



He, Z., Guo, B., [Shi, Y.](#) and Zhao, Y. (2022) Natural disasters and CSR: Evidence from China. *Pacific-Basin Finance Journal*, 73, 101777. (doi: [10.1016/j.pacfin.2022.101777](https://doi.org/10.1016/j.pacfin.2022.101777))

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<https://doi.org/10.1016/j.pacfin.2022.101777>

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Deposited on: 12 July 2022

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Natural disasters and CSR: Evidence from China

Abstract

Using the detailed natural disaster data and a large sample of Chinese listed firms over the period 2011-2019, we examine the link between natural disasters and firms' corporate social responsibility (CSR). We find that both the presence of a severe natural disaster and the number of disaster categories are significantly associated with higher CSR activities in the affected area. We explore the reasons that motivate firms to increase firms' CSR engagement in the disaster area. State ownership, political connections, and institutional ownership are found to be the main driving forces that spur CSR in the disaster area, with empirical evidence showing that the association between natural disasters and CSR only exists in state-owned firms, firms with high political connections, and high institutional ownership. Moreover, only large firms and firms with a high level of cash to asset ratio are capable of increasing immediate CSR activities following natural disasters. We also find disaster CSR activities reward firms with better future accounting and stock market performance than non-disaster CSR activities. Overall, our findings suggest that state ownership, political connections, institutional ownership, and future firm performance provide incentives for firms to enhance CSR investments following natural disasters.

JEL: G23, G34

Keywords: Natural disasters; CSR, State ownership; Political connection; Financial performance

1. Introduction

Corporate social responsibility (CSR) has been considered to be a form of corporate self-regulation (Shirly, 2012), and over the past decades, it has received great attention from both market participants and academic researchers.

There are various factors documented in the literature that influence corporate CSR decisions. Theoretical work by Baron (2008) and Bénabou and Tirole (2010) link CSR with financial performance and consider the various channels in which CSR investments may lead to enhanced financial performance. Nguyen et al. (2020) also suggest that CSR activities create shareholder value. Other studies indicate firms are likely to be spurred to invest in CSR by factors such as institutional investors (Kim et al., 2019; Fu et al., 2019; Chen et al., 2020), foreign investors (Griffin et al., 2020; Cui et al., 2021), state ownership or political connections (Li et al., 2015; Li and Zhang, 2010; Lin et al., 2015), and CEO attributes (Borghesi et al., 2014; Cronqvist and Yu, 2017).

Anecdotally, governments and regulatory authorities stress the importance of corporate social responsibility, and large companies take steps to highlight their investment in these activities. From the initial consideration, CSR aims to contribute to societal goals of a philanthropic, activist, or charitable nature by engaging in or supporting volunteering or ethically-oriented practices (Lee and Kotler, 2013). Therefore, CSR is especially important and valuable for society in times of crises that hit a wide range of the economy, such as natural disasters. This is confirmed by historical evidence that large companies such as Walmart quickly pledged their support and provided funds and supplies for the relief effort after Hurricane Katrina hit Louisiana and Mississippi in the U.S. in 2005.¹ Walmart's responsible philanthropic actions had paved the way for corporations to get involved in natural disasters, an area where only the U.S. government, its officials, and not-for-profit organizations held

¹ In 2005, Hurricane Katrina hit land in Louisiana, U.S. The Category 3 storm caused an estimated \$81 billion in property damages in Louisiana and Mississippi, on top of over \$150 billion in economic impact. The government and its organizations in Louisiana and Mississippi were not equipped to handle the magnitude of this disaster. The response by the U.S. government and NGOs was severely lacking. Walmart, declared the largest corporation at the time, donated a total of \$17 million to relief efforts for Hurricane Katrina, and its CEO, Lee Scott, declared that Walmart employees who were forced to be relocated would automatically be hired at the store nearest their new residences. Inspired by Walmart's efforts, other companies quickly jumped in to give their support and provide funds and supplies for the relief effort. For example, American Airlines flew 85,000 pounds of bottled water and nonperishable food items donated by them to New Orleans. According to the Chamber of Commerce Center for Corporate Citizenship, businesses donated more than \$1 billion in cash and supplies within the first six months of the hurricane.

See <https://www.mni.com/blog/medianews/why-is-corporate-social-responsibility-important-during-natural-disasters/> for more detailed information about the hurricane and corporate donations.

space before. It also set an example for how these same corporations, and those inspired by their actions, would respond when future disasters strike.

What is the association between natural disasters and companies' CSR decisions? What are the motivations that drive the firm to pledge CSR in areas of natural disasters? Despite a large number of donations, philanthropic actions, and CSR activities provided by firms after natural disasters, surprisingly, this research question is understudied in the literature. Empirically, there is scarce evidence on the effects of natural disasters on CSR activities. We fill the gap by using the natural disaster data in China to investigate the link between disasters and CSR.

The Chinese setting is well-suited to conduct our study for the following reasons. First, natural disasters have long been a big problem in China. China had six of the world's top ten deadliest natural disasters, including the top three². Major natural disasters in China include meteorological disasters, earthquakes, geological disasters, biological disasters, and forest and grassland fires. Altogether, there are over 100 types of various natural hazards³. In the last few decades, almost all types of major hazards except volcanic eruptions have hit China. Moreover, all provinces in China are facing negative impacts from natural disasters. Half the country's population and more than 70 percent of Chinese cities are located in areas prone to meteorological, earthquake, geological, and oceanic disasters. Therefore, the corporate philanthropic actions and CSR activities may generate a more meaningful impact on Chinese investors and customers, helping CSR firms quickly gain reputation and public relations. Moreover, the detailed data on different categories of natural disasters collected by the National Bureau of Statistics of China provide first-hand information for large sample analysis.

Second, CSR activities have experienced enormous development over the past decade in China. Before 2008, Chinese firms were not under the mandatory requirement to disclose their CSR information, and they had operated under the perception that international CSR doctrines could simply applied cookie-cutter style. Since the enactment of China's 2008 CSR mandatory disclosure requirement, more and more Chinese listed firms devote to issuing annual reports to describe their CSR activities, which in turn drive investors to be increasingly interested in corporations' philanthropic activities. Moreover, the Sichuan earthquake on May 12, 2008, measuring 7.9 on the

² See https://en.wikipedia.org/wiki/Natural_disasters_in_China

³ These include earthquakes, typhoons, floods, droughts and sandstorms, storm surges, landslides and debris flows, hailstorms, cold waves, heat waves, pests, and rodent disease, forest and grassland fires, and red tides.

Richter scale, not only left 70,000 people dead and five million homeless, but also forever changed the landscape of CSR in China. The scale and timeliness of aid response by both domestic and multi-national corporations reshaped the Chinese understanding of CSR. Companies in China learned from the public's reaction following the disaster, and can incorporate tailored CSR principles into their core strategy for the Chinese market, especially in times and areas of natural disasters.

Third, in emerging economies like China, where political interference is prevalent, firms with stronger political connections and state ownership are found to have a higher corporate social responsibility, such as corporate philanthropy (Li et al., 2015). Chinese government and policymakers had encouraged social business to provide relief efforts in natural disasters, especially when the resources from government and NGOs were limited. In 2016, the Ministry of Civil Affairs of the People's Republic of China issued "Guidelines for organizing and inviting social forces in natural disaster relief efforts"⁴, which can be considered as the official document to encourage entrepreneurs for disaster relief support. Chinese firms thus may have more incentives to invest in CSR in times and areas of natural disasters to build a positive relationship with the government.

Using a large sample of 3,298 Chinese listed firms (24,451 firm-year observations) from 2011 to 2019, this study examines whether the natural disasters influence the CSR activities of the firms in the disaster area. Our baseline results show that both the presence of a serious natural disaster and the number of disaster categories are significantly associated with better CSR performance (higher CSR scores) in the affected area. These results remain robust after including province effect and firm fixed effect and using different sample periods.

We further explore how the magnitude (extent) of each disaster type influences firms' CSR investment using detailed data on each of the five natural disaster categories: earthquake, geological disaster, meteorological disaster, forest and grassland fire, and pests and rodent disease. Specifically, we construct disaster degree variables for each disaster category based on the death toll, economic loss, or affected area. Our empirical results show that the magnitude of the overall disasters is significantly associated with enhanced CSR investment in affected areas. When decomposing the effect of a single disaster category, we find magnitude (degree) of meteorological disaster and forest and

⁴ See http://www.gov.cn/gongbao/2016-02/29/content_5046085.htm for detailed guidelines.

grassland fire generate significant impacts on CSR with meteorological disasters have the strongest effect significant at 1% level.

To better understand the reasons that motivate the firms to increase CSR investments following natural disasters, we further survey the reasons documented in the literature that spur firms to invest in CSR and conduct a group of additional tests accordingly.

