelson & Nordhaus, 2001). In the case of CSR, this would mean that if a firm keeps investing in CSR, the marginal benefit from one additional CSR activity will keep decreasing. High CSR performance increases stakeholder expectations (Burgoon and LaPoire, 1993) and so weakens a firm's ability to produce additional benefits from a subsequent positive action, placing "upper bounds on CSR contributions" (Barnett, 2007).

When a firm first decides to engage in CSR, it will likely invest in the more obvious and easier changes in terms of effort and money commitment, reaping quick benefits. It is often easier to enhance a firm's CSR image when starting from a low base or with no prominent CSR presence. However, once a company has already developed a sound CSR reputation, it becomes increasingly difficult to grow or sustain that reputation and to reap additional benefits through further actions (Sirly & Lvina, 2019). Flammer (2013) provided evidence for diminishing marginal returns of environmental CSR in the case of a new environmental initiative. We extend the same notion to the reputational capital created by overall positive prior CSR performance and test whether the diminishing returns effect holds when we evaluate market reactions to the water subset of CSR actions. We build on Haack et al. (2014)'s predictions of decreasing marginal effects for positive events until a threshold level of "taken-for-grantedness" is reached. This implies a threshold or hurdle effect once a substantial level of past performance is reached and firms experience less market reward for further CSR actions. Therefore, we propose that firms that already have substantial records of prior positive CSR performance will be awarded less by the stock market as a result of one additional responsible action, and we hypothesize:

Hypothesis 3 (H3) Shareholders react less positively to a responsible water action by a firm with substantial presence of prior positive CSR performance than by a firm with no or minimal presence of prior positive CSR performance.

The biggest advantage of this reputational capital from positive CSR performance is that it functions like an insurance cover by helping to preserve economic value (Shui & Yang, 2017; Godfrey et al., 2009). Positive past performance acts as a buffer and provides insurance-like protection against negative market reactions to the firm, in case the firm gets involved in a crisis or an irresponsible action. When a firm enjoys reputational capital from prior good CSR performance, shareholders can be expected to give the firm the benefit of the doubt in excusing the action and be more tolerant in their market reactions. Goodwill and positive perceptions about the firm encourage shareholders to see the company in a more favorable light and assess its subsequent negative action less severely (Godfrey, 2005).

Thus, Godfrey et al. (2009) proposed that in addition to the commonly argued wealth creation features, CSR also possesses wealth protective features in case of a negative event. Along similar lines, Shui and Yang (2017) provided empirical evidence that CSR performance offers insurance-like effects on stock and bond prices of firms at times of negative events. Ducassy (2013) established the same CSR insurance protection in times of financial crisis in the economy. Minor and Morgan (2011) and Peloza (2006) theorized that CSR performance insures firms against loss of reputation in case of an adverse event, and compared the costs of CSR incurred by a firm to insurance premiums paid to avoid or minimize future loss potential. Bhattacharya and Sen (2004) argued CSR performance builds a reservoir of goodwill that can be drawn upon in times of crisis.

As in the case of positive CSR performance above, we extend these arguments to propose a threshold effect of responsible past performance. We do not expect shareholders to be able to differentiate fine gradations of reputation in forgiving new irresponsible actions. However, markets do notice as long as there is some record of past good performance, and offer insurance-like benefits to these good performers but not to firms largely disengaged from CSR issues. More specifically, we test the insurance-like protection offered by noticeable presence of overall CSR past performance in the context of the firm committing a subsequent irresponsible water action:

Hypothesis 4 (H4) Shareholders react less negatively to an irresponsible water action by a firm with presence of substantial prior positive CSR performance than by a firm with no or minimal presence of prior positive CSR performance.

Prior Corporate Socially Irresponsible (CSiR) Performance

Prior CSiR performance can give rise to negative reputation. Several studies have shown that firms with prior records of CSiR engage in subsequent good CSR action to discharge a reputational liability (Kotchen & Moon, 2012; Muller and

Kräussl, 2011; Cho et al., 2006; Konar & Cohen, 1997). For example, if a firm becomes embroiled in a negative controversy or is featured in negative news like an oil spill in the recent past, the firm would have a direct impetus to change its corporate behavior in the immediate future, and shareholders would value that action more than if it seemed to have come out of nowhere (Alakent & Ozer, 2014; Kruger, 2015). Kruger (2015) described this as an “offsetting effect”, whereby shareholders reward positive CSR actions more when they see the actions coming from firms with prior records of CSiR. Coming from previous wrongdoers, these actions pleasantly surprise shareholders and they are more encouraging in their market reactions. Shareholders can be expected to interpret such changes as a direct indication of performance improvement and an effort to compensate for previous CSiR performance (Alakent & Ozer, 2014). As a result, shareholders react more positively than they would have had there been no direct reason for the firm to engage in the CSR action. This leads to our next hypothesis:

Hypothesis 5 (H5) Shareholders react more positively to a responsible water action by a firm with substantial presence of prior negative CSR performance than by a firm with no or minimal presence of prior negative CSR performance.

Contrary to this offsetting effect, when firms with substantial CSiR performance engage in one more irresponsible action, shareholders can be expected to be less surprised than they would be in the case of firms with no or minimal CSiR performance. Along the same principles for diminishing marginal positive returns, we propose a diminishing marginal negative returns phenomenon in this case. Each additional irresponsible action adds to the existing burden of the firm’s reputational liability, but the increase in liability can be expected to slow down with incremental irresponsible actions. As the market slowly gets indifferent to the irresponsibility by these firms, subsequent irresponsible actions stimulate less severe negative market reaction. This echoes theories by Barnett (2014), who argued that stakeholders may not consistently punish irresponsible actions by firms because of various cognitive factors. One such important cognitive factor is expectations by shareholders set by the image or reputation of the firm (Burgoon and LaPoire, 1993; Love & Kraatz, 2017). Since, shareholders already see firms with prior CSiR performance in a negative light and expect less out of them, subsequent irresponsible actions by these firms simply conform with the previous expectations and create less surprise and stir in the market, resulting in milder market reactions (Rhee & Haunschild, 2006). Therefore, we hypothesize:

Hypothesis 6 (H6) Shareholders react less negatively to an irresponsible water action by a firm with substantial presence of prior negative CSR performance than by a firm with no or minimal presence of prior negative CSR performance.

