



# Effect of Firms' Responsive Strategies in Crisis: Based on Big Data Analysis in Social Media

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**Abstract.** In the age of social media, after a crisis event, firms will immediately take responsive actions and publicly announce what they do in news media, in order to attenuate the potential negative impact of crisis. Afterwards, the public in social media will freely discuss and deliver their opinions in the form of word-of-mouths (WOMs), which directly reflect their feeling of firms' responsive strategy. Therefore, based on big data analysis in social media, we attempt to establish the link between crisis firms' responsive actions and public perceptions reflected in online WOMs. Large quantities of secondary panel data are crawled from both search engine and social media. To obtain a robust result, we adopt Panel Vector Auto Regression model to conduct our data analysis. The results show that increased responsive strategies of crisis firms will lead to a significant increase in the strength of online WOMs, while a more positive responsive strategy can significantly decrease the strength of online WOMs in contrary. Our research provides profound theoretical and practical contributions.

**Keywords:** Responsive strategy · Firm crisis · Social media · Big data · Online WOM

## 1 Introduction

Crisis is an emergent event which can bring serious threat to an organization, damaging its survival, development, and reputation. To eliminate the potential negative consequences, firms in crisis always take immediate responsive strategies as soon as a crisis event breaks out. These strategies are composed of various responsive types ranging from positive to negative ones, such as denying, justification, apology, and so on.

In the age of social media, firms are able release their responsive strategies to the public with the highest speed through social media platforms. Meanwhile, they lose full control of the public voice. Everyone can express his opinion arbitrarily in social media (i.e., Sina Microblog), no matter how extreme and reckless the sentence seems. Therefore, development of social media brings both opportunities and challenges to today's enterprises.

In previous literatures, there are two major research directions concerning firms' responsive strategies in crisis. The first one is based on experiment, questionnaire, and case study methodology, which aim to compare the effect of different responsive

strategies, but lacks objectivity with limited subjective behavioral data. The other approach is based on stimulation, which only select a few crisis events as examples to investigate the effect of responsive strategy on the public. The generality cannot be guaranteed with such a small sample. Fortunately, the open environment of social media provides new research opportunity for scholars, where we can crawl everyday real data about firms' responsive strategy and public word-of-mouth, so as to conduct empirical analysis through big data methodology.

In a word, we attempt to solve one research question in this paper: Based on objective big data analysis from social media (news media and social networking sites), what is the real effect of crisis responsive strategy on public perception? Specifically, will the strength and attitude of crisis firms' responsive strategy affect the strength of online WOMs in social media?

To answer the problems, we crawl large quantities of secondary panel data from both search engine and social media to conduct the empirical research. We do not generally analyze the total effect of crisis responsive strategy as usual, but consider the change of everyday responsive strategy of crisis firms and corresponding everyday public opinions. In total, 59 crisis events were selected, and related news reports as well as public WOMs in social media were collected within 30 days after each crisis event. We also quantify the everyday responsive strategies and public perceptions manually through certain standards. Finally, we adopt Panel Vector Auto Regression model to conduct our data analysis. The results show that increased responsive strategies of crisis firms will lead to a significant increasement in the strength of online WOMs, while a more positive responsive strategy can significantly decrease the strength of online WOMs in contrary. Our research provides profound theoretical and practical contributions.

The article is organized as follows. First, we review the relevant literatures from the following three parts: research on crisis firms' responsive strategies and effects; research on the role of social media in responsive to firm crisis; research on the relationship between firm crisis and public perception. Second, we propose our research model and hypotheses. Then, we introduced the methodology of data collection and analysis. Finally, we discuss our results, and conclude this article's contributions and limitations.

## 2 Literature Review

### 2.1 Research on Crisis Firms' Responsive Strategies and Effects

Crisis event is a sudden accident with serious threats to organizations, whose existence may cause huge losses to firms' survival, development, and reputation. Different crisis responsive theories proposed different responsive strategies from different views. Representative theories include Situational Crisis Communication Theory (SCCT) [1], Corporate Apologia Theory [2], Theory of Image Restoration [3] and so on. These theories all focus on the responsive strategies after a crisis event.

Although classified by many different standards in past literatures, crisis responsive strategies are generally distinguished into positive and negative ones. Marcus and

Goodman [4] identified two kinds of responsive strategies by a typical standard: Accommodative-Defensive. Accommodative strategy means recognizing accountability and taking remedy actions, while defensive strategy means denying their own problems and fault. The most well-recognized theory was proposed by Coombs [5], in which he divided the responsive strategies into seven kinds from the most negative to the most positive: Attack Accusers, Denial, Excuse, Justification, Ingratiation, Correction, and Apology. Later, Griffin [6] increased the two-dimensional strategy to three dimensions, and proposed Reticence strategy. In other words, some firms do nothing and have no response to a crisis. In this article, we combine both standards of Coombs [5] and Griffin [6], and divide responsive strategies of firms in crisis into eight kinds.