The first motivation comes from the literature that indicates firms with state ownership or political connections are likely to be engaged in more CSR or corporate philanthropy (Li and Zhang, 2010; Li et al., 2015). Using a sample of listed firms in China, Lin et al. (2015) find that firms contribute to CSR to build political networks and spend resources to bond with a new government via CSR activities. These studies imply that firms may use CSR activities to cater to the government, and CSR performance is driven by political pressure in exchange for rewards from the government in future business. Inspired by these studies, we first test how natural disasters influence CSR activities differently in state-owned enterprises (SOEs) versus non-state-owned enterprises (non-SOEs). Our empirical results show that the association between natural disasters and CSR is only significant in the subsample of SOEs but insignificant in non-SOEs. We further test the natural disasters' impact on CSR in firms with political connections (with high political connections) versus those without political connections (with low political connections) and find consistent results. These results suggest that state ownership or political connection plays an important role in firms' CSR activities after natural disasters.

Prior studies also document CSR activities are likely to be driven by institutional investors who have long investment horizons and can benefit from the reputation insurance that CSR spending provides (Kim et al., 2019; Fu et al., 2019; Chen et al., 2020). Consistent with these studies, our empirical results show the link between disasters and CSR is only significant in the subsample of firms with high institutional ownership but insignificant in firms with low institutional ownership.

Other studies show that larger firms and firms with greater free cash flow demonstrate a higher level of corporate social responsibility because these firms have more resources and are more capable. We conduct our empirical tests accordingly to see the effect of disasters on CSR in different subsamples based on firm size and cash holding. Again, we find consistent evidence that our main regression result is only

significant in larger firms and firms with more cash, suggesting these firms are more capable of investing in CSR after natural disasters.

Another stream of literature explains firms' CSR based on stakeholder theory, which links CSR with corporate financial performance and argues that some stakeholders value certain types of CSR, and these stakeholders may reward firms that engage in these forms of CSR (Agle et al., 1999; Hillman and Keim, 2001; Lev et al., 2010). For example, customers may favor brands produced by firms engaged in CSR (Brown and Dacin, 1997; Schuler and Cording, 2006), and they respond positively to CSR in terms of positive corporate evaluation, product association, and purchase intention (Tian et al., 2011). Employees may accept discounted wages (Bunderson and Thompson, 2009) and stay longer (Cone, 2007; Rupp et al., 2006) when working for a firm involved in CSR that they value. The evaluations from stakeholders enhance firms' reputation as well as financial performance, and in turn, encourage firms to invest more in CSR activities, suggesting that "doing good" may lead a business to "do well" (Gillan et al., 2010).

Inspired by these studies, we test whether firms that invest more in CSR following a natural disaster show higher financial performance in the future. We have two sets of empirical evidence. First, we find CSR investments in disaster periods bring better future financial performance than CSR in non-disaster periods. Second, we find the positive link between disaster period CSR investment and future financial performance is only significant in firms with political connections. Moreover, Madsen and Rodgers (2014) suggest that the corporate disaster relief CSR leads to positive future financial performance mainly through stakeholder attention. We examine this channel but find no significant association between disaster period CSR and analyst attention (or report attention).

Overall, our study provides rich evidence to show the impact of natural disasters on firms' CSR investment in affected areas and to understand the reasons that motivate this impact.

Our study contributes to the literature in a number of ways. First, we contribute new information to the CSR literature on the factors that motivate firms' CSR investment decisions. Prior studies document several factors that influence CSR strategy including ownership structure, firm characteristics, and CEO attributes, but these factors are likely to be endogenously determined by the company. Natural

disasters provide exogenous CSR need from the economy and straightforward incentives for different stakeholders to align their CSR strategy with government and society. This study also reinforces our understanding of the channels that natural disasters may motivate firms' CSR decisions.

Second, our study extends the aforementioned research by using China's natural disaster data to explore how companies build relationships with the government via philanthropic activities. We expand the earlier studies (Lin, Tan, Zhao, and Karim, 2015) by showing that the firms are likely to use CSR to build political networks when these philanthropic activities are in critical need of the government.

Last, our study has shown important policy relevance. Chinese government can learn the companies' motivation and rewards from their CSR strategies and make proper policies to guide CSR activities that can benefit stakeholders of the company and the public. The empirical results suggest institutional ownership and financial constraint are important factors that influence companies' CSR decisions in disaster areas. The conclusions drawn from this research are also relevant to scholars and policymakers in economies where natural disasters hit widely and frequently.

The rest of the paper is presented as follows. We discuss the data, sample, and variables in Section 2. Section 3 presents our main empirical findings. Section 4 provides robustness test results showing the impact of disaster magnitude and the impact of different disaster categories. Section 5 explores the reasons that motivate firms to invest in CSR following natural disasters. Section 6 summarizes and concludes the study.

2. Data, sample, and variable construction

2.1. Data and sample

Our initial sample consists of all firms with listed A-shares on either the Shenzhen or Shanghai stock exchange between 2011 and 2019. We obtain the CSR score from the Hexun website (www.hexun.com), which is the first vertical financial portal website in China. Hexun CSR is a leading CSR scoring system and widely used in research on Chinese listed firms' CSR performance (see Wang et al., 2021; Yi et al., 2021; Zhang et al., 2021; Zhao and Xiao, 2019; Zhu et al., 2021, etc.).

We obtain firm characteristics and shareholder data from the China Stock Market and Accounting Research (CSMAR) database and natural disaster data from the National Bureau of Statistics of China. We exclude the firms in financial sectors and

special treatment (ST) firms, and finally get 24,451 unbalanced firm-year observations from 3,298 firms in 9 years. All of the returns and control variables are winsorized at the 1st and 99th percentiles.

2.2. Variable construction

Our paper tends to investigate the link between natural disasters and firms' CSR performance. Thus, we use a firm's annual CSR score from Hexun as our dependent variable. Specifically, Hexun CSR rating is based on firms' CSR report and annual financial report. It conducts a comprehensive rating towards firms' responsibility in five primary categories including shareholders (30%), employees (15%), suppliers, customers and consumer rights (15%), environmental (20%) and social responsibility (20%), involving a total of 13 secondary and 37 tertiary indicators. One important superiority of using Hexun CSR rating is that it covers all listed firms and will be less subjected to the sample selection bias. In addition, it provides detailed scores for the subfields of CSR.

Our main explanatory variable of interest is natural disasters, which is represented by a set of disaster measures. *Disaster dummy* represents if the province that a firm is located suffered any of the five categories of natural disasters (*i.e.*, earthquake, geological disaster, meteorological disaster, forest and grassland fire, and pests and rodent disease) in a firm-year. *Disaster score* represents the number of disaster categories that the province where a firm is located suffered in a firm-year. *Earthquake degree*, *Geo degree*, *Fire degree*, *Meteo degree*, and *Pest degree* represent the severity of earthquake, geological disaster, forest and grassland fire, meteorological disaster, pest and rodent disease, respectively (see Appendix for detailed definitions). To examine heterogeneous impacts of natural disasters on CSR activities of firms with different characteristics, we divide the original sample into subsamples by firm size (*Firm size*), state ownership (*SOE*), political connections (*Political connections*), political connection level (*Political connection level*), institutional ownerships (*IS*), and cash holdings (*Cash ratio*).

Following prior literature, we include a number of firm-level variables to control for the effects of firm characteristics on firms' CSR performance in all tests including firm size, firm age, leverage, return on assets (*ROA*), Tobin's Q, cash ratio, board independence, and total compensation of executives.

2.3. Summary statistics

Table 1 provides the descriptive statistics for our main variables. Panel A shows that our primary variable of interest, *CSR score*, is significantly positive with a median value of 22.11. The 90th and 10th percentiles CSR scores are 45.99 and 8.48 respectively, indicating clear differences of CSR performance across Chinese listed firms. Panel C reports the descriptive statistics for firm characteristics that we use as control variables in our models. Panel D presents the descriptive statistics for other variables of interest. The 10, 25, 50, 75 and 90 percentiles *Political connection* equal to 1, suggesting that most of the listed firms have at least one board member or management member with political connection. However, the percentiles of *Political connection level* vary significantly across firms. It indicates that although most of our sample firms are politically connected, the strength of their political connections is quite different.

[INSERT TABLE 1 ABOUT HERE]

3. Main findings

3.1. The baseline model

We examine the relation between natural disasters and CSR scores by estimating the baseline model in Eq. (1) as follows:

$$CSRScore_{i,t} = \alpha + \beta Disaster\ dummy_{i,t}(Disaster\ score_{i,t}) + \sum_{n=1}^N \gamma_n X_{n,i,t} + \delta_t + \tau_i + \varepsilon_{i,t}, \quad (1)$$

where $CSRScore_{i,t}$ is the CSR score of firm i in year t . The key explanatory variable, $Disaster\ dummy_{i,t}(Disaster\ score_{i,t})$, is the measure of natural disasters. $X_{n,i,t}$ represents a set of control variables described in section 2.2. We use two variables to measure the natural disasters: $Disaster\ dummy_{i,t}$, which equals to one if the province where firm i 's headquarter is located has any one of the five categories of disasters⁵ in year t and zero otherwise; and $Disaster\ score_{i,t}$, which is the logarithm of the number of natural disaster categories which happened in firm i 's province in year t . We also include industry, province, firm and year fixed effects in the model to control for the effects of time-invariant industry, province or firm characteristics as well as business cycles.