Data and Methodology

Sample Construction

Our sample event construction is based on the S&P 500 firms during the period 2005–2017. We manually collected water-related news articles over the sample period from The Wall Street Journal (WSJ) and The Financial Times (FT), accessed through FACTIVA. The S&P 500 firms are the largest and the most prominent listed firms in the economy, and the two newspapers selected are among the topmost media in international business. This ensured we got maximum coverage of credible and significant public announcements of corporate water actions and related new information. In our search on FACTIVA, we used the following set of carefully selected keywords: “flood”, “drought”, “oil spill”, “hazardous waste”, “toxic”, “radiation”, when the words appeared in the same paragraph as water; “contamination”, “pollution”, “recycling”, “treatment”, “preservation”, “reduction”, “consumption”, “scarcity”, “shortage”, “usage”, “efficiency”, “waste”, and “savings”, when the words appear within three-word-distance of “water”; “safe water”, “fresh water”, “clean water”, and “used water”, when the words appear anywhere in the article. We also considered basic variations for all keywords. For example, for “pollution”, we use the command “pollut*” in FACTIVA to search for any variations of the word like “polluted”, “pollute(s)”, etc. When articles referred to an earlier date or event that might have been featured in some other source, we recorded that too, in case the previous article could be traced and accessed.

We retained only those CSR/CSiR actions by firms that involved some impact on water resources. The actions generated through our search can be broadly classified into three groups:

- **Water usage and savings**, including, but not limited to, product- or process-related water efficiency/inefficiency and water saving/depletion.
- **Contribution to, or refraining from, water pollution/contamination**, like cases of oil spill, toxic/hazardous waste disposal, etc.
- **Charity or voluntary actions**, with regard to the provision of clean water, cleansing of water bodies, water treatment and recycling, or participation in other water-related issues.

Table 2 Sample description

Panel A: Corporate water events by year							
Year	All events		Responsible events		Irresponsible events		
	Freq	%	Freq	%	Freq	%	
2005	18	5.16	10	5.95	8	4.42	
2006	18	5.16	9	5.36	9	4.97	
2007	30	8.60	21	12.50	9	4.97	
2008	24	6.88	14	8.33	10	5.52	
2009	22	6.30	14	8.33	8	4.42	
2010	40	11.46	19	11.31	21	11.60	
2011	41	11.75	14	8.33	27	14.92	
2012	24	6.88	12	7.14	12	6.63	
2013	19	5.44	4	2.38	15	8.29	
2014	35	10.03	19	11.31	16	8.84	
2015	38	10.89	21	12.50	17	9.39	
2016	25	7.16	8	4.76	17	9.39	
2017	15	4.30	3	1.79	12	6.63	
Total	349	100	168	100	181	100	

Panel B: Corporate water events by 2-digit SIC industry (all events)			
2-digit SIC	SIC Industry	Freq	%
13	Oil & gas extraction	73	20.92
20	Food & kindred products	61	17.48
29	Petroleum & coal products	38	10.89
99	Non-classifiable establishments	35	10.03
28	Chemical & allied products	25	7.16
53	General merchandise stores	17	4.87
73	Business services	14	4.01
49	Electric, gas, & sanitary services	14	4.01
58	Eating & drinking places	9	2.58
36	Electronic & electrical equipment	7	2.01
	Others	56	16.05
Total		349	100

Our search generated an initial sample of 497 sample events from 120 companies. Each of these events and associated news articles were further screened at three levels. First, we removed articles with confounding messages, for example, if an article contained a mix of both positive and negative messages, or the article also talked about other aspects like financial performance or acquisition. Second, we excluded articles which were repeat mentions or follow-ups of a previous event already included in our sample, unless there was substantial new information. Third, we omitted events involving firms for which CSR data or firm-level data were not available through Compustat. All three researchers screened and coded the events independently, and only events with 100% intercoder agreement were finally included in the sample. We had a final sample of 349 events, 168 of which were responsible and 181 irresponsible. Examples of

some responsible and irresponsible events from our sample are provided in the Appendix 1 for illustration.

Table 2 reports the sample distribution by year and by industry. Year 2007 has the highest count of responsible water events and year 2010 has the highest peak of irresponsible events. Certain years like 2010, 2011, 2014, and 2015 have high concentration of water events in general. Overall, we have a good representation of both responsible and irresponsible events across all years from 2005 to 2017. When we segregate our sample events by industry (Panel B, Table 2), the top three industries with the highest incidence of water events are Oil & Gas, Food & Kindred Products, and Petroleum & Coal Products, due to the nature of the industries. Our sample events span over 35 broad industry types, top ten of which are reported with detailed numbers

in Table 2, indicating a good representation of water events across a wide range of industries.

Dependent Variable

We used standard event study methodology (McWilliams & Siegel, 1997) to estimate the market reaction to new information of responsible/irresponsible corporate water actions, and the main dependent variable of interest is cumulative abnormal returns (CAR) following an event. We identify an event date as the day a news article containing new information about a corporate water action is first published and brought to public notice. We calculated abnormal returns using the market model,¹ $AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$, where R_{it} is firm i 's return on day t , and R_{mt} is the CRSP equal-weighted index return on day t . $\hat{\alpha}_i$ and $\hat{\beta}_i$ are market model parameters, which were estimated using estimation period of 255 trading days ending 46 days before the event date, and with at least 100 daily returns available during the estimation period. We used a 3-day window to calculate cumulative abnormal returns surrounding an event date and reported the 3-day CAR $(-1, 1)$ in our main empirical models. Both a shorter window $(-1, 0)$ and a longer window $(-2, 2)$ were also used for robustness checks and produced qualitatively the same results. Since the CAR is a market-based measure of abnormal returns to firms' water actions, it effectively provides empirical evidence of forward-looking perception of shareholders. Furthermore, as the dependent variable of interest, CAR is much less subject to endogeneity concerns when we explore the moderating effects of prior general CSR performance to water action-triggered financial impacts (Flammer, 2013; Masulis & Reza, 2015).

