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Environmental Incidents and the Market Value of Firms: An Empirical Investigation in the Chinese Context

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We examine firms listed on the Shanghai/Shenzhen Stock Exchange to investigate stock market reactions to 294 Chinese manufacturing firms involved in 618 environmental incidents between 2006 and 2013. Through our event studies, we find empirical evidence of a significantly negative stock market reaction to announcements of environmental incidents. Our empirical analysis reveals that Chinese firms with higher government share (of ownership) and recognition on social responsibility tend to be less affected by such incidents; however, Chinese firms with stronger personal political ties (i.e., top management teams or board members with concurrent or prior government appointments) are actually affected more when environmental incidents occur. Moreover, environmental incidents caused by Chinese firms can have a significantly negative impact on the market value of their overseas customers.

Keywords: Environmental Incident, China, Stock Market Reaction, Supply Chain, Social Responsibility

1. Introduction

Rapid economic development in developing countries such as China has led to severe environmental problems, including air and water pollution, industrial waste, and the abuse of natural resources. Zhang et al. (2014) report that environmental pollution is extreme in China. A total of 20% of the country's rivers are poisonous (Miao et al. 2015, Yang 2012), and air pollution has been shown to shorten the lifespan of people in Northern China by 5.5 years (Chen et al. 2013). Although environmental incidents in the country are a serious public concern, the reaction of the Chinese stock market to such incidents is unclear. The present study examines their impact on the market value of Chinese firms, and our findings may serve as a reference for various stakeholders (i.e., firms, governments, investors, overseas customers, and nongovernment organizations [NGOs]) seeking to develop effective mechanisms aimed at mitigating environmental incidents in China. In addition to studying the reaction of the Chinese stock market to Chinese suppliers who violate certain environmental regulations, we examine the impact of environmental incidents involving Chinese firms on the stock price of their overseas customers.

Although extant empirical evidence illustrates the positive impact of environmental initiatives on firm performance in the context of developed economies (e.g., Jacobs et al. 2010, Klassen and McLaughlin 1996, Lo et al. 2012), few studies have examined the negative impact of environmental incidents on firm performance in developing countries such as China. Among developing countries worldwide, China appears to have the most severe environmental problems (Jakuboski 2014), and stock market data in the country are relatively accessible with detailed archival data for analysis.

Because of China's unique political and social systems, Chinese firms might address environmental incidents differently than those in developed economies, which may cause investors to react differently to environmental incidents involving Chinese firms. Specifically, firms in China may rely more on certain types of legitimacy, social relations, and political ties as "talismans" that can protect against adverse incidents. First, because of the country's opaque business environment, many Chinese firms utilize social recognition to gain legitimacy, building public trust and reputation. Second, because of China's complex legal structure, Chinese firms with government ownership benefit from such social relations because of the legal and financial support they receive from the government. Third, because of the country's bureaucratic system, many Chinese firms establish personal political ties by appointing current or former government officials to their management teams, with the objective of using these ties to help the firms derive additional administrative support, market intelligence, and policy insight. In other words, Chinese firms are keen to obtain strategic resources (i.e., legitimacy, government relationships, and political ties) to succeed (Acquaah 2007, Hitt et al. 2000, Peng and Heath 1996, Pfeffer and Salancik 1978, Powell 1990) and to mitigate the potentially negative impact of environmental incidents.

To improve its image of being a global polluter, the Chinese government developed the Measures on Open Environmental Information (MOEI), which require governmental organizations to proactively publicize environment-related information (Tan 2014). The MOEI led to the formation of the Institute of Public and Environmental Affairs (IPE), a nonprofit organization based in Beijing that has developed an online database on environmental incidents committed by certain Chinese firms. The IPE database is now a renowned source of information for multinational corporations (MNCs) and NGOs in Western countries; it is specifically used for monitoring the environmental performance of their Chinese suppliers. With increased environmental transparency and tighter monitoring, multinational brands' supply chains are subject to greater public scrutiny (Plambeck et al. 2012). Therefore, an environmental incident committed by an upstream supplier might also cause reputational damage and negative stock market reactions for its overseas customers (Klein et al. 2004). Given this context, we examine the following three research questions (RQs) in this study:

RQ1. Will stock markets react negatively to an environmental incident committed by Chinese firms?

RQ2. Will the (a) social recognition, (b) government ownership, and (c) political ties of Chinese firms mitigate the negative market reactions to environmental incidents involving those firms?

RQ3. Will environmental incidents by Chinese suppliers lead to a negative stock market reaction for their overseas customers?

Because manufacturing operations are a major source of pollution in China, we investigate these three research questions by focusing on manufacturing firms (i.e., Industries C13–C43 under the China Securities Regulatory Commission classification system). Our empirical analysis elucidates these three research questions, as described in the following text. First, we find empirical evidence on the negative impact of environmental incidents on firms' stock performance in China. Second, we also find that Chinese firms with higher recognition on social responsibility and higher government share (of ownership) are affected considerably less after an environmental incident occurs. By contrast, firms with more personal political ties (i.e., those whose top management teams [TMTs] or board members are current or former government officials) are actually affected more after an environmental incident. Our findings suggest that in the Chinese context, firm legitimacy through recognition on social responsibility and government share of ownership is a strategic resource that firms can acquire over time to mitigate operating risks associated with environmental incidents. However, we reveal that TMTs'/board members' personal political ties can become a liability for Chinese firms in the case of environmental incidents. We argue that although personal political ties may enable firms to operate efficiently through interpersonal networks (Sheng et al. 2011), they also might obscure or conceal potential environmental risks to a firm's operations. This leads to greater skepticism from the public and a more negative stock market reaction to environmental incidents. Finally, we find that environmental incidents committed by Chinese suppliers can have a significant negative impact on the market value of their overseas customers, suggesting that environmental incidents of upstream suppliers can directly affect downstream supply chain partners.

2. Literature and Research Questions

Much research has been conducted on the impact of environmental performance on the market value of Western firms. Generally, weak environmental performance typically has a negative effect on firm performance (Brown and Dacin 1997, Gupta and Goldar 2005, Klassen and McLaughlin 1996, Porter and Kramer 2006), whereas strong environmental performance improves firm performance (Jacobs et al. 2010, Lo et al. 2012, Mitra and Datta 2014). By using an event study approach, Klassen and McLaughlin (1996) show that the market reacts positively to environmental improvements but negatively to environmental crises. Jacobs et al. (2010) examine the market reaction to corporate environmental initiatives and environmental awards and certifications in the US market. They find that "philanthropic gifts for environmental causes" and "ISO 14001 certification" are associated with a positive market reaction, whereas "voluntary emission reductions" are associated with a negative one. Pil and Rothenberg (2003) indicate that superior environmental performance could act as a significant driver of superior product quality. Gonzalez-Benito and Gonzalez-Benito (2005) find that environmental management generates competitive outcomes for firms, including a higher product quality and more effective processes. Previous studies, however, focus mainly on developed countries, and only few studies examine this issue within the context of emerging markets.

Gupta and Goldar (2005) examine the impact of environmental ratings on the stock prices of 50 large Delhi-based Centre for Science and Environment-rated pulp and paper, auto, and chlor-alkali firms in India. They find a positive correlation between market returns and the firms' levels of environmental performance. Using survey data from Indian manufacturing firms, Mitra and Datta (2014) find that supplier collaborations aimed at environmental sustainability have a positive effect on environmentally sustainable product design and logistics, which improves the competitiveness and economic performance of these firms. Economic benefits include favorable insurance premiums, because greener firms are at less risk of operation disruptions.

However, investor reactions to environmental incidents are also contingent on the prevailing social, cultural, and institutional environment. A meta-analysis of 64 related papers (Horváthová 2010) suggests that the link between environmental incidents and firm performance is significantly affected by political and legal systems, the status of social development, and geographical factors. Although the literature generally suggests a significantly negative interpretation of environmental incidents, most related studies have been conducted in a Western context. Because of the prevalence of pollution in China, investors may have lower expectations on the environmental performance of Chinese firms and are thus less sensitive to some environmental incidents. Tian et al. (2011) find that Chinese consumers have a low level of corporate social responsibility (CSR) awareness and seldom respond to firms' CSR initiatives. In addition, the Chinese stock market is dominated by individual investors (instead of institutional investors), and research shows that individual investors in China are not sensitive to firms' CSR incidents (Wang et al. 2011). Consequently, the stock market reaction to environmental incidents in China could differ markedly from reactions in other countries. These observations motivated us to examine our first research question (RQ1).

The stock market reaction to environmental incidents in China could differ from reactions in other countries because of China's unique political system, social values, and cultural history. These potentially contributing factors motivated us to explore our second research question (RQ2), which examines whether social recognition, government ownership, and political ties can moderate the negative impact of environmental incidents in the Chinese context. We elaborate on these factors in the following text.

2.1. Recognition on Social Responsibility

Recognition on social responsibility (e.g., receiving CSR awards) is considered particularly critical for gaining political backing and general public recognition in the Chinese context; formal institutions in China are weak, which forces Chinese firms to rely heavily on informal mechanisms when interacting with the government and other stakeholders (Puffer et al. 2010). The established social and political legitimacy might create goodwill and offer insurance-like protection in the case of environmental incidents (Godfrey

2005, Godfrey et al. 2009). Positive attributions from stakeholders through CSR awards are particularly crucial under weak institutional protection contexts in many developing countries such as China.

In China, the market reaction to environmental incidents could be less severe for firms with higher recognition on social responsibility because a favorable reputation is an institutionalized and legitimized perception among stakeholders (King and Whetten 2008, Zucker 1977). Socially responsible behaviors of firms provide the public with an image of persistence and stability, which enables firms to gain the trust of stakeholders (Rhee and Haunschild 2006, Zucker 1977). Firms with favorable reputations are less vulnerable to environmental incidents because shareholders may rationalize that the incident was a careless slip rather than a systematic flaw.

