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CORPORATE INVESTOR CONFIDENCE IN THE AFTERMATH OF A MEGA NATURAL DISASTER: AN EMPIRICAL STUDY OF THE 2008 WENCHUAN EARTHQUAKE

Abstract

Previous studies show that extreme disasters, such as earthquakes, have enormous impacts on individual and organizational behavior, including self-protection. While such experience is important for risk control processes, the influence of disasters on corporate performance and stakeholder perceptions, especially that of investors, has not yet been investigated. Investment behavior however is a key factor in the recovery process. How the corporate world reacts after a disaster is an indicator for the renewal and revival ability of the affected economies and their long-term sustainability.

This study contributes to understanding post-disaster corporate investor confidence investigating how the distance from the severely affected area influences corporate investor confidence. By analyzing 98 publicly listed companies located in the disaster areas of the 2008 Wenchuan earthquake, the analysis finds that during 2008-2013 both geographical and temporal distance serve as promoters in influencing the post-disaster investor confidence. Moderating effects of firm performance and industry risk on the relationship between disaster distance and post-disaster investor confidence are identified. The paper also outlines possible future research directions.

Key words: earthquake, disaster distance, investor confidence, disaster management

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1. Introduction

Earthquakes are among the most dangerous disasters on the planet. Every year they cause substantial economic harm and loss of life in many parts of the world, consequently social and economic instability may be experienced for prolonged periods following their aftermath (Moltchanova et al., 2011; Akason et al., 2006; Meichenbaum, 1995). Earthquakes trigger damage not only to individuals and community groups, but also to corporations. Businesses located in disaster areas are in unusual position because on the one hand, they are negatively impacted by the calamity and on the other, they are expected to join the relief efforts (Madsen and Rodgers, 2015). Furthermore, philanthropic donation to disaster-stricken area is seen as an important part of corporate social responsibility, particularly for publicly listed companies (Jia and Zhang, 2013; Madsen and Rodgers, 2015). Economic recovery is essential for areas affected by calamities to stabilize and provide sustainable livelihood opportunities for the people who live there.

Most earthquake studies focus on the immediate recovery process, including evacuation, disaster relief, and post-disaster philanthropic donation (e.g., Bernardini et al., 2016; D’Orazio et al., 2014; Zheng et al., 2010; Madsen and Rodgers, 2015; Muller and Whiteman, 2009). Although post-disaster relief to individuals and communities plays a crucial role in normalizing people’s lives, the long-term prospects of the affected areas depend on the revival of economic activities. Serious disasters such as earthquakes can cause corporations significant physical and financial damage. Previous research shows that earthquakes destroy industrial facilities and cause big economic losses (Cruz and Steinberg, 2005). An example of such negative effects is the sudden suspension of trade for sixty-six publicly listed companies

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the day after the 2008 Wenchuan earthquake¹. Extreme disasters such as earthquakes are bad news for companies and shareholders. They seriously affect risk perception, resulting in loss of confidence and manifested through reduced investment, as investors look to put their money into safe companies (Mackey et al., 2007). Listed companies may be caught in a vicious circle where poor investor confidence leads to bad performance which in turn makes them even less attractive to investors (Mackey et al., 2007). Understanding the impact mechanism of earthquakes on post-disaster investor confidence can help clarify the root of the problem for enterprise decision-makers, helping alleviate the negative impacts caused by the calamities and assist in economic recovery.

We use the concept of psychological distance and construal level theory (Trope et al., 2007; Liberman and Trope, 1998; Liberman and Trope, 2008; Trope and Liberman, 2000; Trope and Liberman, 2003; Trope and Liberman, 2010) to investigate the determinants influencing corporate investor confidence. Consistent with the classic psychological distance concept, we assume the two main direct disaster distances in our study to be geographical and temporal. As proposed in construal level theory, individuals use concrete, low-level construals to represent near events and abstract, high-level construals to represent distant events (Trope and Liberman, 2003).

A missing piece in this puzzle is knowing under what condition the effects of the disaster distance on investor confidence will be mitigated or aggravated. This calls for a better understanding of the factors which potentially influence investor confidence. Previous studies show that investors increase investment to firms with good prospects and decrease it

¹ <http://money.163.com/08/0513/04/4BQ1MSLI00251RJ2.html>

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when there is potential risk (Wen, 2010; Hamilton et al., 1993; Myers and Majluf, 1984; Porta et al., 1997; De Long et al., 1990). In the case of an extreme calamity, the disaster factor is a primary consideration for investors. The effects of this main disaster factor however may be amplified or diminished by other possible influencing factors, such as firm performance and potential industry risk.

In this study, we propose that disaster distance is the main factor influencing investor confidence in the aftermath of earthquakes. The research aims to determine how geographical and temporal distances impact investor confidence. Furthermore, firm performance may have attenuating effects on the relationship between disaster distance and corporate investor confidence, while investors in industries with high fixed assets may have less confidence in such corporations.

To test these ideas, an empirical study is conducted of 98 listed companies over the period 2008-2013. Geographical distance and temporal distance are applied to measure disaster distance. Firm performance is measured through the net profit in the current year and a distinction is made between companies belonging to a high fixed-asset industry (such as manufacturing and hydropower) and those which do not. After combining these data with information about the companies' financial performance, several hypotheses are tested using random effect regressions and the results show that they are broadly supported.

This study makes three main contributions. Firstly, it enriches the traditional disaster research by expanding it to include corporate performance and post-disaster investor confidence, rather than only analyzing negative effects on individuals and communities. Secondly, it contributes to psychological distance research used mainly to explain evaluation

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and behavior problems in the respective areas of psychological and consumer behavior.

Combining disaster management problems and psychological theory is an innovative interdisciplinary approach adopted in this study which offers new future directions for investigation. Thirdly, the moderating effect of good (e.g. firm performance) and bad (e.g. industry risk) news about listed companies is analyzed in the case of disasters. A relatively complete framework is established for the “disaster – investor” problem and it is hoped that future post-disaster enterprise research can benefit from this viewpoint.

In what follows, we present a theoretical overview and develop the hypotheses. Then, we discuss the method and the results.

