Corporate Social Responsibility and Firms' Resilience to External Disruption

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Abstract

We propose that corporate social responsibility (CSR) serves as an intangible investment in stakeholder relationship to guard against external disruption. We develop a stylized model in which although CSR investment is costly, it helps firms recover from disruption thanks to supports from customers and employees with preferences for CSR. Using factory location data from the toxic release inventory (TRI) database to specify firms' geographic distribution, we find that firms with higher CSR ratings are much less affected by major natural disasters. We then examine the customer and employee channels through which CSR engagement shields firms against external disruption. We find that CSR helps firms survive from natural disasters by enhancing customer satisfaction that leads to more stable post-disaster sales, and enhancing employee satisfaction that leads to higher post-disaster productivity. Our evidence thus highlights CSR as an important intangible assets for firms.

Keywords: natural disasters; corporate social responsibility; operating performance; sustainability; customer loyalty; employee satisfaction.

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1. Introduction

Sustainability and stakeholders' interests have attracted substantial media attention and have become important issues for companies and managers in today's business environment.[1] For example, the overall 200 largest companies that participated in the large-scale survey conducted by Committee Encouraging Corporate Philanthropy (CECP) and Conference Board gave total $20.3 billion in 2016 (with a median of $18.9 million per company).[2] In 2005, 64% of the 250 largest multinational companies published corporate social responsibility (CSR) reports (Porter and Kramer, 2006). More recently, over 50% of Fortune 100 companies have chosen to include CSR statements in their financial statements.[3] However, why firms and their managers and shareholders are willing to (or are forced to) make so much societal investment remains an important debate among economists (see the review of Kitzmueller and Shimshack, 2012). In particular, some prior studies argue that CSR is associated with agency problems and incentive issues (Friedman, 1970; Jensen, 2002; Brown, Helland, and Smith, 2006; Hong, Kubik, and Scheinkman, 2012; Cheng, Hong, and Shue, 2013; Masulis and Reza, 2015), and firms should focus on their profitability but not CSR activities.

To counter these negative beliefs, some recent studies provide empirical evidence suggesting that CSR activities can actually enhance firms' performance and market value (Luo and Bhattacharya, 2006; Lev, Petrovits, and Radhakrishnan, 2010; Flammer, 2015).[4] These value-enhancing effects may be attributed to three channels: consumers, employees, and risks. First, CSR activities strengthen market positions and create new opportunities by improving social image and brand awareness (Porter and van der Linde, 1995; Lev, Petrovits, and Radhakrishnan, 2010). Marketing survey has documented that CSR has a positive effect

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[1] The World Bank defines CSR as "the commitment of businesses to behave ethically and to contribute to sustainable economic development by working with all relevant stakeholders to improve their lives in ways that are good for business, the sustainable development agenda, and society at large" (Kitzmueller and Shimshack, 2012).

[2] These participating companies generated $7.5 trillion in revenue and hired 17 million employees. Source: http://cecp.co/home/resources/giving-in-numbers/

[3] Michael Sater in Forbes CSR blog: https://www.forbes.com/sites/csr/2011/07/20/csr-in-annual-reports-7-conflicting-trends/#23a3b639a114

[4] Wang, Choi, and Li (2008), on the other hand, suggests an inverse U-shape relationship between corporate philanthropy and financial performance.

on consumers' overall assessment of firms' reputation (Brown and Dacin, 1997). Moreover, Sen and Bhattacharya (2001) and Bhattacharya and Sen (2003) show that consumers are more loyal to high-CSR firms, and Navarro (1988) and Bagnoli and Watts (2003) propose models in which socially responsible consumers are willing to pay premium to the products offered by those firms. Such affective value associated with CSR proposed by psychology and marketing literature is confirmed by accounting research,[5] which supports the argument that high-CSR firms behave in a trustworthy and socially responsible manner.

Second, CSR may also enhance employee satisfaction and cohesion through monetary compensation, job security, affective affiliation, and pride. For example, Google's official slogan, "[y]ou can make money without doing evil," installed in employees made them protest against the firm's involvement in Pentagon drone AI project and eventually forced Google to back off from that initiative. When employees (and potential employees) have societal and environmental preferences, firms' CSR accumulates moral capital which attracts talents and reduces employee turnover (Porter and Kramer, 2002; Greening and Turban, 2000; Barnett, 2007). Fombrun, Gardberg, and Barnett, (2000) and Peterson (2004) show that the more employees value CSR, the more willing they will dedicate themselves to the company's operations and sustainability.

Third, instead of doing good for good reasons, some firms engage in CSR to hedge against risks. Activist organizations have nowadays become more aggressive in bringing public attention and pressure on companies' social responsibility (Porter and Kramer, 2006). These groups, together with other stakeholders including governments, may also initiate lawsuits against companies to hold them accountable for various issues (Hong and Liskovich, 2016). All these require firm managers to adapt themselves to a risk-management mindset and to take initiative to hedge external risks related to social and environmental issues (King and Lenox, 2000; Eesley and Lenox, 2006). CSR thus serves the rational and strategic purpose of

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[5] Dhaliwal, Li, Tsang, and Yang (2011) and Dhaliwal, Radhakrishnan, Tsang, and Yang (2012) show that firms issue CSR reports to provide non-financial information to investors and analysts. Kim, Park, and Wier (2012) report that CSR firms are less likely to take part in earnings management or GAAP violations. Kitzmueller and Shimshack (2012) review economics, marketing, and management literature and suggest that economists have accepted such societal and environmental preferences in their models accordingly (e.g., Navarro, 1988; Bagnoli and Watts, 2003).

improving relationship with governments and stakeholders, and can be regarded as a hedging device to diversify and reduce firms' legal risk (Godfrey, 2005; Ghoul, Guedhami, Kim, and Park, 2018).

The above discussions suggest that CSR activities may help firms enhance consumers' loyalty, motivate employees, as well as hedge against potential societal and environmental risks. Motivated by the three channels, we propose CSR activities as intangible investments that protect firms under external disruption risks via the channels of consumer loyalty and employee engagement. To formalize this argument, we derive a simple model with one high CSR firm that is under the threat of external disruptions (or natural disasters in our empirical setting) and operates a factory to satisfy consumers and employees, both have preferences for CSR. In the model, the firm continuously invests in CSR to compete with many non-CSR firms. When a disruption occurs to the focal firm, consumers can choose to buy non-CSR products and employees can quit to work for non-CSR firms, or wait for the focal firm to recover from the disruption but suffers from some loss in their utilities. This stylized and yet meaningful model shows that without external disruption risks, investing in CSR may or may not enhance firm performance, which is consistent with the neoclassic economic theory that disapproves CSR investments. However, under the presence of external disruptions, the focal high-CSR firm's profit is less affected by the disruption. Such a firm resilience associated with CSR results from the channels of both consumers and employees.

In our empirical test, we use natural disasters as exogenous shocks that unexpectedly weaken firms' operating performance, but are unrelated to omitted variables.[6] We employ a differences-in-differences (DID) approach in which we compare the difference in operating performance of high-CSR firms before and after natural disasters to that of low-CSR firms, controlling for firm fixed effects and observable firm characteristics related to operating

[6] According to the Emergency Events Database (EM-DAT), the total damage from natural disasters globally was around US$ 2,908 billion between 1998 and 2017, and the total number of deaths was 1.3 million. US alone recorded $945 billion loss resulted from 482 disasters, whereas China alone recorded $492 billion loss from 577 disasters. Prior studies have documented that natural disasters have a significant impact on GDP per capita, labor markets, mental health, and firm-level operating performance (Kahn, 2005; Raddatz 2007; Luechinger and Raschky 2009; Hsu, Lee, Peng, and Yi, 2018).

performance.[7]

This design based on exogenous disasters enables us to test our proposition that high-CSR firms are more resilient to difficulty without the interference of omitted variables. A common criticism on prior studies for the performance relevance of CSR lies on the difficulty to rule out potential omitted variables that affect firms' current CSR and future performance simultaneously (Hong, Kubik, and Scheinkman, 2012). For example, even if CSR does not matter for firm performance, managers may be more willing to spend on CSR for their private benefits (such as reputation and social status) when they foresee good revenue or stable cash flows. In our DID design, as natural disasters are diagonal to managers' expectation (or other omitted variables), the coefficient on the interaction between CSR and natural disasters in explaining future operating performance is able to appropriately identify how CSR facilitates firms to recovery from difficulties.[8]

In our empirical analysis, we first collect the important natural disasters and the affected areas identified in Barrot and Sauvagnat (2015), which are based on the Spatial Hazard and Loss Database (maintained by the University of South Carolina). To analyze the impact of these disasters on firms, we rely on the U.S. Environmental Protection Agency's (EPA) toxic release inventory (TRI) database to identify the affected factory locations owned by U.S. public manufacturing firms. We also collect the MSCI KLD database to construct a firm's CSR score, which is calculated based on over 80 indicators for its strength and weakness in community, corporate governance, diversity, employee relations, environment, human rights, and product areas. Lastly, we collect the financial and accounting data of U.S. public manufacturing firms from the Compustat/CRSP database. Due to the availability and

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[7] High- and low-CSR firms are defined as firms with CSR scores (constructed from the MSCI KLD database) above and below the top quartile of firms in the same industry before disasters. Since we use the pre-disaster CSR, the change in operating performance due to our test is able to test the role of firms' CSR in mitigating or intensifying the impact of natural disasters on operating performance that is unaffected by changes in CSR after disasters.

[8] If the association between CSR and operating performance were driven by an unobservable factor, then such a factor should also correlate with the occurrence of natural disasters so to deliver a significant coefficient on the interaction between CSR and natural disasters. As it is difficult to identify a potential factor that satisfies this condition, a more reasonable interpretation of the coefficient is that CSR affects the impact from natural disasters.

consistency of MSCI KLD data, our sample period starts from 1995 and ends in 2011.