⁵ The five natural disaster categories include earthquake, geological disaster, meteorological disasters, forest and grassland fire, and pests and rodent disease. Each disaster category dummy indicates the occurrence of the corresponding disaster. The definition of the rules that determine the occurrence of each disaster is given in the Appendix Table A.1

Table 2 reports the results of our baseline regression. In the first two columns, we regress CSR scores on *Disaster dummy*_{*i,t*}. In column (1), we do not control any firm characteristics, while in column (2), we include all the control variables. In both columns, we include year and firm fixed effect and find the coefficient estimates of *Disaster dummy*_{*i,t*} are positive and significant at 1%, suggesting that firms whose headquarter location province experience a natural disaster tend to have significantly higher CSR scores. Specifically, in column (2), the coefficient estimate of *Disaster dummy*_{*i,t*} indicates the occurrence of a natural disaster in a province leads the firms located in that province to increase their CSR scores by 4.637, which is around 30% of the standard deviation of CSR scores in our sample.

In columns (3) and (4), we focus on the number of disaster categories. We regress CSR scores on *Disaster score*_{*i,t*} together with year and firm fixed effect in column (3) and add all the firm characteristics control variables in column (4). In both columns, we find the coefficient estimates of *Disaster score*_{*i,t*} are positive and significant at 1%. Specifically, in column (4) the coefficient estimate suggests that one standard deviation increase in *Disaster score*_{*i,t*} leads to an increase in CSR score by 0.538 ($1.075 \times 0.500 = 0.5375$).

Turning to other firm characteristics, we find that larger firms, more profitable firms (higher ROA or Tobin's Q), firms with larger firm age, lower leverage, and better board monitoring (higher outside director ratio on board) are likely to have higher CSR scores. The empirical results suggest firms with these characteristics either more capable or more willing to invest in corporate social responsibility and our results are broadly consistent with prior CSR studies, such as Borghesi, Houston and Naranjo (2014) and Lau, Lu and Liang (2016).

3.2. Controlling for province and industry fixed effects

Although our key independent variable, natural disaster, is exogenous and out of the control of management, it is possible that firms that invest more in CSR are likely to be located in provinces where more natural disasters occur. Some of these unobservable time-invariant province characteristics, such as social or cultural characteristics that may shape people's attitude towards natural disasters and CSR, could also affect our results. Moreover, firms in some industries are likely to use CSR

to establish public relations and employee relations. To address these concerns, we include province and industry fixed effects and re-estimate our baseline regressions.

The results are reported in columns (5) and (6) of Table 2. We find estimation results remain unchanged for both natural disaster measures. The coefficient estimates of *Disaster dummy*_{*i,t*} in column (5) and *Disaster score*_{*i,t*} in column (6) are both positive and significant at 1%. These results suggest that the influence of both the presence of natural disasters (*Disaster dummy*_{*i,t*}) and the dimensions of natural disasters (*Disaster score*_{*i,t*}) on firms' CSR score is robust after controlling for unobservable time-invariant province and industry characteristics.

[INSERT TABLE 2 ABOUT HERE]

4. The magnitude of disasters and different categories of disasters

In this subsection, we further explore the influence of disaster magnitude on firms' CSR performance and investigate the both the independent and overall effect from different categories of natural disasters.

We first construct a degree measure to evaluate the magnitude of damage for each category of natural disasters based on different dimensions of damage, such as death toll, economic loss or affected area. Each degree measure is constructed to be a variable with value range of 0-1, and the overall disaster degree variable is the sum of the degree variable for each category.⁶

We replace our disaster measures (*Disaster dummy*_{*i,t*} and *Disaster score*_{*i,t*}) in baseline model with the independent and overall degree measures of natural disaster categories (*Earthquake degree*, *Geo degree*, *Fire degree*, *Meteo degree*, *Pest degree*, and *Disaster degree*), and re-estimate our baseline model Eq. (1).

Table 3 presents the estimation results. In columns (1) to (5), we find that the coefficient estimates of *Fire degree* and *Meteo degree* are positive and significant, while the coefficient estimates of *Earthquake degree*, *Geo degree*, and *Pest degree* are insignificant. The most significant impact comes from meteorological disasters with the coefficient estimate of *Meteo degree* significant at 1% level. According to the China

⁶ National Bureau of Statistics of China provides different damage measures for each natural disaster category. We select the damage measures that have continuous data and show adequate variation over time and across provinces to evaluate the degree (magnitude) of each natural disaster category. For example, the *Earthquake degree* evaluates the damage of earthquake from two perspectives: death toll and economic loss. We first calculate the normalized value of death toll and economic loss in each province-year and then *Earthquake degree* is calculated as the average of the two normalized measure. The definitions and calculation process of the degree measure for each natural disaster category are given in the Appendix Table A.1.

National Commission for Disaster Reduction, of all damages caused by natural disasters, 70 percent result from meteorological disasters including floods, droughts, typhoons, and thunderstorms⁷. In addition, China is a country that has suffered regularly from floods throughout its history⁸ and floods represent the most far-reaching disasters for both people and governments in China. It is thus not surprising to find the degree of meteorological disaster (*Meteo degree*) has the strongest impact on firms' CSR. Moreover, since earthquakes usually generate a strong psychological impact on people, we also expect the impact of *Earthquake degree* on CSR would be significantly positive. However, we find the effect from earthquake to be insignificant (column (1)), probably because the frequency and death toll of earthquake are much smaller than those of meteorological disasters⁹.

In column (6), we sum the degree measures of each disaster category and explore the impact of overall degree (magnitude) of natural disasters on CSR. We find the coefficient estimate on *Disaster degree* to be positive and significant at 1%.

Overall, these results indicate besides the presence and categories of natural disasters, the magnitude of disasters also generate significantly positive impact on firms' CSR in the affected province and the independent effect of a single disaster category mainly comes from meteorological disasters and forest and grassland fires.

[INSERT TABLE 3 ABOUT HERE]

5. Reasons that motivate CSR following natural disasters

In section 3 and 4 we conduct several analyses to show that the occurrence, the dimensions and the degree of natural disasters are associated with higher CSR performance of firms located in the disaster province. What are the potential reasons that can explain the strong positive association between natural disasters and firms' CSR investment? In this section, we follow the literature that documents the factors motivating firms to invest in CSR and then discuss several potential reasons that can rationalize our findings.

⁷ See <https://news.cgtn.com/news/2021-05-18/China-to-launch-comprehensive-survey-on-natural-disasters-10mBdT1xX4Q/index.html>

⁸ China has had more than its fair share of world's floods. Of the 10 largest floods around the world during the past 100 years, seven have been in China. See more detailed information at <https://www.channelnewsasia.com/commentary/china-south-floods-2020-hubei-jiangxi-yangtze-1339061>

⁹ The average frequency of the occurrence of earthquake disasters versus meteorological disasters in a province-year is 0.032 versus 0.669, while average death toll of earthquake disasters versus meteorological disasters in a province-year is 1.764 versus 36.998.

5.1. State ownership, political connection and disaster-CSR link

The first reason we explore is that firms are likely to invest in CSR to satisfy government request. Previous studies have shown that determinants such as firm political connections and state ownership are regarded as key factors that shape philanthropic activities, especially in emerging economies where political interference and state ownership are prevalent (Li, Song and Wu, 2015). Lin et al. (2015) also indicates firms in China would invest in CSR to build political networks and are rewarded by the government for their CSR activities. When a natural disaster occurs, individuals were in desperate need of supplies and aid, but the public sector may be unprepared due to lack of resources and funds in a short time, which is witnessed by several serious disasters in history, such as Hurricane Katrina in U.S. and Sichuan Earthquake in China. Therefore, firms have motivation to increase CSR activities during the critical time of disasters, either due to pressure from the government or due to their willingness to build a better relationship with the government. We hypothesize that the influence of natural disasters on CSR are more pronounced for firms with more state ownership or high political connections.

We first focus on the state ownership of the firms. Specifically, we divide our sample firms into SOEs and non-SOEs. We re-estimate our baseline regression models in Eq. (1) in the two subsamples separately. The results are reported in Table 4. In columns (1) and (2), we use the subsample of SOEs and find the coefficient estimates on both natural disaster measures (*Disaster dummy* and *Disaster score*) are positive and significant at 1%. In columns (3) and (4), we focus on the subsample of non-SOEs and find the link between natural disaster measures and firms' CSR scores tend to be insignificant. These results suggest that, only in state-owned firms, where political interferences are prevalent, firms are likely to increase their CSR investment when a natural disaster occurs, in order to provide support and respond to government request.

