Benefits or Costs? The Effects of Diversification with Cross-industry Knowledge on Corporate Value under Crisis Situation

Abstract

Purpose

This paper explores the explanations of "information effect" and "agency effect" of corporate diversification with cross-industry knowledge under a crisis situation.

Design/methodology/approach

Based on an event study of 203 public companies' crises in China between 2008 and 2018, we verify the information and agency effects of corporate diversification under a crisis situation by respectively examining the effects of interactions of corporate unrelated diversification with corporate transparency and knowledge deficiency attribution on the stock market's responses to the crises.

Findings

We find corporate unrelated diversification serves as a buffer in protecting the firm value, while attribution of knowledge deficiency can be a burden. The buffering effect is stronger when the corporate transparency is higher, but weaker when the crisis is attributed to be caused by corporate tacit knowledge deficiency.

Practical implications

Unrelated diversified firms should strengthen information communication with stakeholders so as to break down the cross-industry knowledge barriers of stakeholders, and thus protect

their own value at the onset of a crisis. Also, they can further buffer the loss by reducing stakeholders' perceptions of the corporate tacit knowledge deficiency revealed in the crisis.

Originality/value

This study is the first to illustrate that the information and agency effects of corporate diversification strategy can be partially explained under a crisis situation, which provides meaningful insights about how firms can conduct knowledge management in their daily operations to deal better with corporate crises.

Keywords

Cross-border knowledge; Unrelated diversification; Corporate transparency; Knowledge deficiency attribution; Crisis management

1. Introduction

A persistent concern within the strategy and knowledge management literature is the effect of corporate diversification on the firm value in corporate daily operations (Aggarwal and Samwick, 2003; Ataullah et al., 2014; Teece, 1982). Agency theory highlights the conflicts of interest between managers and shareholders when it comes to strategic decisions, such as those related to corporate diversification (Amihud and Lev, 1981; Denis et al., 1999). Top managers implement diversification strategies usually at the expense of the interests of the firm and its stakeholders to benefit themselves, which constitutes part of the firm's residual costs[1] (Aggarwal and Samwick, 2003; Jensen and Meckling, 1979). Therefore, compared with focused businesses, diversified firms are usually sold at a discount price (Berger and Ofek, 1995). This effect is called the "agency effect" of corporate diversification (Ataullah et al., 2014, p. 228). There is however other literature which presents an alternative view, arguing that there is not necessarily a conflict of interests between managers and shareholders in diversification strategic decision making (Davis et al., 1997; Maksimovic and Phillips, 2002). The purpose of a diversification strategy implemented by managers may be to gain *diversification benefits*, including economy of scope (Teece, 1982), diversification of risk (Maksimovic and Phillips, 2002), and thus increase the firm value (He, 2012). However, due to the information asymmetry caused by diversification, external stakeholders tend to underestimate the firm value (Ataullah et al., 2014; Davis et al., 1997). This effect is called the "information effect" of diversification (Ataullah et al., 2014, p. 228). Hence, the "agency effect" explains how the diversification strategy destroys the firm value from the perspective

of residual costs (Amihud and Lev, 1981), while the "information effect" emphasizes the critical role of information in revealing the benefits of diversification for the firm value (Hadlock et al., 2001). In this study, we unbundle some of the benefits and costs associated with diversification under a crisis situation, and further investigate how corporate diversification with cross-industry knowledge affects corporate market value at the onset of a crisis.

Being a negative event which shatters the overall favorable impression about a firm, a corporate crisis (e.g., a financial fraud event) is likely to trigger negative media reports (Zavyalova et al., 2012), generate extensive negative perceptions (Coombs, 2007), and pose financial and non-financial threats to the firm and its stakeholders (Wei et al., 2017). Although the existing literature has carried out extensive and profound discussions about the impacts of corporate diversification on the firm value in daily operations, only a few studies have explored its impacts under a crisis situation. We speculate that, under a crisis situation, the agency and information effects of diversification on the firm value may also be revealed. More specifically, based on the "information effect", diversification, especially unrelated diversification, enables the firm to develop specialized cross-industry knowledge (Ataullah et al., 2014), which may constitute a barrier for external stakeholders to understand the benefits of a diversification strategy to the firm value (Aoki, 2010). Similarly, at the crisis' onset, the uncertainty about the firm value among its stakeholders is high (Wei et al., 2017). The failure of stakeholders to understand the diversification strategy may affect their perceptions of the impacts of diversification on the firm value. In other words, the crisis situation may bring to

light the "information effect".

On the other hand, the "agency effect" implies that shareholders usually hold that the top managers often benefit themselves at the expense of the firm's interests when they implement diversification strategies (Aggarwal and Samwick, 2003). Corporate crises are usually caused by top managers' self-serving behaviors (Connelly et al., 2016; Laufer and Coombs, 2006), such as financial fraud events (Staubus, 2005). In such a case, the cause of a crisis may also influence stakeholders' perceptions of the impacts of a diversification strategy on the firm value at the crisis' onset. Hence, the "agency effect" may be revealed in a crisis situation.