In fact, past scholars have already conducted a few researches on crisis responsive strategies and corresponding effects. However, the research methodology is relatively subjective, because they are mainly based on questionnaire, experiment, case analysis and stimulation methods. Furthermore, most research are only based a single crisis event, which is insufficient in explaining the impact of crisis responsive strategy from a generally macro view. In this article, we attempt to fill in the research gaps based on big data analysis in social media.

## 2.2 Research on the Role of Social Media in Responsive to Firm Crisis

Generally speaking, social media are regarded as a tool and platform based on interpersonal information communication, sharing and dissemination, with features like participation, openness, connection, sense of community, and so on. On a broad view, social media include not only social networking sites (i.e., Sina Microblog), but also professional forums (i.e., News Media), both of which have a prominent influence on the dissemination and response of a crisis event.

In recent years, some scholars began to compare the different impacts when firms choose different channels in responsive to firm crisis. Sweetser and Metzgar [7] found that when an organization uses blogs to manage crisis, it will convey as much information as possible to the public in a short time, which helps to leave a good impression of the firms on the public. Through an experiment, Schultz [8] found that in contrast to traditional media, microblog plays a more prominent role in crisis management, which can gain more recognition by investors. These studies demonstrate that social media has substantial increase in dissemination speed and scope, thus offer a new opportunity for firms in crisis.

In fact, as an important kind of intermediary, social media plays a double-edged role in the process of crisis response. On one hand, companies can convey their responsive strategies to the public directly and immediately through social media such as news media. On the other hand, because companies lose control of public opinions, people can freely express their opinions and discuss with other users in social media such as Sina Microblog.

Overall, social media influence public perception on firm crisis and responsive strategies through two main channels: news media and social networking websites. So, we attempt to crawl information from both social networking websites and news media to analyze the effect of crisis responsive strategy on the public perception, thus probe the role of social media in crisis response.

### 2.3 Research on the Relationship Between Firm Crisis and Public Perception

Unsurprisingly, firm crisis will necessarily influence public perceptions, thus a few scholars have made a number of researches on their relationships. For instance, a crisis event will decrease consumer's purchase intention and perceived loyalty to a specific brand [9, 10]. These studies are mainly based on experiment and questionnaire methods, so as to explore the change of public perception (i.e., trust, loyalty) after a crisis event.

In fact, with the popularity of social media, the real public perception will be reflected directly in online users' posts in social networking websites. A few literatures have already crawled user reviews after a crisis event, so as to analyze the public's changes after companies take responsive strategies. For example, Xu [11] found that using microblog in responsive to firm crisis can prominently improve public emotions and even raise company's stock price. However, these researches are too general to distinguish the different effects of different crisis response strategies, especially under the social media context.

Therefore, previous studies on the relationship between crisis response strategies and public perception are mainly based on a single event and have less universality. Besides, they hardly focus on the everyday changes of firms' crisis response strategies, thus cannot reflect the time-sequence of both crisis response strategies and public perceptions. Therefore, In this study, we attempt to solve the above problems.

## 3 Research Model and Hypotheses

### 3.1 Research Model

In this paper, we want to explore the effect of crisis responsive strategy on public perception. Specifically, we propose that the strength and attitude of crisis firms' responsive strategy will affect the strength of online WOMs in social media. More details are displayed in Fig. 1.