We first find that firms with more factories located in states affected by natural disasters are associated with significantly lower return on assets (ROA). A firm's ROA reduces by 1.2 percentage points if all of its factories are located in states that experience a natural disaster. However, when we introduce the role of CSR into the regression, we find that high-CSR firms are almost unaffected by natural disasters. We further address the firms' CSR choice issue by using a propensity-score matching method to select control firms that are similar to high CSR firms in observable characteristics but choose not to do high CSR investment due to randomness. Estimating the CSR effect using the matched sample can be regarded as a pseudo-random assignment experiment.

We also find similar results when we use a different CSR database (ASSET4), consider alternative definitions of high-CSR firms, and use the county-level economic loss to measure the severity of disasters and to adjust the weight of affected factories. All these findings support our proposition that high-CSR firms are more resilient in responding to natural disasters. On the other hand, when there is no disaster, higher CSR does not significantly correlate with the focal firm's ROA, which again is consistent with the neoclassic economic theory and our model prediction.

We then examine the channels through which CSR activities effectively benefit the firm in overcoming disruptions brought by natural disasters. The disruption of natural disasters is mainly on operations such that the affected firms' ability in generating sales is affected in a negative way. We first examine our prediction that CSR enhances customer loyalty such that a firm's sales is less affected by natural disasters when the firm's CSR engagement is high. This is because higher customer loyalty gives firms more time to recover and supply their products, i.e., customers are more willing to wait. We further test the relationship between CSR and customer loyalty utilizing the list of "Top 100 Best Global Brands" (published by Interbrand and Businessweek) as a proxy of high customer loyalty and find confirmative results.

Another possible channel that CSR activities moderate the impact of natural disasters on firms relates to employee engagement. Indeed, we find a significant reduction in employee productivity among low-CSR firms after natural disasters but not among high-CSR ones. To verify that CSR is positively associated with employees' pride, affiliation feeling, and satisfaction, which motivate them to work harder during disruption to help the firm, we make use of the list of "100 Best Companies to Work For" (published by Fortune) as a proxy for high job satisfaction, and find that the probability of being included in this list significantly increases with firms' CSR scores. When we separate a firm's CSR score into an employee-related component and a non-employee-related component, we find that both components positively explain employee satisfaction. Thus, working for a high-CSR firms offers employees not only benefits but also pride.

This study adds to the economics literature by proposing and confirming the strategic role of CSR in firm operations and value, especially in today's business environment. We use the occurrence of natural disasters to identify the mitigating effect of CSR, which addresses the omitted variable issue that concerns prior studies claiming the benefits associated with societal and environmental engagement. This study also adds novel evidence to the role of CSR in labor economics. While there is abundant evidence for customers' positive attitude to high-CSR firms, there is still a lack of empirical evidence on employees' incentives. Current studies that suggest employees' CSR preferences are mainly based on survey and case studies (Greening and Turban, 2000; Fombrun, Gardberg, and Barnett, 2000; Peterson, 2004), and is not supported by empirical studies (see Kitzmueller and Shimshack, 2012).[9] Based on data on employee satisfaction, we are able to present evidence for employees' preferences for CSR and their dedication to firms that experience difficult times.

This study is also related to firms' intangible investments by highlighting the economic

[9] Most prior studies, in fact, do not support employees' special preferences and commitment to CSR. Goddeeris' (1988) study takes into account the self-selection issues and find that lawyers are not accepting lower salary to work in the public sector. Frye, Nelling, and Webb (2006) show that CEOs in high-CSR firms receive similar compensation but are subject to higher turnover than those in low-CSR firms. Hubbard, Christensen, and Graffin (2017) also find that CEOs' CSR initiatives intensify the negative relationship between financial performance and CEO dismissal. Using large-scale datasets such as Census data, Leete (2001) and Ruhm and Borkoski (2003) do not find systematic difference between wages in the nonprofit and for-profit sectors after controlling for individual, position, and workplace characteristics. Some studies even report higher compensation for nurse and child care workers in public sectors (Holtmann and Idson. 1993; Mocan and Tekin, 2003).

relevance of CSR activities. Given the emerging awareness of social responsibility and environmental issues, boards and executives are responsible for engaging in CSR initiatives in order to maximize firm value and minimize risk. Moreover, in today's knowledge-based economy, the productivity of intellectual workers largely determines a given firm's survival and success. The Google case discussed earlier exemplifies the importance of social and environmental responsibility in employees' morale and commitment. Our empirical analyses underscore an important connection between CSR and human capital that has implications for shareholders and stakeholders.

2. Model

In this section, we describe a stylized model that enables us to examine how a firm's CSR investment influences its resilience to external disruption. Consider a firm with capacity K can decide to continuously invest G in CSR activities. This firm is also subject to a disruption risk (due to natural disasters), which happens with a probability α. If it happens, the firm loses all its capacity K; however, it can recover from this shock within some time with the help from its employees and patient consumers. Without loss of generality, we do not consider specific competitors. Instead, we assume that this firm is the only one providing a CSR product, and all its competitors provide an identical product (in terms of product attributes and quality) except that they do not invest in CSR. The identical product assumption allows us to assume that the product price p is exogenously given.[10]

Consumer Utility. We consider a pool of consumers and normalize the size of these consumers into 1. These consumers decide whether to buy a CSR product from two dimensions: their valuation of the product modeled by a random number $\varphi \sim U[0,1]$ and their preferrence to CSR modeled by a random number $\eta \sim U[0,1]$. Specifically, consumer *i*'s valuation toward the CSR product is:

[10] We can also assume that the CSR product charges a higher price. This change will only slightly affect the market demand without qualitatively changing our results. Therefore, we let the CSR and non-CSR products have the same price.

$$u_i = \varphi \quad + G\eta \quad - p,$$

and that toward a non-CSR product is simply $u_i = \varphi - p$. As buying the CSR product generates at least the same utility, consumers will buy the CSR product[11] if their preferences locate in Area II in Figure 1A or do not buy at all if their preferences locate in Area I in Figure 1A, leading to a market size of $M_o = 1 - p^2/(2G)$ when there is no disruption shock. With a shock that damages the focal firm's production, consumers can decide (1) do not purchase at all, (2) buy a non-CSR product, or (3) wait until the CSR firm to recover and then buy the CSR product. If consumers waits for the firm to recover, they cannot enjoy the product immediately, and hence, their valuation will be discounted by a factor $\delta < 1$.[12]

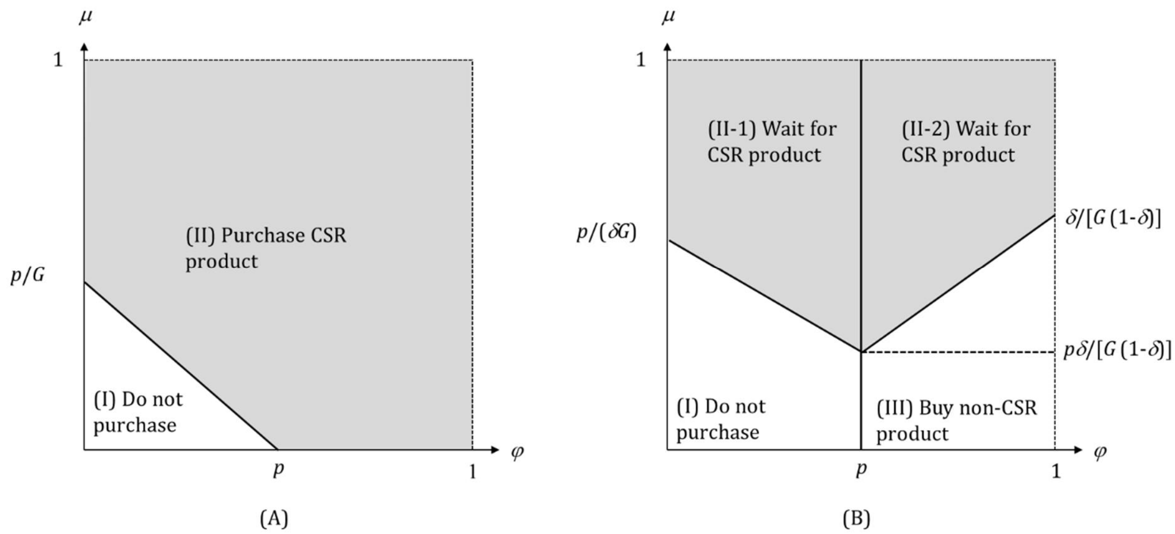

Figure **1** Market segmentation (A) without a disruption and (B) with a disruption

Figure 1B presents the market size when the disruption takes place. First, consumers with $\varphi < p$ (see the left half of Figure 1B) have a low valuation to the product attributes and may not purchase a product at all (Area I). For consumers with higher CSR preference, if they

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[11] Again, this is a simplification from the identical price assumption. But even with a differential pricing, only the portion that $\varphi > p$ and $\eta < \Delta/G$, in which Δ is the price difference between the CSR and non-CSR product, will change. This portion does not change the ones who will wait or not, and hence will not qualitatively change our results.

[12] We consider the case in which $\delta > 1/2$ to simplify the market size when there is a shock. This threshold value also implies that the recovery will not take so long that the product will depreciate to half of its original value during the recovery period.

wait, although their valuation will be discounted as follows:

$$u_i = \delta(\varphi + G\eta) - p,$$

their valuation can still be non-negative. That is, as long as their valuation is non-negative, they will delay their purchase of the CSR product, i.e.,

$$\varphi + G\eta \geq p/\delta,$$

thus leading to the threshold between Area I and II-1 in Figure 1B.