Based on empirical evidence about diversification of cross-industry knowledge, corporate transparency and attributions of knowledge deficiency, in this study we investigate the following three important questions. Firstly, will unrelated diversification positively affect the firm value at the crisis' onset? Secondly, will corporate transparency positively affect stakeholders' perception of the benefits of unrelated diversification to the firm value? Thirdly, will the attribution of corporate knowledge deficiency negatively affect the firm value and the stakeholders' perception of the benefits of unrelated diversification to the firm value? Our findings show that the "information effect" and "agency effect" of unrelated diversification can be partly explained under a crisis situation.

The next section (Section 2) outlines the theoretical background for this study. This is followed by a presentation of the four hypotheses (Section 3) and introduction of the methods, data and empirical results (Section 4-6). The final part summarizes and discusses the findings and puts forward the implications, conclusions and limitations from this research (Section 7).

2. Theory Background

A corporate crisis represents a situation in which "stakeholders believe that the default social codes of the stricken organization are violated" (Yu et al., 2008, p. 454). Therefore, stakeholders actively seek information about the affected firms to address the cognitive dissonance caused by the crisis, and may subsequently adjust their assessment of the firms (Wei et al., 2017). Previous studies have shown that stakeholders rely on their social perceptions when interacting with an organization (Ataullah et al., 2014; Bundy and Pfarrer, 2015). For example, external stakeholders respond to a firm's insider-trading crisis according to their perceptions of corporate diversification (Ataullah et al., 2014). Following this line of thinking, we speculate that stakeholders' responses to a crisis should be affected by their "awareness, perceptions, and knowledge of a firm" (Wei et al., 2017, p. 2105). We thus assume that the level of corporate diversification, as a significant component of the stakeholders' perceptions of an organization (Aoki, 2010; Ataullah et al., 2014), may play a key role in influencing stakeholders' responses to a crisis.

2.1 Unrelated Diversification

Corporate diversification has been widely investigated by strategic management researchers (Hautz et al., 2013; Jacquemin and Berry, 1979; Purkayastha et al., 2012). There are many methods to measure corporate diversification, such as Entropy Measurement (Jacquemin and Berry, 1979), the Blau Coefficient (Blau, 2001) and Specialization Ratio (Grant and Jammine, 1988). The most popular method is entropy measurement introduced by Jacquemin and Berry in 1979, which divides corporate diversification into related and unrelated (Hautz et al., 2013;

Jacquemin and Berry, 1979). Related diversification refers to concentration of firms operating in related industries (e.g., refrigerator and air conditioner manufacturing industries), while unrelated diversification describes the participation level of firms in unrelated industries (e.g., food growing and transportation industries) (Hautz et al., 2013). In this study, we focus on the second type of corporate diversification (i.e., unrelated diversification). As we elucidate below, this is an important dimension of corporate diversification that should influence stakeholders' reaction at the onset of a corporate crisis.

Based on the core assumption of the Resource Dependency Theory (RDT), it is impossible for any organization to obtain all resources it needs internally from itself (Pfeffer, 1972). Organizations thus need to function and survive by resource interactions with factors (e.g., other organizations) in the environment on which they depend (Pfeffer, 1972; Pfeffer and Nowak, 1976). In other words, organizations are "constrained and affected by their environment and act to attempt to manage these resource dependencies by setting up different forms of interorganizational arrangements" (Pfeffer and Salancik, 2003, p. xxxiii), including joint ventures (Inkpen and Currall, 2004), mergers and acquisitions (Haleblian et al., 2009). As a result of special arrangements between the focal firm and its external organizations (e.g., mergers and acquisitions) (Pfeffer and Nowak, 1976; Pfeffer and Salancik, 2003), an unrelated diversification strategy will thus produce an important impact for its survival. We further imply that this impact will also demonstrate under a crisis situation.

The structure of the unrelated diversification reveals the result of the internalization of the firm to various external resources from different industries (Hillman et al., 2009; Pfeffer,

1972; Pfeffer and Salancik, 2003). This determines the firm's level of dependence on external resources (Pfeffer and Nowak, 1976), and the level of the firm's autonomy in regard to the available resources (Hillman et al., 2009; Oliver, 1991). The outbreak of a crisis often requires the firm to timely organize and apply its resources to deal with it to reduce its loss and that for its stakeholders (Alpaslan et al., 2009). Under such situation, the unrelated diversification level, as a manifestation of the resource autonomy level of the firm, affects the corporate ability to deal with emergencies, thus affecting its survival (Oliver, 1991; Pfeffer, 1972).

This study focusses on a crisis situation and how the level of unrelated diversification influences investors' perceptions of the firm and responses to the crisis. It is clear that the "onset of a crisis is characterized by high levels of uncertainty about a firm among its stakeholders" (Bundy and Pfarrer, 2015; Wei et al., 2017, p. 2106). Under this uncertainty condition, stakeholders assess the impact of the crisis on the firm by relying on their perception about the corporate abilities to solve the crisis (Alpaslan et al., 2009; Oliver, 1991; Pfeffer, 1972). Hence, their responses to the crisis will be affected by the level of corporate unrelated diversification.