Independent Variables

Prior CSR and CSiR Performance Measures

In order to test Hypotheses 2 to 5, the independent variables needed to be reasonable measures of prior CSR and CSiR performance by a firm. In order to determine the level of CSR and CSiR performance, we used KLD ESG data by MSCI—a data set with annual snapshots of the environmental, social, and governance performance of publicly listed US firms, and one of the most widely used sources of CSR data in current research (Cheng et al., 2014; Flammer, 2013; Godfrey et al., 2009; Kruger, 2015, etc.). KLD STATS assigns scores against CSR performance of firms

across seven key ESG stakeholder domains: community, corporate governance, diversity, employee relations, environment, human rights, and product. Under each of these domains, there are multiple indicators of CSR strengths and concerns, specified separately, against which KLD STATS issues a binary score. Good/bad actions are recorded as “1” representing the presence of a strength/concern and “0” indicate the absence of an action. Summing up total strengths and total concerns across all seven CSR domains provides composite scores for aggregate CSR strength and concern.

The total yearly strength and concern scores, therefore, act as good proxies for representing positive and negative CSR performance by a firm on an annual basis. The advantage of using KLD data is that it recognizes that the same firm might be having good performance and reputation in some CSR issue areas and bad in others simultaneously, and provides parallel strength and concern scores. We used a one year lag for these variables to capture prior performance because the immediate past scores are likely to form the latest and most relevant reputational image that the investors carry in their minds. It also avoids complications induced by CSR performance in the year of the focal event.

While differentiating between firms in terms of CSR/CSiR performance, we used high-low dummies for both strength (indicating CSR performance) and concern (indicating CSiR performance) based on a cutoff point of 1. A strength and concern score of more than 1 indicate considerable presence of positive and negative CSR performance, respectively. A similar approach to measuring CSR with a hurdle effect cutoff has been applied in existing studies (Godfrey et al., 2009; Kruger, 2015). The relationship between CSR and financial performance is not linear (Barnett & Salomon, 2012), and Giese and Nagy (2018) showed that the market reacted most intensely to new positive or negative information for companies that did not have extreme CSR scores. Therefore, beyond a threshold, the magnitude of the strength or concern scores often becomes irrelevant or less significant in influencing market reactions.

We used a cutoff score of 1, identifying firms with strengths and concerns of more than 1 as high strength and high concern groups, respectively, and those with no or minimal (just 1) strengths and concerns as the low group counterparts. We checked that none of the firm-years in our sample have had a single evaluation indicator in KLD CSR data. This strengthens our confidence that the construction of our key explanatory variable—*high strength (dummy)* and *high concern (dummy)*—is less likely to be affected by the possible drawback that some items across categories may no longer be reported after specific year. The *high strength (dummy)* and *high concern (dummy)* variables based on CSR strength and concern scores from the year before an event (1-year time lag) were the main independent variables used in our regression model.

¹ We also calculated CAR using the Fama–French 3-factor model, and replaced the market model CAR with the Fama–French 3-factor model CAR for a robustness check. This robustness check leaves our results intact.

As an additional test, we also used a continuous measure of water performance derived from Trucost water consumption data and ran an auxiliary analysis using this measure. This helped us verify that when we measure performance from the specific field of water, the results are compatible with what we get for performance associated with general CSR. Trucost has been one of the leading sources for water consumption data starting from 2005. It currently covers about 93% of global markets by capitalization and is widely used by investors and other stakeholders (Trucost, 2015). However, Trucost does not provide strengths and concerns separately, and we could not form two separate independent variables for positive and negative performance, but rather had to use a single estimate based on water performance by firms for the auxiliary tests.

We used the water intensity ratio provided by Trucost on an annual basis. This is calculated by dividing water processed and purchased by the revenue of a company and helps to neutralize any firm size effects and associated water use impacts. To further reduce the problem of size and type of industry on water consumption and to get rid of any yearly anomalies, we calculated how the water intensity ratio changed in the event preceding year over the year before that (before one year, over before two years, of an event). We used this percentage change in water intensity as our explanatory variable and termed it as *water performance measure*.

Control Variables

We controlled for a number of firm-level characteristics in our regression models, including Return on Equity (*ROE*), calculated by dividing net income by total equity; *Leverage*, calculated by dividing total liabilities by total assets; *Tobin's q* calculated as the sum of market capitalization and total liabilities divided by total assets; firm size (*Size*) by taking the natural logarithm of firm sales/revenue; *Age*, by taking the natural logarithm of number of years since the formation of the company; *Number of Analysts* by taking the natural logarithm of the number of analysts following the firm to understand the level of scrutiny the focal firm is under; and *Recom Change* by taking the average change in analyst recommendation that the focal firm experienced in the preceding month prior to an event. All variables were extracted from Compustat, except *Number of Analysts* which was obtained from Eikon by Thomson Reuters, and *Recom Change* which was taken from the IBES database. These firm-level controls were lagged by one year to reflect the company's position prior to an event and to align with the timeframe for which the CSR performance scores were taken. As for the *Recom Change* variable, the most recent data from the month preceding an event were used for maximum relevance. We also included controls for time trend and

industry fixed effects, and their interaction. The time variable represented the year in which the event took place and industry was captured at the 2-digit SIC code level available through Compustat.

Table 3 reports the descriptive statistics and correlation for all dependent, independent, and control variables. All variables were winsorized at the 1st and 99th percentiles. All correlation coefficients are low to moderate, limiting potential concern about multicollinearity for our regression model.