However, environmental incidents might also lead to more negative market reactions for firms with higher recognition on social responsibility as a result of an expectancy violation effect. A firm's good reputation enhances stakeholder expectations regarding the firm's behavior (Shapiro 1983), and these high expectations generate speculation that drives shareholders to invest in such firms (Stigler 1983). When environmental incidents are disclosed, investors may modify their beliefs and adjust their behaviors and stop investing in the offending firms (Cyert and DeGroot 1987), leading to a more severe drop in their market value. Faced with opposing viewpoints regarding the impact of social recognition on market reactions associated with environmental violations, we examine whether recognition on social responsibility moderates the negative impact of environmental incidents to address RQ2a. We measure recognition on social responsibility according to the number of social responsibility awards received by a firm prior to an environmental incident, using a yearly depreciation rate corresponding to the event year.

2.2. Government Share of Ownership

Since 1997, the Chinese government has converted many state-owned enterprises (SOEs) into shareholding corporations, enabling them to sell their shares on the Shanghai and Shenzhen Stock Exchanges. To attract direct investment and improve SOE competitiveness, the Chinese government concurrently encourages SOEs to seek "mixed ownership" as a solution to their financial problems (Meyer and Wu 2014). In addition, the Chinese government acquires private firms for the strategic development of a certain industry. Despite the call for mixed ownership, mixed-ownership companies that have a higher percentage of government ownership can ensure superior resource allocation, greater protection of assets, and more favorable tax rates (Lau et al. 2002). Moreover, in the event of a serious environmental incident, a firm with a higher percentage of government ownership is more likely to receive stronger financial and legal support from the central government, which provides investors with greater confidence. Therefore, we seek to reaffirm the moderating role of government ownership to address RQ2b.

2.3. Personal Political Ties

Sun et al. (2015) suggest two major types of political ties exist between a firm and the Chinese government: (a) an organizational association through government ownership, and (b) a personal political association between senior management and government officials. Although the government's share of ownership provides direct support for a firm to operate successfully in China, the general belief is that conducting business in China also requires personal political ties. Such ties, which include concurrent appointments in the firm and government or the hiring of former government officials, are considered to be a crucial means for building social relations with the government. However, when an environmental incident occurs, firms with personal political ties are likely to attract extra media attention and cause additional social concern. Such doubtfulness in the public results in greater uncertainty in the stock market, making investors more anxious when environmental incidents occur with firms that have a high level of personal political ties. Hence, there are opposing viewpoints regarding the impact of political ties on market reactions to environmental incidents.

On one hand, a common perception exists among Chinese investors that senior executives with a political background are more capable of concealing the issue so that what is reported appears to be much less serious than what has actually occurred (Chen and Wu 2007, Zhou 2010). Chen and Wu (2007) suggest that many government officials with administrative authorities in China can cover up negative incidents. Government officials associated with a polluting company might also be motivated to conceal any incidents to protect their personal reputations. Such phenomena have been documented by scholars in this area (e.g., Lu 2000, Zhou 2010) and are widely reported by the Chinese media. Thus, if the truth (i.e., the real consequences of the environmental incident) were to be eventually revealed, the company would need to pay a much higher price than what was originally reported. Such doubtfulness among the public might create further concern in the community.

On the other hand, one of the major purposes of appointing government officials is to provide a social network and build effective relations with the government. Consequently, investors may believe that such personal political ties would assist in protecting a firm if it were involved in an environmental incident. In other words, investors might believe that personal political ties could protect firms through personal government networks, and thus they will react less negatively to environmental incidents. These opposing viewpoints motivated us to examine the possible moderating effect of personal political ties on the market value of firms in the case of environmental incidents in order to address RQ2c.

2.4. Overseas Customers

Because of greater supply chain transparency and the initiatives of the Chinese government (i.e., MOEI), it is much easier for overseas customers (i.e., sourcing firms) and NGOs to obtain information on the environmental performance of Chinese firms. Furthermore, stakeholders can assess the commitment of a sourcing firm to environmental performance in the supply chain by various means (Lo et al. 2012). In fact, many MNCs, such as Starbucks and Target, have established ethical sourcing departments to safeguard against unethical sourcing behaviors and to strictly control the ethical behaviors of their suppliers. This commitment reflects the importance of ethical sourcing in developed countries.

However, environmental incidents involving Chinese suppliers might have no impact on their overseas customers, as evidenced by some recent incidents. For example, recent socially irresponsible labor practices at Foxconn appear to have had little negative impact on Apple's sales growth. Consumers may expect that pollution is common in developing countries and believe that the issue is not the responsibility of individual buyers (Josephs 2014). Jacobs and Singhal (2017) find that the Rana Plaza disaster, the second-worst industrial incident in history, did not have a negative impact on the stock prices of retailers that sourced from Bangladesh because the accident might have been considered to be beyond the control of retailers as contracted buyers. Similarly, investors might perceive that environmental incidents in China are beyond the control of overseas buyers and thus buyers should not be held accountable. Given these opposing viewpoints, we examine the impact of environmental incidents in China on the stock market reactions of their overseas customers to address RQ3. Figure 1 displays our framework and visualizes our research questions.

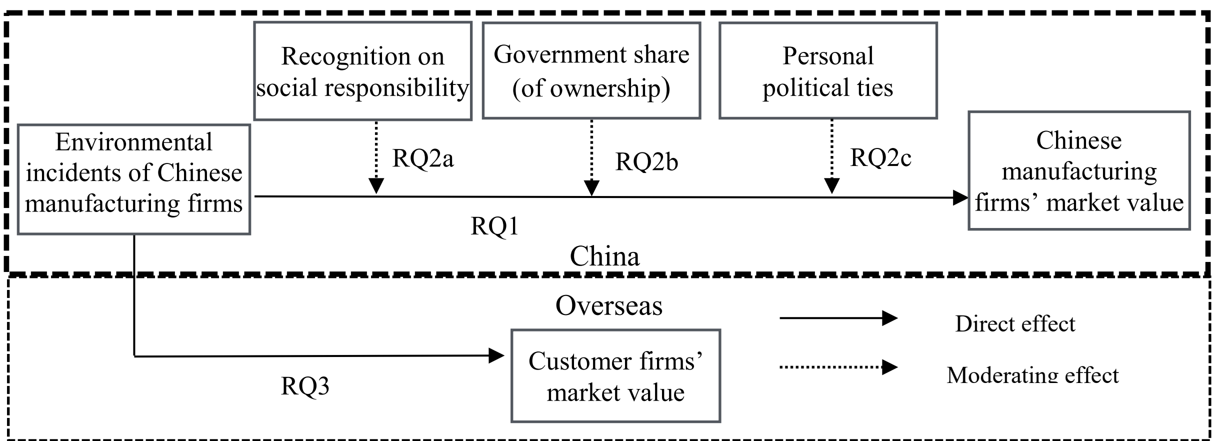

Figure 1: Research Framework of the Direct and Moderating Effects

3. Data Sources and Variables

3.1. Environmental Incidents

Although the Chinese government collects and monitors information associated with environmental incidents, the actual data are managed by various Chinese government offices in different departments; news service agencies in different counties, cities, and provinces; or other offices at the central government in Beijing. Gathering information on environmental incidents from disaggregated data sources is challenging for researchers. This was the situation until 2006, when IPE, a Beijing-based NGO supported by the central government, was established.[1] IPE gathers information on environmental incidents from various government departments or news service agencies at different levels and establishes an easily accessible database. Although the IPE database provides the date for when the government announces environmental incidents, this date is not necessarily the earliest date that the public becomes aware of the news. This discrepancy can occur for two reasons. First, there could be multiple government sources and IPE might not correctly identify the source that first recorded the data. Second, media reports are occasionally released before the government makes a formal announcement. We thus searched individual environmental incidents through WiseNews[2] to ensure we captured the public notification date.

From the IPE database, we identified 1,833 environmental incidents involving 524 publicly listed manufacturing firms between 2004 and 2013 (there is a total of 1,675 listed manufacturing firms in China by 2014).[3] We define the announcement date of the incident as day 0. We deleted 377 routine monitoring reports that are published on a daily or monthly basis that did not involve any major environmental incidents (e.g., NO_x emission levels exceeding the standard by 0.1 in a monthly monitoring report). We then removed 311 duplicate announcements to avoid double-counting. In this study, which uses the event study methodology (e.g., Brown and Warner 1985; detail justifications in Section 4.1), we evaluate abnormal stock price changes of the sample firms during a short time period (i.e., Days −1, 0, and 1). Therefore, we further eliminated 257 incidents with unavailable stock price data because these firms were under trade suspension in the period. We discarded 45 announcements because of inadequate historical stock price data (200 trading days from Day −11 prior to the incident), which were required to conduct our event study. We also discarded 62 incidents announced in or before 2005, the year in which the Chinese government implemented a non-tradable share (NTS) reform. The trading before the NTS reform is against the assumption of market efficiency for a short-term event study. We also discarded 5 announcements related to nuclear or radiation incidents. These events differ considerably from most other types of environmental incident and may receive additional attention from both the government and the public.

3.1.1. Confounding Events

[1] IPE aims to "promote widespread public participation in environmental governance" by collecting and disseminating all historical and current environmental incident announcements from various government offices (i.e., cities, provincial, and central). IPE has concurrently compiled information from other sources, including newspapers and companies' corporate social responsibility reports. IPE also interacts with violators to provide updates of their follow-up or corrective measures on the Website. In the research community, it is recognized as a trusted resource of environmental incident announcements in China, and the data provided by IPE are commonly referenced by academic publications, including *Journal of Operations Management* (e.g., Gualandris et al. 2015), *Harvard Business Review* (e.g., Lee 2010), and *Nature* (e.g., Qiu 2010).

[2] WiseNews (wisernews.wiser.net), the most comprehensive Chinese news database, covers 1,600 newspapers and periodicals published in Mainland China, Hong Kong, and Taiwan. Most university research libraries subscribe to this news database for research on events in Mainland China. Although WiseNews covers both daily news sources and periodicals, our data collection focuses only on the daily news sources.

[3] IPE was established in 2006, but its database contains data on companies' environmental incidents since 2004.