Next, consumers with $\varphi \geq p$ (the right half of Figure 1B) will buy a either a non-CSR or a CSR product (with a delay) by trading off between the utility of buying a non-CSR product, $\varphi - p$ (in Area II), and the utility of delaying their purchase, $\delta(\varphi + G\eta) - p$ (Area II-2). Specifically, when

$$\delta(\varphi + G\eta) - p > \varphi - p \geq 0 \text{ or } \eta > (1-\delta)/(G\delta),$$

they will wait. As a result, the market size when the disruption occurs is:

$$M_d = 1 - \frac{p^2}{2G} - \frac{1-\delta}{2G\delta}[2p + (1-p)^2] = M_o - \frac{1-\delta}{2G\delta}(1 + p^2).$$

Employee Incentives. Prior literature has shown that CSR can motivate employee to work efficiently, build loyalty, and reduce turnovers. In turn, the unit production costs can be lowered as employees not only work harder, but also incur less rework, scraps, and defects. We model this effect by considering a linear cost function $c(G) = c_0 - \beta G$, to capture that the unit production cost decreases in a firm's CSR engagement, but the rate at which this cost decreases is relatively smaller than the base cost (i.e., $c_0 \gg \beta$). For notation purpose, we let $r = p - c_0$, the base profit per unit.

On the other hand, under a disruption, different employees may act differently. Similar to the consumer side, when a firm is hit by an external disruption, it may not be able to pay wages due to financial difficulty. As a result, some employees may decide to leave the firm, while some may decide to stay, trading off a discounted wage and/or extra pride for producing CSR products. To capture the differential actions, we assume an employee's preference of manufacturing CSR products is $\chi\sim\ U[0,1]$, and his/her wage remain constant W, regardless of working for a CSR or a non-CSR firm. For simplicity, if there is no disruption, all employees are indifferent to move or not, and hence, the entire workforce to produce capacity K is 1. Under a disruption, employees who leave the firm to work in a non-CSR firm receives an utility of W, whereas employees who decide to stay receives an utility of $\delta W + G\chi$, capturing the delayed wage as well as the extra pride of producing CSR products under the downtime.

Therefore, we can find the workforce base under a disruption. Employees with $\chi \in [0,(1-\delta)W/G)$ will leave, as the utility of leaving the CSR firm outweighs the utility of staying (i.e., $W > \delta W + G\chi$), whereas employees with $\chi \in [(1-\delta)W/G, 1]$ will stay. We set $F = 1-(1-\delta)W/G$ to denote the remaining workforce after a disruption.

Firm Profit. Our goal is to understand how a firm's performance (measured by ROA, which is the return/profit $\pi(G)$ divided by the previous period's asset, K) is impacted by a disruption. Therefore, we will explore the following two relationships:

$$\frac{\partial(\pi(G)/K)}{\partial\alpha} \text{ and } \frac{\partial^2(\pi(G)/K)}{\partial\alpha\partial G}.$$

As K is a constant, we can simplify $\pi(G)/K$ to $\pi(G)$ in deriving the relationship.

Next, we define the firm profit. The firm earns a revenue of pM_o if there is no disruption (with a probability of $1-\alpha$) and earns a revenue of pM_d if there is a disruption (with probability α). It spends G on CSR activities, and pays a unit production cost of $c(G)$ per unit sold. It pays a wage of $1\cdot W$ if there is no disruption, and pays a wage $FW + (W + W_a)(1-F)$ if employee departure occurs, in which W_a is the additional cost paid in order to restore the sufficient workforce, such as additional hiring costs to recruit full-time workers as well as a higher hourly rate for part-time workers, etc. Finally, it needs to recover its capacity before it can resume its production, i.e., restoring capacity K, should a disruption happens. In sum, its expected profit function can be expressed as:

$$\pi(G) = \big(p - c(G)\big)[(1-\alpha)M_o + \alpha M_d] - [(1-\alpha)W + \alpha(W + (1-F)W_d)] - G - \alpha K$$

$$= (r + \beta G)\left(M_o - \alpha\frac{1-\delta}{2G\delta}(1+p^2)\right) - W - \alpha W_d\frac{(1-\delta)W}{G} - G - \alpha K.$$

We can show that:

$$\frac{\partial(\pi(G)/K)}{\partial\alpha} = -\frac{(r+\beta G)}{K}\frac{1-\delta}{2G\delta}(1+p^2) - \frac{W_d}{K}\frac{(1-\delta)W}{G} - 1 < 0,$$

indicating that disruption always hurt firm performance. We can also show that:

$$\frac{\partial^2(\pi(G)/K)}{\partial\alpha\partial G} = \frac{r}{K}\frac{1-\delta}{2G^2\delta}(1+p^2) + \frac{W_d}{K}\frac{(1-\delta)W}{G^2} \geq 0,$$

indicating that higher CSR investment always helps firm under disruption to recover faster. In particular, we can break the terms into two channels (and both are positive): the former term ($\frac{r}{K}\frac{1-\delta}{2G^2\delta}(1+p^2)$) reflects the consumer channel which is driven by the unit profit r and price p, whereas the latter ($\frac{W_d}{K}\frac{(1-\delta)W}{G^2}$) reflects the employee channel which is driven by both wage terms, W_d and W.

As a final note, we take the derivative of the profit function with respect to G, and we have:

$$\frac{\partial(\pi(G)/K)}{\partial G} = \beta + \frac{rp^2}{2G^2} - 1 + \frac{\alpha(1-\delta)}{G^2}\left(\frac{r(1+p^2)}{2\delta} + W_d W\right).$$

First, by letting the first derivative as 0, we can show that the optimal CSR investment is always positive, confirming the signs of $\partial(\pi(G)/K)/\partial\alpha$ and $\partial^2(\pi(G)/K)/(\partial\alpha\partial G)$. When $\alpha = 0$, the sign of $\partial(\pi(G)/K)/\partial G$ is still ambiguous, implying that when there is no disruption risk, although CSR benefits resulting from consumers (i.e., $rp^2/(2G^2)$) and employees (i.e., β) still exist, it may not be able to offset the cost (i.e., the minus one term). With disruption risk ($\alpha > 0$), the benefits of CSR can be further amplified (see the last term), but again, the sign of this derivative is still undetermined. This finding echoes the neoclassic economic theory that CSR is costly and managers should focus on maximizing firm profits instead of engaging in such an investment. As a result, our model reconciles the neoclassic economic theory and the recent prevalence of CSR activities and news coverage by introducing the role of external disruption: CSR is costly in general; however, it may serve as an intangible capital that will pay off timely in firms' difficulty times.

3. Data, Summary Statistics, and Empirical Methodology

To empirically test our hypotheses, we combine state-level natural disaster data, factory-level location data, firm-level corporate social responsibility (CSR) data, and firm-level accounting data for U.S. public firms in manufacturing industries.

We follow Barrot and Sauvagnat (2015) and define natural disasters as major disasters that last for fewer than thirty days and that have a total estimated damage of over one billion 2013 constant dollars. We obtain the U.S. natural disaster data from the Spatial Hazard and Loss Database, which is maintained by the University of South Carolina. There are a total of 24 major disasters (e.g., blizzards, floods, hurricanes) that occurred within our sample period between 1995 and 2011.

To assess the impact of natural disasters on firms' operating performance, we use the U.S. EPA's toxic release inventory (TRI) database to identify U.S. firms' factory locations. The TRI database was established in response to the 1986 Emergency Planning and Community Right-to-Know Act (EPCRA), which requires firms in manufacturing industries with Standard Industrial Classification (SIC) codes between 2000 and 3999 to report their factories' locations as well as their storage, use, and releases of hazardous substances. While this paper does not focus on firms' toxic release data, this database nevertheless provides us with a rich source for identifying factories' locations. Table 1 lists all the disasters during the sample period, as well as the state location and number of sample firms' factories affected by these disasters.

[Insert Table 1 Here]

A firm is considered affected by natural disasters in a year when at least one of its factories is located in a state that is affected by any disasters in that period. Because firms differ in their number of factories, our main explanatory variable in our regression analysis is *AFFECTED_RATIO*, which represents the percentage of a firm's factories being affected by natural disasters in any given year. We calculate this variable as the ratio of the number of factories impacted by natural disasters to the total number of factories that belong to firm *i*.

We then collect U.S. public firms' corporate social responsibility data from the Kinder, Lydenberg, Domini, & Co. (KLD) database, with sample period from 1994 to 2011. KLD assesses a firm's CSR activities through seven dimensions that include community, corporate governance, diversity, employee relations, environment, human rights, and product. For each dimension, KLD would evaluate a firm from both the strength and concern aspects. The evaluations are based on pre-set criteria. For example, under the community dimension, a firm can earn one point under strength if it has consistently given over 1.5% of trailing three-year net earnings before tax to charity. It could earn another point if the company is a prominent participant in public/private partnerships that support housing initiatives for the economically disadvantaged. To calculate the overall CSR score of a firm, we first use scaled strength score minus scaled concern score under each dimension, and then sum these scores across all seven dimensions. The scaling is done by dividing the raw strength (concern) score by the highest score within the same category, which is to ensure the strength score is comparable to concern score.

To address possible differences in CSR across different industries, we define firm-year observations as "high CSR" if the firm-year observation has a CSR score in the top quartile within an industry (defined by three-digit SIC codes) in a given year. We then use *H_CSR* as a dummy variable that equals one for those firms with high CSR, and that equals zero otherwise. We do vary the cutoff threshold in the robustness section. In addition, we define each industry in this paper at the three-digit SIC level; this definition serves as a compromise between an overly coarse partition that may pool together unrelated industries and an overly narrow partition that leads to misclassification (Hou and Robinson, 2006; Giroud and Mueller 2010).

We also consider various ways to define CSR as robustness check. First, we use the CSR score (*CSR*) rather than the dummy variable *H_CSR*. Second, we use a CSR score that only considers strength. For each dimension, we give a firm one point if it has positive strength points. We then sum across all CSR dimensions (denoted as *CSR1* in the paper). Third, we opt not to scale CSR strength or concern under each dimension. Instead, we deduct raw concern score from raw strength score and sum across all seven dimensions (denoted as *CSR2*). Lastly, we give a firm one point in each of the seven dimensions if the firm has no concern score in that dimension and has at least one positive strength score. We then sum these points across all dimensions (denoted as *CSR3*). See Section 5.1 for more details.