Regression Model

In order to test the effects of prior CSR/CSiR performance on market reaction to a water event, we used the following regression model:

$$CAR_i = \alpha + \beta \text{ high strength dummy}_i + \gamma \text{ high concern dummy}_i + \pi \text{ Controls}_i + \varepsilon_i$$

where i indexes corporate water events, and CAR_i represents cumulative abnormal returns to the focal firm over the 3-day window surrounding the event; α is the constant, β and γ are the two coefficients of interest against our two main independent variables, with the *high strength dummy* representing presence of CSR performance and *high concern dummy* representing presence of CSiR performance. *Controls* is a vector of firm-level characteristics and other controlled effects, and ε is the error term. We used ordinary least squares (OLS) regression and clustered error variance at the 2-digit SIC industry level.

To determine the past performance effects of water performance in particular, we used the same regression specification, replacing the *high strength dummy* and *high concern dummy* of overall CSR performance with the *water performance measure* derived from Trucost water data.

Results and Findings

Stock Market Reaction to Water Events

In order to test H1 and H2 we analyzed the cumulative abnormal returns (CARs) following responsible and irresponsible water events over different CAR calculation windows. The results are shown in Table 4. The mean CAR is significantly positive for responsible events over all three reported windows, summing to 0.35% (p -value = 0.037) over the 3-day window. Similarly, the mean CAR is significantly negative for irresponsible events over all three reported windows, reaching -0.613% (p -value = 0.001) over the 3-day window. This provides evidence in favor of H1 and

Table 3 Descriptive statistics and correlations

Responsible events (N= 168)												
	Mean	Std. Dev	1	2	3	4	5	6	7	8	9	10
1. CAR (- 1,1)	0.004	0.022	1									
2. Strength dummy	0.958	0.200	-0.095	1								
3. Concern dummy	0.940	0.237	0.013	0.073	1							
4. ROE	0.221	0.171	-0.177*	0.156*	-0.022	1						
5. Leverage	0.595	0.179	0.054	0.170*	0.149	0.113	1					
6. Size (ln)	10.72	1.163	-0.006	0.261*	0.251*	-0.031	0.346*	1				
7. Age (ln)	4.337	0.668	-0.118	0.119	0.197*	0.135	0.336*	0.301*	1			
8. Tobin's Q	2.311	1.177	-0.089	0.049	-0.188*	0.450*	-0.452*	-0.405*	-0.193*	1		
9. No. of Analysts(ln)	3.082	0.339	0.040	0.164*	-0.055	-0.187*	-0.258*	0.004	-0.349*	-0.042	1	
10. Recom Change	0.113	0.815	-0.023	-0.044	0.066	-0.082	0.049	0.041	0.073	0.012	0.042	1
Irresponsible events (N= 181)												
1. CAR (- 1,1)	-0.006	0.024	1									
2. Strength dummy	0.873	0.334	0.248*	1								
3. Concern dummy	0.867	0.340	0.269*	0.487*	1							
4. ROE	0.134	0.357	0.070	0.313*	0.147*	1						
5. Leverage	0.560	0.146	-0.024	0.014	-0.103	-0.256*	1					
6. Size (ln)	10.39	1.561	0.150*	0.528*	0.456*	0.287*	-0.045	1				
7. Age (ln)	4.303	0.637	0.139	0.393*	0.380*	0.134	-0.047	0.610*	1			
8. Tobin's Q	2.012	0.942	0.024	0.008	-0.097	-0.045	-0.030	-0.133	-0.133	1		
9. No. of Analysts(ln)	3.137	0.340	-0.001	0.155*	-0.066	0.031	-0.231*	-0.157*	-0.236*	-0.002	1	
10. Recom Change	0.083	0.836	0.061	0.098	0.117	-0.066	0.169*	-0.068	-0.033	0.137	0.013	1

*Represents coefficients with *p* values ≤ 0.05

Table 4 Cumulative abnormal returns (CARs) in % over different windows

	Responsible events				Irresponsible events			
	N	Mean	P-value	Std. Dev	N	Mean	P-Value	Std. Dev
CAR (- 1,0)	168	0.291*	0.067	0.020	181	-0.416***	0.004	0.019
CAR (- 1,1)	168	0.352**	0.037	0.022	181	-0.613***	0.001	0.024
CAR (- 2,2)	168	0.496**	0.049	0.032	181	-0.567**	0.028	0.034

Two tailed sig: **p* ≤ 0.1; ***p* ≤ 0.05; ****p* ≤ 0.01

H2. There is also an indication that the negative reaction to irresponsible events is slightly stronger than the positive reaction to positive events.

Effects of CSR and CSiR Performance on Market Reaction

In order to test if the strength and concern dummies based on prior CSR performance show any substantial difference in CAR between the high and low groups, we next ran univariate t-tests and investigated if the mean of the two groups vary significantly from zero, and also from each other. The results are shown in Table 5. In the case of responsible water events, the CAR for the high strength group is lower by 103 basis points compared to low strength group. But when the

high strength firms get involved in an irresponsible event, the prior high CSR strength provides them with insurance coverage, and they experience a smaller fall in share price of only 38 basis points, compared to the low strength firms who see a fall of 220 basis points. This difference of 181 basis points is highly significant (*p*-value = 0.0007).

In terms of market value, the average market capitalization for firms in the responsible water event pool is around \$141 billion, so a 1.03% difference in CAR translates to about \$1.4 billion. This means, as a result of diminishing marginal returns, high CSR performance firms gain about \$1.4 billion less than their low CSR performance counterparts. Similarly, given the average market capitalization of \$115 billion for firms in irresponsible water event pool, a difference of 1.81% translates to a market value of about

Table 5 CAR comparison between high and low CSR strength/concern group. CARs (-1, 1) are reported in %

	Responsible events				Irresponsible events						
	N	Mean	Diff. of Mean	Median	Diff. of Median	Std. Dev	Mean	Diff. of Mean	Median	Diff. of Median	Std. Dev
Past responsible performance (CSR)	High Strength	161	0.31* (0.057)	-1.03 (0.219)	0.26** (0.040)	-0.60 (0.247)	0.020	1.81*** (0.001)	-0.21* (0.067)	1.56*** (0.004)	0.023
	Low Strength	7	1.34 (0.442)		0.86 (0.453)		0.043	-2.20*** (0.001)	-1.76*** (0.003)		0.026
Past irresponsible performance (CSiR)	High Concern	158	0.36** (0.033)	0.12 (0.868)	0.29** (0.013)	0.30 (0.514)	0.021	1.93*** (0.000)	-0.22** (0.038)	2.23* (0.085)	0.023
	Low Concern	10	0.24 (0.820)		-0.01 (0.754)		0.033	-2.29*** (0.001)	-2.45** (0.023)		0.029

P-values from *t*-tests are in parentheses
 Two tailed sig: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$

\$2.10 billion, indicating the worth of insurance benefit enjoyed by high CSR performance firms compared to low CSR performance firms on an average.