To remove the influence of confounding events (including declarations of dividends, announcements of an impending merger, signings of a major government contract, announcements of a new product, filings of major damages lawsuits, announcements of unexpected earnings, and changes in key executives (McWilliams and Siegel 1997), we searched for confounding events near the date of each announcement by using a 4-day window (i.e., Days −2, −1, 0, and 1), as Klassen and McLaughlin (1996) recommended. Using WiseNews to search for various confounding events, we found 142 announcements in our sample with confounding events from 2 days before to 1 day after the event date (Days −2 to 1). We also found 16 announcements that included firms with market rumors within 15 days prior to the event (e.g., unverified news of restructuring or divestitures, joint ventures, acquisition activities, and large lawsuits), which might lead to potential fluctuations in stock price. In total, we discarded 158 incidents with confounding events from our sample. Finally, we conducted our analysis using a final sample of 618 environmental incidents that involved 294 manufacturing firms.

Table 1a shows the steps for constructing the final sample; we recorded the announcement date, location, fine amount, legal action, source of announcement, and incident type. For each environmental incident, we collected historical data on the stock price and market index from the Thomson Reuters Eikon database, and Fama–French three factors from the financial database provided by GTA Information Technology Co., Ltd[4] for the offending firm according to the estimation period (explained in the following section). Table 1b shows the descriptive statistics of the sample.

[Insert Table 1a & b here]

3.1.2. Classification of Environmental Incidents

We classify the environmental incidents into four major types. First, IPE traditionally classifies environmental incidents with direct pollution into two major types: air pollution (Type 1) and water pollution (Type 2). IPE also reports the government announcements of environmental violations identified through government inspections (Type 3). Next, for environmental incidents caused by firms that operate without the required environmental impact assessments (EIA), we classify these incidents as Type 4. We further code instances in which multiple incident types are mentioned in an announcement as Type 5. The number of announcements of each types of incidents are 153 (Type 1), 232 (Type 2), 228 (Type 3), 52 (Type 4), and 47 (Type 5). In our model, we control the classification of environmental incidents by using five dummy variables (i.e., Type 1: Air_i, Type 2: $Water_i$, Type 3: $Government\_assessment_i$, Type 4: EIA_i, and Type 5: $Multiple_i$).

[4] GTA is a leading global provider of China financial market data that provides integrated financial research solutions for over 2,000 educational, research, and financial institutions worldwide. Its databases are widely used by researchers at more than 1,000 universities and financial institutions. Over 1,700 academic papers published in leading Journals (e.g., *Journal of Finance* and *Journal of Financial Economics*) were based on GTA databases.

Among these 618 incidents, 229 of them reported legal action or administrative orders issued by government departments. In 92 cases, the only penalty was a fine. In 29 incidents, firms were ordered to halt production or close the factory for remedial action (six of them also received a fine). In 108 incidents, firms were ordered to eliminate the pollution problems within a given period (twenty-two of them also received a fine). For the incidents that clearly indicated the amount of fine being issued as a penalty, the mean (median) amount of fine is 63,699 RMB (50,000 RMB). The maximum and minimum amounts of the fines in our sample are 300,000 RMB and 760 RMB, respectively.

3.2. Moderating factors

Recognition on social responsibility *(Recognition_on_social_responsibility$_i$)*. We obtained data for the recognition on social responsibility (e.g., general CSR awards; environmental awards; awards related to integrity, credibility, and honesty; and charity awards) through a three-step approach. We first collected award information from the official website (or annual report) of each of the 294 firms. Next, we performed a search by company name to determine whether the firms have received either or both of the two most prestigious CSR and environmental awards in China (i.e., China CSR Award Submit and China Environmental Award). Finally, we performed keyword searches (e.g., [company name or stock code] + [award]) on popular search engines (e.g., Google and Baidu) and Chinese news portals regularly used by investors (e.g., Xinhuanet.cn, Sina.com, ifeng.com, 163.com, and the Thomson Reuters Eikon database). At the first step, we collected information on 623 awards in total and added 12 awards at Step 2 (no award was added at Step 3).

We measured each firm's recognition on social responsibility (*Recognition_on_social_responsibility$_i$*) based on the number of awards received by the firm since the year of incorporation up to the year before the environmental incident. However, the value of an award is likely to depreciate over time. We thus set an exponential depreciation rate at 20% per year by assuming that the value of an award depreciates by approximately half in every 3-year period.[5] Our results remain robust when we set the depreciation rates to 30% or 10%. The exponential function on the value of social recognition for a firm is set as follows:

$$Recognition\_on\_social\_responsibility_{i,t} = \sum_{t=ic}^{ev-1} AW_t * (1 - DR)^{ev-1-t} , \quad (1)$$

where $Recognition\_on\_social\_responsibility_{i,t}$ denotes social recognition of firm *i* in year *t*, *ev* is the year that the event occurred, *ic* is the year that the firm is incorporated, AW_t is the number of awards received in year *t*, and *DR* is the depreciation rate.

[5] Assuming a firm won an award in 2006 and the environmental incident happened in 2010, the value of the award depreciates by $1 \times (0.8)^3 = 0.512$. We would not include any award in the event year (i.e., 2010). There would be no discount in 2009, a 20% discount in 2008, and so on.

Government share of ownership (*Government_share*$_i$). We measured the government share of ownership (*Government_share*$_i$) according to the percentage of the government-owned shares for each firm *i* by using data from the Thomson Reuters Eikon database.

Personal Political Ties (*Personal_political_ties*$_i$). To collect data on personal political ties, we examined the background of TMT/board members for each of the 294 firms at the year of the 618 announcements. We identified the names of the directors of each firm and their past and concurrent position(s) at various governmental organization(s) (if any) from the GTA's financial database. If a TMT/board member was currently or previously employed by a governmental organization when an environmental incident was announced, we considered the company to have one effective personal political tie. Several types of political ties are associated with different governmental organizations under the Chinese political system; however, we focused on those with ministries under the State Council and Local People's Government.[6] Both governmental organizations are administrative authorities responsible for developing and executing government policies specifically related to the country's industrial and commercial sectors. Departments under these two units are concerned with customs, taxation, industry and commerce, food and drug administration, environmental protection, work safety, and so on. They directly regulate the industrial and commercial sectors. Personal political ties with ministries under the State Council might aid firms in gaining additional administrative support, market intelligence, and policy insight. For the data on all government positions, we differentiated governmental organizations into four levels according to the Chinese government's official classification system: (i.e., national, provincial, city, and district). We assigned scores to the four levels (4 = national, 3 = provincial, 2 = city, and 1 = district level) based on the assumption that national-level political ties are the most powerful of these ties.

To measure the personal political ties of each firm *i* (*Personal_political_ties*$_i$), we first counted the number of personal political ties for each firm *i*. We then multiplied the value by the corresponding score assigned for the governmental level. Finally, we added the results to obtain a personal political ties score for each firm *i* for when an environmental incident was announced. Previous research has adopted a similar approach in measuring political ties. For example, Fan et al. (2007) trace the political connections of senior management and boards of directors according to whether they are current or former officers of a local or central government. Hillman (2005) measures political ties according to the number of board directors with political experience at the local or national level. In Appendix Table A1, we provide an example of five firms from the sample with information on different types of environmental incidents, the aforementioned moderating effects, and the corresponding abnormal stock returns.

[6] We do not count TMT/board members who hold concurrent position(s) at the People's Congress, the People's Court and the People's Procuratorate, Chinese People's Political Consultative Conference, or the Congress of the Communist Party of China as political ties in our analysis because these organizations do not have direct power in regulating company operations. For robustness checks, we also tested the effects of these four types of political ties but found no significant impact on abnormal stock returns.

3.3 Control Factors

We used the following control factors to ensure that our results are robust. We collected related financial data (e.g., sales, market value, and other accounting data) from the Thomson Reuters Eikon database. Unless stated otherwise, the factors are based on the fiscal year ending prior to the announcement date.

Incident history ($Incident\_history_i$). We controlled for each firm's history of environmental incidents, which is firm *i*'s yearly average number of environmental incidents disclosed before the current incident and since becoming publicly listed. Pollution history may affect a firm's reputation and investors' perceptions of the firm.

First company event ($First\_company\_event_i$) and **first company event in the year** ($First\_company\_event\_year_i$). To distinguish between a first-time incident versus repeat offenses, we used a dummy variable ($First\_company\_event_i$: 1 = first-time offender, 0 = repeat offender) to control for the effect of the number of offenses. Although certain firms might be involved in multiple environmental incidents, recent events are likely to have a stronger impact on investor perceptions. Therefore, we controlled for this factor ($First\_company\_event\_year_i$: 1 = first incident of the year, 0 = second or additional incidents within the fiscal year).

Damage ($Damage_i$). We differentiated the events between regulatory violations versus those with actual damage to the environment according to the content of the announcements; for this, we used the dummy variable $damage_i$ (1 = event with actual damage, 0 = regulatory violations without specifying the actual damage) to reflect the severity of the event, which may affect investors' judgments.

Source of information ($Source\_of\_information_i$). We coded environmental incidents uncovered by the government (e.g., through government inspections) as 1; otherwise, we coded the variable as 0 (e.g., reports from news media).

Daily ($Daily_i$). For announcements made on a daily basis instead of some other regular schedule (e.g., monthly or quarterly), we coded this variable as 1; otherwise, it is coded as 0 (i.e., regular/scheduled announcements). Approximately 90% of the announcements are from unscheduled daily sources, whereas the other 10% are made through regular/scheduled announcements (but still published by daily news sources).

Firm diversification ($Firm\_diversification_i$). Firm diversification is the Herfindahl index of a firm's sales by industry segment. Firms that are more diversified are likely to be less negatively affected because an environmental incident might affect the operations of only a certain product type, leaving other business lines unaffected.

Firm size ($Market\_value\_of\_equity_i$). We measured firm size by the natural logarithm of a firm's market value of equity 10 days prior to the announcement date. Larger firms are more likely to have a stronger financial position and management capability and thus be less affected by a single negative incident.