2.2 Attribution of Knowledge Deficiency in Crisis

Knowledge was previously defined as "the awareness of what one knows through study, reasoning, experience or association, or through various other types of learning" (McInerney, 2002, p. 1009). Corporate knowledge in particular can be seen from different perspectives (Polanyi, 1966; Quinn, 1999). For instance, Quinn (1999) equates corporate knowledge with

professional intelligence within an organization, and divides it into four categories: cognitive knowledge, advanced skills, systems understanding, and self-motivated creativity. A more concise classification is that of Polanyi (1966) who divides corporate knowledge into "explicit" and "tacit". Explicit knowledge refers to knowledge that can be systematized, standardized and recorded (McInerney, 2002), such as production technology knowledge. Tacit knowledge, on the other hand, is indescribable knowledge that resides in the human mind, such as values, and implicit ways of doing things (Chuang et al., 2016; Polanyi, 1966).

With the continuous development of management theory, corporate knowledge has become a significant resource for the firms in gaining competitive advantage in a dynamic business environment (Barney, 1991; Campanella et al., 2019). The main focus in knowledge management has been on the role of knowledge in promoting the development of corporate capabilities and competitive advantages, with less attention paid to the harm caused by knowledge deficiencies on the corporate market value, especially in a crisis situation. In reality, the competitive advantage obtained by firms based on their superior knowledge resources may quickly dissipate due to crisis events caused by knowledge deficiencies. For instance, in 2016, South Korea's Samsung was abandoned by the Chinese market because of its senior executives' reluctance to recall the faulty phones sold in mainland China at the beginning of the mobile phone explosion event. In 2019, Samsung withdrew its last Chinese mobile phone factory, while it previously held nearly a third of the market shares in China [2].

Past studies have shown that situational factors play a key role in influencing how

stakeholders interpret corporate crises (Bundy and Pfarrer, 2015; Wei et al., 2017).

Attribution theory argues that humans are intuitive psychologists who try to comprehend their environment and seek causal explanations, especially when the events are negative and unexpected (Weiner, 2006). At the onset of a crisis, stakeholders usually tend to identify its causes based on characteristics, such as their perceived intention, controllability, and severity (Bundy and Pfarrer, 2015; Coombs, 2007). In turn, these causal attributions will affect the stakeholders' perceptions of, and attitudes toward, a firm (Coombs, 2007). Corporate knowledge deficiency, as an important perceived cause, usually represents a vital identification target when stakeholders try to comprehend the crisis (Coombs, 2004; Laufer and Coombs, 2006). For example, stakeholders will attribute the product harm incident caused by technical failure to technical knowledge deficiency (Laufer and Coombs, 2006). We thus speculate that the attribution of knowledge deficiency perceived by stakeholders will affect their responses to the crisis, and thus influence the firm value.

3. Hypothesis Development

3.1 Effect of Unrelated Diversification

Based on the view of RDT, unrelated diversification implies an organizational structure that is constructed by a special interaction between the firm and its external partners that are not in the same industry (Pfeffer and Nowak, 1976; Pfeffer and Salancik, 2003). At the onset of a crisis, this structure affects the firm's survival by determining its level of dependence on external resources and the level of autonomy to its internal resources (Drees and Heugens, 2013; Oliver, 1991). Accordingly, unrelated diversification can influence its stakeholders'

perceptions and decision-making following a crisis event (Ataullah et al., 2014).

In responding to a corporate crisis, stakeholders rely on information other than the event itself, including the level of corporate unrelated diversification, to form the basis of their evaluation (Ataullah et al., 2014; Godfrey et al., 2009). At the onset of a crisis, a firm with high (vs. low) unrelated diversification level usually possesses a lower level of dependence on external resources (Drees and Heugens, 2013), and a higher level of autonomy in its internal resources (Oliver, 1991). This condition allows the firm to timely rely on its internal resources to disperse and defuse the crisis' risks, so as to reduce the losses for itself and its stakeholders (Alpaslan et al., 2009). In this case, high (vs. low) unrelated diversification level may positively affect the external stakeholders' assessments of the impacts of the crisis on the firm, and thus protect its value at the crisis onset. Following this logic, we therefore postulate:

Hypothesis 1: *Unrelated diversification has a positive effect on the firm's market value at the onset of a crisis.*

3.2 Moderating Effect of Corporate Transparency

As a special organizational structure, unrelated diversification reveals that firms usually possess a variety of cross-industry knowledge (Hadlock et al., 2001). Although the firm's internal staff may be able to access the classified knowledge about various parts of the diversified firm, outside investors may not have access to the relevant cross-industry knowledge (Thomas, 2002). Additionally, "the interactions among different segments, which are likely to possess distinctive cognitive assets, make diversified firms more complex and harder for outsiders to understand" (Aoki, 2010; Ataullah et al., 2014, p. 230). In such a case,

the value of unrelated diversification may be underestimated by external stakeholders (Ataullah et al., 2014).