2. Theory and hypotheses

In this section, the theoretical framework adopted in the study is explained which allows four hypotheses to be formulated and then empirically tested. The context of the analysis is earthquakes – a low-frequency but high-consequence event, which often causes a significant damage, especially in densely populated areas (Fiedrich, 2000). Parallels can be drawn with other natural calamities, such as fires, floods, hurricanes and extreme weather events, or environmental disasters, such as toxic spills, chemical explosions and nuclear contamination. They similarly can have significant psychological distance effects. War zones and military conflicts also destabilize economic performance and affect investor confidence. We specifically examine the case of earthquakes because of their sudden, shattering and long-lasting psychological effects. The 2008 Wenchuan (also known as Sichuan) earthquake is used to test the hypotheses as an example of an extreme natural calamity with devastating effects which killed 69,000 people, 18,000 were reported missing, 374,000 were injured

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(Sina, 2008) and 4.8 million left homeless (BBC News, 2008). The direct economic damage caused by the Wenchuan earthquake is estimated at US\$124 billion (Wu et al., 2012).

Natural disasters seriously disrupt business operations, particularly when there is damage caused to infrastructure, buildings, communications, supply of resources, energy and materials with many people suffering from post-disaster stress disorder and other psychological conditions. Hall (2018) points out that the economic repercussions in the aftermath can be as bad as the damage caused by the natural disaster. In some cases, the economic recovery can take very long as investor confidence is shattered, the liquidity in the financial sector is increased, information is incomplete and shareholders look for alternative easier investment opportunities. According to OECD (2004, p. 11), these “negative consequences can be substantial, especially if there is a threat of repetition of the disaster” as is the case of earthquakes. Improving investor confidence is a key ingredient in the recovery process (OECD, 2004) and this study investigates what are the contributing factors to achieve this.

2.1 Psychological distance and construal level theory in the context of earthquake

For many victims, the experience of an earthquake is inexpressible, sudden and deep shock. It often has long-term ongoing psychological consequences, and the impact is widespread (Akason et al., 2006).

The four dimensions of psychological distance are space, time, social distance and probability (Trope et al., 2007). In the context of a disaster, the former two are more objective compared to the latter two distances and they are the focus of this investigation. Construal level theory is widely employed to explain psychological distance in previous studies (Trope

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et al., 2007; Trope and Liberman, 2003). According to this theory, individuals tend to employ low-level construal with close psychological distance. On the contrary, high-level construal is usually applied when psychological distance is distant (Trope et al., 2007). Geographical distance has been put forward as the key factor influencing risk perception by Loewenstein (2001). The risk perceived by the public accordingly differs with the geographical distance from the earthquake place. Time is another kind of psychological distance influencing post-disaster risk perception, and according to Trope et al. (2007) distant future events are represented in a more abstract, structured and high-level manner than more imminent occurrences. Events happening in the past or future result in different risk perception relatively to their psychological distance.

2.2 Disaster distance and post-disaster investor confidence

Space and time are the two main factors affecting the perspective of psychological distance and influencing people's risk perception in the aftermath of a disaster. Applying this logic, the two main disaster distances considered in this study are geographical and temporal. Catastrophic risk events, particularly geohazards, usually happen in accidental times and places, however, the shock waves of an earthquake are not temporary or limited to one spot. People's perceptions are seriously affected which in many ways is expected.

Geographical distance is an important factor affecting stakeholder perception. Farley et al. (1993) found that in the New Madrid earthquake the response measures by families were negatively related to their distance from the earthquake's centre. Lindell (1994) also found that physical distance has important influence on the risk perception of the public in other disasters, such as volcano eruptions and toxic gas leakages. Other studies have similarly

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proposed that distance, or the specific location, is the main factor which helps explain risk perception (Peacock et al., 2005). Rosoff et al. (2012) analysed data from the New York individual medical assistance following the September 11, 2001 terror attacks and found that the risk of disease increases with the narrowing of the distance to the World Trade Center – a relationship which did not exist prior to the horrific incident. It is logical to expect investors to be similarly affected.

Post-disaster investor confidence is also influenced by the time factor. At the beginning, people have a clear perception and recollection about the details of the negative information associated with the disaster. These details however subside over time and leave a more abstract memory in the future. Liberman et al. (2007) explain that individuals use concrete, low-level construals to represent recent events and abstract, high-level construals for more distant occurrences. In goal-related decisions, desirability for an activity depends on the target, and is a high-level construal (Liberman and Trope, 1998). The feasibility of achieving this target on the other hand is a low-level construal (Liberman and Trope, 1998). This logic is similar to Robbennolt (2000)'s proposition in social psychology research that over time consumers gradually ignore negative information about products and are not as strongly hit as when they receive bad news for the first time; hence, their purchase intention progressively recovers.

Investor confidence is the investor's feeling that nothing can go wrong with an investment (Shiller, 2000). This means investors perceive no or little risk about their investment decision. As proposed in construal level theory, individuals use concrete, low-level construals to represent near events and feasibility weighs heavier than desirability.

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Consistent with this logic, investors feel more risks than benefits when located in a close disaster distance to an earthquake, because they perceive low feasibility for investment income, and desirability plays no role in a close psychological distance. On the opposite, abstract, high-level construals are used to represent distant events, and investors feel more benefits than risks when in a distant disaster distance to the earthquake because desirability weighs heavier than feasibility in such a condition. Resulting from this logic, we propose the following relationships of disaster distance and post-disaster investor confidence with reference to a big earthquake:

Hypothesis 1: Investors have more confidence in firms with farther geographical distance from the big earthquake.

Hypothesis 2: Investors have more confidence in firms with farther temporal distance from the big earthquake.

2.3 Firm performance, industry risk and post-disaster investor confidence

Investor confidence is a psychological characteristic. Besides, investor belief and decision-making change with investor confidence, giving rise to variations in the stock trading volumes and transaction prices.

The confidence of investors stems from their judgment about the future (Shiller, 2000). For listed companies, good performance shows a promising future to investors. For example, investors from different countries and regions are willing to pay higher premiums for better corporate governance (Newell and Wilson, 2002) which means that they have more confidence in better performing companies.

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As for listed companies in disaster areas, investors firstly take the negative impact of the disaster into consideration. They are likely to have more confidence in companies which are at a far disaster distance from the earthquake place. Positive firm-related factors and good news about listed companies (i.e. good firm performance) may help strengthen investor confidence, as they provide a better prospect for investors which can diminish the negative influence of the disaster (Mackey et al., 2007). Accordingly, the following hypotheses are formulated:

Hypothesis 3a: Firm performance has a negative effect on the relationship between geographical distance from the earthquake and investor confidence.