ISO 14001 certification (*$ISO14001_i$*). We controlled for ISO14001-certification (certified = 1 when an environmental incident is announced, otherwise = 0), because certified firms might be more capable of resolving underlying environmental issues. We obtained the certification records of the environmental management system (i.e. ISO 14001) from the Certification and Accreditation Administration of the People's Republic of China (http://www.cnca.gov.cn/).

Three-year averaged industry-adjusted operating returns on assets (ROA_i). ROA_i is measured as a firm's operating profits divided by total assets and adjusted by industry. We used the 3-year average industry-adjusted ROA prior to the environmental incident to prevent 1-year ROA volatility. Firms with higher profitability give investors the impression that they are more efficiently managed and are thus more capable of solving underlying environmental issues.

Other control factors. We controlled for industry-specific effects (e.g., the likelihood of environmental incidents by industry or the perceived severity of an event because of the nature of the industry) by using a dummy variable for industry ($Industry\_Dummy_i$). We also controlled for the year of the announcement ($Year\_Dummy_i$) because general economic conditions vary between years.

3.4. Sample of Overseas Customers

To obtain information on each firm's downstream customers, we reviewed the financial reports of firms for the years in which environmental incidents occurred. We identified the names of their five largest customers, which are disclosed at the discretion of firms. Of the 618 environmental incidents committed by 294 Chinese firms, we identify 64 incidents (committed by 51 Chinese firms) that reported at least one publicly listed overseas customer in their top-five supplier records in the year's annual reports. Specifically, in 42 incidents, we found only one publicly listed overseas customer; in 15 announcements, we found two overseas customers; in six announcements, we found three overseas customers; and in one announcement, we found five overseas customers. Therefore, from these 64 announcements, we identified a total of 95 publicly listed overseas customers (i.e., 42 × 1 + 15 × 2 + 6 × 3 + 1 × 5) linked to the 64 environmental incidents of their Chinese suppliers. We deleted seven customer firms because of a lack of historical stock price data for the 200-day event period prior to the incident. We removed nine incidents with confounding events that occurred during the event period. Finally, we obtained 79 customer incidents involving 56 overseas customers operating in 12 overseas markets. The top three oversea markets in our sample are Hong Kong (24 announcements), United States (19 announcements), and Japan (10 announcements). Appendix Tables A2 shows the distribution of the stock markets. The announcement online times (Beijing time) were converted to the local time of each corresponding overseas market. If the announcement was made after the closing time of the overseas stock market, then the date of the incident is marked as the next trading day. We obtained the stock price on the announcement date of these downstream customers from the Thomson Reuters Eikon database. Table 2 shows the descriptive statistics of the announcements involving overseas customers, respectively. The currency used in different markets is converted to US dollars based on the exchange rate on the event date. Appendix Figure 1 displays a flowchart of our data collection process.

[Table 2 is about here]

4. Analysis and Results

4.1. Direct Effect of Environmental Incidents (RQ1)

4.1.1. Environmental Incidents and Market Value Firms

We adopted the event study methodology (e.g., Brown and Warner 1985) to measure market reactions to announcements of environmental incidents. We calculate the abnormal returns (an estimate of the percentage change in stock prices associated with an event) on stock prices by adjusting them with market-wide movements. To convert the calendar days into event days, we use Day 0 for the announcement date. Consistent with previous event studies conducted in other contexts (e.g., Hendricks and Singhal 2009, Jacobs and Singhal 2014), we use a 2-day event period which includes the announcement day (Day 0) and the trading day prior to the announcement (Day −1) to account for the potential event information leakage in the day before the announcement is published (Hendricks and Singhal 2009, Jacobs and Singhal 2014). We use a three-factor model (Fama and French 1993) to estimate abnormal returns. Specifically, this model assumes a linear relationship between the return of any stock and three factors (i.e., company size, company price-to-book ratio, and market risk) over time, as follows:

$$R_{it} = \alpha_i + R_{ft} + \beta_{i1}\left[R_{mt} - R_{ft}\right] + \beta_{i2}SMB_t + \beta_{i3}HML_t + \varepsilon_{it}\ , \quad (2)$$

where R_{it} is the return on stock *i* for day *t*; α_i denotes the intercept of the relationship for stock *i*; R_{ft} is the risk-free return on day *t*; R_{mt} represents the market return on day *t*; SMB_t is the **small minus big** (market capitalization) portfolio return on day *t*; and HML_t denotes the **high minus low** (book-to-market ratio) portfolio return on day *t*; β_{i1}, β_{i2}, and β_{i3} are the slopes of the relation for stock *i* relative to the market index return minus risk-free returns, SMB, and HML, respectively; and ε_{it} is the disturbance term for stock *i* on day *t*.

We use a 200-day estimation period (from Day −210 to −11) to compute the expected returns for each firm (Jacobs and Singhal 2014). If a firm has fewer than 40 days of stock price data, we disregard that firm when estimating the abnormal returns with equation (2) (Jacobs et al. 2010). The estimation period ends 10 trading days prior to the event day; this protects the estimates against the effects of the announcement and ensures that nonstationarity in the estimates is not a serious concern (Jacobs et al. 2010). We estimate parameters $\hat{\alpha}_i$, $\hat{\beta}_{i1}$, $\hat{\beta}_{i2}$, $\hat{\beta}_{i3}$, and $\hat{S}^2_{\varepsilon_i}$ (the variance of ε_{it}), associated with the Fama–French three-factor model, by using regression (ordinary least squares estimation) over the 200-day estimation period. The abnormal returns A_{it} for firm *i* on day *t* are defined as the difference between the actual and expected returns, expressed as follows:

$$A_{it} = R_{it} - \left(\hat{\alpha}_i + R_{ft} + \hat{\beta}_{i1}\left[R_{mt} - R_{ft}\right] + \hat{\beta}_{i2}SMB_t + \hat{\beta}_{i3}HML_t\right). \tag{3}$$

To test whether abnormal returns A_{it} are associated with the 618 environmental incident announcements and significantly different from zero, we use the Wilcoxon signed-rank test to test the statistical significance of the median abnormal returns and the binomial sign test to determine whether the percentage of negative abnormal returns during the event period is significantly higher than 50%.

The formulas for calculating mean abnormal returns, cumulative abnormal returns, statistical tests for single and multiple days, and equations for the market model are presented here. The mean abnormal returns, $\bar{A}_t$, for day *t* are expressed as

$$\bar{A}_t = \sum_{i=1}^{N} \frac{A_{it}}{N}. \tag{4}$$

where A_{it} is the abnormal returns for firm *i* on day *t*, resulting from equation (3), and *N* denotes the sample size (the number of announcements).

Cumulative abnormal returns, $CAR(t_1, t_2)$, over a period [t_1, t_2], is the sum of the daily mean abnormal returns, $\bar{A}_t$.

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} \bar{A}_t. \tag{5}$$

Each A_{it} is divided by its estimated $\hat{S}_{\varepsilon_i}$ value (i.e., the standard deviation of ε_{it}) to obtain a standardized abnormal returns, so that the statistical significance, TS_t, of the mean abnormal returns can be tested in equation (4). The abnormal returns are assumed to be independent across events with a mean of 0 and a variance of $\hat{S}^2_{\varepsilon_i}$ under the null hypothesis. Based on the central limit theorem, the sum of the *N* standardized abnormal returns is about normal, with an average of 0 and variance *N*. Thus, the test statistic for single-day period, TS_t, for Day *t* is

$$TS_t = \sum_{i=1}^{N} \frac{A_{it}/\hat{S}_{\varepsilon_i}}{\sqrt{N}}. \tag{6}$$

The multiple-day period test statistic, TS_e, is obtained in a manner similar to that for a single day:

$$TS_e = \sum_{i=1}^{N} \frac{\left(\sum_{t=t_1}^{t_2} \overline{A_t}\right)/\sqrt{\sum_{t=t_1}^{t_2} \hat{S}^2_{\varepsilon_i}}}{\sqrt{N}}. \tag{7}$$

For the robustness test of the event study results, we adopt the market model instead of the three-factor model. The market model assumes a linear relationship between the return of any stock and that of the market portfolio over a period:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}. \tag{8}$$

where R_{it} denotes return of stock *i* on the day *t*, R_{mt} is the market index return on day *t*, α_i is the intercept of the relation for stock *i*, β_i denotes the slope of the relation for stock *i* relative to the market index return, and ε_{it} is the disturbance term for stock *i* on day *t*.

We use a 200-day estimation period (from Day −210 to −11) to calculate the expected returns for each sample firm (Jacobs and Singhal 2014). The estimation period ends 10 trading days prior to the event day to safeguard the estimates from the effects of the announcement and to ensure that any nonstationarity in the estimates is not a major concern (Jacobs et al. 2010). We estimate the market model parameters $\hat{\alpha}_i$, $\hat{\beta}_i$, and $\hat{S}^2_{\varepsilon_i}$ (the variance of ε_{it}) by using regression (ordinary least squares estimation) over the 200-day estimation period. The abnormal returns, A_{it}, for firm *i* on day *t* are defined as the difference between the actual and expected returns, as follows:

$$A_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \,. \tag{9}$$

The calculation for mean abnormal returns ($\overline{A_t}$) for day *t*, cumulative abnormal returns ($CAR(t_1, t_2)$) over a period [t_1, t_2], the test statistic (TS_t) for day *t*, and multiple-day period test statistics (TS_e) are the same as in equations (4), (5), (6), and (7). Table 3 lists the abnormal returns for Days −1, 0, and 1. We also analyze the cumulative abnormal returns over 2-day periods: from Day −1 to 0.