For firms with high concern, when these firms engage in a subsequent responsible water action, they are significantly rewarded by the market with a mean CAR of 36 basis points (p -value = 0.033). This means, in terms of market value, the firms with prior CSiR presence are rewarded by about an amount of \$0.5 billion on average, as a result of their subsequent positive action. However, in case of an irresponsible water event, both high concern and low concern firms receive significant negative market reaction. But the negative CAR for the high concern group is significantly lower than that of the low concern group by 193 basis points (p -value = 0.0003). This represents a market value impact of about \$2.2 billion on average.

However, since we used a hurdle rate to get an indicator variable of CSR and CSiR presence, and most firms from our S&P sample had multiple counts of strengths and concerns, the number in the high and low strength and concern groups are not very balanced. Therefore, we also used non-parametric median tests to check if the results reiterate findings based on mean values. The median column in Table 5 reports these median values, along with p values for whether the median values significantly differ from zero. The median values are close to the mean values for all subgroups and bear similar levels of significance. The difference in median column also reports the same indication as carried by the difference in means, with significant difference between high strength and low strength median CARs (156 basis points; p -value = 0.004) and between high concern and low concern median CARs (223 basis points; p -value = 0.085) in case of irresponsible events. To further validate these indications from univariate analysis and to test H3, H4, H5 and H6, we next applied multivariate regression.

We regressed the 3-day CARs, from responsible and irresponsible events separately, on our list of control variables and our two main dummies of interest. Table 6 shows our main regression results. For robustness, we report our models changing combinations of time and industry variables. In the first model, we control for only industry fixed effects by using industry dummies represented by 2-digit SIC industry codes. In the second, we control for both industry and time fixed effects. Finally, the third model represents our full specification model, where we control for industry and time interaction as well as industry and time variables.

Table 6 shows that in the case of responsible events, the *high strength* group consistently experience lower CARs than the low strength group, and this difference is highly significant in all three models. In model 3, our full specification model, the CAR for the high strength group is significantly lower by 160 basis points (p -value = 0.044) compared to the low strength group, whereas model 1 and 2 report even

Table 6 Impact of prior CSR performance on CARs (− 1,1)

	Responsible events			Irresponsible events		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<i>High strength (dummy)</i>	−0.019*** (0.003)	−0.019*** (0.006)	−0.016** (0.044)	0.016** (0.031)	0.016** (0.024)	0.019*** (0.002)
<i>High concern (dummy)</i>	0.014 (0.352)	0.014 (0.339)	0.025** (0.048)	0.015*** (0.004)	0.015*** (0.001)	0.009* (0.051)
<i>ROE</i>	−0.004 (0.745)	−0.004 (0.751)	−0.012 (0.619)	−0.005 (0.507)	−0.005 (0.513)	−0.017** (0.041)
<i>Leverage</i>	0.020 (0.184)	0.021 (0.198)	0.019 (0.402)	−0.005 (0.837)	−0.005 (0.787)	0.012 (0.518)
<i>Size</i>	0.002 (0.627)	0.002 (0.634)	0.005 (0.265)	−0.002 (0.447)	−0.002 (0.428)	0.000 (0.857)
<i>Age</i>	−0.006 (0.115)	−0.006 (0.120)	−0.008** (0.038)	0.002 (0.570)	0.002 (0.567)	0.002 (0.690)
<i>Tobin's Q</i>	0.001 (0.743)	0.001 (0.739)	0.002 (0.606)	−0.002 (0.527)	−0.002 (0.674)	−0.001 (0.813)
<i>No. of Analysts</i>	0.007 (0.226)	0.007 (0.265)	0.011 (0.137)	−0.008* (0.069)	−0.009* (0.083)	−0.005 (0.514)
<i>Recom Change</i>	−0.000 (0.790)	−0.000 (0.782)	−0.001 (0.483)	0.001 (0.570)	0.001 (0.602)	0.001 (0.702)
Time trend		✓	✓		✓	✓
Industry effects	✓	✓	✓	✓	✓	✓
Time trend and industry effects			✓			✓
Obs	168	168	168	181	181	181
R ²	0.335	0.335	0.502	0.185	0.185	0.253

P-values are in parentheses

Two tailed sig: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$

higher difference of 190 basis points and higher significance at 1% level of confidence. This provides support for H3 that presence of prior CSR performance exhibits diminishing marginal returns, and that the stock market reacts less positively to a positive water initiative by the high strength group than it does for the low strength group. For irresponsible events, the CARs of the high strength group in all three models in Table 6 are significantly higher than their low strength counterparts. The difference amounts to 190 basis points in model 3 (p -value = 0.002) showing that the fall in share price is lower for the high strength group than for the low strength group. This provides evidence in favor of an insurance effect of prior CSR performance as proposed in H4. In terms of market value, these CAR differences indicate the average worth of diminishing marginal returns effect to be about \$2.25 billion, and insurance effect about \$2.20 billion, in line with our univariate findings.

The *high concern* dummy shows that firms with presence of prior CSiR performance earn significantly more CAR from subsequent responsible water events. Though in model 1 and model 2 for responsible events we only get directional results, in model 3 including the full specification,

the positive coefficient of 250 basis points is significant at the 5% confidence level (p -value = 0.048). This significant positive coefficient indicates that the market reacts more positively to responsible water actions by the high concern group compared to the low concern group, providing evidence for the offsetting effect specified in H5. Finally, when we turn to the high concern group in the case of irresponsible events, we see that they experience a lower fall in CARs than the low concern group, as indicated in all three models. In model 3 this difference is shown to be about 100 basis points (p -value = 0.051). But both model 1 and 2 report higher magnitude of difference of 160 basis points, both significant at 1% level of confidence. Therefore, we have evidence in favor of the diminishing marginal negative returns effect resulting from market indifference, as hypothesized in H6. In terms of market value, these CAR differences indicate the average worth of offsetting effect to be about \$3.5 billion, and diminishing marginal negative returns effect about \$1.04 billion, in line with our univariate findings.