[INSERT TABLE 4 ABOUT HERE]

Next, we explore how the political connection of a firm could influence the impact of natural disasters on CSR. Specifically, we re-estimate our baseline regression models in Eq. (1) in the different subsamples based on firms' political connection measures. The results are presented in Table 5. We use two variables to measure a firms' political connection. The first one is Political connections, which is a dummy variable

indicating whether there is any member on board or management that has political connection. Using this dummy variable, we divide our sample into firms with and without political connections. In columns (1) and (2), with a subsample of firms with political connections, we find the baseline results remain unchanged and the coefficient estimates of natural disaster measures are significant at 1%. In columns (3) and (4), with a subsample of firms without any political connection, we find the disaster and CSR association become insignificant.

Since a large number of the firms have at least one politically connected member on board or management, the division of our sample based on *Political connections* dummy would make the number of observations in each subsample unbalanced. To address this concern, we further construct our second political connection measure, *Political connection level*, which equals 1 if the percentage of politically connected board or management members is above median percentage and 0 otherwise. Based on this dummy variable, we divide our sample into firms with high political connection level (columns (5) and (6)) and low political connection level (columns (7) and (8)). Again, we find the results show similar patterns as those in columns (1) to (4) that the influence of natural disasters on CSR is much stronger in firms with high level of political connections.

Overall, these results support our hypothesis that firms are likely to increase CSR activities following natural disasters due to political interference. The significant association between natural disaster measures and CSR scores only exist in state owned firms or firms with political connections.

[INSERT TABLE 5 ABOUT HERE]

5.2. Institutional ownership and disaster-CSR link

A long-standing literature has investigated the impact of institutional investors on CSR and documents a positive relationship. For example, Harjoto and Jo (2011) find that institutional ownership increases firms' CSR engagement. Chava (2014) finds institutional ownership is negatively related with a firm's environmental concerns. Dhaliwal et al. (2011) find that dedicated institutions hold shares of firms that initiate CSR disclosure and exhibit better CSR performance. Dyck, Lins, Roth, and Wagner (2019) show that institutional ownership is positively associated with firms' environmental and social performance and this relation is causal. A recent study by Chen, Dong and Lin (2020) also shows that an exogenous increase in institutional

holding caused by Russell Index reconstitutions improves portfolio firms' CSR performance.

CSR activities are driven by institutional investors mainly due to the reputation insurance that CSR spending provides, and long-term institutional investors benefit more from such insurance (Fu, Tan and Yan, 2019). In affected areas where natural disasters hit, people are more sensitive to firms' CSR policies and respond quickly to relief contributions. If a firm does not take suitable CSR strategy when a natural disaster occurs, it may quickly face negative publicity from customers and other stakeholders¹⁰. As such, intuitional investors, who cares and benefit more from reputation insurance provided by CSR, would have strong motivation to spur firms to invest in CSR following natural disasters.

To test this hypothesis, we investigate how the institutional ownership of a firm could influence the link between natural disasters and CSR. We re-estimate our baseline regression models in Eq. (1) in the subsamples with high institutional ownership versus low institutional ownership, where firms with institutional investor's shareholding ratio above the median ratio are categorized as *high IS* firms, otherwise as *low IS* firms.

The regression results are reported in Table 6. In columns (1) and (2), we use the subsample of firms with high intuitional shareholdings and the coefficient estimates on both natural disaster measures are positive and significant at 1%. Columns (3) and (4) report the results using the subsample of low intuitional ownership firms, and we find the association between natural disaster measures and firms' CSR scores become insignificant. These results confirm our hypothesis that institutional ownership is another driving factor that spurs firms to invest in CSR after natural disasters.

[INSERT TABLE 6 ABOUT HERE]

5.3 Firm size, cash to asset ratio and disaster-CSR link

CSR literature has documented several firm fundamentals that are associated with firms' CSR performance. For example, larger firms and firms that generate more cash are found to have more resources to invest in socially responsible activities (Borghesi,

¹⁰ In the days and weeks following the Sichuan earthquake, many multi-national corporations pursued a global CSR policy in line with their international standard. Domestic firms, by all accounts, out-donated multinationals. The popular perception was that international firms' relief contributions did not match those of local Chinese companies in terms of scale or timeliness, and were not commensurate with their presence in the Chinese market. Chinese consumers quickly seized upon this disparity by openly attacking major MNCs, calling for a boycott of their products and publicly condemning companies that donated too little.

Houston and Naranjo, 2014; Chen et al., 2020; Kim et al., 2019). Moreover, larger firms may face more publicity concerns following natural disasters and they are more motivated to gain reputation insurance via CSR investments. Firms with higher cash to asset ratio could have abundant cash on hand and be more capable of increasing CSR activities when a sudden natural disaster occurs and urgent support and aids are needed from the society.

Table 7 reports the empirical results of regressions that investigate the association between natural disaster measures and CSR scores in subsample of large firms and small firms separately. Firms with total assets above the median total assets of the sample are categorized as large firms, otherwise as small firms. In columns (1) and (2), we find, in the subsample of large firms, the disaster-CSR link is positive and significant at 1% while in columns (3) and (4), we find this relationship tends to be insignificant in subsample of small firms.

[INSERT TABLE 7 ABOUT HERE]

We further conduct regressions to test the disaster-CSR relationship in different subsamples based on firms' cash to asset ratio. Firms with cash ratio above the median cash ratio of the sample are categorized as high cash firms, otherwise as low cash firms. The results are presented in Table 8. In columns (1) and (2), we find the relationship between disaster measures and CSR scores is positive and significant in subsample of high cash firms, but this relationship is insignificant for subsample of low cash firms in columns (3) and (4).

[INSERT TABLE 8 ABOUT HERE]

Overall, these results suggest that when natural disaster occur, large firms and firms with high cash to asset ratio are likely to increase CSR activities, probably because these firms have more resources and be more capable to enhance immediate CSR investments after natural disasters.

5.4 Natural disasters, CSR investment and future financial performance

An important motivation for managers to undertake CSR investments is that they are consistent with the firm's financial interests. According to stakeholder theory, some stakeholders may view firms' CSR activities valuable and reward firms that invest in CSR (Agle et al., 1999; Hillman and Keim, 2001; Lev et al., 2010). For example, providing benefits to employees and establishing a reputation for being socially responsible may help firms attract and keep high-quality employees (Montgomery and

Ramus, 2007; Rupp et al., 2006), attract and maintain loyal customers who transform a good CSR record into positive product associations and purchase intention (Brown and Dacin, 1997; Schuler and Cording, 2006; Tian et al., 2011), and mitigate legal, political and tax risk (Huseynov and Klamm, 2012; Karpoff et al., 2005). Moreover, government may reward firms that spend resources in CSR activities with a higher level of government subsidies or a greater propensity to receive future government subsidies. The rewards from stakeholders change into profits and finally lead to better future financial performance.

In this subsection, we explore whether the firms that increase CSR investments following natural disasters are rewarded with better future performance. We employ *ROA* and *ROE* to measure a firms' accounting performance, and measure its stock market performance with *Tobin's Q*. To examine the impact of CSR on future performance, we use the performance measures in year $t+1$ as dependent variables, and CSR scores in year t as key explanatory variable. We include the same set of year t control variables in Eq. (1), together with year and firm fixed effect. To distinguish the effect of CSR on future performance in disaster period from the effect in normal period, we run the same set of regressions separately for disaster subsample (Disaster dummy=1) and non-disaster subsample (Disaster dummy=0).

The results are reported in Table 9 Panel A. Columns (1) to (4) reports the results showing the effect on firms' future accounting performance (*ROE* in columns (1) and (2), and *ROA* in columns (3) and (4)). In columns (1) and (3), we find in disaster subsamples, the coefficient estimates of *CSR scores* are positive and significant, suggesting that CSR activities following natural disasters are associated with significantly better future accounting performance. However, the effect of CSR on future accounting performance tends to be insignificant in non-disaster subsample in columns (2) and (4). We then focus on the effect of CSR scores on future stock market performance (*Tobin's Q*) in columns (5) and (6). We find in both disaster subsample and non-disaster subsample, the CSR activities are associated with positive future Tobin's Q and significant at 10%.

It is also documented in previous studies that companies' disaster relief CSR leads to more attentions from investors which finally contribute to better financial performance (Madson and Rodgers, 2014). We test this channel and replace the performance measures with *Analyst attention* (columns (7) and (8)) and *Reports attention* (columns (9) and (10)), to see whether CSR activities are associated with

future analyst or report attention from the market. However, we do not find any significant evidence to support this association, neither in disaster subsample nor in non-disaster subsample.

Last, since we find political connections is an important factor that motivates firms to invest in CSR following natural disasters, we further test the associate between disaster CSR activities and future performance in firms with and without political connections respectively. Specifically, we employ the disaster subsamples (*Disaster dummy*=1), further decomposing it into politically connected group and politically non-connected group, and re-estimate the regression models in Table 9 Panel A.