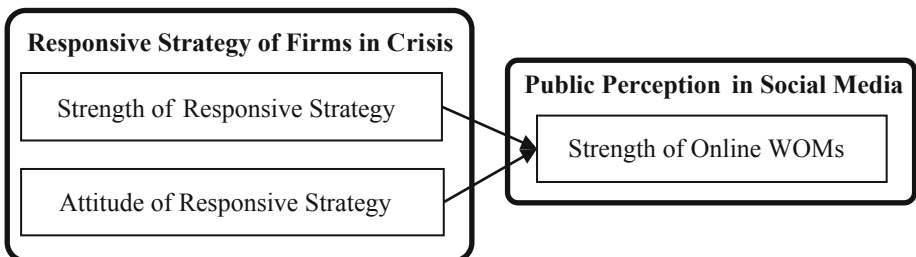


Fig. 1. Research model

### 3.2 The Relationship Between Responsive Strategy of Firms in Crisis and Public Perception in Social Media

After the occurrence of a crisis event, the information dissemination speed and influence scope will increase exponentially, thus the popularity of the firm will increase in both news media and social media. Then, this crisis event will gradually involve more and more participants to share and express their opinions. In the era of social media, a hot event can lead to hot discussions in online platforms. Based on Negativity Bias Theory [12], negative events will be more easily to catch people's eyes. The same thing will happen when the firms in crisis announce their response strategies. The public likes to follow the trends of crisis events, and keep an eye on company's responsive strategy, so as to deliver their opinions in social media at first time. Therefore, when more responsive strategies are released in news media, more WOMs will be generated in social media correspondingly. We propose Hypothesis 1:

***Hypothesis 1: There is a positive linear correlation between the strength of crisis firms' responsive strategy and the strength of online WOMs about crisis event in social media.***

The crisis firms' responsive strategies can reflect the firms' positive or negative attitudes to the crisis events. When a company takes a positive response strategy to solve a crisis, such as apology, product recalls, and compensate the customer loss, public trust and satisfaction on the firm will be recovered. In other words, only by positively taking the responsibility and admitting own faults, can organizations radically prevent the deterioration and expansion of a crisis event, thus relevant discussions will be fewer and fewer. Otherwise, the firms will definitely see a serious negative effect. Therefore, when a company takes a more positive responsive strategy to cope with crisis event, the discussions in social media will be less as the public begins to forgive the firm. We propose Hypothesis 2:

***Hypothesis 2: There is a negative linear correlation between the attitude of crisis firms' responsive strategy and the strength of online WOMs about crisis event in social media.***

## 4 Data Collection and Analysis

### 4.1 Sample Selection and Data Sources

We use secondary data from multiple sources. Relevant big data are crawled from two different social media platforms: search engine (Baidu) and social networking site (Sina Microblog). We chose totally 59 crisis events and grabbed both the news reports and online WOMs within 30 days after occurrence of each crisis event. Therefore, we constructed an integrated panel data set. Main variables and definitions are shown in Table 1.

**News Data.** Based on the biggest search engine in China (Baidu), we used the tool “Webripper” and chose the name of each crisis event as keywords, so as to search and grab all the links and contents of relevant news reports posted on professional public news media within 30 days after the occurrence of each crisis event. After deleting repetitive news articles, we acquired a final data set containing 6892 items of news, including news links, news titles, post time, detailed content, and so on.

**Responsive Strategy Data.** Because not all the news reports are related to crisis responsive strategies, we first filtered the news by titles and keywords in the content. Then, according to the standards of Coombs [5] and Griffin [6], we manually classified these responsive strategies into eight kinds from the most negative to the most positive: attack accusers, denial, excuse, justification, reticence, ingratiation, correction, and apology, and numbered them from 1 to 8.

Finally, on the basis of the manually-operated data, we computed two key indicators on responsive strategies. First, to reflect the proactivity of firms under a crisis event, we counted the volume of everyday responsive strategies within 30 days after occurrence of each crisis (Action Volume, AC\_VO). Second, we computed the mean value of everyday responsive strategies' types to demonstrate the firms' attitudes on the crisis (Action Attitude, AC\_AT), with a value ranging from 1 to 8. The higher the value, the more positive the firms are in responsive to the crisis event.

**Online WOMs Data.** By the tool C#, we crawled the online WOM data from the most famous social networking sites, Sina Microblog, which has the largest user base in China. Again, we used the name of each crisis event as keywords, and collected crisis-relevant WOMs within 30 days after occurrence of each crisis. Finally, our sample included a panel data set with 225,491 pieces of online WOMs in Sina Microblog. We counted the volume of everyday posts, forwards and comments related to each crisis event in Sina Microblog, and defined this variable as WOM\_VO (WOM Volume) (Table 1).

**Table 1.** Main variables and definitions

Variable name (Abbreviation)		Definition	Data source
Independent variable	Strength of Responsive Strategy (AC_VO)	Log of the volume of everyday responsive strategies within 30 days after occurrence of each crisis	Baidu Search Engine
	Attitude of Responsive Strategy (AC_AT)	Mean value of everyday responsive strategies' types/attitudes	Baidu Search Engine
Dependent variable	Strength of Online WOM (WOM_VO)	Log of the volume of everyday posts, forwards and comments in social media related to each crisis event	Sina Microblog

**Table 2.** Descriptive statistics and correlation matrix

	1	2	3
1. AC_VO	1.000		
2. AC_AT	-0.043	1.000	
3. WOM_VO	0.429**	0.048	1.000
Mean	1.900	4.740	4.133
Standard variance	1.160	0.913	1.835
Observations	437	437	265

Notes. \*p < 0.1; \*\*p < 0.05.