[Insert Table 3 here]

We first examine the impact of environmental incident announcements on abnormal returns on each day from Day −1 to 1. We present the results from the three-factor model in Table 3, which shows that the mean (median) abnormal returns for Day −1 are −0.20% (−0.31%) and significantly less than zero ($p < 0.05$ and $p < 0.01$), and 57.8% of abnormal returns are negative and significantly greater than 50% ($p < 0.01$). Similarly, the mean (median) abnormal returns for Day 0 are negative at −0.20% (−0.28%) and significantly less than zero ($p < 0.05$ and $p < 0.01$ for the mean and median, respectively), and 55.7% of abnormal returns are negative; this proportion is significantly greater than 50% ($p < 0.01$). The mean (median) abnormal returns for Day 1 are 0.17% (−0.15%) and do not differ significantly from zero, and 53.7% of abnormal returns are negative and significantly greater than 50% ($p < 0.1$). Examining the cumulative impact over a 2-day period from Day −1 to 0 reveals that the mean (median) abnormal returns are −0.41% (−0.57%) and significantly less than zero (both at $p < 0.01$), and 58.1% of abnormal returns are negative and significantly greater than 50% ($p < 0.01$). The results in Table 3 show that the stock market in China reacts negatively to environmental incidents.

4.1.2. Robustness Test on the Direct Effect

Cross-sectional dependence test. Events may be clustered by industry and time, and such a clustering effect may inflate the magnitude of abnormal returns, rendering our statistical tests oversensitive (Brown and Warner 1980, Jacobs and Singhal 2017). To test for potential clustering effects among our observations, we conduct a crude dependence test. The statistical results remain negatively significant for all periods, supporting the robustness of our analysis (Appendix Table A3).

Environmental pollution incidents versus regulatory violations. In our sample of 618 environmental incidents involving 294 firms, we include both environmental pollution incidents and regulatory violations without immediate damage. We analyze possible differences in investor reactions between these two types of events. We find that Chinese investors reacted to both environmental incidents with damage (n = 458) and regulatory violations (n = 160) in a similarly negative manner, with a mean (median) drop of 0.39% (0.68%) and 0.45% (0.38%), respectively, but the result is nonsignificant.

Using the market model, prior environmental incidents, and length of confounding event time-windows. We conduct additional robustness tests to verify our findings. First, we rerun the analysis using the market model instead of the Fama–French three-factor model. Second, we delete firms with a prior environmental incident during the 200-day estimation period. Third, we omit firms with confounding events based on different time windows (i.e. 2-day window: Days −1 to 0, 3-day window: Days −1 to 1, and 5-day window: Days −2 to 2; Jacobs et al. 2010, McWilliams and Siegel 1997, Meznar et al. 1994) in defining the confounding events. We are using different time windows because stock markets in developing countries are less mature, and the influence of confounding events may be more severe. The results indicate that the impact of environmental incidents remains largely the same (Appendix Tables A4 and A5).

4.2. Recognition on Social Responsibility, Government Share, and Personal Political Ties (RQ2)

4.2.1. Analysis of the Three Moderating Factors

We develop a two-stage model to examine whether a negative stock market reaction toward environmental incidents is moderated by three factors: recognition on social responsibility ($Recognition\_on\_social\_responsibility_i$), government share of ownership ($Government\_share_i$), and personal political ties ($Personal\_political\_ties_i$). At the first stage, the cumulative abnormal returns CAR_i from Day −1 to 0 are regressed against all the control variables, and the residuals ($Residual_i$) from the first-stage regression are obtained. At the second stage, the residuals ($Residual_i$) obtained at the first stage (as a dependent variable) are regressed against recognition on social responsibility ($Recognition\_on\_social\_responsibility_i$), government share of ownership ($Government\_share_i$), and personal political ties ($Personal\_political\_ties_i$).

$$\textbf{Stage 1}\ CAR_i = \beta_0 + \beta_1 Industry\_Dummy_i + \beta_2 Year\_Dummy_i + \beta_3 Air_i + \beta_4 Water_i \\ + \beta_5 Government\_assessment_i + \beta_6 EIA_i + \beta_7 Multiple_i \\ + \beta_8 Incident\_History_i + \beta_9 First\_company\_event_i \\ + \beta_{10} First\_company\_event\_year_i + \beta_{11} damage_i \\ + \beta_{12} Source\_of\_information_i + \beta_{13} Daily_i + \beta_{14} Firm\_diversification_i \\ + \beta_{15} Market\_value\_of\_equity_i + \beta_{16} ISO14001_i + \beta_{17} ROA_i + Residual_i; \quad (10)$$

$$\textbf{Stage 2}\ Residual_i = \beta_{00} + \beta_{01} Recognition\_on\_social\_responsibility_i + \\ \beta_{02} Government\_share_i + \beta_{03} Personal\_political\_ties_i + e_i; \quad (11)$$

where e_i is the disturbance term of the regression model. Table 4 shows the correlations of the variables and Table 5 lists the results of two-stage regression model.

[Insert Table 4 and 5 about here]

Stage 1 concerns the parameter estimates and *t* statistics only for the control variables. At Stage 2, we examine the three possible moderating factors in the Chinese context. At Stage 2, the coefficient of $Recognition\_on\_social\_responsibility_i$ is significantly positive ($p < 0.05$), implying that the negative consequences (abnormal stock returns) of a firm's environmental incidents are less severe for firms with higher recognition on social responsibility.

The coefficient for $Government\_share_i$ is significantly positive ($p < 0.01$), indicating that the negative consequences (abnormal stock returns) of a firm's environmental incidents are less severe for firms with a higher percentage of government share. A high proportion of government share of ownership is useful for mitigating the negative impact of environmental incidents. Finally, the coefficient for $Personal\_political\_ties_i$ is significantly negative ($p < 0.05$), which means that the market reacts more negatively to firms with stronger personal political ties. This result shows that personal political ties become a liability in the case of environmental incidents, and they exacerbate the negative impact of environmental incidents on firm stock price.

Overall, our regression models are highly significant, with *F* values of 1.657 and 6.179 for Stage 1 (control-factor model) and Stage 2 (moderating-effect model), respectively. For Stage 2, the R^2 (adjusted R^2) value is 3.0% (2.5%). These results are acceptable because our regression is based on cross-sectional data; our values are comparable with those reported in the previous studies that use a similar method to obtain their findings on abnormal stock prices with smaller samples (e.g., Klassen and McLaughlin 1996).

4.2.2. Robustness Tests on Moderating Factors

To ensure the robustness of the three moderating factors, we first rerun the regression analysis based on the CAR_i derived from the market model. We also use the results of abnormal returns obtained from the subsample excluding firms with prior environmental incidents during the 200-day estimation period as well as the three models with different time windows for removing confounding events (see Section 4.1.2.). Compared with the results in Table 5 (e.g., the main results of the moderating effects), the results based on the different tests remain largely identical (Appendix Table A6).

4.3 Suppliers' Environmental Incidents on their Overseas Customers' Market Value

To examine the impact of environmental incidents involving Chinese firms (i.e., suppliers) on their overseas customers, we employ the market model (instead of the Fama–French three-factor model) because the daily values for the three factors are unavailable in some stock markets [i.e., equations (8) and (9)]. To compare abnormal returns across different stock markets, we only compare each overseas customer firm's stock returns against its own stock market performance. We estimate the abnormal returns in the same event period (Days −1 and 0), as well as from Days 0 to 1 to account for the possibility of information delays between China's market and overseas markets. Table 6 shows the abnormal returns for the Chinese firms (n = 64) that reported overseas customers, the corresponding overseas customers (n = 79), and the corresponding Chinese customers (n = 131).

[Inserts Table 6 about here]

Table 6 shows that the mean (median) abnormal returns for Day −1 of overseas customers (n = 79) are 0.00% (0.08%); these do not differ significantly from zero ($p > 0.1$), and 44.3% of abnormal returns are negative and not significantly different from 50% ($p > 0.1$). However, the mean (median) abnormal returns for Day 0 are negative at −0.56% (−0.35%) and significantly less than zero at the ($p < 0.05$ and $p < 0.01$), and 65.8% of abnormal returns are negative and significantly greater than 50% ($p < 0.01$). The mean (median) abnormal returns for Day 1 are −0.57% (−0.29%) and significantly less than zero ($p < 0.05$ and $p < 0.1$), and 54.4% of abnormal returns are negative but not significantly greater than 50% ($p > 0.1$).

We examine the cumulative impact over a 2-day period from Day −1 to 0 and find that the mean (median) abnormal returns are −0.55% (−0.31%) and significantly less than zero (both $p < 0.1$). For the 2-day period from Day 0 to 1, the mean (median) abnormal returns are −1.13% (−0.23%) and significantly less than zero ($p < 0.01$ and $p < 0.05$), and 57.0% of abnormal returns are negative but not significantly greater than 50% ($p > 0.1$). The results suggest that environmental incidents involving Chinese suppliers have a significantly negative impact on their overseas customer firms' stock prices. Table 6 also illustrates the stock reaction of the corresponding Chinese supplier firms (n = 64), however, we do not find similar significant results in the two-tailed tests. This may be because the sample size is significantly smaller than our main sample (n = 618).

For the purpose of comparison, we also examine the impact of environmental incidents on local Chinese customers (instead of overseas customers). Based on a sample of 131 local customers listed in Shanghai or Shenzhen, we find no significantly negative impact of environmental incidents on local customers on individual days in the event period. However, we find that the mean abnormal returns for the 2-day period from Day −1 to 0 is 0.49%, which is marginally significant at the 10% level.

We believe that sourcing ethics has been a more sensitive issue in developed countries such as the United States than that in the developing countries such as China (Reuter et al. 2010). With China's opening up and economic forms, firms in developed countries have been sourcing extensively in China. Currently, China is the largest exporter to the United States. Some multinational retailing corporations, such as Walmart, have more than 80% of their suppliers located in China. According to Krueger (2008), the ethical expectations of many people in developed countries are that corporations ought to be held to the same type of ethical standards in developing countries as they are in their home countries. When the sourcing practices of buyers deviate and fall below public expectations, offending corporations are often severely criticized by the public, damaging their brands and reputations. If a supplier has a serious pollution record, it implies that the sourcing firm does not meet public expectations in upholding the required environmental standards in supply management. As mentioned, many MNCs such as Starbucks and Target have established ethical sourcing departments to safeguard against such behaviors and to strictly control their suppliers' ethical behaviors. However, few Chinese firms have established ethical sourcing departments.