The results are presented in Panel B of Table 9. Columns (1) to (6) reports the impact of a firm's CSR scores on future *ROE* (columns (1) and (2)), *ROA* (columns (3) and (4)) and *Tobin's Q* (columns (5) and (6)). In columns (1), (3) and (5) (politically connected group), we find the coefficient estimate of *CSR scores* are positive and significant, while in columns (2), (4) and (6) (politically non-connected group), we find the coefficient estimates on *CSR scores* are all insignificant. These results suggest that a firm's CSR investment following natural disasters is significantly associated with positive future accounting performance and stock market performance, but only in group of firms that have political connections. In columns (7) to (10), we test the association between CSR performance and future analyst or report attention, in both politically connected and non-connected firms. Again, we do not find any significant result for this association.

Overall, the empirical tests in this subsection provide abundant evidence to show: (1) Firms' CSR performance is associated with better accounting performance and stock market performance, and this association is much stronger when natural disasters occur; (2) The rewards for CSR investment following natural disasters (better future performance) only exist for firms with political connections; (3) There is no significant association between CSR and future analyst attention.

[INSERT TABLE 9 ABOUT HERE]

6. Conclusion

CSR practice has become a critical corporate issue attracting significant attention from both academia and industry in recent years. Meanwhile, together with climate change, rapid economic growth, and urbanization, the intensifying natural disaster risk is putting a strain on the global resources, environment, and economy, especially for emerging economies like China. From time to time, we observe that large corporations get involved in natural disasters through CSR activities and respond quickly to pledge their support and provide funds and supplies for the relief effort. In this study, we focus on the link between natural disasters and firms' CSR performance. Using the detailed natural disaster data and a large sample of 3,298 Chinese listed firms over the period 2011-2019, we examine the role of natural disasters on enhancing firms' CSR performance in the affected area. We find that both the presence of a serious natural disaster and the number of disaster categories are significantly associated with a higher CSR performance of firms in the disaster province. This relationship is robust after including year, industry, and province fixed effect as well as firm fixed effect.

We further focus on the impact of the degree of natural disasters and find the overall degree of disasters is positively associated with CSR activities in the affected province. In addition, we examine the effect from each of the five categories of natural disasters and find the effect of degree of independent disasters come from meteorological disasters and forest and grassland fires, with the degree of meteorological disasters generating the most significant impact on CSR.

We explore the reasons that motivate firms to foster corporate social responsibility after natural disasters. State ownership and political connections are found to be important reasons that drive firms to increase disaster-CSR. We find our baseline results are significant only in state-owned firms and firms with political connections or with high political connections but insignificant in non-SOEs and firms with low or no political connections. Institutional ownership is found to be another driving factor that spurs firms to invest in CSR after natural disasters, with empirical evidence showing that the association between natural disasters and CSR only exists in firms with high institutional ownership. Furthermore, only large firms and firms with a high level of cash to asset ratio are capable of increasing CSR activities following natural disasters.

We also investigate whether the CSR activities following natural disasters lead to better future firm performance. We find the CSR activities do bring better future accounting and stock market performance for a firm, and the CSR-performance link is stronger and more significant in disaster subsample, indicating firms' investment in CSR during natural disaster period lead to higher rewards than that during the non-disaster period. We provide further evidence to show that the CSR-performance link during the disaster period only exists for firms with political connections, which confirms the role of political connections found in the previous section.

Overall, our findings suggest that factors such as state ownership, political connections, and institutional ownership motivate firms to increase CSR activities after natural disasters. Large firms and high cash firms have more immediate resources for CSR investment after natural disasters. The firms that invest in CSR after natural disasters are rewarded with better firm performance. Our study also has important policy implications. The empirical evidence from this research is particularly relevant to scholars and policymakers aiming to understand the impact of natural disasters on corporate policies and corporate social responsibilities in economies where natural disasters hit widely and frequently.

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Appendix A. Variable definitions

Variable	Definition	Source
<i>CSR score</i>	The firm-level annual CSR score from Hexun	Hexun.com
<i>Disaster dummy</i>	Dummy variable that equals 1 if the province that a firm is located suffered any of the five types of natural disasters (i.e., earthquake, geological disaster, meteorological disaster, forest and grassland fire, and pests and rodent disease) in that year, and 0 otherwise. In other words, it equals 1 if the value of any of the five natural disaster dummies is 1, and 0 otherwise. <i>Earthquake dummy</i> equals 1 if the province that a firm is located suffers at least one earthquake with magnitude greater than 6 in that year, and 0 otherwise. Geological disaster dummy (<i>Geo dummy</i>) equals 1 if the province that a firm is located suffers at least one geological disaster with 10 or more death toll in that year, and 0 otherwise. Forest fire dummy (<i>Fire dummy</i>) equals 1 if the province that a firm is located suffers at least one serious or extraordinarily serious forest and grassland fire in that year, and 0 otherwise. Meteorological disaster dummy (<i>Meteo dummy</i>) equals 1 if the province that a firm is located suffers at least one meteorological disaster with 10 or more death toll in that year, and 0 otherwise. Pests and rodent disease dummy (<i>Pest dummy</i>) equals 1 if the province that a firm is located suffers the disaster of pests and rodent disease with the affected area of 66,700 hectares or more in that year, and 0 otherwise.	
<i>Disaster score</i>	$Disaster\ score = \log(1 + Earthquake\ dummy + Geo\ dummy + Fire\ dummy + Meteo\ dummy + Pest\ dummy)$	
<i>Earthquake degree</i>	<i>Earthquake degree</i> is the disaster degree measure of earthquake, which evaluates the damage of earthquake from two perspectives: death toll and economic loss. It is calculated as the average value of two normalized variables, eqde1 and eqde2. Specifically, eqde1 represents the normalized earthquake death toll, and eqde2 represents the normalized economic loss caused by earthquake. We normalize a variable into 0-1 range using the following equation: $normalized\ X_i = \frac{(X_i - X_{min})}{(X_{max} - X_{min})}$, Where X represents the original value of the variable, X_{max} and X_{min} represents the maximum and minimum value of this variable in our sample, respectively.	
<i>Geo degree</i>	<i>Geo degree</i> is the disaster degree measure of geological disaster, which evaluates the damage of geological disasters from two perspectives: death toll and economic loss. It is calculated as the average value of two normalized variables, geode1 and geode2. Specifically, geode1 represents the normalized death toll caused by geological disasters, and	

	geode2 represents the normalized economic loss caused by geological disasters. The normalization is similar to the procedure used for the calculation of <i>Earthquake degree</i> .	
<i>Fire degree</i>	<i>Fire degree</i> is the disaster degree measure of forest and grassland fire, which evaluates the damage of forest and grassland fires from two perspectives: number of serious and extraordinarily serious forest and grassland fires and affected area of the disaster. It is calculated as the average value of two normalized variables, firede1 and firede2. Specifically, firede1 represents the normalized number of serious and extraordinarily serious forest fires, and geode2 represents the normalized affected area of forest and grassland fires. The normalization is similar to the procedure used for the calculation of <i>Earthquake degree</i> .	
<i>Meteo degree</i>	<i>Meteo degree</i> is the disaster degree measure of meteorological disaster, which evaluates the damage of meteorological disasters from two perspectives: death toll and affected area. It is calculated as the average value of two normalized variables, meteode1 and meteode2. Specifically, meteode1 represents the normalized number of death toll caused by meteorological disasters, and meteode2 represents the normalized affected area of meteorological disasters. The normalization is similar to the procedure used for the calculation of <i>Earthquake degree</i> .	
<i>Pest degree</i>	<i>Pest degree</i> is the disaster degree measure of pest and rodent disease, which evaluates the damage of pests and rodent diseases using the normalized affected area of pest and rodent disease. The normalization is similar to the procedure used for the calculation of <i>Earthquake degree</i> .	
<i>Political connections</i>	Dummy variable that equals 1 if there is at least one member on board or management has political connection, and 0 otherwise. We defined a politically connected member following Fan et al. (2007).	
<i>Political connection level</i>	Dummy variable that equals 1 if the percentage of politically connected board or management members is above median percentage, and 0 otherwise.	
<i>Firm size</i>	Natural logarithm of the book value of total assets	CSMAR
<i>Firm age</i>	Natural logarithm of listed years plus 1	CSMAR
<i>Leverage</i>	Total debt divided by total assets	CSMAR
<i>ROA</i>	Net income divided by total assets	CSMAR
<i>Tobin's Q</i>	Market value of equity and debt divided by total assets	CSMAR
<i>Cash ratio</i>	Total amount of cash and short-term investments divided by total assets	CSMAR

<i>Board independence</i>	Percentage of independent board members of a company	CSMAR
<i>Compensation</i>	Total compensation of executives	CSMAR
<i>ROE</i>	Net income divided by average equity	CSMAR
<i>IS</i>	Institutional investor's shareholding ratio	CSMAR
<i>Analyst Attention Reports</i>	Number of analysts (teams) who have conducted tracking analysis on the company in a year.	CSMAR
<i>Attention</i>	Number of research reports which have released a tracking analysis on the company in a year	CSMAR
Subsample Categories		
<i>SOE vs. non-SOE</i>	Firms with government or government-controlled banks as its ultimate owners are categorized as SOEs; firms controlled by nongovernmental institutions/individuals are categorized as non-SOEs.	
<i>PC vs. NPC</i>	Firms with at least one member on board or management has political connection are categorized as PC, otherwise as NPC.	
<i>HPC vs. LPC</i>	Firms with the percentage of board or management political connection above the median percentage are categorized as HPC, otherwise as LPC.	
<i>Large vs. Small</i>	Firms with total assets above the median total assets of the sample are categorized as large firms, otherwise as small firms.	
<i>High CH vs. Low CH</i>	Firms with cash ratio above the median cash ratio of the sample are categorized as high FC firms, otherwise as low FC firms.	
<i>High IS vs. Low IS</i>	Firms with institutional investor's shareholding ratio above the median ratio are categorized as high IS firms, otherwise as low IS firms.	