We use the Compustat database to obtain U.S. public firms' accounting data from 1995 to 2012. We measure firm *i*'s operating performance in year *t* by *ROA*, which is defined as income before depreciation in year *t* divided by total assets in year *t* – 1. To examine the pure effect of natural disasters on operating performance, we follow the empirical setting of Giroud and Mueller (2010), who study the impact of the passage of Business Combination Laws on firm-level ROA. We construct the same control variables used in their study. To control for firm size differences, we use the natural log of total assets to measure a firm's size (*SIZE*). To account for the possible non-linear effect of firm size, we also control for *SIZE2* (i.e., the square of *SIZE*). Further, we control for the life-cycle differences of firms with *AGE*, which is defined as the natural log of the number of years a firm has been in the Compustat database. Additionally, we add several control variables to the regression, including *PAGE*, which is the average age of factories (defined as the number of years a factory has existed in the TRI database). We also control for asset intangibility (*INTANG*), amortized research and development expenses (*RDC*), selling, general, and administrative expenses (*SGA*), and advertisement expenses (*AD*) for the effects of intangible assets and potential differences in firm characteristics between high and low CSR firms.[13]

[13] *INTANG* is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. *RDC* is the natural log of one plus amortized research & development (R&D) expenses in the past five years i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k))$, in which RD_t is R&D expenses at year *t*. *SGA* and *AD* are amortized sales, general, and administrative expenses and amortized advertisement expenses similarly defined as RDC.

Finally, given the extent to which local development, institutional quality, income equality, and macroeconomic conditions might influence a firm's ability to respond to natural disasters, we follow Giround and Mueller (2010) and use *STATE_YEAR* to control for the time-varying state effect. We calculate *STATE_YEAR* as the state-year average of the dependent variable, *ROA*, without the focal firm itself. In the same way, we control for unobservable industry-level, time-varying shocks with *IND_YEAR*, which is the industry-year average of the dependent variable, *ROA*, without the firm itself. As discussed earlier, we define each industry in this paper at the three-digit SIC level.

We eliminate firm-year observations for which data on ROA and factory location are missing. To eliminate the impact of outliers, we require a firm to have at least one million in total assets to be included in our study, and we also follow Giroud and Mueller (2010) to trim ROA at 1% at each tail. In sum, we use a total of 5,158 firm-year observations.

In Table 2, we present summary statistics for all variables used in this study. For an average firm in the dataset, its *ROA* is 0.16 and 20% of its factories are impacted by natural disasters each year, as reflected by the mean of *AFFECTED_RATIO*, which is 0.20. We check that the affected ratios for high CSR and low CSR firms and find that they are fairly similar, both around 20%. The *CSR* reported in Table 2 is the CSR score, which, on average, is 0.42 in the sample.

[Insert Table 2 Here]

4. Empirical Results

4.1 Natural Disasters, CSR and Operating Performance

In this section, we empirically examine whether the engagement in CSR could moderate the impact of natural disasters on firms.

4.1.1 The Effect of CSR: Baseline Regression

We follow Giroud and Mueller (2010) to establish our baseline regression. Specifically, we regress a firm's operating performance (*ROA*) on disaster impact (*AFFECTED_RATIO*) interacted with the high CSR dummy (*H_CSR*) as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}, \quad (1)$$

for which *AFFECTED_RATIO*, the percentage of firm *i*'s factories impacted by natural disasters in calendar year t – 1, is matched with accounting data with fiscal year end in year t. *Xb* is a set of control variables that include *SIZE*, *SIZE2*, *AGE*, *PAGE*, *INTANG*, *RDC*, *SGA*, *AD*, *IND_YEAR*, and *STATE_YEAR* in year *t*. μ_t and η_i control for year and firm fixed effects, respectively. The standard errors of coefficients are clustered at the state-level, given that we use natural disasters at the state level (Rogers, 1993; Petersen, 2009; Giroud and Mueller, 2010; Flammer and Kacperczyk, 2015). For each firm and year, *H_CSR* equals one if the CSR score of firm *i* in year *t*-1 is within the top quartile in the industry, and equals zero otherwise. β_1, the variable of interest here, measures the moderating effect of CSR. We expect the coefficient to be positive and significant, based on our main hypothesis.

We report the results in Table 3. From both Columns (1) and (2) of Table 3, we confirm that firms that are not considered high spenders in terms of CSR (*H_CSR*=0) are negatively affected by natural disasters. The coefficient on *AFFECTED_RATIO* is -0.013 with control variables, meaning when 20% (the mean of *AFFECTED_RATIO*) of the factories of a none-*H_CSR* firm is hit by natural disasters, the firm's operating performance would decrease by 0.26 percentage points (0.013*20%). For a firm that is not geographically diversified (i.e., all factories are hit by natural disasters), its ROA would decrease by 1.3 percentage points.

[Insert Table 3 Here]

However, the coefficient on the interaction term (β_1) is positive and significant, meaning high CSR firms suffer significantly less in terms of operating performance when hit by natural disasters. Considering the magnitude of β_1 is similar to that of the coefficient on *AFFECTED_RATIO*, these high CSR firms are barely affected by natural disasters, thus supporting our hypothesis. On a related note, β_3 (the coefficient on *H_CSR*) is not significant for both columns, echoing our model implication that without the consideration of disruptions, CSR is a costly investment and its benefits may not outweigh its costs.

4.1.2 The Effect of CSR: Firms' CSR Choice and Propensity Score Matched Sample

In this subsection, we aim to further mitigate the concern about firms' CSR choice by using a popular matching method: propensity score matching, a widely used and simple method to address endogeneity problems (Roberts and Whited, 2013). We conduct propensity score matching to prepare a matched sample in which all sample firms are similar in observable characteristics. In particular, we conduct the first-stage logit regression to calculate the propensity score of a firm identified as a high CSR (treated) firm as follows:

$$H\_CSR_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 SIZE2_{i,t} + \beta_3 AGE_{i,t} + \beta_4 RDC_{i,t} + \beta_5 AD_{i,t} + \beta_6 SGA_{i,t} + \sigma_j + \varepsilon_{i,t}. \qquad (2)$$

Estimating Equation (2) enables us to understand the determinants of firms' CSR choice. We then implement the following one-to-one matching without replacement approach: for each high CSR firm (*H_CSR* = 1), we find a control firm that is not another high CSR firm but has a propensity score closest to the high CSR firm (within 0.001 caliper). This control firm can be regarded as a firm that should have chosen to have high CSR investment but do not do so due to randomness. We then estimate Equation (1) using a matched sample that includes only high CSR firms and control firms, which allows us to assess the effect of CSR in a pseudo-random assignment experiment.

From the two columns of Table 4, we obtain results similar to those in Table 3. Firms that are not considered high CSR ones are negatively affected by natural disasters as evidenced by the negative and significant coefficient on *AFFECTED_RATIO* in both columns. High CSR firms, however, are largely immune to these natural disasters as the coefficients on the interaction term between *AFFECTED_RATIO* and *H_CSR* is positive and of similar magnitude with the coefficient on *AFFECTED_RATIO*. Hence, we confirm that our baseline results are not driven by other characteristics that may influence firms' CSR choice.

[Insert Table 4 Here]

4.2 Why High CSR Firms Are Less Affected?

In this section, we empirically investigate why firms with high CSR investment are less affected by disasters along the two channels presented in our model: the customer channel is discussed in Sections 4.2.1 and 4.2.2, and the employee channel is discussed in Sections 4.2.3 and 4.2.4.

4.2.1 Natural Disasters, CSR, and Customer Loyalty

Natural disasters disrupt the operations of the firms and thus delay firms' supply to customers. However, customers with CSR preferences are more willing to tolerate a longer lead time to get their products from high CSR firms. Therefore, although natural disasters affect firms' production in a negative way, firms with high CSR have customers who are more willing to wait and thus suffer little from disasters.

To test this proposition, we use the following model to see the impact of natural disasters on firms' sales:

$$SALE_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}, \quad (3)$$

in which *SALE* is the ratio of total sales to beginning-of-the-year total assets, also known as asset turnover. All other variables are defined as the same as in Equation (1). The results are reported in the first two columns of Table 5. We find negative significant coefficients on *AFFECTED_RATIO* in both columns, confirming our prediction that natural disasters disrupt firms' sales on average.

[Insert Table 5 Here]

To examine the heterogeneous impact of natural disasters on high and low CSR firms, we estimate the following regression model:

$$SALE_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} * L\_CSR_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}. \quad (4)$$

in which *L_CSR* is a dummy variable that equals one if *H_CSR* equals zero. All other variables are defined as the same as in Equation (1). In this model, β_1 measures the impact of natural disasters on high CSR firms' sales, whereas β_2 measures the impact of natural disasters on low CSR firms. The results are reported in the last two columns of Table 5. Note that we use both L_CSR and H_CSR in this model specification to better observe the heterogeneous impact of CSR on sales of the two groups.

The last two columns of Table 5 show that β_1 is statistically indistinguishable from zero while β_2 is negative and significant. Our finding that high CSR firms' sales are less affected by natural disasters is supportive to the customer channel.

4.2.2 CSR and Customer Loyalty

The customer channel relies on the assumption that CSR is positively associated with customer loyalty such that when disasters hit, customers are more willing to wait for those high CSR firms to recover their supply of products from disasters than to switch to other suppliers. It is, however, difficult to measure customer loyalty. Instead, we use brand value as a proxy based on the premise that customer loyalty and brand value are highly correlated. Specifically, we make use of the Top 100 Best Global Brands[14] published by Interbrand and Businessweek, which is selected because of the long time-series of data it provides (it is available from 2000 to 2012). One key component of the index is brand strength, which measures the ability of the brand to create loyalty and, therefore, sustainable demands and profits in the future. Therefore, brands included in this list are considered of high customer loyalty. To formally test our assumption that high CSR firms tend to have higher customer loyalty, we estimate the following model:

$$BEST\_BRAND_{i,t} = \beta_0 + \beta_1 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \varepsilon_{i,t}, \qquad (5)$$

in which *BEST_BRAND* is a dummy variable that equals one for firms having brands in the list of Top 100 Best Global Brands in year *t*. The definitions of other variables remain the same.