Buyers in developed countries may hold similarly high expectations regarding the ethical behaviors of their foreign suppliers as though they were operating in their home countries, and such a difference across the supply chain could lead to issues with purchasing ethics. For Chinese buyers sourcing locally, such differences in ethical standards between buyers and suppliers do not exist. In fact, in contrast to their overseas counterparts, ethical sourcing is rarely considered a major issue in China and thus receives little media attention (Kolk et al. 2010). For example, a keyword search using such terms as "ethical sourcing" or "purchasing ethics" in Western news sources (i.e., Factiva) results in more than 2,000 related news articles. However, a search based on similar Chinese terms in the corresponding news sources in China (i.e., WiseNews) results in no related news articles, which shows that topics such as "sourcing ethics" or "purchasing ethics" receive little if any media attention in China.

Although the Hong Kong stock market is highly internationalized with global institutional investors, it might still differ from other markets because of its proximity to Mainland China. To test for robustness, we exclude firms listed in Hong Kong as overseas customers. The results reveal that the impact of environmental incidents involving Chinese firms on overseas customers remains significantly negative after the Hong Kong-listed firms are deleted (Appendix Table A7).

5. Implications

5.1. Implications for Manufacturers

Our results challenge the common belief that investors in emerging markets are unconcerned with environmental issues (e.g., Saleh et al. 2011). Instead, our findings on China are consistent with findings from India that indicate that weak environmental performance (measured by an environmental rating) leads to negative abnormal stock returns (Gupta and Goldar 2005). Therefore, manufacturers in China should endeavor to comply with environmental regulations, especially when there is evidence that the market will react negatively to environmental incidents. Furthermore, our findings reveal that overseas customers will also suffer when their suppliers in China are involved in environmental incidents. To avoid losing overseas customers as a result of environmental incidents, manufacturers in China should be proactive in managing their environmental performance.

5.2. Implications for Policymakers

Our analysis reveals that the market value of overseas customer firms can be negatively affected by environmental incidents involved Chinese suppliers. The Chinese government should consider improving the transparency of and public access to information about the environmental performance of Chinese firms to assist exporters in building trust with potential overseas customers. More transparent and accessible public information on Chinese firm environmental performance can assist NGOs and overseas customers in monitoring Chinese manufacturers and in phasing out polluting firms through a market mechanism.

In addition to strong law enforcement of environmental regulations, the Chinese government can provide positive incentives for Chinese firms to devote additional resources to improving their social and environmental responsibility. For example, developing different levels of national CSR and environmental awards could motivate more firms to improve their environmental performance. In particular, our results show that recognition on social responsibility is a helpful resource for Chinese firms because it builds investor confidence in the case of environmental incidents.

Although our results indicate that Chinese investor reactions to environmental incidents are significantly negative, the mean (median) decline of 0.41% (0.57%) indicates that the magnitude of the reactions are low compared with those reported in related studies on developed countries (e.g., Klassen and McLaughlin 1996). This implies that there might be room for policymakers to raise the public awareness and concern on corporate environment incidents.

5.3. Implications for NGOs, Investors, and Researchers

NGOs can continue to play an independent and critical role as enforcers by exposing Chinese contract manufacturers who violate environmental regulations and by pressuring multinational retailers to take corrective and proactive action.[7] Concurrently, NGOs can also play the role of independent endorsers. This would facilitate developing the environmental legitimacy of firms through awards and recognitions, which act as a "carrot" to Chinese manufacturers to minimize their environmental risks.

Our results reveal that an environmental incident committed by a Chinese supplier has a significantly negative impact on both the supplier and its overseas customers. Therefore, investors should focus more on the environmental performance of the supply chain partners, not just that of a particular firm. Moreover, our results reveal that personal political ties generate a stronger negative market reaction to environmental incidents. Thus, investors and firms should be aware that although the personal political ties of firms might benefit daily operations, but negative corporate incidents might lead to additional public attention on such controversial political connections.

Our evidence shows that the impact of environmental incidents involving upstream suppliers on downstream customers can be significant. These findings may serve as a critical reference for future research on sustainability issues arising from emerging markets. Researchers on sustainable supply chains should consider linking upstream and downstream members in their research design. For example, examining the impact of social misconduct (e.g., sweatshops) run by upstream suppliers on downstream customers is warranted.

6. Concluding Remarks

To the best of our knowledge, our study is the first to examine the impact of environmental incidents on a firm's stock returns in China in addition to how a Chinese manufacturer's environmental incidents lead to negative abnormal returns for customers overseas. This shows that the consequences of an environmental incident are more likely to be far-reaching in a global supply chain. Our findings indicate that multinational firms should not underestimate the negative impact of environmental incidents on their upstream suppliers, and they should be proactive in developing strategic plans to prevent such incidents and to mitigate the associated risks in terms of the likelihood of occurrence and environmental impact.

A major purpose of this study is the exploration of how various political and social factors in a Chinese context could potentially moderate the negative impact of environmental incidents. Specifically, we focus on the recognition on social responsibility, government share of ownership, and personal political ties. We

[7] For example, the Green Choice Alliance is a coalition of NGOs (including IPE) that promotes a global green supply chain by encouraging large companies to evaluate the environmental performance of their vendors in procurement processes. Specifically, this independent coalition independently audits the environmental performance of various Chinese manufacturing firms that supply products for international brands such as Apple, Gap, and H&M. The coalition shares its findings with these international brands and publishes them, along with corrective actions taken by the brands, on the Internet. This open information has forced companies such as Apple and Timberland to take corrective action with their Chinese manufacturing firms to avoid humiliation in the public (Plambeck et al. 2012).

find that the accumulated number of recognitions on social responsibility can serve as a buffer against negative environmental incidents in China. With the government increasingly underscoring the importance of CSR and the common expectations of Chinese society, recognition on social responsibility is likely to be critical for gaining political and social legitimacy, which serves as an intangible firm resource that protects firms in cases of environmental incidents. We adopt a broader view of social responsibility by covering all the related awards prior to the environmental incidents, showing how such awards can be valuable to firms. We also find that government support through direct-share ownership is likely to build investor confidence, thereby mitigating negative reactions toward environmental incidents. Nevertheless, connections with government officials through personal ties might lead to greater skepticism in cases of environmental incidents. This study is the first to identify the role of government shares and personal political ties following an environmental incident. The legitimacy secured through personal political ties in China might be critical to firms prior to an environmental incident, but such legitimacy could become a liability to the firm involved in an environmental incident. The value of personal political ties is tenuous, and their true value is questionable in the long term. This finding not only provides important implications for firms in emerging markets but also serves as a reference for researchers seeking to explore similar moderating effects in developed markets.

Our study has several limitations. First, because the Chinese government does not have a common platform for reporting environmental incidents, we must rely on the IPE database to identify incidents. Although IPE currently provides the most comprehensive database for environmental incidents in China, we cannot dismiss the possibility of critical environmental incidents being missing from the database. Additionally, the sample firms are all Chinese-listed firms, and thus the findings may differ in other emerging markets (e.g., India). Finally, we do not provide any weighting of the CSR awards in our records even though several awards are presented at the national level, others at the provincial level. We did not assign weights based on level because our evaluation of the award's significance might differ from that of investors.

Although our study focuses on environmental incidents in manufacturing industries, our model and analysis might be applicable to other sectors in supply chains (e.g., transportation; Hao et al. 2015; Lee et al. 2016) or other social responsibility issues (e.g., product safety and safety violations in the production process; Tang and Babich 2014). With growing concerns on ethical standards in supply chains, customers and investors possess greater awareness regarding the risks of operational safety performance (Fan et al. 2014, Lo et al. 2014, Wiengarten et al. 2017). A safety incident is likely to have a negative impact on a firm's financial performance, and the government share of ownership and recognition on social responsibility may have a similar mitigating effect. We believe that this finding has significant implications for Chinese manufacturers, overseas customers, and policymakers.

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Table 1a: Number of Announcements and Firms in the Sample

Announcements	Number of Announcements
Number of environmental announcements collected from IPE	1,833
not classified as routine monitoring reports	1,456
without duplication issues	1,145
with trading data	888
with sufficient historical stock price data to conduct the event study	843
in or after 2006	781
unrelated to nuclear or radiation	776
without confounding events	618
Effective announcements for RQ1	**618**
with sales data for calculating firm diversification	603
without negative price-to-book ratio	597
Effective announcements for RQ2	**597**
with at least one publicly listed overseas customer	64
Effective announcements for RQ3	**64**
Firms	Number of Firms
Number of firms in China's stock market	2,684
Manufacturing firms	1,675
with environmental incidents	524
after eliminations of unsuitable announcements	294
Final sample manufacturing firms for RQ1	**294**
Final sample manufacturing firms for RQ2	**285**
Final sample manufacturing firms for RQ3	**51**

Table 1b: Descriptive Statistics of the Sample Firms in the 618 Announcements (for RQ1)

	Total Assets (RMB 000,000)	Sales (RMB 000,000)	Net Income (RMB 000,000)	Number of Employees (000)	ROA	Debt-to-Equity Ratio	Price-to-Book Value	Market Value (RMB 000,000)	Outstanding Stock (000,000)	Stock Price (RMB)
Mean	12,384.64	10,533.06	582.88	9.86	0.05	1.19	3.12	11,384.97	1,008.24	12.69
Median	4,123.02	3,053.35	137.27	4.00	0.05	0.81	2.66	4,877.37	483.88	9.66
Std. Error	23,807.38	20,209.13	1,741.79	17.67	0.07	1.74	15.68	21,724.19	1,840.52	9.69
Maximum	202,008.00	191,558.99	19,307.69	177.62	0.50	30.74	63.58	316,441.84	17,512.00	71.95
Minimum	143.81	39.77	-8,022.28	0.03	-0.73	0.00	-360.98	390.16	73.39	2.08

Note. Market value, outstanding shares, and stock price data are for Day −10

Table 2: Descriptive Statistics of Overseas Customers (*n* = 79)