Table 1a. Summary Statistics

Variables	# of obs (1)	STD (2)	10% (3)	25% (4)	Median (5)	75% (6)	90% (7)
Panel A: CSR variables							
<i>CSR score</i>	24,451	15.643	8.480	16.480	22.110	27.450	45.990
Panel B: Disaster variables							
<i>Disaster dummy</i>	24,062	0.381	0.000	1.000	1.000	1.000	1.000
<i>Disaster score</i>	24,062	0.500	0.000	0.693	1.099	1.386	1.386
<i>Earthquake degree</i>	24,062	0.010	0.000	0.000	0.000	0.000	0.000
<i>Geo degree</i>	24,062	0.101	0.000	0.000	0.013	0.061	0.208
<i>Fire degree</i>	24,062	0.043	0.000	0.000	0.004	0.022	0.044
<i>Meteo degree</i>	24,062	0.238	0.000	0.000	0.500	0.500	0.500
<i>Pest degree</i>	24,062	0.128	0.013	0.049	0.140	0.204	0.273
<i>Disaster degree</i>	24,062	0.379	0.013	0.138	0.668	0.803	0.920
Panel C: Firm-characteristic variables							
<i>Firm size</i>	24,451	1.305	20.586	21.154	21.924	22.848	23.863
<i>Firm age</i>	24,451	0.795	1.099	1.609	2.303	2.890	3.091
<i>Leverage</i>	24,451	0.213	0.144	0.250	0.410	0.581	0.716
<i>ROA</i>	24,451	0.065	0.001	0.016	0.041	0.075	0.114
<i>ROE</i>	24,451	0.129	-0.004	0.028	0.069	0.118	0.175
<i>Tobin's Q</i>	24,451	1.276	1.057	1.237	1.589	2.281	3.381
<i>Cash ratio</i>	24,451	0.133	0.041	0.072	0.126	0.218	0.354
<i>Board independence</i>	24,451	0.053	0.333	0.333	0.357	0.429	0.429
<i>Compensation (in million yuan)</i>	24,451	4.846	1.769	2.691	4.183	6.778	10.763
Panel D: Other variables							
<i>Political connection</i>	24,451	0.201	1.000	1.000	1.000	1.000	1.000
<i>Political connection level</i>	24,451	0.497	0.000	0.000	0.000	1.000	1.000
<i>Institutional ownership</i>	24,408	24.870	7.637	22.838	45.829	64.069	75.816
<i>Analyst Attention</i>	17,138	10.140	1.000	2.000	6.000	14.000	25.000
<i>Reports Attention</i>	17,165	25.213	1.000	4.000	11.000	29.000	56.000

This table presents the summary statistics for the main variables (see Appendix for definitions) used in this study. It contains a sample of Chinese listed firms over the period 2011-2019. Financial firms and ST firms are removed from the sample. Panel A shows statistics on CSR scores, while Panel B presents measures of natural disasters. Panel C shows the firm-characteristic variables (firm controls), while Panel D concludes with a list of other variables used in the paper. The mean and standard deviation are determined across these observations for the variable. We also report the value of the variable at the 10th, 25th, 50th, 75th, and 90th percentile of the distribution of the variable. Control variables and returns are winsorized at the 1st and 99th percentiles.

Table 1b. Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
<i>CSR score</i> (1)	1.000																		
<i>Disaster dummy</i> (2)	-0.052	1.000																	
<i>Disaster score</i> (3)	-0.037	0.748	1.000																
<i>Disaster degree</i> (4)	-0.008	0.697	0.910	1.000															
<i>Firm size</i> (5)	0.229	-0.108	-0.075	-0.071	1.000														
<i>Firm age</i> (6)	0.085	-0.056	-0.025	-0.017	0.519	1.000													
<i>Leverage</i> (7)	0.028	0.000	0.015	0.024	0.597	0.418	1.000												
<i>ROA</i> (8)	0.298	0.007	-0.012	-0.021	-0.167	-0.217	-0.429	1.000											
<i>ROE</i> (9)	0.209	0.009	0.001	-0.014	0.011	-0.030	-0.063	0.469	1.000										
<i>Tobin's Q</i> (10)	-0.048	-0.022	0.026	0.007	-0.392	-0.087	-0.312	0.232	0.149	1.000									
<i>Cash ratio</i> (11)	0.066	-0.089	-0.054	-0.032	-0.333	-0.268	-0.446	0.305	0.119	0.157	1.000								
<i>Board independence</i> (12)	0.007	-0.059	-0.026	-0.044	0.031	-0.020	-0.006	0.005	0.006	0.043	0.025	1.000							
<i>Compensation</i> (13)	0.184	-0.096	-0.044	-0.068	0.499	0.227	0.228	0.079	0.149	-0.096	-0.078	-0.007	1.000						
<i>SOE</i> (14)	0.149	-0.096	-0.049	-0.011	0.414	0.522	0.333	-0.180	-0.043	-0.146	-0.121	-0.042	0.101	1.000					
<i>Political connection</i> (15)	0.034	0.027	0.009	0.021	0.071	0.063	0.058	-0.055	-0.023	-0.070	-0.035	-0.030	0.022	0.092	1.000				
<i>Political connection level</i> (16)	0.029	0.064	0.032	0.047	0.111	0.102	0.073	-0.042	-0.009	-0.106	-0.056	-0.054	-0.032	0.231	0.190	1.000			
<i>Institutional ownership</i> (17)	0.199	-0.059	-0.052	-0.033	0.458	0.323	0.265	0.016	0.105	-0.094	-0.086	-0.049	0.194	0.424	0.057	0.118	1.000		
<i>Analyst Attention</i> (18)	0.230	-0.018	0.002	-0.001	0.274	-0.005	0.009	0.355	0.359	0.134	0.059	0.039	0.335	-0.020	-0.026	-0.031	0.178	1.000	
<i>Reports Attention</i> (19)	0.215	-0.020	-0.001	-0.006	0.273	-0.001	0.017	0.339	0.361	0.137	0.055	0.042	0.344	-0.029	-0.025	-0.036	0.169	0.961	1.000

This table shows the correlation matrix for the main variables used in this study.

Table 2. Natural Disasters and CSR Performance

Dep. Variable	CSR score					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Disaster dummy</i>	4.637*** (0.000)	4.171*** (0.000)			4.122*** (0.000)	
<i>Disaster score</i>			1.407*** (0.001)	1.075*** (0.004)		1.349*** (0.001)
<i>Firm size</i>		3.944*** (0.000)		4.003*** (0.000)	3.559*** (0.000)	3.556*** (0.000)
<i>Firm age</i>		5.285*** (0.000)		5.311*** (0.000)	0.072 (0.747)	0.07 (0.754)
<i>Leverage</i>		-5.621*** (0.000)		-5.557*** (0.000)	-5.035*** (0.000)	-5.028*** (0.000)
<i>ROA</i>		80.324*** (0.000)		80.823*** (0.000)	91.469*** (0.000)	91.519*** (0.000)
<i>Tobin's Q</i>		0.236** (0.040)		0.226* (0.051)	0.113 (0.344)	0.109 (0.362)
<i>Cash ratio</i>		-0.267 (0.805)		0.035 (0.974)	0.916 (0.381)	0.973 (0.352)
<i>Board independence</i>		5.812* (0.067)		6.322** (0.049)	1.845 (0.455)	1.825 (0.460)
<i>Compensation</i>		-0.049 (0.358)		-0.057 (0.285)	0.245*** (0.000)	0.245*** (0.000)
Fixed effects: Year	Y	Y	Y	Y	Y	Y
Fixed effects: Industry	N	N	N	N	Y	Y
Fixed Effects: Province	N	N	N	N	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y	N	N
Observations	24,047	23,092	23,737	22,839	22,940	22,940
Adj R^2	0.470	0.551	0.468	0.549	0.378	0.378

This table contains regression results of natural disasters and firm characteristics on corporate social responsibility. Each regression contains year fixed-effects. We control for industry, province, and firm fixed-effects in regressions (1)-(6), respectively. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 3. Impacts of Different Types of Disasters on CSR Performance