[14] There are three key components to determine brand value: an analysis of the financial performance of the branded products or services, of the role the brand plays in purchase decisions, and of the brand's competitive strength. The details can be found at https://www.interbrand.com/best-brands/best-global-brands/methodology/ .

We also include time fixed effects in the model. We cannot use firm fixed effects in this setting because whether a firm has a brand on the list is a persistent pattern; thus, the inclusion of firm fixed effects will absorb all cross-sectional variation and leaves us only very limited time series variation.

Since the dependent variable is a dummy variable, we opt to use logit/probit regressions. The results are reported in Table 6. We observe that *H_CSR* is positive and significant in both Columns (1) and (2) based on logit regressions, suggesting high CSR firms are more likely to have brands that have high customer loyalty, i.e., CSR is positively associated with customer loyalty. To ensure robustness of the results, we also run probit regressions and report the results in the last two columns. The results are qualitatively the same. In sum, we find that customer loyalty and CSR engagement of firms are positively associated, confirming our assumption in verifying the customer channel.

[Insert Table 6 Here]

4.2.3 Natural Disasters, CSR, and Employee Productivity

CSR enhances employees' pride, affiliation feeling, and satisfaction, which motivate them to work harder during external disruptions. To examine the employee channel, we examine the impact of natural disasters on labor productivity for high CSR firms and low CSR firms using the following regression model:

$$PROD_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} * L\_CSR_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}, \quad (6)$$

in which *PROD* is labor productivity that is measured by the ratio of sales to the total number of employees (*PROD_SALE*) or the ratio of net income to the total number of employees (*PROD_NI*). *L_CSR* is a dummy variable that equals one if *H_CSR* equals zero. All other variables are defined as the same as in Equation (1). In this model, β_1 measures the impact of natural disasters on labor productivity for high CSR firms, whereas β_2 measures the impact of natural disasters on labor productivity for low CSR firms. We report the results in Table 7.

[Insert Table 7 Here]

We find that across all four columns of Table 7 that natural disasters significantly reduce labor productivity of low CSR firms as β_2 are negative and significant, suggesting a significant impact of natural disasters on labor productivity. Meanwhile, β_1 are statistically indistinguishable from zero in all four columns, suggesting that the impact of natural disasters on employee productivity is mitigated by CSR and supporting the employee channel.

4.2.4 CSR and Job Satisfaction

Our employee channel is based on the assumption that CSR is positively associated with job satisfaction such that when disasters hit, employees are more willing to work extra miles to help their firms if these firms have high CSR investment. To validate this assumption, we use the following model:

$$BEST\_FM_{i,t} = \beta_0 + \beta_1 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \varepsilon_{i,t}, \quad (7)$$

in which *BEST_FM* is a dummy variable that equals one for firms in the list of 100 Best Firms To Work For In America published by Fortune[15]. *BEST_FM* is a proxy for job satisfaction and indicates employees having higher job satisfaction if a firm is in the list (Edmans 2011, 2012). The definitions of other variables remain the same. We also include time fixed effects in the model. We cannot use firm fixed effects in this setting for the same reasons as discussed in Equation (5).

Since the dependent variable is a dummy variable, we opt to use logit/probit regressions. The results are reported in Panel A of Table 8. We see that *H_CSR* is positive and significant in both Columns (1) and (2) based on logit regressions, suggesting that high CSR firms are more likely to be in the best firm to work for list, i.e., CSR is positively associated with job satisfaction. We also run probit regressions and report the results in the last two columns. The results are qualitatively the same. In sum, we find that job satisfaction of employees and CSR engagement of firms are positively associated, which validates the assumption of the

[15] We would like to thank Alex Edmans for making this data available online at http://alexedmans.com/data/.

employee channel.

[Insert Table 8 Here]

Given that the CSR score has a dimension that specifically assesses employee treatment, it may not be very surprising for us to find a positive association between CSR and job satisfaction. We argue, however, that the results reported in Table 8 are not coming from the employee treatment dimension alone, but are also related to the non-employee related dimensions of CSR. For this purpose, we calculate two CSR scores: CSR_EMP is a CSR score based on only the employee treatment dimension, and *CSR_NON_EMP* is a CSR score based on all dimensions other than the employee treatment dimensions.[16] Based on these two new CSR scores, we recalculated the *H_CSR* dummy in the same fashion and use *H_CSR_NON_EMP* and *H_CSR_EMP* to denote *H_CSR* for *CSR_NON_EMP* and *CSR_EMP*, respectively. We re-run Equation (7) by replacing *H_CSR* with these two dummies and the results are reported in Panel B of Table 8. Again, we use both logit and probit models to ensure the robustness of the results. We find that the results are pretty consistent in that both dummies are positively significant across all columns, suggesting that job satisfaction is also associated with employee-unrelated dimensions of CSR.

5. Robustness Tests

We provide several robustness tests of our results in this section. We start with alternative ways of defining CSR and then consider the difference in the severity of each natural disasters. Our results are robust to all these specifications.

5.1 Alternative Measures of CSR

5.1.1 Alternative Ways to Calculate CSR

To ensure our results is not sensitive to the way we calculate CSR scores for firms, we vary the definitions of CSR as follows. First, we use a CSR score that only considers strength. For

[16] The way we calculate these CSR scores is similar to our original CSR score except for now we do not sum across all dimensions but separately sum employee dimension and other dimensions.

each dimension, we give a firm one point if it has positive strength points. We then sum across all CSR dimensions (denoted as *CSR1*). Second, we opt not to scale CSR strength or concern under each dimension. Instead, we deduct raw concern score from raw strength score and sum across all seven dimensions (denoted as *CSR2*). Lastly, we give a firm one point in each of the seven dimensions if the firm has no concern score in that dimension and has at least one positive strength score. We then sum these points across all dimensions (denoted as *CSR3*).

For each robustness CSR measure, we define the corresponding *H_CSR* as firms with CSR score in the top quartile within an industry-year. Using these alternative CSR scores, we re-run regressions using Equation (1) and present the results in Table 9.

[Insert Table 9 Here]

The coefficients on *AFFECTED_RATIO*H_CSR* are consistently positive in all six columns in the table while the coefficients on *AFFECTED_RATIO* are persistently negative and significant. These estimates suggest that our baseline results are not sensitive to the ways we calculate the CSR score.

5.1.2 Alternative CSR Data Source—ASSET4

In this section, we utilize another commonly used database that provides information regarding a firm's engagement in corporate social responsibilities: the ASSET4 database of Thomson Reuters, which provides normalized CSR scores ranging from 0 to 100 for firms. The score is already normalized and is directly comparable across all firms in the database. Thus we do not take industry top quartile to define high CSR but use raw score provided by the ASSET4 database instead (denote as *CSR_AST4*)[17]. The higher the score, the more a firm is engaging in corporate social responsibility activities. Using this data we reassess the role that CSR plays in mitigating the impact of natural disasters on firms by estimating the

[17] The data is only available from 2002 onwards and thus give us a smaller sample size. We also use 0 to 1 instead of 0 to 100. i.e., all raw CSR scores are divided by a factor of 100 to ensure regression coefficients are not too small.

following regression model:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * CSR\_AST4_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 CSR\_AST4_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}. \quad (8)$$

As shown in Table 10, the coefficients on *AFFECTED_RATIO*CSR_AST4* are positive and significant in both columns, indicating that firms with high CSR engagement are less affected by the negative impact of natural disasters and showing that our results hold in an alternative CSR database.

[Insert Table 10 Here]

5.1.3 Alternative Cutoffs for High_CSR and Original CSR Score

So far we define firms in the top quartile in terms of CSR within an industry-year as high CSR ones. In this subsection, we vary the cutoff points by using the 70^{th} percentile or the 80^{th} percentile to define *H_CSR*, and estimate Equation (1) and report the results in Table 11.

[Insert Table 11 Here]

From Columns (1) to (4), we observe the same pattern as we have seen when using the top quartile (the 75^{th} percentile) as the cutoff point. We still find that none-*H_CSR* firms are negatively affected while high CSR firms are not affected by natural disasters. One thing to note is that the statistical significance of the interaction term gets weaker when we use the 80^{th} percentile to define high CSR. This is expected given that when we choose such a high cutoff point, we assigm some of high CSR firms to the none-*H_CSR* sample that are barely affected by natural disasters, thus reducing the difference between none-*H_CSR* sample and *H_CSR* sample.

Moreover, we use the original CSR score (as explained in Section 3.1) instead of *H_CSR* and modify Equation (1) as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}. \quad (9)$$

We report the regressions results in Columns (5) and (6) of Table 11. Our results are again consistent with our earlier findings. Thus, our results are not due to the choice of cutoff thresholds for high CSR firms.

5.2 Severity of Natural Disasters

As not all natural disasters are equally disruptive, we take the severity of natural disasters into account and search online news and manually collect data on firms' economic losses due to natural disasters at the county level. We obtain 1,539 county-year economic loss observations. We calculate a loss-weighted *AFFECTED_RATIO* by assigning a weight of one (original weight) to plants in locations where we cannot find economic loss data, and assinging one plus the economic loss in billions (maximum is 17) as the weight for plants in counties for which we can find economic loss data. Using these weights, we calculate a weighted *AFFECTED_RATIO* that takes into consideration of the severity of natural disasters. We re-run our baseline regression in Equation (1) and Table 3 using this alternative measure and report the results in Table 12. We find that the coefficient on *AFFECTED_RATIO* remains negative and significant, and the coefficient on the interaction term of *AFFECTED_RATIO* and *H_CSR* remains positive and significant, consistent with our baseline results.