Table 7 Robustness checks using different combinations of explanatory variables

	Responsible events			Irresponsible events		
	Model 1: net score	Model 2: only strength	Model 3: only concern	Model 1: net score	Model 2: only strength	Model 3: only concern
<i>High strength (dummy)</i>		-0.013 (0.117)			0.022*** (0.001)	
<i>High concern (dummy)</i>			0.025* (0.057)			0.014** (0.014)
<i>Net score dummy</i>	0.001 (0.780)			0.005** (0.032)		
<i>ROE</i>	0.007 (0.660)	0.001 (0.975)	-0.001 (0.961)	-0.017** (0.048)	-0.019** (0.026)	-0.015* (0.063)
<i>Leverage</i>	-0.014 (0.164)	0.002 (0.953)	-0.002 (0.925)	0.023 (0.323)	0.010 (0.597)	0.023 (0.274)
<i>Size</i>	0.005 (0.252)	0.005 (0.254)	0.004 (0.278)	0.006*** (0.000)	0.001 (0.422)	0.004** (0.048)
<i>Age</i>	-0.010* (0.056)	-0.009** (0.041)	-0.009** (0.046)	0.003 (0.420)	0.002 (0.666)	0.002 (0.559)
<i>Tobin's Q</i>	-0.000 (0.969)	0.001 (0.833)	0.000 (0.902)	-0.003 (0.614)	-0.002 (0.775)	-0.002 (0.685)
<i>No. of Analysts</i>	0.007 (0.307)	0.011 (0.184)	0.006 (0.363)	0.006 (0.563)	-0.004 (0.688)	0.002 (0.858)
<i>Recom Change</i>	-0.001 (0.741)	-0.001 (0.681)	-0.001 (0.580)	0.001 (0.731)	0.001 (0.683)	0.001 (0.772)
Time trend	✓	✓	✓	✓	✓	✓
Industry effects	✓	✓	✓	✓	✓	✓
Time trend and industry effects	✓	✓	✓	✓	✓	✓
Obs	168	168	168	181	181	181
R ²	0.480	0.483	0.497	0.224	0.247	0.233

P-values are in parentheses

Two tailed sig: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$

Robustness

For robustness, we repeated our tests using CARs calculated over 5-day $(-2,2)$ and 2-day $(-1,0)$ windows. We also applied alternative methods of CAR calculation using value weighted market portfolio, and the Fama–French 3-factor model. Our results remained qualitatively same under all scenarios. Another important concern could be that since we are using both strength and concern scores in the same model, it might sometimes give spurious results. We therefore, used a net score dummy, formed by deducting the concern score from the strength score and then identifying those with a net score of 1 or higher as the high group. We also used only strength and only concern once at a time in a model. These results reported in Table 7 give us a weaker picture of the proposed relationships since the models do not represent all variables and specifications. But this helps illustrate that even

without the full specifications, the offsetting, insurance, and diminishing negative return effects all come out significant (p values of 0.057, 0.001, and 0.014, respectively). Though diminishing positive returns marginally loses significance (p -value = 0.117), the direction of the result maintains. The net score dummy maintains indication of the insurance effect, with the high net score group realizing higher CAR (50 basis points, p -value = 0.032) in the case of irresponsible events. Although the net score model does not provide any significant results for responsible events, it does not also show anything contradictory to our proposed effects. If we use continuous variables of strength and concern to replace the dummy variables, the results lose significance, except diminishing marginal returns (H3). However, this does not contradict to our findings, as we hypothesize hurdle effects rather than continuous effects.

Table 8 Impact of prior water performance on CARs

	Responsible events			Irresponsible events		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<i>Water performance measure</i>	−0.007 (0.278)	−0.007 (0.293)	−0.011** (0.027)	0.009** (0.010)	0.009*** (0.006)	0.009** (0.016)
<i>ROE</i>	0.009 (0.501)	0.009 (0.530)	0.018 (0.359)	−0.007 (0.376)	−0.007 (0.418)	−0.018*** (0.008)
<i>Leverage</i>	0.005 (0.716)	0.004 (0.771)	−0.021* (0.098)	−0.002 (0.938)	−0.002 (0.939)	0.024 (0.260)
<i>Size</i>	0.003 (0.506)	0.003 (0.506)	0.005 (0.273)	0.003** (0.051)	0.003* (0.068)	0.005*** (0.000)
<i>Age</i>	−0.009* (0.050)	−0.009* (0.055)	−0.012** (0.025)	0.003 (0.422)	0.003 (0.423)	0.002 (0.675)
<i>Tobin's Q</i>	−0.001 (0.769)	−0.001 (0.797)	−0.001 (0.809)	−0.003 (0.542)	−0.003 (0.569)	−0.004 (0.532)
<i>No. of Analysts</i>	0.004 (0.502)	0.003 (0.712)	0.007 (0.300)	−0.001 (0.905)	0.000 (0.965)	0.006 (0.511)
<i>Recom Change</i>	0.000 (0.863)	0.000 (0.883)	−0.001 (0.513)	0.001 (0.669)	0.001 (0.679)	0.001 (0.736)
Time trend		✓	✓		✓	✓
Industry effects	✓	✓	✓	✓	✓	✓
Time trend and industry effects			✓			✓
Obs	149	149	149	162	162	162
<i>R</i> ²	0.220	0.221	0.414	0.133	0.134	0.228

P-values are in parentheses

Two tailed sig: **p* < 0.1; ***p* < 0.05; ****p* < 0.01

A remaining concern is that KLD ESG dataset already includes water issues under its ENV categories. In addition, several items under strength and concern of ENV categories are directly related to firms' actions to water issues. This might cause the problem that our key explanatory variables are not clearly separate from research contexts. Therefore, for robustness, we excluded all the water parameters in calculating our CSR score from KLD and repeated our tests with this truncated measure. Our reported findings maintain, except the offsetting effect loses significance.