Hypothesis 3b: Firm performance has a negative effect on the relationship between temporal distance from the earthquake and investor confidence.

Previous research has proposed that risk is a key factor influencing individual investors' investment decisions (Stone and Grønhaug, 1993; Cohn et al., 1975). Investors in earthquake areas are likely to consider the risk associated with the nature of the industry itself and how vulnerable it is to the seismic activities. An industry with high potential risk causes investor stress and can be compared to fixed bad news that cannot be rapidly eliminated. Industry risk in this study relates to companies belonging to industries with large fixed assets, such as manufacturing and hydropower, which are likely to suffer more destruction during earthquakes. Thus, industry risk may be a burden for investors to perceive the potential risk caused by the disaster, and this idea leads to the following predictions:

Hypothesis 4a: Industry risk has a positive effect on the relationship between geographical distance from the earthquake and investor confidence.

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Hypothesis 4b: Industry risk has a positive effect on the relationship between temporal distance from the earthquake and investor confidence.

All four hypotheses are tested using data from China's 2008 Wenchuan earthquake. The research method, sample and estimation model are presented below followed by the results and discussion sections.

3. Research method

The above hypotheses are tested with data collected about the investor shareholdings of listed companies for the six-year period between 2008 and 2013. Further details about the sample size, variables and estimation methods are given below in order to explain the approach taken in identifying corporate investor confidence.

3.1 Sample and data

All A-share listed companies headquartered in Sichuan, Gansu, Shanxi province and Chongqing municipality – the worst hit areas in the 2008 Wenchuan earthquake, are included in the study. Companies which moved out of the disaster-influenced areas in the aftermath of the mega earthquake were eliminated. The final sample comprises a balanced panel of 98 companies over 588 firm-year observations collected from 11 different industries.

3.2 Dependent variable

The main dependent variable in this research is *post-disaster investor confidence*. It is measured by the total value of shareholdings of the top ten shareholders. This variable is standardized to correct for skewness.

We have referred to several studies using these three main indicators (corporate growth, YrPB and INST) to measure investor confidence in the Chinese market. This method is

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appropriate in the context of traditional finance, however, it is not suited for an extreme disaster situation because it considers only institutional and ignores all individual investors. In fact, individual investors are more vulnerable to the sudden shocks in a disaster scenario. First, they are not as professional as institutional investors. When exposed to a sudden disaster, individual investors are more likely to use heuristic information processing while institutional investors tend to process information in a more systematic way (Chaiken, 1980), which leads to a more obvious fluctuation of individual compared to institutional investors' shareholdings. Second, the largest institutional investor is perceived to hold an information advantage (Schnatterly, Shaw, & Jennings, 2008). With the advantages of higher professional experience and more information, institutional investors are less likely to be influenced by the external environment. Conversely, individual stakeholders are more likely to be affected in the disaster context.

A further reason for selecting this way of measuring investor confidence is because big shareholders usually consider shareholding as investment rather than speculation. Their interests are better aligned with those of the companies with less incentives for expropriation (Ma et al., 2010). Also, big shareholders usually have greater influence on others as they are represented on management and supervisory boards, have more power due to their larger shares and affect decision-making (Hackethal et al., 2003; Guerrero-Villegas et al., 2018).

3.3 Independent variable

Disaster distance is the key independent variable in this research. In the case of earthquake, geographical distance and temporal distance are the two analyzed dimensions of disaster distance. The *geographical distance* is measured as the linear distance between

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the center of the earthquake and the location of the company headquarters. *Temporal distance* is measured as the time interval between the year of the earthquake and the statistical year.

The geographical distance is also standardized because of its high standard deviations.

3.4 Moderating variables

Firm performance and *industry risk* are the two moderating variables in this study. The former is measured as net profit (Palepu, 1985) and the latter relates to whether the focal company exists in a potentially vulnerable industry, such as manufacturing or hydropower, or not.

The finally sample consists of 11 different industries, which is too many to be coded as dummy variables in a model. Existing literatures have given references about industry division, suggesting a division scheme depends on the main research theme. For example, Gao (2011) divided industries into two types with high or low levels of public contact to find the relationship between industry sector and philanthropic giving. Consistent with this logic, under the situation of earthquake, an industry with high potential risk causes investor stress and can be compared to fixed bad news that cannot be rapidly eliminated. Companies in industries such as manufacturing and hydropower are likely to experience higher production capacity losses and other damages as a result of a big earthquake because they usually possess large shares of fixed assets that can be ruined. A company in such an industry is labeled as 1, otherwise 0. The net profit variable is standardized due to its high standard deviations.

3.5 Control variables

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Five control variables are used in the study, namely firm size, cash holding, firm location and probability of earthquake. *Firm size* is measured by total assets (Agrawal and Knoeber, 1996), commonly used to measure enterprise scale. *Leverage* is measured by the asset-liability ratio (Sharpe, 1994) while *cash holding* is used to measure the liquidity risk of corporate assets (Jia and Zhang, 2013). *Firm location* is represented as to whether the company is located in Sichuan (the province of the Wenchuan earthquake) or not, as this province experienced the most severe economic and livelihood damage. To reflect the *probability of earthquake*, companies in a city located on a seismic belt – a narrow zone on the Earth's surface along which most earthquake activity occurs because of movement of the large tectonic plates (Encyclopaedia Britannica, 2011), have a high probability of earthquake and are labeled as 1, otherwise 0. The variables with high standard deviations are similarly standardized to correct for skewness.

3.6 Estimation methods

As the sample consists of multiple observations over time for each company, it was important to use an analytic technique appropriate for panel data. To select a proper statistical method, we followed the Hausman test (Baltagi et al., 2003), which suggested random effect model to be used for these data. The generalized least squares (GLS) method is thus used to test the hypotheses. In all models, the robust standard errors are specified, which helps account for any misspecification in the correlation structure (Hardin and Hilbe, 2002). The variables included in the interaction terms (disaster distance and firm performance/industry risk) are also centered (Wowak et al., 2016). All analyses were performed with Stata 12.

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4. Results

The descriptive statistics and correlations are shown in Table 1. Any means and standard deviations are reported as untransformed and uncentered values, while the correlations employ the transformed and centered variables used in the models.