Furthermore," transparency is the perceived quality of intentionally shared information from a sender" (Schnackenberg and Tomlinson, 2016, p. 1788). In relation to the firm and its stakeholders, "transparency is seen as a critical element of knowledge sharing such that increased transparency brings increased awareness, coherence, and comprehensibility to information exchanged between two parties" (Schnackenberg and Tomlinson, 2016, p. 1788). Accordingly, high (vs. low) level of corporate transparency reduces the information asymmetry between the firm and its stakeholders and breaks the cross-industry knowledge barrier for the stakeholders (Aoki, 2010). This condition helps external stakeholders to perceive the benefits of corporate unrelated diversification to the firm, especially at the onset of a crisis. On the contrary, low (vs high) level of corporate transparency strengthens the cross-industry knowledge barrier for stakeholders (Aoki, 2010), which makes them unable to comprehensively understand the value of unrelated diversification (Ataullah et al., 2014). At the onset of a crisis, therefore, the response of stakeholders is likely to be unaffected by the level of unrelated diversification. We thus argue that the buffering effect of unrelated diversification will be more effective when corporate transparency is high. We therefore predict:

Hypothesis 2: *There is a positive interaction between unrelated diversification and corporate transparency on the firm's market value such that the positive effect of unrelated diversification is stronger when corporate transparency is high (vs. low).*

3.3 Main and Moderating Effects of Knowledge Deficiency Attribution

Several attributions and classifications of corporate crises exist in the literature (Connelly et al., 2016; Coombs, 2004). For example, Coombs (2004) divides corporate crises into three clusters, i.e., victim, accident and intention, according to the attribution of the responsibility for the crisis. Connelly et al. (2016) argue that crises are caused by two types of corporate failures, which they label as competency failure and integrity failure. In this study, based on attribution theory (Weiner, 2006), and the classification of corporate knowledge (i.e., explicit and tacit knowledge according to McInerney, 2002; Whitley, 2000), we hold that, with the exception of the crises in which the firms are perceived as victims, firms' crises are caused by their explicit and tacit knowledge deficiencies (Laufer and Coombs, 2006; Wang and Lu, 2010). This study thus divides the crises into three clusters, namely victim, explicit knowledge, and tacit knowledge.

The victim cluster includes crises that are perceived as having no knowledge deficiency need to be repaired, with the firm perceived as a victim of the crisis (Coombs, 2007). Examples of this kind of crises include product tampering and rumors (Coombs, 2004). The explicit knowledge cluster includes crises caused by corporate explicit knowledge deficiency, such as technical failure incidents (Laufer and Coombs, 2006). Since explicit knowledge has attributes that can be documented and modified (Broadbent, 1998), this deficiency is perceived as having a low difficulty level of repair, with the crisis seen as unintentional and solvable (McInerney, 2002). Finally, the tacit knowledge cluster includes crises caused by corporate tacit knowledge deficiency, such as financial fraud events (Staubus, 2005). Due to

the incalculable and unpredictable characteristics of corporate tacit knowledge (Whitley, 2000), this deficiency is perceived as having a high difficulty level of repair (Connelly et al., 2016), with the crisis seen as intentional and unmanageable (Broadbent, 1998).

Stakeholders often attribute the cause of a crisis to a corporate knowledge deficiency (Coombs, 2007; Wang and Lu, 2010), and their attributions may influence their attitudes towards the firm (Wei et al., 2017). The corporate knowledge deficiency perceived by the stakeholders as more difficult to be repaired, means that they trust the firm less, because it is more likely to pose a long-term threat to the interests of the firm and its stakeholders (Bundy and Pfarrer, 2015; Connelly et al., 2016). In consequence, they may punish the firm depending partly on their attributions of knowledge deficiency. Therefore, how the market value of the firm changes due to a corporate crisis should also be a function of the stakeholders' attribution of knowledge deficiency: when stakeholders perceive that the corporate knowledge deficiency revealed in the crisis is more difficult to be repaired, the information from such strong attribution poses a greater threat to the firm's market value. We thus hold that the shareholders' responses to the crisis may become more severe as the perceived difficulty level of repairing the knowledge deficiency increases and the crisis cluster changes from victim, to explicit knowledge deficiency, and to tacit knowledge deficiency. Following this logic, we thus predict:

Hypothesis 3: *The negative effect of corporate crises on the firm's market value is stronger as the perceived difficulty level of repairing knowledge deficiency increases.*

As we argued earlier, based on the view of RDT, the buffering effect of unrelated

diversification should alleviate the damage of a crisis to the firm value – as a result of the stakeholders' tendency to evaluate the impacts of the crisis on the firm by their perceptions of the corporate ability to solve emergencies. This is especially likely to happen when there is no or limited difficulty level of repairing the knowledge deficiency (i.e., when it is attributed to the victim or explicit knowledge deficiency), which would make stakeholders trust that the firm can rely on its own resources to solve the crisis autonomously. This effect should be weakened, however, when the knowledge deficiency is attributed to the tacit knowledge deficiency. Under this condition, stakeholders find it hard to believe that firms can repair the knowledge deficiency through its own efforts. According to the devil effect (Bradburn et al., 2004), "a single dishonest behavior is sufficient to produce a confident attribution that the actor is dishonest" (Reeder and Brewer, 1979, p. 68). As a consequence, the firm value should be significantly and consistently depressed when the knowledge deficiency revealed in the crisis is attributed to the tacit knowledge deficiency, regardless of what is the level of corporate unrelated diversification. Following this logic, we thus predict:

Hypothesis 4: *There is a negative interaction between unrelated diversification and attribution of knowledge deficiency on the firm's market value such that the positive effect of unrelated diversification is stronger when the perceived difficulty level of repairing knowledge deficiency is low (vs. high).*