[Insert Table 12 Here]

6. Conclusion

In this paper, we propose that corporate social responsibility (CSR) serves as an intangible investment in stakeholder relationship to guard against external disruption. We first develop a stylized model to discuss the channels. In our model, CSR is costly in general; however, CSR enhances customer loyalty and employee satisfaction, both help firms survive under difficulty. Our model thus reconciles the neoclassic economic theory and the recent prevalence of CSR activities and news coverage by introducing the role of external disruption.

We then find confirmatory empirical evidences for our model and channels. Firms with higher CSR investment are much less affected by major natural disasters compared with those without. This design based on exogenous disasters enables us to test our proposition that high-CSR firms are more resilient to difficulty without the interference of omitted variables. We further address the firms' CSR choice issue by using a propensity-score matching method to select control firms that are similar to high CSR firms in observable characteristics but choose not to do high CSR investment. We also find similar results when we use a different CSR database (ASSET4), consider alternative definitions of high-CSR firms, and use the county-level economic loss to measure the severity of disasters and to adjust the weight of affected factories.

We also present empirical support to the channels through which CSR activities help firms in overcoming natural disasters. For the customer channel, we find that CSR enhances customer loyalty and that a firm's sales is less affected by natural disasters when the firm's CSR engagement is high. For the employee channel, we find that CSR enhances employee satisfaction and that a firm's productivity is less affected by natural disasters when the firm's CSR engagement is high. Our empirical evidence collectively indicate that CSR engagement serves as an important intangible capital for firms.

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Table 1 Major Disasters

This table describes the 24 natural disasters that occurred in the U.S. territory from 1995 to 2011. Names, years, and locations of each natural disaster are obtained from Table 1 of Barrot and Sauvagnat (2015). The data were originally from the Spatial Hazard and Loss Database for the U.S., which is maintained by the University of South Carolina. Number of affected factories equals the total number of factories impacted by the disaster. Abbreviations for U.S. states used in the table: AL (Alabama), AK (Alaska), AZ (Arizona), AR (Arkansas), CA (California), CO (Colorado), CT (Connecticut), DE (Delaware), FL (Florida), GA (Georgia), HI (Hawaii), ID (Idaho), IL (Illinois), IN (Indiana), IA (Iowa), KS (Kansas), KY (Kentucky), LA (Louisiana), ME (Maine), MD (Maryland), MA (Massachusetts), MI (Michigan), MN (Minnesota), MS (Mississippi), MO (Missouri), MT (Montana), NE (Nebraska), NV (Nevada), NH (New Hampshire), NJ (New Jersey), NM (New Mexico), NY (New York), NC (North Carolina), ND (North Dakota), OH (Ohio), OK (Oklahoma), OR (Oregon), PA (Pennsylvania), RI (Rhode Island), SC (South Carolina), SD (South Dakota), TN (Tennessee), TX (Texas), UT (Utah), VT (Vermont), VA (Virginia), WA (Washington), WV (West Virginia), WI (Wisconsin), and WY (Wyoming).

Disaster	Year	Type	Number of Affected Factories	Affected Location
Opal	1995	Hurricane	1153	AL, FL, GA, LA, MS, NC, SC
Blizzard	1996	Blizzard	1687	CT, DE, IN, KY, MA, MD, NC, NJ, NY, PA, VA, WV
Fran	1996	Hurricane	310	NC, SC, VA, WV
Ice Storm	1998	Ice Storm	289	ME, NH, NY, VT
Bonnie	1998	Hurricane	452	NC, VA
Georges	1998	Hurricane	604	AL, FL, LA, MS
Floyd	1999	Hurricane	1724	CT, DC, DE, FL, MD, ME, NC, NH, NJ, NY, PA, SC, VA, VT
Allison	2001	Hurricane	1825	AL, FL, GA, LA, MS, PA, TX
Isabel	2003	Hurricane	1326	DE, MD, NC, NJ, NY, PA, RI, VA, VT, WV
Southern California Wildfires	2003	Wildfire	448	CA
Charley	2004	Hurricane	4	FL, GA, NC, SC
Jeanne	2004	Hurricane	550	AL, FL, GA, KY, MD, NC, NY, OH, PA, SC, VA, WV
Ivan	2004	Hurricane	2011	AL, FL, GA, KY, LA, MA, MD, MS, NC, NH, NJ, NY, PA, SC, TN, WV
Frances	2004	Hurricane	611	DE, FL, GA, MD, NC, NJ, PA, SC, VA
Dennis	2005	Hurricane	442	AL, FL, GA, MS, NC
Katrina	2005	Hurricane	1795	AL, AR, FL, GA, IN, KY, LA, MI, MS, OH, TN
Rita	2005	Hurricane	283	AL, AR, FL, LA, MS
Wilma	2005	Hurricane	1	FL
Midwest Floods	2008	Floods	1166	IA, IL, IN, MN, MO, NE, WI
Gustav	2008	Hurricane	212	AR, LA, MS
Ike	2008	Hurricane	1059	AR, LA, MO, TN, TX
Blizzard Groundhog Day	2011	Blizzard	2536	CT, IA, IL, IN, KS, MA, MO, NJ, NM, NY, OH, OK, PA, TX, WI
Irene	2011	Hurricane	504	CT, MA, MD, NC, NJ, NY, VA, VT
Tropical Storm Lee	2011	Hurricane	1096	AL, CT, GA, LA, MD, MS, NJ, NY, PA, TN, VA

Table 2 Summary Statistics

This table presents summary statistics of variables that have been used in the baseline regressions in our paper. ROA is defined as income before depreciation in year t divided by total assets in year t-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters. CSR is the corporate social responsibility score. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses similarly defined as RDC. PROD_SALE is labor productivity measured by the ratio of sales to the total number of employees. PROD_NI is labor productivity measured by the ratio of net income to the total number of employees. The sample period covers 1995 to 2012.

Variable	OBS	Mean	S.D.	P25	P50	P75
ROA	5158	0.16	0.09	0.10	0.15	0.20
AFFECTED_RATIO	5158	0.20	0.31	0.00	0.00	0.33
CSR	5158	0.42	0.70	0.00	0.00	1.00
SIZE	5158	7.92	1.52	6.78	7.84	8.92
AGE	5158	3.39	0.65	2.89	3.61	3.91
PAGE	5158	2.48	0.47	2.22	2.54	2.83
INTANG	5158	0.29	0.18	0.15	0.27	0.40
RDC	5158	0.09	0.16	0.01	0.05	0.12
SGA	5158	6.99	1.97	5.97	7.08	8.17
AD	5158	1.63	2.61	0.00	0.00	2.88
PROD1	5133	19.64	58.02	4.87	13.20	27.60
PROD2	5133	377.50	543.91	186.12	257.47	370.39

Table 3 Natural Disaster, Corporate Social Responsibility, and Operating Performance

This table presents the regression results using the following equation:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}.$$

ROA is defined as a firm's income before depreciation in fiscal year t divided by total assets in fiscal year t-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year t-1. H_CSR is a dummy variable for high CSR. It is one in year t if the raw CSR score is in the top quartile within the industry. Xb is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ROA	(2) ROA
AFFECTED_RATIO*H_CSR	0.014**	0.014**
	(0.031)	(0.021)
AFFECTED_RATIO	-0.012*	-0.013**
	(0.059)	(0.032)
H_CSR	0.004	0.005
	(0.371)	(0.272)
SIZE		0.123***
		(0.000)
SIZE2		-0.007***
		(0.000)
AGE		-0.031
		(0.275)
PAGE		0.009
		(0.278)
INTANG		-0.109***
		(0.001)
RDC		0.028**
		(0.025)
SGA		-0.003*
		(0.080)
AD		-0.003
		(0.207)
IND_YEAR		0.109***
		(0.000)
STATE_YEAR		0.054
		(0.214)
Constant	0.221***	-0.212*
	(0.000)	(0.076)
Firm FE	Y	Y
Time FE	Y	Y
Observations	5,158	5,158
Adj. R-Squared	0.519	0.541

Table 4 Natural Disaster, Corporate Social Responsibility, and Operating Performance (Propensity-Score Matching)

This table presents the regression results using the following equation:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t},$$

for a propensity-score matched sample to address the potential difference of high CSR (H_CSR=1) firms and low CSR (H_CSR=0) firms. The propensity score is calculated based on a logit model with firm size, age, research & development, advertisement, selling, general, and administrative expenses and industry dummies as independent variable. The one-to-one match without replacement is done with a propensity score within 0.001 caliper. ROA is defined as a firm's income before depreciation in fiscal year *t* divided by total assets in fiscal year *t*-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year *t*-1. H_CSR is a dummy variable for high CSR. It is one in year *t* if the raw CSR score is in the top quartile within the industry. *Xb* is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1 - 0.2k)$), in which RD_t is R&D expenses at year *t*. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ROA	(2) ROA
AFFECTED_RATIO*H_CSR	0.035*	0.036**
	(0.060)	(0.030)
AFFECTED_RATIO	-0.027*	-0.033**
	(0.071)	(0.044)
H_CSR	-0.002	-0.003
	(0.783)	(0.647)
SIZE		0.171**
		(0.012)
SIZE2		-0.009**
		(0.017)
AGE		0.025
		(0.545)
PAGE		0.004
		(0.826)
INTANG		-0.186***
		(0.001)
RDC		0.026*
		(0.075)
SGA		-0.005*
		(0.090)
AD		0.001
		(0.840)
IND_YEAR		0.137***
		(0.010)
STATE_YEAR		-0.056
		(0.267)
Constant	0.207***	-0.622
	(0.000)	(0.107)
Firm FE	Y	Y
Time FE	Y	Y
Observations	1,120	1,120
Adj. R-Squared	0.596	0.627

Table 5 Natural Disaster, Corporate Social Responsibility, and Customer Loyalty

This table presents the regression results using the following equation:

$SALE_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$,

or

$SALE_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} * L\_CSR_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$.