Table 2 reports the results of the four hypotheses tests predicting post-disaster investor confidence (Model 1 to 6). In the first hypothesis, a positive association between geographical distance and post-disaster investor confidence is predicted. In Model 2, the main effect of geographical distance on post-disaster investor confidence is positive and significant ($p < 0.1$). Thus hypothesis 1 is supported. Hypothesis 2 states that the relationship between temporal distance and post-disaster investor confidence is positive. The significant positive coefficient ($p < 0.05$) in Model 2 indicates that the temporal distance indeed has a positive effect on the post-disaster investor confidence.

Table 1. Descriptive statistics and correlations

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Investor confidence										
2. Geographical distance	0.103 (0.013)									
3. Temporal distance	0.128 (0.002)	0.000 (1.000)								
4. Total asset	0.731 (0.000)	-0.016 (0.701)	0.139 (0.001)							
5. Leverage	-0.022 (0.587)	-0.003 (0.946)	-0.083 (0.044)	-0.036 (0.380)						
6. Cash holding	-0.052 (0.206)	-0.021 (0.617)	-0.026 (0.529)	-0.026 (0.527)	0.001 (0.984)					
7. Firm location	0.053 (0.201)	-0.837 (0.000)	0.000 (1.000)	0.089 (0.030)	-0.081 (0.049)	0.007 (0.860)				
8. Probability of earthquake	0.057 (0.164)	-0.448 (0.000)	0.000 (1.000)	0.061 (0.137)	-0.119 (0.004)	0.024 (0.555)	0.709 (0.000)			
9. Firm performance	0.382 (0.000)	-0.081 (0.049)	0.090 (0.029)	0.454 (0.000)	-0.028 (0.506)	0.014 (0.743)	0.132 (0.001)	0.090 (0.029)		
10. Industry risk	0.122 (0.003)	-0.162 (0.000)	0.000 (1.000)	0.153 (0.000)	-0.090 (0.029)	0.028 (0.496)	0.213 (0.000)	0.276 (0.000)	0.076 (0.065)	
Mean	3.60E+08	338.27	2.50	5.95E+09	1.24	-7.94E+07	0.52	0.68	2.67E+08	0.76
S.E.	6.08E+08	250.25	1.71	1.21E+10	8.64	1.10E+09	0.50	0.47	1.05E+09	0.43

Note. n=588; p-value are in parentheses.

Table 2. Generalized least squares (GLS) models predicting post-disaster investor confidence

	Post-disaster investor confidence											
	Model 1	p-value	Model 2	p-value	Model 3	p-value	Model 4	p-value	Model 5	p-value	Model 6	p-value
Total asset	0.713 (0.202)	0.000	0.679 (0.192)	0.000	0.617 (0.167)	0.000	0.680 (0.194)	0.000	0.675 (0.188)	0.000	0.674 (0.191)	0.000
Leverage	0.000 (0.001)	0.682	0.001 (0.001)	0.474	0.001 (0.001)	0.428	0.001 (0.001)	0.347	0.001 (0.001)	0.470	0.000 (0.001)	0.864
Cash holding	-0.004 (0.015)	0.809	-0.002 (0.015)	0.895	0.003 (0.013)	0.791	-0.002 (0.015)	0.884	-0.001 (0.015)	0.941	-0.002 (0.015)	0.890
Firm location	-0.050 (0.177)	0.776	0.793 (0.474)	0.094	0.806 (0.495)	0.103	0.768 (0.469)	0.101	0.918 (0.481)	0.056	0.796 (0.477)	0.095
Probability of earthquake	0.083 (0.162)	0.609	-0.174 (0.171)	0.308	-0.179 (0.181)	0.322	-0.170 (0.169)	0.314	-0.257 (0.189)	0.172	-0.176 (0.171)	0.305
Firm performance	-0.140 (0.101)	0.168	-0.140 (0.099)	0.159	-0.123 (0.053)	0.020	-0.072 (0.108)	0.505	-0.136 (0.098)	0.167	-0.142 (0.099)	0.154
Industry risk	0.029 (0.069)	0.676	0.062 (0.101)	0.538	0.078 (0.102)	0.443	0.057 (0.098)	0.559	0.011 (0.090)	0.899	0.064 (0.102)	0.531
Geographical distance			0.402 (0.215)	0.062	0.389 (0.229)	0.089	0.396 (0.214)	0.065	0.451 (0.206)	0.029	0.403 (0.216)	0.062
Temporal distance			0.025 (0.010)	0.018	0.025 (0.010)	0.015	0.020 (0.012)	0.090	0.025 (0.011)	0.018	0.025 (0.011)	0.017
Geographical distance* Firm performance					-0.170 (0.035)	0.000						
Temporal distance* Firm performance							-0.029 (0.017)	0.086				
Geographical distance* Industry risk									0.333 (0.109)	0.002		
Temporal distance* Industry risk											0.031 (0.017)	0.074
Constant	-0.078 (0.064)	0.218	-0.429 (0.192)	0.026	-0.456 (0.198)	0.021	-0.400 (0.191)	0.037	-0.375 (0.172)	0.029	-0.430 (0.193)	0.026
Wald chi2	22.50(7)		49.05(9)		193.12(10)		49.65(10)		62.09(10)		50.78(10)	
P value	0.002		0.000		0.000		0.000		0.000		0.000	
Observations	588		588		588		588		588		588	

Note. n=588; Values in table are unstandardized regression coefficients. Standard errors are in parentheses.

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Hypotheses 3a proposes that the relationship between geographical distance and post-disaster investor confidence would diminish (i.e. become less positive) as firm performance advances. The significant negative coefficient ($p = 0.000$) on the interaction term in Model 3 indicates that firm performance indeed moderates the relationship as predicted. To further understand this interaction, we plotted the relationship in Figure 1 at low and high levels of geographical distance and firm performance.