4. Methods

4.1 Sample and Data Sources

We use a sample of crises events related to Chinese listed companies to test the above four

hypotheses. The reason why this study examines listed companies is because according to China's economic regulations, they are subjected to strict requirements for information disclosure, such as corporate announcements. Furthermore, their financial statements are widely available (Zavyalova et al., 2012). Following the procedures outlined by Wei et al. (2017), this study investigates crisis events by reviewing news reports in China Business News and the China Securities Journal published between 2008 and 2018 [3]. China Business News is a major newspaper for business and economic news whose reports are timely and accurate, while the China Securities Journal is a significant international newspaper which provides information about Chinese listed firms (Wei et al., 2017). There were 233 crises during the study period. We removed 30 observations which were confounded by releases of information about significant events, e.g., announcement of major sales or mergers, within seven days of a crisis (Godfrey et al., 2009). The final sample which was analyzed consists of 203 crisis events. Detailed information about the crises and firms is shown in Appendix S1 and S2.

4.2 Dependent Variable: Cumulative abnormal returns

The dependent variable in the regression models used to investigate the potential influence of a crisis event on corporate market value is cumulative abnormal adjusted returns (CAR). A firm's CAR connected with a crisis event is calculated over a three-day (-1, 1) time window. This is in line with previous studies arguing that this method can timely "capture possible information leakage prior to a crisis while minimizing confounds of post-crisis events" (e.g., McWilliams and Siegel, 1997; Wei et al., 2017, p. 2109). The calculation method of CAR is

as follows.

Abnormal returns refer to the unexpected percentage-gaps between the expected normal return and the real return. Following prior research (Godfrey et al., 2009; Wei et al., 2017), the market model is applied to obtain the expected normal return, abnormal return and cumulative abnormal returns, namely:

$$R_{it} = A_i + B_i R_{mt} + E_{it} ,$$

where R_{it} represents the normal return of security i on day t, A_{it} captures the intercept, and Bi is the systematic risk associated with security I; R_{mt} is the return on the market portfolio of stocks on day t and E_{it} is the error term of security i on day t. Subsequently, the abnormal return is estimated as:

$$AR_{it} = R_{it} - (A_i + B_i R_{mt}) .$$

In this model, AR_{it} represents the abnormal return of security i on day t and A_i and B_i are the ordinary least squares parameter estimates of security i. Thus, the three-day cumulative abnormal return ($CAR_{3\text{-day}}$) over the 3-day (n: -1, 0, +1) event window for each security i is calculated as follows.

$$CAR_{3\text{-day}} = \sum_{t=n}^{n=(-1,0,+1)} AR_{it}$$

The expected returns are calculated for the period of 128 to 8 trading days before the critical incident (i.e., a total of 120 trading days) (Wei et al., 2017). Furthermore, the daily market return volatility is calculated using the equal weight average of the Shanghai Stock Exchange Composite Index and the Shenzhen Stock Exchange Component Index. All return

and market data were obtained from the Accounting Research Database (CSMAR,

http://www.gtarsc.com/Home).

4.3 Independent Variables

Unrelated diversification. This study analyses the corporate unrelated diversification level

because it exposes firms to more situations where the information and agency effects can be

manifested. On the one hand, unrelated diversification level reveals the knowledge

convergence of different industries present in each firm, which may trigger the "information

effect". On the other hand, the "agency effect" of unrelated diversification may be of more

concern to stakeholders, because cross-industry operations provide managers with greater

opportunities to reduce the risk of their own interests being damaged (Ataullah et al., 2014).

Each firm's unrelated diversification level is measured by the method of entropy. As

previously explained, one of the important benefits of the entropy measure is that it can be

used to distinguish between related and unrelated diversification. According to the method

proposed by Jacquemin and Berry (1979), the unrelated diversification level reveals the

amount of company sales derived from different two-digit Standard Industrial Classification

(SIC) industry groups [4]. All data are available from the corporate financial statement in

CSMAR. The unrelated diversification – UD, is calculated as:

$$UD = \sum_{j=1}^{n} P_j \log(1 / P_j)$$

where P_j is the proportion of the jth industry group sales in the total sales of the firm. Larger

values for the entropy measure reveal less concentration of sales within industry groups and

represent higher unrelated diversification level.

Attribution of knowledge deficiency. To measure the attribution of knowledge deficiency, we reviewed news coverage of each crisis at its onset. Two of the authors used the coding scheme of Schoenherr et al. (2014), Wei et al. (2017) and Connelly et al. (2016) to separately code each crisis based on its descriptions, and categorized all crises into different types, including "product harms, product defects, product tampering, malicious rumors, technical accidents, organizational misdeed, environment spill, stealth pollution, and financial fraud" (Wei et al., 2017, p. 2111) (see Appendix S1). All codes were 95% consistent between the two coders, manifesting high reliability (Weber, 1990). The remaining 5% difference was resolved through discussions to reach consensus. Finally, in order to test the veracity of the coding, we also invited a visiting scholar to code 50 randomly selected critical events, and the results were still reliable with a compliance rate of 89%. The different types of crises were then classified into three clusters, including "victim" (coded as 1), "explicit knowledge" (coded as 2), and "tacit knowledge" (coded as 3). For instance, if at the onset of a crisis, the news coverage describes no quality problem at the firm itself but at other pharmaceutical firms, the event can be regarded as being of the type of product harms, and the firm can be classified as the victim (Wei et al., 2017). If the news coverage describes a factory explosion caused by employees' technical problem, the event can be regarded as the type of technical accidents, which belongs to the deficiency of corporate explicit knowledge (Schoenherr et al., 2014). Finally, if the news coverage describes a financial fraud incident caused by a joint fraud of the company's general manager and chief financial officer, the event can be regarded as being

of the type of financial fraud, which belongs to deficiency of corporate tacit knowledge (Schoenherr et al., 2014; Connelly et al., 2016). The higher the score, the higher the perceived difficulty level of repairing the knowledge deficiency.