Dep. Variable	CSR score					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Earthquake degree</i>	7.754 (0.394)					
<i>Geo degree</i>		-0.488 (0.624)				
<i>Fire degree</i>			5.947** (0.030)			
<i>Meteo degree</i>				1.405*** (0.002)		
<i>Pest degree</i>					3.650 (0.346)	
<i>Disaster degree</i>						1.088*** (0.003)
<i>Firm size</i>	4.002*** (0.000)	4.005*** (0.000)	4.000*** (0.000)	4.003*** (0.000)	4.002*** (0.000)	4.001*** (0.000)
<i>Firm age</i>	5.313*** (0.000)	5.328*** (0.000)	5.363*** (0.000)	5.350*** (0.000)	5.292*** (0.000)	5.328*** (0.000)
<i>Leverage</i>	-5.589*** (0.000)	-5.597*** (0.000)	-5.591*** (0.000)	-5.578*** (0.000)	-5.579*** (0.000)	-5.569*** (0.000)
<i>ROA</i>	80.881*** (0.000)	80.865*** (0.000)	80.828*** (0.000)	80.832*** (0.000)	80.883*** (0.000)	80.835*** (0.000)
<i>Tobin's Q</i>	0.229** (0.048)	0.229** (0.048)	0.225* (0.052)	0.229** (0.048)	0.228** (0.049)	0.228** (0.049)
<i>Cash ratio</i>	0.000 (1.000)	0.005 (0.996)	0.061 (0.955)	0.034 (0.975)	-0.029 (0.979)	0.023 (0.983)
<i>Board independence</i>	6.297* (0.050)	6.294* (0.051)	6.215* (0.054)	6.344** (0.049)	6.323** (0.049)	6.326** (0.049)
<i>Compensation</i>	-0.056 (0.296)	-0.056 (0.295)	-0.056 (0.290)	-0.057 (0.290)	-0.056 (0.292)	-0.057 (0.290)
Fixed effects: Year	Y	Y	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y	Y	Y
Observations	22,839	22,839	22,839	22,839	22,839	22,839
Adj R^2	0.549	0.549	0.549	0.549	0.549	0.549

This table contains regression results of degrees of different types of natural disasters on corporate social responsibility to show their independent and overall impacts on firms' CSR performance. Regressions in column (1)-(5) examine the impacts of earthquake degree, geological disaster degree, forest fire degree, meteorological disaster degree, and pests and diseases degree on firms' CSR performance, respectively (see Appendix for definitions). Regression in column (6) examine the relationship between total disaster degree and firms' CSR performance. We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 4. State Ownership, Natural Disasters and CSR Performance

Dep. Variable	CSR score			
	SOE=1		SOE=0	
	(1)	(2)	(3)	(4)
<i>Disaster dummy</i>	6.395*** (0.000)		0.832 (0.489)	
<i>Disaster score</i>		1.962*** (0.007)		0.531 (0.210)
<i>Firm size</i>	5.079*** (0.000)	5.058*** (0.000)	3.103*** (0.000)	3.200*** (0.000)
<i>Firm age</i>	1.639 (0.331)	1.507 (0.377)	3.660*** (0.000)	3.693*** (0.000)
<i>Leverage</i>	-9.071*** (0.000)	-8.978*** (0.000)	-3.945*** (0.001)	-3.829*** (0.001)
<i>ROA</i>	88.416*** (0.000)	88.431*** (0.000)	78.403*** (0.000)	78.715*** (0.000)
<i>Tobin's Q</i>	0.727*** (0.005)	0.724*** (0.006)	0.010 (0.932)	0.007 (0.957)
<i>Cash ratio</i>	1.800 (0.509)	2.666 (0.327)	0.362 (0.742)	0.389 (0.726)
<i>Board independence</i>	10.867* (0.057)	11.430** (0.047)	2.788 (0.398)	3.387 (0.311)
<i>Compensation</i>	0.035 (0.686)	0.026 (0.762)	-0.149** (0.020)	-0.160** (0.013)
<i>Constant</i>	-102.220*** (0.000)	-98.530*** (0.000)	-55.166*** (0.000)	-57.325*** (0.000)
Fixed effects: Year	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y
Observations	8,326	8,264	14,766	14,575
Adj R^2	0.558	0.555	0.555	0.555

This table contains regression results of natural disasters and firm characteristics on corporate social responsibility to examine the impact of natural disasters on firms' CSR activities in state-owned firms (SOEs) versus non-state-owned firms (non-SOEs). Specifically, we divide the sample into two subsamples: Firms with government or government-controlled banks as their ultimate owners are categorized as SOEs; firms controlled by nongovernmental institutions/individuals are categorized as non-SOEs. We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 5. Political Connections, Natural Disasters and CSR Performance

Dep. Variable	CSR score							
	PC: Political connections		NPC: No political connections		HPC: High political connection level		LPC: Low political connection level	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Disaster dummy</i>	4.457*** (0.000)		1.651 (0.611)		6.573*** (0.000)		2.160* (0.058)	
<i>Disaster score</i>		1.007*** (0.009)		0.917 (0.603)		1.859*** (0.002)		0.149 (0.775)
<i>Firm size</i>	3.941*** (0.000)	3.997*** (0.000)	1.988 (0.170)	2.193 (0.123)	4.462*** (0.000)	4.540*** (0.000)	3.593*** (0.000)	3.649*** (0.000)
<i>Firm age</i>	5.433*** (0.000)	5.457*** (0.000)	0.073 (0.982)	0.012 (0.997)	6.297*** (0.000)	6.409*** (0.000)	4.754*** (0.000)	4.788*** (0.000)
<i>Leverage</i>	-5.677*** (0.000)	-5.603*** (0.000)	-5.640 (0.162)	-6.274 (0.130)	-7.337*** (0.000)	-7.508*** (0.000)	-4.515*** (0.001)	-4.495*** (0.001)
<i>ROA</i>	81.207*** (0.000)	81.794*** (0.000)	71.292*** (0.000)	69.868*** (0.000)	81.844*** (0.000)	82.429*** (0.000)	78.724*** (0.000)	79.231*** (0.000)
<i>Tobin's Q</i>	0.245** (0.043)	0.240** (0.047)	-0.776 (0.147)	-0.765 (0.148)	0.248 (0.257)	0.226 (0.306)	0.110 (0.417)	0.099 (0.467)
<i>Cash ratio</i>	-0.315 (0.779)	0.010 (0.993)	-2.036 (0.593)	-2.594 (0.499)	2.435 (0.191)	2.575 (0.171)	-0.320 (0.810)	-0.084 (0.949)
<i>Board independence</i>	5.606* (0.088)	5.975* (0.072)	2.176 (0.833)	3.847 (0.705)	7.232 (0.196)	7.708 (0.177)	6.384* (0.095)	7.049* (0.069)
<i>Compensation</i>	-0.054 (0.327)	-0.062 (0.260)	-0.337 (0.101)	-0.342* (0.096)	0.000 (0.997)	-0.018 (0.829)	-0.101 (0.136)	-0.106 (0.120)
Fixed effects: Year	Y	Y	Y	Y	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,116	21,876	809	800	10,230	10,140	12,256	12,099
Adj R ²	0.552	0.550	0.620	0.609	0.555	0.555	0.578	0.575

This table contains regression results of natural disasters and firm characteristics on corporate social responsibility based on different subsamples. First, we study the impact of natural disasters on firms' CSR activities in two subsamples: Firms with at least one politically connected member on board or management are categorized as PC, otherwise as NPC. Second, we further examine the impact of natural disasters on firms' CSR activities in two subsamples based on political connection level: Firms with the percentage of politically connected board or management members above the median percentage are categorized as HPC, otherwise as LPC. We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 6. Intuitional Ownerships, Natural Disasters and CSR Performance

Dep. Variable	CSR score			
	HIS		LIS	
	(1)	(2)	(3)	(4)
<i>Disaster dummy</i>	5.216*** (0.000)		0.750 (0.573)	
<i>Disaster score</i>		2.006*** (0.001)		0.188 (0.685)
<i>Firm size</i>	5.638*** (0.000)	5.694*** (0.000)	2.083*** (0.000)	2.171*** (0.000)
<i>Firm age</i>	6.952*** (0.000)	6.903*** (0.000)	3.323*** (0.000)	3.387*** (0.000)
<i>Leverage</i>	-9.311*** (0.000)	-9.344*** (0.000)	-3.077** (0.030)	-2.899** (0.041)
<i>ROA</i>	87.390*** (0.000)	87.900*** (0.000)	77.442*** (0.000)	77.713*** (0.000)
<i>Tobin's Q</i>	0.380** (0.025)	0.379** (0.025)	-0.097 (0.506)	-0.112 (0.444)
<i>Cash ratio</i>	-0.618 (0.727)	-0.187 (0.915)	0.810 (0.542)	1.010 (0.451)
<i>Board independence</i>	3.462 (0.515)	4.008 (0.456)	3.877 (0.276)	4.347 (0.226)
<i>Compensation</i>	0.047 (0.498)	0.040 (0.570)	-0.191** (0.024)	-0.203** (0.017)
Fixed effects: Year	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y
Observations	11,434	11,332	11,396	11,248
Adj R^2	0.558	0.556	0.555	0.555