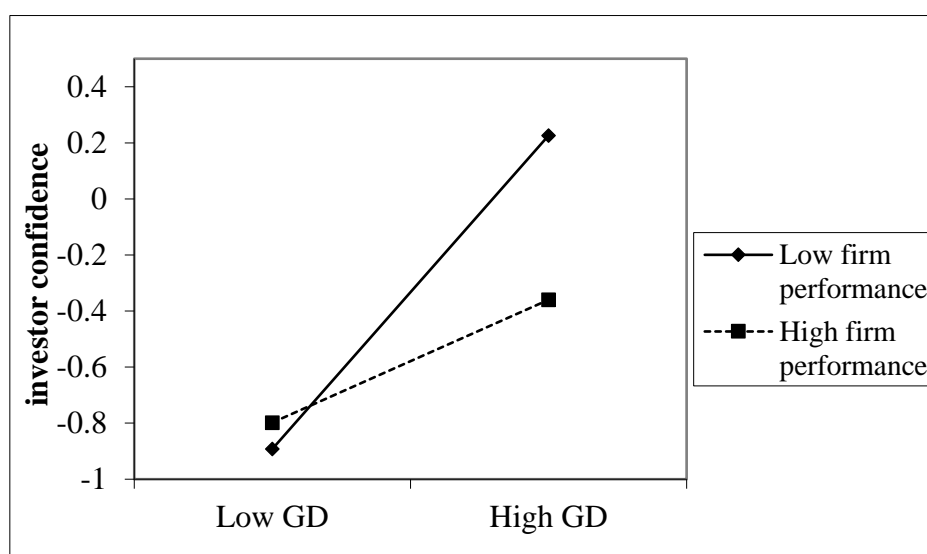


Figure 1. The joint effect of geographical distance (GD) and firm performance on post-disaster investor confidence

Hypothesis 3b argues that the relationship between temporal distance and post-disaster investor confidence would diminish as firm performance advances, and the negative and significant ($P < 0.1$) interaction term in Model 4 supports this. Similarly, we plotted this interaction in Figure 2 at low and high levels of temporal distance and firm performance.

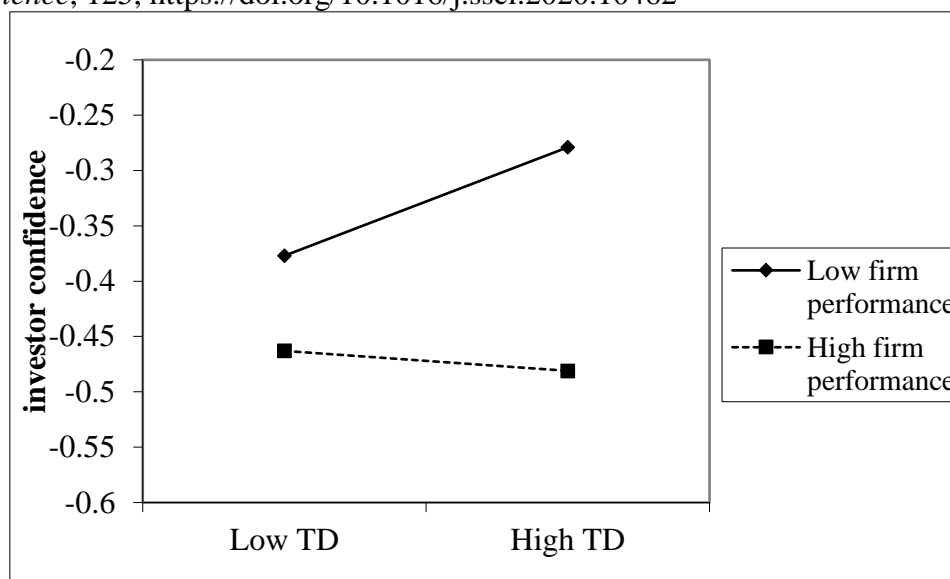


Figure 2. The joint effect of temporal distance (TD) and firm performance on post-disaster investor confidence

Hypothesis 4a predicts that the relationship between geographical distance and post-disaster investor confidence would become stronger (i.e. more positive) as industry risk advances, and the positive and significant ($P < 0.01$) coefficient of the interaction term in Model 5 shows that the influence of geographical distance on post-disaster investor confidence indeed grows stronger as industry risk advances. Figure 3, which graphs this relationship at low and high levels of geographical distance and industry risk, illustrates that the effect geographical distance on post-disaster investor confidence is more positive for companies in high risk industries. Hypothesis 4a is thus also supported. Hypothesis 4b predicts that the relationship between temporal distance and post-disaster investor confidence would become stronger as industry risk advances, and the positive and significant ($P < 0.1$) coefficient of the interaction term in Model 6 shows that the influence of temporal distance on post-disaster investor confidence indeed grows stronger as industry risk advances. We plotted this relationship in Figure 4.

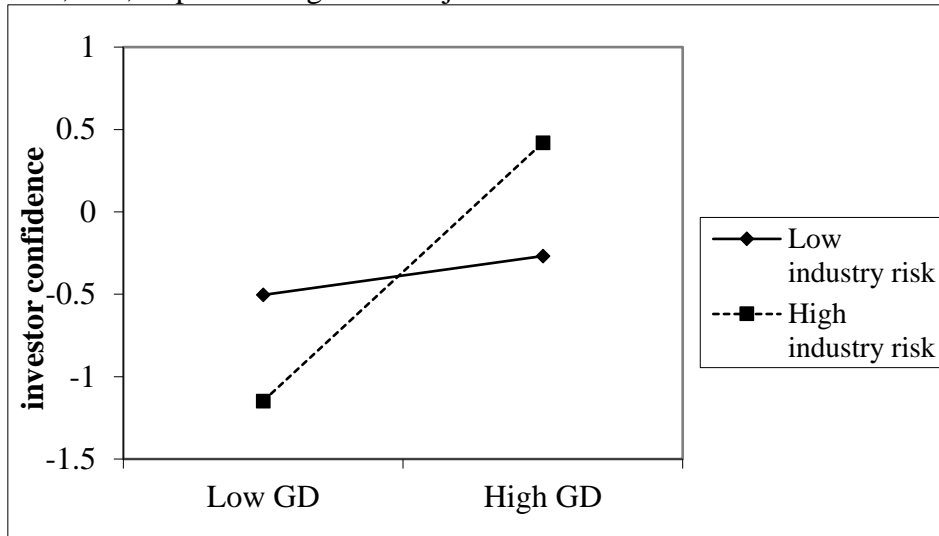


Figure 3. The joint effect of geographical distance (GD) and industry risk on post-disaster investor confidence