	Total Assets (USD 000,000)	Sales (USD 000,000)	Net Income (USD 000,000)	Number of Employees (000)	ROA	Debt-to-Equity Ratio	Price-to-Book Value	Market Value (USD 000,000)	Outstanding Shares (000,000)	Stock Price (USD)
Mean	47,354.05	37,020.19	2,357.47	88.80	0.11	0.91	2.34	26,891.34	2,749.30	93.16
Median	7,714.40	5,940.33	369.72	25.50	0.10	0.56	1.79	5,704.36	1,079.77	11.33
Std. Error	98,919.04	51,971.03	8,492.59	164.72	0.09	1.05	2.07	47,700.72	9,318.14	289.48
Maximum	797,769.00	189,142.26	28,135.71	1,290.00	0.49	5.00	15.04	209,058.35	80,932.37	1,392.53
Minimum	30.55	11.27	-28,695.00	0.06	-0.13	0.00	0.12	62.85	2.17	0.03

Note. Market value, outstanding shares, and stock price data are for Day −10

Table 3: Abnormal Returns of the 618 Environmental Incident Announcements

	Day -1	Day 0	Day 1	Day −1 to 0
n	618	618	618	618
Mean abnormal returns	-0.0020	-0.0020	0.0017	-0.0041
t statistic	-2.18*	-2.05*	1.64	-3.05**
Median abnormal returns	-0.0031	-0.0028	-0.0015	-0.0057
Wilcoxon signed-rank *Z* statistic	-3.73**	-3.32**	-0.27	-4.22**
% Abnormal returns negative	57.8%	55.7%	53.7%	58.1%
Binomial sign test *Z* statistic	-3.82**	-2.90**	-1.85+	-4.03**

Note. All tests are two-tailed: $+p < 0.10$; $*p < 0.05$; $**p < 0.01$

Table 4: Correlation Table

No	Variables	Mean	Std. Deviation	1	2	3	4	5	6	7	8	9	10	11	12
1	*Incident_history*$_i$	0.13	0.19												
2	*First_company_event*$_{i}$ *(D)*	0.48	0.50	-0.635**											
3	*First_company_event_year*$_{i}$ *(D)*	0.83	0.37	-0.432**	0.429**										
4	*Damage*$_{i}$ *(D)*	0.74	0.44	-0.022	-0.019	0.019									
5	*Source_of_information*$_{i}$ *(D)*	0.79	0.41	0.099*	-0.105**	-0.005	-0.162**								
6	*Daily*$_{i}$ *(D)*	0.90	0.31	-0.045	0.073	0.068	-0.077	-0.138**							
7	*Firm_diversification*$_i$	0.49	0.25	-0.060	0.064	-0.037	0.052	0.009	-0.010						
8	*Market_value_of_equity*$_{i}$ *(NL)*	15.52	1.11	0.238**	-0.189**	-0.118**	-0.051	0.051	-0.013	0.090*					
9	*ISO14001*$_{i}$ *(D)*	0.45	0.50	0.186**	-0.168**	-0.073	-0.046	-0.062	0.009	0.050	0.189**				
10	*ROA*$_i$	-0.01	0.05	0.020	0.027	-0.048	0.078	-0.003	0.031	0.095*	0.273**	0.100*			
11	*Recognition_on_social_responsibility*$_i$	0.42	1.08	0.181**	-0.179**	-0.064	0.008	-0.010	-0.026	-0.057	0.223**	0.052	0.023		
12	*Government_share*$_i$	0.22	0.24	-0.068	0.148**	-0.015	0.035	-0.008	0.029	0.088*	0.067	-0.177**	0.028	-0.186**	
13	*Personal_political_ties*$_i$	1.46	2.44	-0.005	-0.049	-0.007	0.037	-0.042	0.040	-0.026	0.186**	0.064	0.084*	0.004	0.074

Note. n=597;

$*p < 0.05$; $**p < 0.01$;

(D): Dummy variable; (NL): Natural logarithm;

ROA$_i$ is the 3-year average industry-adjusted ROA prior to the environmental incident;

Industry_dummy$_i$, pollution type dummies (i.e. *Air*$_i$, *Water*$_i$, *Government_assessment*$_i$, *EIA*$_i$, and *Multiple*$_i$), and *Year_dummy*$_i$ are not shown in this table—they are categorical dummy variables

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Table 5: Two-Stage Regression Results for the Event Period Day −1 to 0.

Variable (Prediction)	Stage 1	Stage 2
Intercept	0.009 (0.336)	-0.003 (-1.598)
$Industry\_dummy_i$	-	-
$Year\_dummy_i$	-	-
Air_i	-0.003 (-0.811)	-
$Government\_assessment_i$	-0.001 (-0.343)	-
EIA_i	0.004 (0.574)	-
$Multiple_i$	0.003 (0.534)	-
$Incident\_history_i$	0.020 (1.989)*	-
$First\_company\_event_i$	0.000 (0.019)	-
$First\_company\_event\_year_i$	0.006 (1.536)	-
$Damage_i$	0.000 (0.009)	-
$Source\_of\_information_i$	-0.004 (-1.158)	-
$Daily_i$	-0.012 (-2.499)*	-
$Firm\_diversification_i$	-0.001 (-0.132)	-
$Market\_value\_of\_equity_i$	-0.001 (-0.552)	-
$ISO14001_i$	0.002 (0.634)	-
ROA_i	0.013 (0.424)	-
$Recognition\_on\_social\_responsibility_i$ (+)		0.003 (2.443)*
$Government\_share_i$ (+)		0.017 (3.202)**
$Personal\_political\_ties_i$ (-)		-0.001 (-2.424)*
n	597	597
Model *F* value	1.657**	6.179**
R^2	12.2%	3.0%
Adjusted R^2	4.8%	2.5%

Note. All tests are two-tailed: *$p < 0.05$; **$p < 0.01$; *$Water_i$* as a pollution-type dummy is excluded by the statistical software because of its mutual exclusivity with other dummy variables; *t* statistics are indicated in parentheses

Table 6: Abnormal Returns for the Environmental Incidents of the Chinese Firms, Downstream (Overseas) Customers, and Downstream (Chinese) Customers.

	Day -1	Day 0	Day 1	Day -1 to 0	Day 0 to 1
Chinese Firms (n = 64)					
Mean abnormal returns	-0.0020	-0.0014	0.0018	-0.0033	0.0005
t statistic	-0.72	-0.50	0.63	-0.89	0.12
Median abnormal returns	-0.0069	-0.0025	-0.0023	-0.0042	-0.0011
Wilcoxon signed-rank *Z* statistic	-1.44	-1.41	-0.18	-1.41	-0.02
% Abnormal returns negative	60.9%	54.7%	56.3%	60.9%	50.0%
binomial sign test *Z* statistic	-1.63	-0.76	-0.88	-1.63	0.00
Overseas Customers (n = 79)					
Mean abnormal returns	0.0000	-0.0056	-0.0057	-0.0055	-0.0113
t statistic	0.02	-2.33*	-2.43*	-1.78+	-3.08**
Median abnormal returns	0.0008	-0.0035	-0.0029	-0.0031	-0.0023
Wilcoxon signed-rank *Z* statistic	-0.28	-2.83**	-1.81+	-1.91+	-2.29*
% Abnormal returns negative	44.3%	65.8%	54.4%	57.0%	57.0%
Binomial sign test *Z* statistic	-0.9	-2.70**	-0.79	-1.13	-1.13
Chinese Customers (n = 131)					
Mean abnormal returns	0.0022	0.0027	0.0005	0.0049	0.0032
t statistic	1.11	1.59	0.27	1.68+	1.42
Median abnormal returns	-0.0010	0.0016	-0.0020	-0.0017	0.0001
Wilcoxon signed-rank *Z* statistic	-0.14	-1.09	-0.42	-0.38	-0.50
% Abnormal returns negative	52.7%	45.8%	54.2%	55.7%	48.9%
Binomial sign test *Z* statistic	-0.52	-0.79	-0.87	-1.22	-0.09