Results Using Trucost Water Performance Measures

We also carried out tests using water consumption data from Trucost to check if prior performance in the specific field of water creates reputational effects compatible with the findings on general CSR strengths and concerns. Since Trucost data do not provide separate indications of strengths and concerns, we used a single continuous measure of water performance and checked if that has any connection with the way the market reacts to a subsequent water action. Table 8

shows our regression results using the 3-day CAR as the dependent variable and the water performance measure from Trucost as the main independent variable. The number of observations is different than in the KLD model because some firm-years that were included in our previous analysis had missing data for Trucost.

The results show that the higher the water performance measure (better water performance), the lower is the CAR from a responsible water event. Model 1 and 2 provide directional indication of this, while model 3 with full specification of the industry and time variables shows that the negative coefficient of −0.011 is significant with a *p*-value of 0.027. This indicates that the diminishing marginal return effect is strongly evident even when we look at a firm's specific performance and reputation in the field of water and on a continuous rather than a hurdle basis. In the case of irresponsible events, the insurance effect is strongly evident and significant in all 3 models. The higher the water performance measure (better water performance), the higher is the CAR (less fall in share price), by about 90 basis points (*p*-value = 0.016 in model 3).

Discussion

Although prior research has used event study methodologies to explore the market reaction to CSR events in different contexts, ours is the first study that investigates the market reactions in the new business ethics context of corporate water actions. Water demands exclusive research attention as a scarce, irreplaceable, and underpriced natural resource, representing rising concerns for sustainability in both the natural and business world. Despite growing awareness among all stakeholders about the ethical and allocative implications of business water usage and other corporate water actions, there is still a long way to go to give water its due worth, and corporate water actions remain an under-researched field. Our empirical work helps by exploring and quantifying the financial impact of corporate water actions in a large sample setting. Our findings should encourage business organizations to pay more attention to responsible water actions and also aid understanding of how water is a financial as well as a material and ethical issue for large firms.

We analyze manually constructed sets of responsible and irresponsible water actions and test stock market reactions. Our findings show that the market reacts positively to a responsible water action (CSR), and negatively to an irresponsible water action (CSiR). This demonstrates that, just like any other aspects of CSR, water deserves to be considered and incorporated in the CSR strategies of organizations in its own right. This is not only because of the moral implications, but also because it can offer strategic and financial advantages and carry value for shareholders as reflected in the stock market. This finding suggests that firms should be more aware of their water actions, engaging more responsibly and reporting their positive actions through more transparent reporting and disclosure.

Another important contribution of our paper is that we capture the theoretical distinction between CSR performance and actions, and show that market reactions to water-based CSR/CSiR actions bear strong relationships with prior overall CSR and CSiR performance by firms. We explain these associations in terms of positive and negative reputation built from the prior CSR and CSiR performance by firms. These associations help to show that effects of general CSR/CSiR performance reputation extends to water issues, and that the financial impacts of water actions should be interpreted in relation with the broader context of overall firm CSR and CSiR performance.

Most related research has concentrated on the creation of reputational capital from prior good CSR performance and its effects for subsequent events from specific areas. However, we point out that prior negative CSR (CSiR)

performance could create reputational liability that is a separate and independent construct from reputational capital. We devise a two-by-two matrix proposing four distinct effects of past responsible and irresponsible performance on market reaction in the context of water actions. Our analysis shows favorable evidence for all four proposed effects: diminishing positive marginal returns and an insurance effect for past responsibility; and diminishing negative marginal returns and an offsetting effect for past irresponsibility. Our findings support previous studies like Flammer (2013), Godfrey et al. (2009) and Kruger (2015), which have provided evidence in favor of diminishing marginal returns, insurance, and offsetting, respectively, from varying areas of CSR. However, our contribution is unique because we provide empirical support for the complete grid of all four effects shown in Table 1 in a single study, focusing on events from the under-explored ethical domain of corporate water actions. This adds more uniformity to the results, from one of the most under-researched areas of CSR. Our study is also unique in exploring the overall effects of general past CSR performance as a composite measure. In her 2013 paper, Flammer mentioned that one of the main directions for future research could be to investigate if the diminishing marginal returns, which her paper demonstrated for environmental CSR, applies to CSR in general. We answer this call, by investigating the impact of aggregate past performance arising out of all kinds of CSR, and exploring if this prior CSR influences market reactions in the niche context of corporate water actions.

We find these effects of prior CSR/CSiR performance on market reactions to be very strong and robust. Even when we narrow down our scope and definition of prior performance to the specific field of water, and use specific water consumption data from Trucost as a measure of water performance, we obtain similar results as proposed in our matrix. Given the continuous nature of this measure, we are able to construct a continuous score for corporate water performance. With this narrower scope (water performance only) but more precise (continuous span data) measure of performance, we get strong evidence in favor of both the diminishing positive marginal returns and insurance effects. This suggests that whether we measure performance broadly at general CSR level or from the specific domain of water actions, our proposed reputational effects are equally applicable in both scenarios.

Implications of the Findings

Our findings have both theoretical and practical implications. First and foremost, our study informs researchers and practitioners about the shareholder wealth effects of

corporate water actions. These impacts should motivate business organizations to drive responsible water actions, and avoid irresponsible water actions simultaneously. Secondly, our study demonstrates that the shareholder wealth effects of water actions are associated with the broader context of overall firm CSR and CSiR performance. In studying the influence of prior CSR/CSiR performance, this paper contributes to the strategic CSR literature, adding new perspectives to theories positioning CSR as a source of competitive advantage and reputational capital. We extend these theories by proposing that prior negative CSR performance (CSiR) can similarly act as a strategic disadvantage and reputational liability. In case of any subsequent positive action by the firm, CSR reputational capital and CSiR reputational liability independently affect the way market reacts to the action, and both factors need to be built in together for a comprehensive analysis of effects. From a practical perspective, our study emphasizes the incentives for firms to balance between doing good actions and avoiding bad actions.