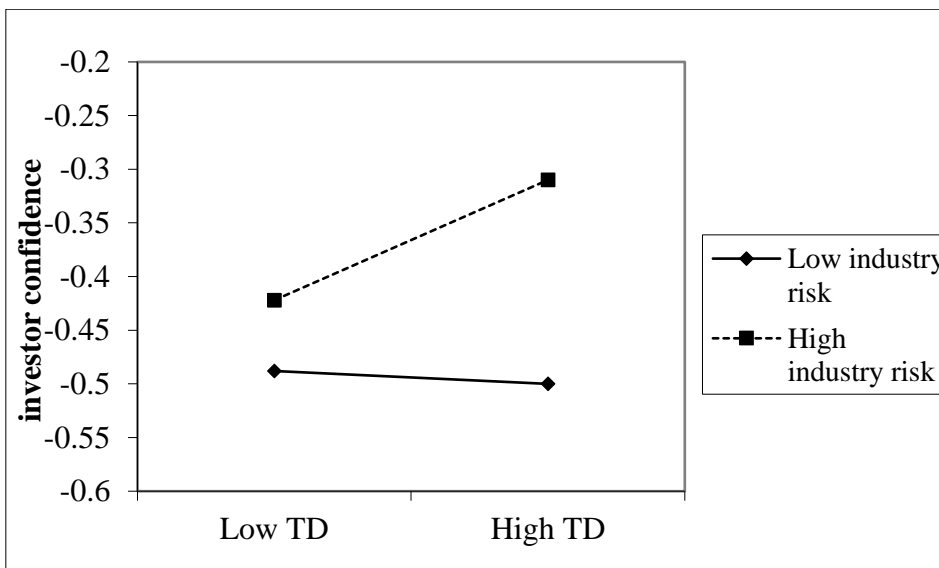


Figure 4. The joint effect of temporal distance (TD) and industry risk on post-disaster investor confidence

5. Discussion

This study aimed to identify the key factor influencing investor confidence in the aftermath of an extreme disaster, such as a mega earthquake. There have been many earthquake studies, but the influence on business is rarely investigated. Integrating the psychological distance concept and construal level theory (Trope and Liberman, 2010), this study shows that disaster distance is a critical factor in influencing post-disaster investor

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confidence. The research also demonstrates that firm performance and industry risk play

important moderating roles in the disaster-investor relationship, as the effects of geographical and temporal distance can diminish with the growth of firm performance, and the effect of geographical distance can amplify with the growth of industry risk.

The overarching contribution of this analysis is in the application of the psychological distance concept and construal level theory in the case of earthquakes. Psychological distance researchers have shown that it affects mental construals which in turn guide prediction, evaluation, and behavior, as revealed in past research in the area of consumer psychology. Disaster research usually focusses on relief for the injured (e.g., Zheng et al., 2010), urgent evacuation models (e.g., Bernardini et al., 2016; D’Orazio et al., 2014), or other protective measures for individuals and the public. At the beginning, these two bodies of literatures appeared to have no relevance because they focus on different areas and have followed separate paths. By integrating the psychological distance concept and the earthquake case, a new argument is developed about how disaster distance manifests in post-disaster investor confidence. The results indicate that investors in companies with far disaster distance have more confidence. This is consistent with previous research which shows that investors invest in companies with good prospects but avoid firms with potential risk. The moderating effects of firm performance and industry risk also help explain this.

The integration of the psychological distance concept, construal level theory and post-disaster investor confidence provides a more effective framework for understanding the consequences of extreme disasters, especially regarding enterprises which have suffered in the disaster. To predict the other potential factors influencing investor confidence, we argued that good news (such as firm performance) and bad news (such as potential industry risk) of listed companies may interact with disaster distance.

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Although the findings from the current study are quite insightful for understanding disaster recovery, there are limitations in this research, which provide opportunities for further investigation. First, we only focused on investor confidence of publicly listed companies in disaster areas, partly because of data availability. Future work based on these ideas can focus on other vital aspects of the companies, such as firm performance and strategies, or compare firms in and outside the disaster areas. Such an analysis should not be limited to listed firms only. Second, we studied the changes in post-disaster investor confidence in the six years after the Wenchuan earthquake. There is however possibility that the changes would differ in a shorter or longer time frame, or even not exist. Thus, in the future a multi-stage process of temporal distance under a disaster situation could be investigated. Third, in this study we considered the influence of government only by distinguishing the location of the companies in terms whether they are inside or outside Sichuan. This is a relatively rough consideration given previous research describing government as the major stakeholder encouraging companies to engage in post-disaster relief activities (Jia and Zhang, 2013; OECD, 2004). Hence, future research should specifically consider the government factor.

6. Conclusion

A substantial number of earthquake studies have focused on post-disaster relief, but there has rarely been concern about the negative effects of a disaster on companies. Disasters not only immediately affect people and property, but also have long-lasting impacts on the companies' abilities to operate in the disturbed areas. The influence of disasters on corporate performance and stakeholder perceptions, especially that of investors, was investigated in this study for the first time. It focused exclusively on how disaster distance influences post-disaster investor confidence which is a critical factor affecting industry performance. We show that geographical and temporal are the two main disaster distances manifesting in post-

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disaster investor confidence and their influence is consistent. Also, we confirmed that the influence of the disaster distance on post-disaster investor confidence can be amplified or diminished by the moderating effects of firm performance and potential industry risk.

Although our results may not be unexpected – it is logical to expect that disasters would have negative effects on all related constituents, they are still meaningful and supported with empirical evidence. This research also brings together empirical evidence and theoretical explanation which allows us to conclude that the different degree of negative impact depends on the disaster distance. This is also the first time disaster distance is measured through the psychological distance concept, and we were able to show that the negative influence of a disaster varies as disaster distance changes. The developed new conceptual framework may be used for other extreme disasters and is likely to produce similar conclusions.

The main practical implication from this study is the understanding that the economic recovery process will be weaker for companies at a shorter disaster distance, particularly when they depend on fixed assets and their performance has not been strong. As disaster recovery is in most cases a joint effort between government, industry and the community, there is need to identify priorities and ways to support the most affected firm at a short disaster distance. On the other hand, with increasing disaster distance the prospects for improved investor confidence and steady economic recovery look better. These are considerations to be taken into account by enterprise decision-makers as well as by government and policy makers.