SALE is a firm's efficiency in generating sales from its assets measured by sales divided by beginning-of-the-year total assets. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year t-1. H_CSR is a dummy variable for high CSR. It is one in year t if the raw CSR score is in the top quartile within the industry. L_CSR is a dummy variable that equals one if H_CSR equals zero. Xb is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) SALE	(2) SALE	(3) SALE	(4) SALE
AFFECTED_RATIO	-0.061**	-0.057**		
	(0.025)	(0.030)		
AFFECTED_RATIO*H_CSR			-0.003	-0.003
			(0.950)	(0.942)
AFFECTED_RATIO*L_CSR			-0.072***	-0.068***
			(0.007)	(0.010)
H_CSR			0.019	0.003
			(0.334)	(0.877)
SIZE		-0.042		-0.036
		(0.778)		(0.811)
SIZE2		-0.001		-0.002
		(0.841)		(0.799)
AGE		-0.453		-0.450
		(0.216)		(0.220)
PAGE		0.051*		0.050*
		(0.087)		(0.088)
INTANG		-0.582**		-0.581**
		(0.017)		(0.017)
RDC		0.094		0.095
		(0.137)		(0.133)
SGA		0.000		0.000
		(0.979)		(0.985)
AD		-0.025*		-0.024*
		(0.075)		(0.077)
IND_YEAR		-0.000		-0.000
		(0.237)		(0.237)
STATE_YEAR		0.000		0.000
		(0.781)		(0.782)
Constant	1.456***	3.285**	1.459***	3.252**
	(0.000)	(0.044)	(0.000)	(0.047)
Firm FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Observations	5,148	5,148	5,148	5,148
Adj. R-Squared	0.585	0.601	0.585	0.601

Table 6 Corporate Social Responsibility and Customer Loyalty

This panel presents the regression results using the following equation:
$BEST\_BRAND_{i,t} = \beta_0 + \beta_1 H\_CSR_{i,t} + Xb_{i,t} + \mu_t + \varepsilon_{i,t}$.
BEST_BRAND is a dummy variable that equals one for firms having brands in the 100 Best Global Brands list. H_CSR is a dummy variable for high CSR. It is one in year *t* if the raw CSR score is in the top quartile within the industry. *Xb* is a set of control variables that include SIZE, SIZE2, AGE, INTANG, RDC, AD, and WAGE. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$) , in which RD_t is R&D expenses at year *t*. AD amortized advertisement expenses similarly defined as RDC. WAGE is amortized sales, general, and administrative expenses (similarly defined as RDC) scaled by the total number of employees. Logit model is used in Columns (1) and (2) while probit model is used in Columns (3) and (4). The sample period covers 1994 to 2011. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) BEST_BRAND	(2) BEST_BRAND	(3) BEST_BRAND	(4) BEST_BRAND
	LOGIT	LOGIT	PROBIT	PROBIT
H_CSR	2.471***	0.882*	1.209***	0.500**
	(0.000)	(0.079)	(0.000)	(0.045)
SIZE		4.543		1.854
		(0.149)		(0.246)
SIZE2		-0.171		-0.063
		(0.262)		(0.428)
AGE		0.613		0.274
		(0.419)		(0.409)
INTANG		-0.765		-0.235
		(0.535)		(0.710)
RDC		-4.104		-2.029
		(0.117)		(0.120)
AD		0.346***		0.181***
		(0.001)		(0.000)
WAGE		0.002		0.001*
		(0.151)		(0.078)
Constant	-4.306***	-34.828**	-2.310***	-15.772**
	(0.000)	(0.025)	(0.000)	(0.048)
Time FE	Y	Y	Y	Y
Observations	4,291	4,151	4,291	4,151
Pseudo R-Squared	0.167	0.573	0.171	0.579

Table 7 Natural Disaster, Corporate Social Responsibility, and Labor Productivity

This table presents the regression results using the following equation:

$$PROD_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} * L\_CSR_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}.$$

PROD is labor productivity defined as a firm's sales in fiscal year t divided by the total number of employees (denoted as *PROD_SALE*) or net income divided by the total number of employees (denoted as *PROD_NI*). AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year t-1. H_CSR is a dummy variable for high CSR. It is one in year t if the raw CSR score is in the top quartile within the industry. L_CSR is a dummy variable that equals one if H_CSR equals zero. *Xb* is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) PROD_SALE	(2) PROD_SALE	(3) PROD_NI	(4) PROD_NI
AFFECTED_RATIO*H_CSR	-0.255	-0.700	-3.156	-0.716
	(0.957)	(0.881)	(0.904)	(0.968)
AFFECTED_RATIO*L_CSR	-6.744**	-6.510**	-30.460***	-29.301**
	(0.018)	(0.022)	(0.004)	(0.031)
H_CSR	3.529	2.919	2.604	-8.995
	(0.267)	(0.343)	(0.796)	(0.326)
SIZE		3.476		-205.993
		(0.872)		(0.158)
SIZE2		0.210		13.631
		(0.892)		(0.174)
AGE		-7.962		-34.583
		(0.556)		(0.418)
PAGE		6.084		-15.428
		(0.147)		(0.590)
INTANG		-16.555		-168.778*
		(0.362)		(0.069)
RDC		0.939		5.204
		(0.738)		(0.449)
SGA		-0.806		2.431
		(0.171)		(0.535)
AD		-1.811**		-10.468**
		(0.041)		(0.013)
IND_YEAR		0.047***		0.544***
		(0.004)		(0.001)
STATE_YEAR		0.005		0.158
		(0.616)		(0.137)
Constant	15.049***	2.656	267.572***	1,046.484*
	(0.000)	(0.966)	(0.000)	(0.056)
Firm FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Observations	5,133	5,133	5,133	5,133
Adj. R-Squared	0.594	0.598	0.891	0.913

Table 8 Corporate Social Responsibility and Job Satisfaction

Panel A. Corporate Social Responsibility and Job Satisfaction

This panel presents the regression results using the following equation:
$BEST\_FM_{i,t} = \beta_0 + \beta_1 H\_CSR_{i,t} + Xb_{i,t} + \mu_t + \varepsilon_{i,t}$.
BEST_FM is a dummy variable that equals one for firms in the 100 Best Companies to Work For in America list. H_CSR is a dummy variable for high CSR. It is one in year t if the raw CSR score is in the top quartile within the industry. Xb is a set of control variables that include SIZE, SIZE2, AGE, INTANG, RDC, AD, and WAGE. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. AD amortized advertisement expenses similarly defined as RDC. WAGE is amortized sales, general, and administrative expenses (similarly defined as RDC) scaled by the total number of employees. Logit model is used in Columns (1) and (2) while probit model is used in Columns (3) and (4). The sample period covers 1994 to 2011. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) BEST_FM	(2) BEST_FM	(3) BEST_FM	(4) BEST_FM
	LOGIT	LOGIT	PROBIT	PROBIT
H_CSR	2.625***	1.519***	1.154***	0.680***
	(0.000)	(0.001)	(0.000)	(0.001)
SIZE		3.106		0.933
		(0.180)		(0.228)
SIZE2		-0.124		-0.032
		(0.293)		(0.425)
AGE		-0.400		-0.159
		(0.231)		(0.277)
INTANG		-3.227**		-1.602**
		(0.044)		(0.023)
RDC		0.657**		0.369**
		(0.030)		(0.032)
AD		0.091		0.053*
		(0.183)		(0.096)
WAGE		0.001*		0.001**
		(0.067)		(0.034)
Constant	-6.040***	-21.712**	-2.930***	-7.884**
	(0.000)	(0.050)	(0.000)	(0.030)
Time FE	Y	Y	Y	Y
Observations	4,591	4,448	4,591	4,448
Pseudo R-Squared	0.206	0.352	0.205	0.349

Panel B. Employee Related CSR, Employee Unrelated CSR, and Job Satisfaction

This panel presents the regression results using the following equation:
$BEST\_FM_{i,t} = \beta_0 + \beta_1\ H\_CSR\_EMP_{i,t} + \beta_2\ H\_CSR\_NON\_EMP_{i,t} + Xb_{i,t} + \mu_t + \varepsilon_{i,t}$.
BEST_FM is a dummy variable that equals one for firms in the 100 Best Companies to Work For in America list. *H_CSR_EMP* is a dummy variable for high CSR in terms of employee dimension. It is one in year *t* if the raw CSR (employee dimension) score is in the top quartile within the industry. *H_CSR_NON_EMP* is a dummy variable for high CSR in terms of non-employee dimension. It is one in year *t* if the raw CSR (without employee dimension) score is in the top quartile within the industry. *Xb* is a set of control variables that include SIZE, SIZE2, AGE, INTANG, RDC, AD, and WAGE. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$) , in which RD_t is R&D expenses at year *t*. AD amortized advertisement expenses similarly defined as RDC. WAGE is amortized sales, general, and administrative expenses (similarly defined as RDC) scaled by the total number of employees. Logit model is used in Columns (1) and (2) while probit model is used in Columns (3) and (4). The sample period covers 1994 to 2011. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) BEST_FM	(2) BEST_FM	(3) BEST_FM	(4) BEST_FM
	LOGIT	LOGIT	PROBIT	PROBIT
H_CSR_EMP	2.217***	1.394***	1.023***	0.639***
	(0.000)	(0.001)	(0.000)	(0.001)
H_CSR_NON_EMP	3.279***	2.712***	1.437***	1.277***
	(0.000)	(0.000)	(0.000)	(0.000)
SIZE		2.520		0.745
		(0.251)		(0.332)
SIZE2		-0.096		-0.023
		(0.395)		(0.576)
AGE		-0.427		-0.179
		(0.155)		(0.200)
INTANG		-3.114**		-1.593**
		(0.035)		(0.011)
RDC		0.590*		0.320**
		(0.052)		(0.046)
AD		0.108*		0.060**
		(0.077)		(0.043)
WAGE		0.001**		0.001**
		(0.011)		(0.015)
Constant	-6.976***	-19.668*	-3.379***	-7.433**
	(0.000)	(0.058)	(0.000)	(0.038)
Time FE	Y	Y	Y	Y
Observations	4,591	4,448	4,591	4,448
Pseudo R-Squared	0.308	0.426	0.304	0.422

Table 9 Natural Disaster, Corporate Social Responsibility, and Operating Performance (Alternative CSR Measure)

This table presents the regression results using the following equation:

$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$.