Note. All tests are two-tailed: +$p < 0.10$; *$p < 0.05$; **$p < 0.01$

Appendix

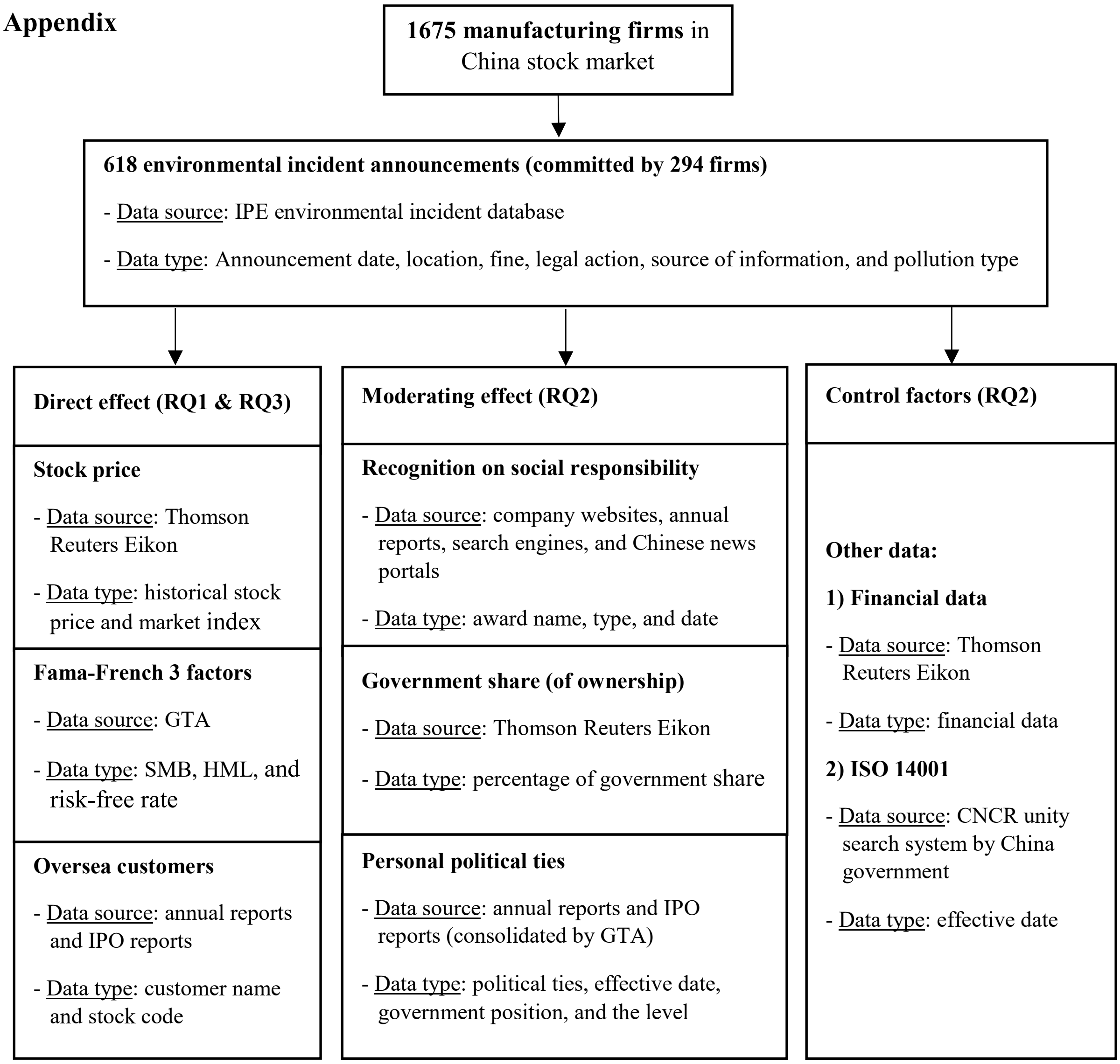

Figure A1: Data Collection Process and Data Source

Table A1: Examples of Five Sample Firms Involved in Different Types of Environmental Incidents, the Three Moderating Effects (i.e., *Recognition_on_social_responsibility*$_i$, *Government_share*$_i$, *Personal_political_ties*$_i$) and the Corresponding Abnormal Stock Returns for Each Firm

Company Code	**Company Name**	**Business Nature**	*Recognition_on_social_responsibility*$_i$	*Government_share*$_i$	*Personal_political_ties*$_i$	**Description of Environmental Incidents**	**Incident Type**	**Incident Year**	**Day -1**	**Day 0**	**Day 1**	**Day -1 to 0**
600623	DOUBLE COIN HOLDINGS LTD.	Rubber and plastic products industry	No	66.99%	9	The factory did not comply with wastewater discharge standards and discharged excessive pollutants with their wastewater	Water	2008	-0.70%	0.65%	1.20%	-0.05%
600367	GUIZHOU REDSTAR DEVELOPING CO., LTD.	Raw chemical materials and chemical products	A score of 0.85	52.13%	0	The factory did not comply with standards on air pollutant emissions (e.g., toxic gas—hydrogen sulfide) and wastewater discharge and was ordered to stop the wastewater and air pollutant discharge immediately	Multiple	2008	-1.15%	1.31%	3.18%	0.16%
000488	SHANDONG CHENMING PAPER HOLDINGS CO., LTD.	Papermaking and paper products	No	24.06%	2	The factory discharged a large amount of water pollutants into Xiaoqing River, causing severe environmental problems to the neighborhood	Water	2007	-1.00%	-0.95%	0.01%	-1.95%
000731	SICHUAN MEIFENG CHEMICAL INDUSTRY CO., LTD.	Raw chemical materials and chemical products	No	4.42%	3	The factory did not comply with the wastewater discharge standards (e.g., toxic chemical indicated by the presence of ammoniacal nitrogen [NH_3-N])	Water	2010	-0.18%	-0.37%	0.65%	-0.55%
002420	GUANGZHOU ECHOM SCIENCE&TECHNOLOGY CO., LTD.	Rubber and plastic products industry	No	0.00%	4	The factory did not comply with air pollution requirements; insufficient use of air pollutants filtering/handling facilities	Air	2012	-6.45%	-4.02%	-4.15%	-10.47%

Table A2: Distribution of Stock Markets

Stock Market	Country/Region	Number of Announcements
Hong Kong Stock Exchange	Hong Kong	24
New York Stock Exchange	United States	19
Tokyo Stock Exchange	Japan	10
Korea Exchange	Korea	9
Frankfurt Stock Exchange	Germany	5
Taiwan Stock Exchange	Taiwan	3
London Stock Exchange	United Kingdom	2
National Stock Exchange of India	India	2
Singapore Exchange	Singapore	2
Copenhagen Stock Exchange	Denmark	1
Euronext Brussels	Belgium	1
Euronext Paris	France	1
Total		79

Table A3: Test Statistics of the Crude Dependence Test

	Day -1	Day 0	Day -1 to 0
n	618	618	618
Mean abnormal returns	-0.0020	-0.0020	-0.0041
t statistic	-1.82^{+}	-1.82^{+}	-2.64**

Note. All tests are two-tailed: $^{+}$p ≤ 0.10; *p ≤ 0.05; **p ≤ 0.01

Table A4: Abnormal Returns for Environmental Incidents in China for the Market Model

	Day -1	Day 0	Day 1	Day -1 to 0
n	618	618	618	618
Mean abnormal returns	-0.0021	-0.0017	0.0014	-0.0039
t statistic	-2.25*	-1.76^{+}	1.45	-2.88**
Median abnormal returns	-0.0034	-0.0022	-0.0010	-0.0049
Wilcoxon signed-rank *Z* statistic	-3.69**	-2.75**	0.00	-3.83**
% Abnormal returns negative	58.9%	54.7%	53.6%	58.3%
Binomial sign test *Z* statistic	-4.38**	-2.29*	-1.81^{+}	-4.11**

Note. All tests are two-tailed: $^{+}p \leq 0.10$; *$p \leq 0.05$; **$p \leq 0.01$

Table A5: Abnormal Returns for Environmental Incidents in China's Market with No 200-Day Prior Incidents and Different Time Windows Capturing Confounding Events

	Model 1: No Prior Environmental Incident During the 200-Day Estimation Period			Model 2: 2-Day Confounding Event Time-Window			Model 3: 3-Day Confounding Event Time-Window			Model 4: 5-Day Confounding Event Time-Window		
	Day -1	Day 0	Day -1 to 0	Day -1	Day 0	Day -1 to 0	Day -1	Day 0	Day -1 to 0	Day -1	Day 0	Day -1 to 0
n	504	504	504	662	662	662	638	638	638	604	604	604
Mean abnormal returns	-0.0024	-0.0019	-0.0042	-0.0023	-0.0019	-0.0042	-0.0019	-0.0019	-0.0039	-0.0020	-0.0022	-0.0042
t statistic	-2.28*	-1.64	-2.79**	-2.48*	-2.02*	-3.23**	-2.07*	-2.00*	-2.92**	-2.06*	-2.20*	-3.07**
Median abnormal returns	-0.0040	-0.0027	-0.0058	-0.0031	-0.0027	-0.0055	-0.0030	-0.0027	-0.0056	-0.0030	-0.0029	-0.0058
Wilcoxon signed-rank *Z* statistic	-3.91**	-3.05**	-3.91**	-4.04**	-3.26**	-4.45**	-3.76**	-3.26**	-4.19**	-3.60**	-3.50**	-4.23**
% Abnormal returns negative	58.93%	55.75%	58.53%	58.01%	55.74%	57.70%	57.84%	55.49%	57.68%	57.78%	55.96%	58.44%
Binomial sign test *Z* statistic	-3.96**	-2.68**	-3.83**	-4.08**	-3.04**	-3.97**	-3.92**	-2.86**	-3.88**	-3.78**	-3.02**	-4.15**

Note. All tests are two-tailed: +$p \leq 0.10$; *$p \leq 0.05$; **$p \leq 0.01$

Table A6: Summary of Parameter Estimates (t Statistics) from the Two-Stage Regression Results for the Market Model with No 200-Day Prior Incidents and Different Time Windows Capturing Confounding Events

Variable (Prediction) ^	Model 1: Market Model	Model 2: No Prior Environmental Incident During the 200-Day Estimation Period	Model 3: 2-Day Confounding Event Time-Window	Model 4: 3-Day Confounding Event Time-Window	Model 5: 5-Day Confounding Event Time-Window
Recognition_on_social_ responsibility$_i$ (+)	0.003 (2.64)**	0.003 (2.33)*	0.003 (2.80)**	0.003 (2.77)**	0.003 (2.86)**
Government_share$_i$ (+)	0.016 (2.93)**	0.019 (3.17)**	0.017 (3.17)**	0.018 (3.41)**	0.019 (3.37)**
Personal_political_ ties$_i$ (-)	-0.001 (-2.54)*	-0.001 (-2.35)*	-0.001 (-2.65)**	-0.001 (-2.84)**	-0.001 (-2.65)*
n	597	486	640	616	584
Model *F* value	6.179**	5.956**	6.998**	7.686**	7.307**
R^2	3.0%	3.6%	3.2%	3.6%	3.6%
Adjusted R^2	2.5%	3.0%	2.7%	3.2%	3.1%

Note. All tests are two-tailed: *$p \leq 0.05$; **$p \leq 0.01$; ^ the control variables were included in the test at the first stage, but the value is not reported here to save space

Table A7: Abnormal Returns for Overseas Customers (Hong Kong-Listed Firms Excluded)

	Day-1	Day 0	Day 1	Day -1 to 0	Day 0 to 1
n	55	55	55	55	55
Mean abnormal returns	-0.0001	-0.0070	-0.0071	-0.0071	-0.0141
t statistic	-0.02	-2.87**	-2.28*	-1.88+	-3.07**
Median abnormal returns	0.0005	-0.0044	-0.0034	-0.0031	-0.0025
Wilcoxon signed-rank *Z* statistic	-0.66	-3.12**	-1.74+	-2.22*	-2.54*
% Abnormal returns negative	45.5%	70.9%	56.4%	60.0%	61.8%
Binomial sign test *Z* statistic	-0.54	-2.97**	-0.95	-1.35	-1.62

Note. All tests are two-tailed: +$p \leq 0.10$; *$p \leq 0.05$; **$p \leq 0.01$