This table contains regression results of natural disasters and firm characteristics on corporate social responsibility to examine the impact of natural disasters on firms' CSR activities in firms with high versus low institutional ownership. Specifically, we divide the sample into two subsamples: Firms with institutional shareholding ratios above the median ratio are categorized as high institutional shareholdings (HIS), otherwise as low institutional shareholdings (LIS). We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 7. Firm Size, Natural Disasters and CSR Performance

Dep. Variable	CSR score			
	Large firm		Small firm	
	(1)	(2)	(3)	(4)
<i>Disaster dummy</i>	6.705*** (0.000)		0.973 (0.273)	
<i>Disaster score</i>		1.900*** (0.003)		-0.044 (0.916)
<i>Firm size</i>	4.018*** (0.000)	4.112*** (0.000)	2.178*** (0.000)	2.136*** (0.000)
<i>Firm age</i>	7.279*** (0.000)	7.196*** (0.000)	0.640 (0.386)	0.632 (0.393)
<i>Leverage</i>	-10.862*** (0.000)	-11.441*** (0.000)	-3.360*** (0.005)	-3.002** (0.012)
<i>ROA</i>	86.264*** (0.000)	87.883*** (0.000)	74.038*** (0.000)	74.224*** (0.000)
<i>Tobin's Q</i>	0.785*** (0.009)	0.755** (0.014)	0.008 (0.941)	-0.007 (0.950)
<i>Cash ratio</i>	-2.741 (0.295)	-2.264 (0.394)	2.039* (0.069)	2.189* (0.052)
<i>Board independence</i>	9.654* (0.062)	10.152* (0.055)	2.810 (0.425)	3.211 (0.364)
<i>Compensation</i>	-0.001 (0.992)	-0.007 (0.911)	0.081 (0.341)	0.065 (0.445)
Fixed effects: Year	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y
Observations	11,601	11,439	11,169	11,083
Adj R^2	0.549	0.546	0.617	0.618

This table contains regression results of natural disasters and firm characteristics on corporate social responsibility to show the impact of natural disasters on firms' CSR performance in subsample of large versus small firms. Specifically, we divide the sample into two subsamples: Firms with total assets above the median total assets of the sample are categorized as large firms, otherwise as small firms. We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 8. Cash Holdings, Natural Disasters and CSR Performance

Dep. Variable	CSR score			
	HCH: High cash holdings		LCH: Low cash holdings	
	(1)	(2)	(3)	(4)
<i>Disaster dummy</i>	4.335*** (0.001)		1.805 (0.126)	
<i>Disaster score</i>		1.693*** (0.006)		0.310 (0.491)
<i>Firm size</i>	4.906*** (0.000)	4.820*** (0.000)	2.459*** (0.000)	2.644*** (0.000)
<i>Firm age</i>	8.883*** (0.000)	8.863*** (0.000)	0.175 (0.813)	0.071 (0.923)
<i>Leverage</i>	-8.171*** (0.000)	-8.154*** (0.000)	-3.526*** (0.004)	-3.294*** (0.007)
<i>ROA</i>	88.974*** (0.000)	89.167*** (0.000)	73.975*** (0.000)	73.692*** (0.000)
<i>Tobin's Q</i>	0.264 (0.253)	0.223 (0.337)	0.058 (0.658)	0.068 (0.607)
<i>Cash ratio</i>	-4.568** (0.038)	-4.368** (0.048)	2.014 (0.220)	2.154 (0.193)
<i>Board independence</i>	5.770 (0.248)	6.677 (0.186)	6.523* (0.079)	6.947* (0.063)
<i>Compensation</i>	-0.042 (0.512)	-0.043 (0.502)	0.106 (0.220)	0.080 (0.360)
Fixed effects: Year	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y
Observations	11,361	11,238	11,144	11,026
Adj R^2	0.530	0.528	0.586	0.587

This table contains regression results of natural disasters and firm characteristics on corporate social responsibility to show the impact of natural disasters on firms' CSR performance in firms with high versus low cash holdings. Specifically, we divide the sample into two subsamples: Firms with cash ratio above the median cash ratio of the sample are categorized as firms with high cash holdings (HCH), otherwise as firms with high cash holdings (LCH). We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.

Table 9. CSR Activities, Financial Performance, and Firm Visibility

<i>Panel A. CSR activities, financial performance and firm visibility in disaster subsample versus non-disaster subsample</i>										
Dep. Variable=	ROE (t+1)		ROA (t+1)		Tobin's Q (t+1)		Analyst Attention (t+1)		Reports Attention (t+1)	
	disaster=1	disaster=0	disaster=1	disaster=0	disaster=1	disaster=0	disaster=1	disaster=0	disaster=1	disaster=0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>CSR score</i>	0.000*** (0.007)	0.000 (0.173)	0.000** (0.027)	0.000 (0.825)	0.001* (0.066)	0.002* (0.050)	0.004 (0.533)	-0.002 (0.871)	-0.001 (0.943)	-0.019 (0.557)
<i>Firm size</i>	-0.041*** (0.000)	-0.023** (0.015)	-0.017*** (0.000)	-0.012*** (0.004)	-0.305*** (0.000)	-0.374*** (0.000)	3.306*** (0.000)	2.617*** (0.000)	7.282*** (0.000)	6.000*** (0.001)
<i>Firm age</i>	-0.019*** (0.002)	-0.017 (0.142)	-0.016*** (0.000)	-0.016** (0.022)	0.425*** (0.000)	0.276*** (0.006)	-0.352 (0.565)	-2.185* (0.061)	-0.179 (0.909)	-5.956** (0.038)
<i>Leverage</i>	0.093*** (0.000)	0.099*** (0.003)	0.011 (0.137)	0.022 (0.159)	0.162 (0.160)	0.532** (0.036)	1.030 (0.314)	0.874 (0.726)	4.281* (0.097)	4.450 (0.504)
<i>ROA</i>	0.299*** (0.000)	0.242*** (0.004)	0.182*** (0.000)	0.126*** (0.003)	0.171 (0.520)	1.061 (0.134)	36.731*** (0.000)	30.769*** (0.000)	86.353*** (0.000)	71.226*** (0.000)
<i>Tobin's Q</i>	0.011*** (0.000)	0.008*** (0.001)	0.005*** (0.000)	0.003** (0.025)	0.307*** (0.000)	0.293*** (0.000)	1.843*** (0.000)	2.039*** (0.000)	4.270*** (0.000)	5.297*** (0.000)
<i>Cash ratio</i>	0.097*** (0.000)	0.094*** (0.000)	0.043*** (0.000)	0.045*** (0.000)	0.363*** (0.001)	0.237 (0.314)	2.771*** (0.009)	3.021 (0.170)	6.941*** (0.010)	7.819 (0.160)
<i>Board independence</i>	0.012 (0.703)	0.072 (0.137)	0.007 (0.668)	-0.008 (0.748)	0.252 (0.295)	0.440 (0.318)	-0.805 (0.737)	5.750 (0.280)	-0.786 (0.905)	15.815 (0.276)
<i>Compensation</i>	0.002*** (0.000)	0.000 (0.570)	0.001** (0.011)	-0.000 (0.875)	0.014*** (0.000)	-0.001 (0.829)	0.183*** (0.000)	0.050 (0.476)	0.428*** (0.001)	0.200 (0.321)
Fixed effects: Year	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	18,702	4,078	16,065	3,466	15,630	3,389	12,842	2,888	12,857	2,892
Adj R ²	0.280	0.296	0.423	0.410	0.685	0.679	0.650	0.620	0.632	0.605

Table 9. (continued)

<i>Panel B. Disaster period CSR activities, financial performance and firm visibility for firms with and without political connections</i>										
Dep. Variable=	ROE (t+1)		ROA (t+1)		Tobin's Q (t+1)		Analyst Attention (t+1)		Reports Attention (t+1)	
	Political connection=1	Political connection=0	Political connection=1	Political connection=0	Political connection=1	Political connection=0	Political connection=1	Political connection=0	Political connection=1	Political connection=0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>CSR score</i>	0.000*** [0.007]	0.000 [0.669]	0.000** [0.025]	-0.000 [0.560]	0.001* [0.084]	-0.003 [0.607]	0.006 [0.405]	0.030 [0.421]	0.006 [0.716]	0.069 [0.481]
Other controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects: Year	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed Effects: Firm	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	17,956	617	15,412	523	14,999	501	12,313	417	12,329	417
Adj R^2	0.281	0.355	0.424	0.455	0.689	0.679	0.649	0.772	0.631	0.754

Panel A of this table reports regression results of firms' CSR activities on financial performance and firm visibility during disaster period versus non-disaster period. Panel B presents regression results of disaster period CSR activities on financial performance and firm visibility for firms with and without political connections. We control for firm and year fixed effects in each column regression. All the standard errors are clustered by firm, and the p-values are reported in parentheses. ***, **, and * indicate that the parameter estimate is significant at the 1%, 5%, and 10% level, respectively.