ROA is defined as a firm's income before depreciation in fiscal year t divided by total assets in fiscal year t-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year t-1. For CSR1, we use a CSR score that only considers strength. For each dimension, we give a firm one point if it has positive strength points. We then sum across all CSR dimensions. For CSR2, we opt not to scale CSR strength or concern under each dimension. Instead, we deduct raw concern score from raw strength score and sum across all seven dimensions. For CSR3, we give a firm one point in each of the seven dimensions if the firm has no concern score in that dimension and has at least one positive strength score. We then sum these points across all dimensions. H_CSR is a dummy variable for high CSR. It is one in year t if the raw CSR score is in the top quartile within the industry. Columns (1) and (2) use CSR1 as a measure of CSR, Columns (3) and (4) use CSR2, and Columns (5) and (6) use CSR3. Xb is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA	(6) ROA
	CSR1		CSR2		CSR3	
AFFECTED_RATIO *H_CSR	0.018***	0.017***	0.013**	0.014***	0.014**	0.014**
	(0.000)	(0.000)	(0.027)	(0.009)	(0.038)	(0.029)
AFFECTED_RATIO	-0.014**	-0.014**	-0.012*	-0.014**	-0.012*	-0.013**
	(0.042)	(0.023)	(0.055)	(0.026)	(0.060)	(0.033)
H_CSR	-0.008	-0.004	0.003	0.004	0.004	0.004
	(0.224)	(0.472)	(0.428)	(0.348)	(0.374)	(0.322)
SIZE		0.121***		0.123***		0.122***
		(0.000)		(0.000)		(0.000)
SIZE2		-0.007***		-0.007***		-0.007***
		(0.000)		(0.000)		(0.000)
AGE		-0.032		-0.031		-0.032
		(0.263)		(0.282)		(0.270)
PAGE		0.008		0.009		0.009
		(0.285)		(0.273)		(0.279)
INTANG		-0.108***		-0.108***		-0.109***
		(0.001)		(0.001)		(0.000)
RDC		0.027**		0.028**		0.028**
		(0.026)		(0.024)		(0.025)
SGA		-0.003*		-0.003*		-0.003*
		(0.092)		(0.082)		(0.079)
AD		-0.003		-0.003		-0.003
		(0.173)		(0.199)		(0.197)
IND_YEAR		0.109***		0.109***		0.109***
		(0.000)		(0.000)		(0.000)
STATE_YEAR		0.054		0.055		0.055
		(0.219)		(0.211)		(0.213)
Constant	0.221***	-0.198	0.221***	-0.213*	0.220***	-0.206*
	(0.000)	(0.106)	(0.000)	(0.075)	(0.000)	(0.080)
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	5,158	5,158	5,158	5,158	5,158	5,158
Adj. R-Squared	0.519	0.541	0.519	0.541	0.519	0.541

Table 10 Natural Disaster, Corporate Social Responsibility, and Operating Performance (ASSET4 Data)

This table presents the regression results using the following equation:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * CSR\_AST4_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 CSR\_AST4_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}.$$

ROA is defined as a firm's income before depreciation in fiscal year t divided by total assets in fiscal year t-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year t-1 weighted by economic loss caused by each natural disasters at county level. CSR_AST4 is the raw CSR score from ASSET4 database scaled by 100. Xb is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ROA	(2) ROA
AFFECTED_RATIO*CSR_AST4	0.043**	0.044**
	(0.043)	(0.029)
AFFECTED_RATIO	-0.039**	-0.043***
	(0.010)	(0.004)
CSR_AST4	0.008	0.004
	(0.590)	(0.791)
SIZE		0.152**
		(0.030)
SIZE2		-0.008**
		(0.029)
AGE		-0.022
		(0.701)
PAGE		0.025*
		(0.053)
INTANG		-0.087**
		(0.048)
RDC		0.057
		(0.422)
SGA		-0.004*
		(0.057)
AD		-0.001
		(0.493)
IND_YEAR		0.106**
		(0.011)
STATE_YEAR		0.013
		(0.740)
Constant	0.155***	-0.524
	(0.000)	(0.127)
Firm FE	Y	Y
Time FE	Y	Y
Observations	1,737	1,737
Adj. R-Squared	0.629	0.648

Table 11 Natural Disaster, Corporate Social Responsibility, and Operating Performance (Alternative Cutoff for High CSR)

This table presents the regression results using the following equation:

$$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}.$$

ROA is defined as a firm's income before depreciation in fiscal year *t* divided by total assets in fiscal year *t*-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year *t*-1. H_CSR is a dummy variable for high CSR. It is one in year *t* if the raw CSR score is above 70th percentile within the industry in Columns (1) and (2). In Columns (3) and (4), the cutoff is 80th percentile. Columns (5) and (6) use continuous CSR measure instead of a dummy variable. *Xb* is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1 - 0.2k)$), in which RD_t is R&D expenses at year *t*. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA	(6) ROA
	70th		80th		Continuous	
AFFECTED_RATIO *H_CSR	0.013**	0.013**	0.013	0.012*		
	(0.029)	(0.024)	(0.107)	(0.096)		
AFFECTED_RATIO*CSR					0.004**	0.004**
					(0.024)	(0.017)
AFFECTED_RATIO	-0.012*	-0.013**	-0.012*	-0.013**	-0.014**	-0.015**
	(0.061)	(0.032)	(0.073)	(0.042)	(0.030)	(0.017)
H_CSR	0.004	0.005	0.002	0.003		
	(0.288)	(0.158)	(0.677)	(0.412)		
CSR					-0.001	-0.000
					(0.640)	(0.850)
SIZE		0.124***		0.123***		0.122***
		(0.000)		(0.000)		(0.000)
SIZE2		-0.007***		-0.007***		-0.007***
		(0.000)		(0.000)		(0.000)
AGE		-0.031		-0.032		-0.031
		(0.283)		(0.270)		(0.275)
PAGE		0.008		0.009		0.009
		(0.282)		(0.275)		(0.268)
INTANG		-0.109***		-0.109***		-0.109***
		(0.000)		(0.001)		(0.001)
RDC		0.027**		0.027**		0.027**
		(0.025)		(0.026)		(0.028)
SGA		-0.003*		-0.003*		-0.003*
		(0.080)		(0.083)		(0.085)
AD		-0.003		-0.003		-0.003
		(0.213)		(0.205)		(0.177)
IND_YEAR		0.109***		0.109***		0.109***
		(0.000)		(0.000)		(0.000)
STATE_YEAR		0.054		0.054		0.054
		(0.213)		(0.213)		(0.218)
Constant	0.221***	-0.216*	0.220***	-0.210*	0.221***	-0.206*
	(0.000)	(0.069)	(0.000)	(0.079)	(0.000)	(0.085)
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	5,158	5,158	5,158	5,158	5,158	5,158
Adj. R-Squared	0.519	0.541	0.518	0.541	0.518	0.540

Table 12 Natural Disaster, Corporate Social Responsibility, and Operating Performance (Severity of Natural Disasters)

This table presents the regression results using the following equation:

$ROA_{i,t} = \beta_0 + \beta_1 AFFECTED\_RATIO_{i,t-1} * H\_CSR_{i,t-1} + \beta_2 AFFECTED\_RATIO_{i,t-1} + \beta_3 H\_CSR_{i,t-1} + Xb_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$.

ROA is defined as a firm's income before depreciation in fiscal year t divided by total assets in fiscal year t-1. AFFECTED_RATIO is the percentage of a firm's factories impacted by natural disasters in calendar year t-1 weighted by economic loss caused by each natural disasters at county level. H_CSR is a dummy variable for high CSR. It is one in year t if the raw CSR score is in the top quartile within the industry. *Xb* is a set of control variables that include SIZE, SIZE2, AGE, PAGE, INTANG, RDC, SGA, AD, IND_YEAR, and STATE_YEAR. SIZE is the natural log of total assets. SIZE2 is the square of SIZE. AGE is the number of years a firm has been in the Compustat database. PAGE is the average age of plants; the age of a plant is the number of years it has existed in the TRI database. INTANG is the percentage of intangible assets defined as total assets minus current assets and net value of property, plants, and equipment scaled by total assets. RDC is the natural log of one plus amortized research & development (R&D) expenses in the past five years (i.e., $\sum_{k=0}^{4} RD_{t-k}(1-0.2k)$), in which RD_t is R&D expenses at year t. SGA and AD are amortized sales, general, and administrative expenses and amortized advertisement expenses, similarly defined as RDC. IND_YEAR and STATE_YEAR are industry-year and state-year averages of ROA without the focal firm itself, respectively. The sample period covers 1995 to 2012. Robust standard errors are clustered at the state level. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ROA	(2) ROA
AFFECTED_RATIO*H_CSR	0.011*	0.012**
	(0.063)	(0.042)
AFFECTED_RATIO	-0.013**	-0.014**
	(0.032)	(0.018)
H_CSR	0.004	0.005
	(0.322)	(0.246)
SIZE		0.124***
		(0.000)
SIZE2		-0.007***
		(0.000)
AGE		-0.031
		(0.275)
PAGE		0.009
		(0.281)
INTANG		-0.109***
		(0.000)
RDC		0.027**
		(0.026)
SGA		-0.003*
		(0.080)
AD		-0.003
		(0.209)
IND_YEAR		0.109***
		(0.000)
STATE_YEAR		0.054
		(0.214)
Constant	0.222***	-0.211*
	(0.000)	(0.076)
Firm FE	Y	Y
Time FE	Y	Y
Observations	5,158	5,158
Adj. R-Squared	0.519	0.541