### 4.2 Research Model

We use PVAR model (Panel Vector Auto Regression) to conduct our data analysis [13]. Due to the following three reasons, PVAR is very suitable for this research. First of all, PVAR can capture both the direct and indirect impact among endogenous factors, so this method can help us to explore the mutual influence between firm’s crisis responsive strategy and public perception, which is similar to Simultaneous Equation Models. Second, result of PVAR is robust even if problems such as heteroscedasticity and serial correlation exist [14]. Third, we can incorporate the fixed panel effect vector  $u$  and time trend vector  $T$  in PVAR models, which are difficult to observe in simple models.

Our analysis of PVAR model follows the standard steps. First, based on Granger Causality Test, we prove the appropriateness of PVAR model in this research. Then, based on results of Unit Root Test, we try to judge our model validity. The Panel Unit Root Test rejected the null hypothesis, and verified that all the results of endogenous variables are smaller than critical value (see Table 3). Therefore, we can use the three endogenous variables to estimate our model. In the end, based on Information Criterion, we determine the time lag of the PVAR model. Specifically, the result of SBIC (Schwarz-Bayesian Information Criterion) showed that lagging one day is the most fitted to our PVAR model.

**Table 3.** Result of Unit Root Test

Variable	Test statistics	P value
AC_VO	277.2208	<.0001
AC_AT	297.6315	<.0001
WOM_VO	111.0674	<.0001

### 4.3 Data Analysis Results

We analyze how responsive strategies of crisis firms influence public perceptions in social networking sites, data regression results are shown in Table 4. It is worth to note that in PVAR model, the coefficients reported in Table 4 are not the general coefficients

as we know. Differently, they represent the iterative cumulative effect of one-unit shock of each endogenous variables [15].

**Table 4.** Results of Panel Vector Auto Regression

One-unit Shock Endogenous variables	DV: WOM_VO <sub>i, t</sub>
AC_VO <sub>i, t-1</sub>	0.964*** (0.186)
AC_AT <sub>i, t-1</sub>	-3.864*** (1.095)
WOM_VO <sub>i, t-1</sub>	0.582*** (0.112)

Note. This model is a balanced PVAR model with fixed effect; Numbers in parentheses are standard variance; \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

According to the data analysis results, increased responsive strategies of crisis firms will lead to significant increment in the strength of online WOMs in social media the next day, which supports Hypothesis 1. Meanwhile, when the firms adopt more positive responsive strategies to cope with a crisis event, the strength of online WOMs significantly decreased, in accordance with Hypothesis 2. In other words, the public will talk more when firms take more responsive actions, but talk less if they take effective positive actions since they forgive the firms.

## 5 Discussion and Implications

### 5.1 Discussion of Findings

Based on the empirical research from big data crawled from Baidu and Sina Microblog, we answer our research questions about how the responsive strategies of crisis firms impact the public perceptions in social media. We find an opposite effect between the strength and attitude of responsive strategies on the strength of online WOMs. In specific, respond more after a crisis may induce more discussions in social media, whether it is good or bad still needs more investigation. In contrast, positive response is a relatively safe way because these actions can make the public quiet, which implies that the public might forgive the firms in crisis and don't want to condemn them anymore.

### 5.2 Implications, Limitations and Future Research

This research has profound theoretical and practical contributions. From the theoretical perspective, past researches on crisis responsive strategy usually adopted methods like questionnaire, experiment, stimulation, and so on. Our empirical research method based on big data in social media is more objective and can be generalized. Besides, most relevant studies do not take the time effect in consideration. We look at the everyday changes of firms' crisis response strategies, thus can reflect the time-sequence of both crisis response strategies and public perceptions. In practice, firms should not



only respond more when a crisis event happens, because what matters is their attitudes. A positive responsive strategy can help firms to recover from the negative crisis more quickly.

There are also a few limitations in our research, and need to be improved in the future. First, although we used panel data in this article, the data set is a little too small. We need to collect more crisis events and corresponding responsive strategies, thus explore their relationships more systematically. Second, the measurements of responsive strategies only include strength and attitude. In future research, we will try to include more indexes to analyze the effect of crisis firms' responsive strategies, such as strategy consistency, continuity, and so on. Third, there are many other factors influencing the effect of crisis responsive strategy such as crisis types. We did not control them in our study. These are all gaps for us to investigate in further researches.

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