4.4 Moderating Variable: Corporate transparency

Following Yu et al. (2017) and Xu et al. (2019), we define corporate transparency as the number of announcements a firm makes in the year prior to a crisis. The data about the number announcements come from the well-known financial terminal Choice (http://choice.eastmoney.com/), which is an Internet Big Data Financial Hyper Terminal for different users, such as financial investment institutions, research and academic organizations (Xu et al., 2019). Its data contain "stocks, funds, bonds, indices, commodities, foreign exchanges, macro industries, and many other data varieties" (Xu et al., 2019, p. 1032). Most importantly, this database can timely update corporate announcements, financial and operational data, and research reports.

4.5 Control Variables

We controlled for the following factors in our analysis to ensure that the results are robust. In terms of corporate characteristics, for explaining the possibility that large firms may attract more attention from stakeholders, such as investors and the media (Zavyalova et al., 2012), the log-transformed values of annual sales before the crisis were used to measure the *firm size*. We also considered the effects of the financial index *Tobin's Q*, *profitability* and *leverage* on the firms' stock market value (Wei et al., 2017). *Profitability* was measured by the ratio of the net profit margin on sales, and *leverage* was measured by the asset-liability

ratio. These data were obtained from the CSMAR.

In terms of event attributes, considering the influence of the ***type of crisis*** on the attribution of blame, we also created 3 dummies for the crisis types that occurred most frequently in our data, including technical accidents (19%), organizational misdeed (19%), and product harms (11%), and added them as control variables. The ***number of fatalities*** in one crisis always determines the social influence level, we thus controlled for this variable (Lo et al., 2018). Considering the potential effects of industry attributes, we further controlled for ***return on assets*** of the corporate main business industry (Chang and Thomas, 1989), and measured it by the ratio of industry net profit to total industry assets. Finally, to exclude the potential effects of corporate market competitive advantage on stakeholders' responses to the firm (Chang and Singh, 2000), we also controlled for the ***market share*** in the corporate main business industry, which was measured by the proportion of corporate main business revenue and industry revenue in the year before the crisis (Buzzell et al., 1975). These data were obtained from CSMAR and the Choice database.

5. Results

The daily average abnormal returns (AAR) are shown in Figure 1 where negative values indicate that the crisis events have a negative impact on the firm's value. Abnormal returns are significantly depressed on the day of the crisis as well as over the two-day period following the crisis event (i.e., day 0 to day 2). Vulnerability was significantly high for the two days before a crisis (i.e., day -1 and day -2), indicating possible crisis information

leakage that induces an earlier negative reaction among stakeholders (Wei et al., 2017). All descriptive data for the variables are presented in Table 1.

---- Insert Figure 1 here ----

---- Insert Table 1 here ----

Table 2 includes the regression models used showing the values of CAR connected with crises in the 3-day window (i.e., day [-1, 1]). We estimated model 1 as the base model which includes only control variables. The main effects of the independent variables, i.e., unrelated diversification and attribution of knowledge deficiency, and the moderating variable, i.e., corporate transparency, are added in model 2. Additionally, we respectively included the moderating effect of corporate transparency on unrelated diversification in model 3, and the interaction effect of unrelated diversification and attribution of knowledge deficiency in model 4. Model 5 is the complete model which contains all main and moderating effects in this study. The highest variance inflation factor (VIF) in Model 5 is 1.640. Multicollinearity is thus not a serious problem in our data.

---- Insert Table 2 here ----

Model 2 tests the main effects of unrelated diversification and attribution of knowledge deficiency. The increase in the R^2 statistic from Model 1 to Model 2 is significant (0.060, p=0.000). Unrelated diversification is significantly and positively related to CAR (p=0.011), supporting hypothesis 1 that unrelated diversification can provide a buffering effect for the firm value at the crisis onset. In this study, the protection of the firm value is also seen as the benefits associated with unrelated diversification. Additionally, the attribution of knowledge

deficiency has a negative and significant effect on CAR (p=0.007), supporting hypothesis 3 that stronger attribution of knowledge deficiency represents a burden for investors at the crisis onset.

The moderating effect of corporate transparency on unrelated diversification is tested by Model 3. The increase in the R^2 statistic from Model 2 to Model 3 is significant (0.045, p=0.000). A positive and significant moderating effect of corporate transparency on unrelated diversification (0.237, p=0.001) is revealed. The positive effect of unrelated diversification on CAR remains significant at a high-level corporate transparency, but is non-significant at a low-level of corporate transparency. Hypothesis 2 is thus supported. For further interpreting this moderating effect, based on the Johnson–Neyman technique (Hayes, 2017; Spiller et al., 2013), we identified the region indicating the range of corporate transparency beyond which the effect of unrelated diversification is significant (see Figure 2 and Figure 3). According to the figure, only when the value of the corporate transparency is greater than 79 can the positive effect of unrelated diversification be significant.