Restoring the economic performance of companies and corporations after a major calamity through investment is an important aspect of achieving long-term sustainability and improving people's livelihood opportunities. The 2008 Wenchuan earthquake was only one example of a natural calamity. Volcano eruptions, environmental contamination or fires pose a different set of threats and challenges to companies and corporations. Furthermore, with

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climate change-related rising temperatures and increased occurrence of extreme weather

events, including hurricanes, inundations or droughts, it is important to understand the

reaction of the financial sector and gauge investor confidence. All these represent challenges

and need for future research.

References

Agrawal, A., Knoeber, C. R., 1996. Firm performance and mechanisms to control agency problems between managers and shareholders. *Journal of Financial and Quantitative Analysis* 31(3), 377-397. DOI: 10.2307/2331397

Akason, J. B., Olafsson, S., Sigbjörnsson, R., 2006. Perception and observation of residential safety during earthquake exposure: a case study. *Safety Science* 44(10), 919-933. DOI: 10.1016/j.ssci.2006.06.003

Baltagi, B. H., Bresson, G., Pirotte, A., 2003. Fixed effects, random effects or Hausman–Taylor? A pretest estimator. *Economics Letters* 79(3), 361-369. DOI: 10.1016/j.ssci.2006.06.003

Bernardini, G., D’Orazio, M., Quagliarini, E., 2016. Towards a “behavioural design” approach for seismic risk reduction strategies of buildings and their environment. *Safety Science* 86, 273-294. DOI: 10.1016/j.ssci.2016.03.010

BBC News, 2008. 'Five million' homeless in quake. <http://news.bbc.co.uk/2/hi/asia-pacific/7405103.stm>

Chaiken, S., 1980. Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology* 39(5), 752. DOI: 10.1037/0022-3514.39.5.752

Cohn, R. A., Lewellen, W. G., Lease, R. C., Schlarbaum, G. G., 1975. Individual investor risk aversion and investment portfolio composition. *Journal of Finance* 30(2), 605-620. DOI: 10.1111/j.1540-6261.1975.tb01834.x

Cruz, A. M., Steinberg, L. J., 2005. Industry preparedness for earthquakes and earthquake-triggered hazmat accidents in the 1999 Kocaeli earthquake. *Earthquake Spectra*, 21(2), 285-303. DOI: 10.1193/1.1889442

D’Orazio, M., Spalazzi, L., Quagliarini, E., Bernardini, G., 2014. Agent-based model for earthquake pedestrians’ evacuation in urban outdoor scenarios: Behavioural patterns definition and evacuation paths choice. *Safety Science* 62 (62), 450-465. DOI: 10.1016/j.ssci.2013.09.014

De Long, J. B., Shleifer, A., Summers, L. H., Waldmann, R. J., 1990. Positive feedback investment strategies and destabilizing rational speculation. *Journal of Finance* 45(2), 379-395. DOI: 10.1111/j.1540-6261.1990.tb03695.x

Encyclopaedia Britannica, 2011. Seismic belt. Written by the Editors of Encyclopaedia Britannica. <https://www.britannica.com/science/seismic-belt>

Farley, J. E., Barlow, H. D., Finkelstein, M. S., & Riley, L., 1993. Earthquake hysteria, before and after: A survey and follow-up on public response to the Browning forecast. *International Journal of Mass Emergencies and Disasters*, 11(3), 271-277.

Fiedrich, F., Gehbauer, F., Rickers, U., 2000. Optimized resource allocation for emergency response after earthquake disasters. *Safety Science* 35(1), 41-57. DOI: 10.1016/S0925-7535(00)00021-7

Published as: Wei, J., Wang, A., Marinova, D. (2020) Corporate investor confidence in the aftermath of a mega natural disaster: an empirical study of the 2008 Wenchuan earthquake, *Safety Science*, 125, <https://doi.org/10.1016/j.ssci.2020.10462>

Gao, Y., 2011. Philanthropic disaster relief giving as a response to institutional pressure: Evidence from China. *Journal of Business Research* 64(12), 1377-1382. DOI: 10.1016/j.jbusres.2010.12.003

Guerrero-Villegas, J., Giráldez, P., Perez-Calero, L., Hurtado-Gonzalez, J.-M., 2018. Ownership concentration and firm performance: the moderating effect of the monitoring and provision of resources board roles. *Revista Espanola de Financiacion y Contabilidad* 47(4), 464-484. DOI: 10.1080/02102412.2018.1449722

Hackethal, A., Schmidt, R. H., Tyrell, M., 2003. Corporate governance in Germany: transition to a modern capital-market-based system?. *Journal of Institutional and Theoretical Economics* 159(4), 664-674. DOI: 10.1628/0932456032584612

Hall, M. 2018. The financial effects of a natural disaster. Investopedia. <https://www.investopedia.com/financial-edge/0311/the-financial-effects-of-a-natural-disaster.aspx>

Hamilton, S., Jo, H., Statman, M., 1993. Doing well while doing good? The investment performance of socially responsible mutual funds. *Financial Analysts Journal* 49(6), 62-66. DOI: 10.2469/faj.v49.n6.62

Hardin, J. W., Hilbe, J. M., 2002. Generalized estimating equations. Chapman and Hall/CRC. DOI: 10.1201/9781420035285

Jia, M., & Zhang, Z., 2013. Managerial ownership and corporate social performance: Evidence from privately owned Chinese firms' response to the Sichuan earthquake. *Corporate Social Responsibility and Environmental Management*, 20(5), 257-274. DOI: 10.1002/csr.1289

Liberman, N., Trope, Y., 1998. The role of feasibility and desirability considerations in near and distant future decisions: A test of temporal construal theory. *Journal of Personality and Social Psychology* 75(1), 5. DOI: 10.1037/0022-3514.75.1.5

Liberman, N., Trope, Y., 2008. The psychology of transcending the here and now. *Science* 322(5905), 1201-1205. DOI: 10.1126/science.1161958

Lindell, M. K., 1994. Perceived characteristics of environmental hazards. *International Journal of Mass Emergencies and Disasters* 12(3), 303-326.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., Welch, N., 2001. Risk as feelings. *Psychological Bulletin* 127(2), 267. DOI: 10.1037/0033-2909.127.2.267

Ma, S., Naughton, T., Tian, G., 2010. Ownership and ownership concentration: which is important in determining the performance of China's listed firms? *Accounting and Finance* 50(4), 871-897

Mackey, A., Mackey, T. B., Barney, J. B., 2007. Corporate social responsibility and firm performance: Investor preferences and corporate strategies. *Academy of Management Review*, 32(3), 817-835. DOI: 10.5465/amr.2007.25275676

Madsen, P. M., Rodgers, Z. J., 2015. Looking good by doing good: The antecedents and consequences of stakeholder attention to corporate disaster relief. *Strategic Management Journal* 36(5), 776-794. DOI: 10.1002/smj.2246

Meichenbaum, D., 1995. Disasters, stress and cognition. In: Hobfall, S.E., de Vries, M.W. (Eds.), *Extreme Stress and Communities: Impact and Intervention*. Kluwer Academic Publishers, Dordrecht/Boston/London, pp. 33-61.