Although firms with prior CSR performance earn returns at a lower rate from a subsequent responsible action than firms with no notable presence of prior CSR performance, the returns are positive for both groups. That is, all firms benefit on average from responsible water actions, but the market develops more expectations from the high performers and provides greater incentives to the low performers to engage in good actions. As good CSR performance raises the bar, firms need to maintain and build on their good practices to maintain legitimacy and meet expectations (Mishina et al., 2010). This is a particularly striking finding in the current context where expectations of CSR are increasing, gradually decreasing the value of the status quo (Barnett, 2007). More importantly, firms that keep doing good deeds keep accumulating additional buffers for a rainy day. In case the firm makes a mistake, or faces a crisis, the market can be expected to provide value protection or insurance-like benefits, and react less negatively to the event, as reward for the firm's prior good performance.

As for firms with notable presence of prior irresponsibility, corporate leaders should not feel demotivated to engage in a subsequent good action or think that the market will not be responsive enough in case they do. Rather, the market

reacts more positively as encouragement to this group when they do something responsible, which we term an offsetting effect. In the case of a subsequent irresponsible action, firms that already have records of prior CSiR performance, experience less negative market reactions compared with their counterparts. This is an extension of the same diminishing returns principle that is experienced with positive past performance and subsequent responsible actions. The market holds higher expectations from firms without prior CSiR performance records, and grows somewhat indifferent to the subsequent bad actions of poor performers with prior CSiR.

A key theoretical nuance in our study is that all the effects that we propose are non-continuous in nature and are connected with hurdle rates as the general relationship between CSR and CFP is non-linear in nature (Barnett & Salomon, 2012). Especially, in the case of both the offsetting and diminishing negative marginal returns, the effects of prior CSiR performance are strictly proposed for marginal defaulters. Since reputational liability is sticky and more difficult to overcome than positive reputation (Sirsly & Lvina, 2019; Zavyalova et al., 2017), if the CSiR performance and associated negative reputation get too high, it might rather generate a sense of distrust among shareholders and hamper the firm's credibility. Regarding offsetting effect, the positive market reaction represents market encouragement provided to marginal CSiR performers to engage in subsequent positive actions. Regarding diminishing negative marginal returns, if the firms keep continuing the CSiR performance, at some stage the shareholders may likely give up on these firms and rather start penalizing them at an increasing rate (Haack et al., 2014; Zavyalova et al., 2017). The practical implication from this theoretical extension is to highlight incentives for firms to avoid repeated bad or irresponsible deeds.

Limitations and Scope for Future Research

Our study has its own limitations. First of all, we have not explored the long-run financial impact of corporate water actions. Investigating either long-run abnormal returns to corporate water actions, or commonly used long-term firm

performance measures like return on assets, free cash flow, Tobin's Q, etc., in the context of corporate water actions, could prove to be interesting avenues for future research. Secondly, our sample was limited to those S&P 500 listed companies mentioned in water news articles. Future research including smaller and/or private firms could further explore whether the effects we reported is generalizable to less publicly visible firms. Third, we only tested the two-by-two matrix of CSR and CSiR performance in the context of corporate water actions. Future research could explore the empirical implications of this matrix in a wider span of CSR areas, separately or on an aggregate level. Finally, and most importantly, although our study sheds indirect light on the value of water actions to shareholders, we acknowledge that the value of water is far broader in ethical and allocative terms than stock market reactions.

Conclusion

Contemporary trends such as climate change, urbanization, population growth, and a surge in industrial and economic activities, have continued to exacerbate various

water-related problems. Water underpins human health, natural habitats, and socio-economic systems, but is routinely not considered or valued appropriately in the current economic system. Our study is the first to establish that stock markets react to corporate water actions. We find that responsibility toward water issues is rewarded and that irresponsibility is noticed and punished in the financial market. Past CSR and CSiR performance influence market reactions when firms undertake subsequent responsible or irresponsible water actions. Our findings are useful to future researchers, suggesting new research directions and focus for studies on corporate water actions specifically and CSR more broadly. They also serve as a call to arms for corporate leaders and policy-makers to more fully value this traditionally undervalued resource.

Appendix 1

See Table 9

Table 9 Examples of sample events

Company name	News date	Featured water issues
Responsible water actions		
IBM	25-Apr-07	IBM helps bid to protect important river systems
Chesapeake Energy Corp	19-Nov-12	Drillers begin reusing 'frack water'
Johnson and Johnson	21-Mar-13	Helping to preserve New Jersey's Raritan River
e-Bay	8-Sep-14	Firms avoid drought effects – air-cooled computer servers, low-flow toilets conserve water on west coast
Conoco Phillips	27-Oct-14	Oil sands group commits to cutting environmental impact; COSIA commits to reducing fresh water use at some operations
Microsoft	24-Jun-15	High tech rethinks water use for cooling—harvesting rainwater is one alternative
Coca Cola	29-Aug-16	Coca Cola and its bottling partners meet 2020 water replenishment goal five years early
Irresponsible water actions		
Pulte Homes Inc	12-Jun-08	Feds fine homebuilders for water pollution
General Electric	18-Dec-10	EPA Presses GE on Cleanup of River
Baker Hughes Inc	1-Feb-11	Energy companies faulted on fracturing
Apple Inc	1-Sep-11	Apple faces environmental criticism in China over supplier plants
Anadarko Petroleum Corp	23-Feb-12	Judge rules BP, Anadarko Liable in Gulf Spill
Tesoro Logistics	10-Oct-13	Tesoro logistics pipeline spills 20,000 barrels in North Dakota; accident appears to be the largest to date in Bakken Shale Formation
Coca Cola	19-Jun-14	Water shortage shuts Coke plant in India
Berkshire Hathaway Inc	22-Jul-16	Berkshire Hathaway utility, others to clean up coal plant waste

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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