---- Insert Figure 2 here ----

---- Insert Figure 3 here ----

Model 4 tests hypothesis 4 by examining the interaction between unrelated diversification and attribution of knowledge deficiency. The R^2 statistic increases significantly from Model 2 to Model 4 (0.034, p=0.000). A negative interaction effect between unrelated diversification and attribution of knowledge deficiency is revealed by the regression analysis (-0.201, p=0.005). The analysis shows that the unrelated diversification

has a positive effect on the abnormal stock return for the victim type firms (0.576, p=0.003) and the explicit knowledge deficiency (0.203, p=0.018), but its effect is negative and not significant for the tacit knowledge deficiency (-0.002, p=0.990) (see Figure 4). In other words, unrelated diversification buffers the negative effect of crises on investor reaction only when the initial attribution of knowledge deficiency is at a lower level (i.e., victim and explicit knowledge deficiency), but not when it is high (i.e., tacit knowledge deficiency). This depression of the firm value caused by the failure of the buffering effect of unrelated diversification is regarded as the costs associated with unrelated diversification. These results are supportive of Hypothesis 4. We also tested the above results when all main and moderating effects are added simultaneously, the results still remained substantially unchanged (see Model 5).

---- Insert Figure 4 here ----

Among the control variables, severe crises that result in a great number of fatalities damage more the firm value. A positive and significant effect of the corporate market share on CAR was also tested, suggesting that higher competitive advantage in the market could result in the firms suffering less damage at the crisis onset.

6. Robustness Checks

A series of robustness checks were performed to further confirm the results from this study. Firstly, we calculated the 7-day CAR and ran the models again to test the robustness of our results. The main results did not change (see Appendix S3). Secondly, considering the high correlation between the crisis types and attribution of knowledge deficiency, we also

conducted a robustness checks by analyzing the models without the three dummy variables. Our results did not change (see Appendix S4).

Thirdly, we selected substitution variables to measure unrelated diversification and corporate transparency again. For unrelated diversification, we chose the measurement of the Blau coefficient [5] (Blau, 2001) to replace the method of entropy measure. The results also did not change (see Appendix S5). For corporate transparency, we respectively chose the number of announcements made by the firms in the two (and three) years before the crisis to replace the number of announcements in the one year prior to the crisis. We reran the regression model and the results did not change (see Appendix S6 and S7).

Finally, for additional control variables, we also considered the effects of corporate tenure in the stock market and type. The former was measured by the time interval between the date when the firm went public and the date of the event, and reran the regression model by adding it as a control variable. All results did not change (see Appendix S8). For the latter, we created four dummies for the corporate types that occurred most frequently in our data, including Pharmacy (30.5%, 62), Manufacturing of Chemical Materials and Products (8.3%, 17), and Wine, Beverage and Refined Tea Manufacturing (6.4%, 13), Capital Market Services (0.9%, 2), and added them as control variables. We reran the regression model and the results also did not change (see Appendix S9). All robustness checks confirmed the vigor of our findings.

7. Discussion, Conclusion and Limitations

7.1 Discussion

Although past research has extensively explored the effects of diversification strategy on the firm value in daily operations (Aggarwal and Samwick, 2003; Ataullah et al., 2014; Chen and Keung, 2018), there is insufficient analysis of its impacts in a crisis situation. Using an event study of 203 corporate crises in China, we tested the relationships between the unrelated diversification level, corporate transparency, knowledge deficiency attribution and the stock market's responses to the crisis. Our empirical results show that in a crisis situation the "information effect" and "agency effect" of unrelated diversification on the firm value can be partially explained.

Using a cross-border knowledge management perspective (Aoki, 2010; Hadlock et al., 2001), we explored a unique dimension of the corporate diversification strategy—unrelated diversification, which captures the perception of corporate cross-industry knowledge by external stakeholders (Chen and Keung, 2018). Our investigation of the interaction between unrelated diversification and corporate transparency shows that firms with a high (vs. low) unrelated diversification level are initially insulated from a crisis, especially when they possess higher transparency. These results resonate with the conclusion of Ataullah et al. (2014) that corporate information transparency plays a crucial role in the correct assessment of unrelated diversification value by the external stakeholders, and reveal the "information effect" of diversification in a crisis situation. Based on this, we argue that the benefits associated with unrelated diversification can be obtained by the firm under a crisis situation when it exhibits higher transparency.

The simultaneous examination of unrelated diversification and corporate transparency

also allowed us to shed light on the effect of the centralized strategy on the firm value at the

onset of a crisis. A closer look at Figure 3 reveals that at very low levels of unrelated

diversification (i.e., centralized strategy), the firm value can actually drop significantly when

corporate transparency is high (vs. low). This phenomenon may be caused by the fact that

high interaction between the firm and stakeholders in daily operations makes the stakeholders

more aware of the limitations in the abilities of centralized firms to spread the risk of crises.

Additionally, these results could also be combined with the Kang's (2013) research, which

focuses on the effects of unrelated diversification level on the firm's willingness to

communicate with its stakeholders, to further explore the reasonable information disclosure

mechanism of firms in response to crises under different diversification strategies.