Moltchanova, E., Khabarov, N., Obersteiner, M., Ehrlich, D., Moula, M., 2011. The value of rapid damage assessment for efficient earthquake response. *Safety Science* 49(8), 1164-1171. DOI: 10.1016/j.ssci.2011.03.008

Muller, A., Whiteman, G., 2009. Exploring the geography of corporate philanthropic disaster response: A study of Fortune Global 500 firms. *Journal of Business Ethics* 84(4), 589-603. DOI: 10.1007/s10551-008-9710-7

Published as: Wei, J., Wang, A., Marinova, D. (2020) Corporate investor confidence in the aftermath of a mega natural disaster: an empirical study of the 2008 Wenchuan earthquake, *Safety Science*, 125, <https://doi.org/10.1016/j.ssci.2020.10462>

Myers, S. C., Majluf, N. S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13(2), 187-221. DOI: 10.1016/0304-405X(84)90023-0

Newell, R., Wilson, G., 2002. A premium for good governance. *McKinsey Quarterly* 3(2), 20-23.

Organisation for Economic Co-operation and Development (OECD), 2004. Large-scale disasters: Lessons learned. OECD Publications Service, Paris, France. <https://www.oecd.org/futures/globalprospects/40867519.pdf>

Palepu, K., 1985. Diversification strategy, profit performance and the entropy measure. *Strategic Management Journal* 6(3), 239-255. DOI: 10.1002/smj.4250060305

Peacock, W. G., Brody, S. D., Highfield, W., 2005. Hurricane risk perceptions among Florida's single family homeowners. *Landscape and Urban Planning* 73(2), 120-135. DOI: 10.1016/j.landurbplan.2004.11.004

Porta, R. L., Lakonishok, J., Shleifer, A., Vishny, R., 1997. Good news for value stocks: Further evidence on market efficiency. *Journal of Finance* 52(2), 859-874. DOI: 10.1111/j.1540-6261.1997.tb04825.x

Robbennolt, J. K., 2000. Outcome Severity and Judgments of “Responsibility” : A Meta - Analytic Review. *Journal of Applied Social Psychology* 30(12), 2575-2609. DOI: 10.1111/j.1559-1816.2000.tb02451.x

Rosoff, H., John, R. S., Prager, F., 2012. Flu, risks, and videotape: escalating fear and avoidance. *Risk Analysis* 32(4), 729-743. DOI: 10.1111/j.1539-6924.2012.01769.x

Sharpe, S. A., 1994. Financial market imperfections, firm leverage, and the cyclicity of employment. *The American Economic Review*, 84(4), 1060-1074.

Shiller, R. J., 2000. Measuring bubble expectations and investor confidence. *The Journal of Psychology and Financial Markets*, 1(1), 49-60. DOI: 10.1207/S15327760JPFM0101_05

Schnatterly, K., Shaw, K. W., Jennings, W. W., 2008. Information advantages of large institutional owners. *Strategic Management Journal* 29(2), 219-227. DOI: 10.1002/smj.654

Sina, 2008. Casualties of the Wenchuan Earthquake (in Chinese). <http://news.sina.com.cn/pc/2008-05-13/326/651.html>

Stone, R. N., Grønhaug, K., 1993. Perceived risk: Further considerations for the marketing discipline. *European Journal of Marketing*, 27(3), 39-50. DOI: 10.1108/03090569310026637

Trope, Y., Liberman, N., 2000. Temporal construal and time-dependent changes in preference. *Journal of Personality and Social Psychology* 79(6), 876. DOI: 10.1037/0022-3514.79.6.876

Trope, Y., Liberman, N., 2003. Temporal construal. *Psychological Review* 110(3), 403. DOI: 10.1037/0033-295X.110.3.403

Trope, Y., Liberman, N., 2010. Construal-level theory of psychological distance. *Psychological Review* 117(2), 440. DOI: 10.1016/S1057-7408(07)70013-X

Trope, Y., Liberman, N., Wakslak, C., 2007. Construal levels and psychological distance: Effects on representation, prediction, evaluation, and behavior. *Journal of Consumer Psychology* 17(2), 83-95. DOI: 10.1016/S1057-7408(07)70013-X

Wen, Y. F., 2010. Capital investment decision, corporate governance, and prospect theory. *Procedia-Social and Behavioral Sciences* 5(5), 116-126. DOI: 10.1016/j.sbspro.2010.07.060

Wu, J., Li, N., Hallegatte, S., Shi, P., Hu, A., Liu, X., 2012. Regional indirect economic impact evaluation of the 2008 Wenchuan Earthquake. *Environmental Earth Sciences* 65(1), 161-172. DOI: 10.1007/s12665-011-1078-9

Published as: Wei, J., Wang, A., Marinova, D. (2020) Corporate investor confidence in the aftermath of a mega natural disaster: an empirical study of the 2008 Wenchuan earthquake, *Safety Science*, 125, <https://doi.org/10.1016/j.ssci.2020.10462>

Wowak, A. J., Mannor, M. J., Arrfelt, M., McNamara, G., 2016. Earthquake or glacier? How CEO charisma manifests in firm strategy over time. *Strategic Management Journal* 37(3), 586-603. DOI: 10.1002/smj.2346

Zheng, X. F., Yao, Z. X., Liang, J. H., Zheng, J., 2010. The role played and opportunities provided by IGP DMC of China National Seismic Network in Wenchuan earthquake disaster relief and researches. *Bulletin of the Seismological Society of America* 100(5), 2866-2872. DOI: 10.1785/0120090257