Additionally, our finding that perceived corporate knowledge deficiency in the crisis has

effects on the firm value provides empirical evidence for the impacts of causal attribution

which was hypothesized but rarely tested previously (Coombs, 2004). These findings also

resonate with the empirical evidences of Wei et al. (2017) that describe the negative effect of

crisis responsibility attribution on the firm value. In addition, our results also show that the

buffering effect of unrelated diversification on the firm value is valid only when the cause of

the crisis is not attributed to the tacit knowledge deficiency by stakeholders. These results

could partly explain the "agency effect" of diversification in a crisis situation (Aggarwal and

Samwick, 2003), that is, unrelated diversification strategy will not have the positive impact

on firm value at the onset of a crisis if the corporate managers are perceived as having ethical

deficiency. Based on this, we argue that the costs associated with unrelated diversification

will affect the firm under a crisis situation when it has tacit knowledge deficiency.

7.2 Implications and Conclusion

Theoretical contributions. Firstly, prior literature based on the agency theory and the viewpoint of information asymmetry has extensively discussed the influence mechanism of diversification on the firm value in daily operations (e.g., "information effect" and "agency effect" of diversification) (Ataullah et al., 2014; Denis et al., 1999). In this study, based on the reaction of stakeholders to the corporate crisis in the context of information asymmetry (Bundy and Pfarrer, 2015; Wei et al., 2017), we partly explain the agency and information effects of diversification strategy with cross-industry knowledge in a crisis situation. These findings expand the research perspective of cross-industry knowledge management to the field of crisis management, and shed new light on the long-standing discussion of the value of diversification strategy to the firm in the strategic management literature.

Secondly, in the literature on applied attribution theory, responsibility attribution has long been regarded as a critical construct in determining stakeholders' response to corporate crises (Bundy and Pfarrer, 2015). However, one point that is usually neglected previously is that at the onset of a crisis, stakeholders should attribute the cause of the crisis first and then make the responsibility attribution. For instance, before the firm takes more responsibility for the crisis (e.g., financial fraud), stakeholders should have attributed the cause of the crisis to corporate ethical failings rather than corporate competence problems or rumor. We therefore extend the application of attribution theory by empirically testing the influence of knowledge deficiency attribution on the firm value at the crisis' onset.

Finally, prior literature based on resource dependence views held that the key to protecting the firm value is to reduce its dependence on external resources (Oliver, 1991; Pfeffer and Salancik, 2003), while those based on agency theory emphasized that effective supervision of managers is an effective way to reduce agency cost and thus improve firms' performance (Hillman and Dalziel, 2003; Jensen and Meckling, 1979). Although these two fields have been intensively studied previously, only a few studies have focused on the interaction between these two modes of firm value intervention. By empirically testing the interaction between attribution of knowledge deficiency and unrelated diversification level under a crisis scenario, we find that when the supervision mode based on the agency theory view fails (e.g., firms are considered to possess tacit knowledge deficiency), the protection mode of the firm value based on the resource dependence view will also fail (i.e., the buffering effect of unrelated diversification is ineffective). These findings provide meaningful insights into the jointly discussion of the two theories, and are thus of particular theoretical value.

Practical implications. Firstly, in this study, the exploration of the buffering effect of unrelated diversification in a crisis situation assists firms to understand the stakeholders' crisis response mechanism--stakeholders tend to rely on their perceptions of the firm's unrelated diversification level to evaluate the impacts of the crisis to the firm and then the response to the crisis, so as to help firms to repair the crisis-caused damage by making better use of their own strategic advantages. For instance, after the crisis, unrelated diversified firms can verify the initial positive evaluation of stakeholders by quickly publicizing their distinct

advantages in the autonomy of diversified resources, so as to mitigate the damage of the crisis to the firm value.

Secondly, the explanation of the information effect of unrelated diversification in a crisis scenario suggests that in corporate daily operations, firms with unrelated diversification structure should increase their information interaction with stakeholders, especially the interaction of diversified knowledge information, so as to increase stakeholders' understanding of the benefits of unrelated diversification strategy to the firm value and thus make the buffering effect of unrelated diversification in a crisis situation more effective. Also, firms that implement centralized strategy should avoid causing concern to stakeholders about their ability for resource autonomy while communicating with them.

Finally, the partly explanation of the agency effect of unrelated diversification in a crisis scenario suggests that at the onset of a crisis, firms should try their best to avoid creating stakeholders' perceptions that the crisis is caused by deficiency in corporate tacit knowledge. When the crisis is attributed by the stakeholders to corporate tacit knowledge deficiency, the crisis repair behaviors of the firm should focus on eliminating the negative cognitive bias of stakeholders towards the firm. For instance, an example is replacing the CEO and all employees involved in the crisis.

Conclusion. In studying how corporate diversification with cross-industry knowledge affects stakeholders' reactions to a corporate crisis, we proposed four hypotheses and provided empirical evidence for the combined effects of corporate unrelated diversification, corporate transparency and attribution of knowledge deficiency on the corporate market value

at the onset of a crisis. Our research extends the "agency effect" and "information effect" of diversification on the firm value in a crisis scenario, and enlightens how firms can better conduct corporate strategic and knowledge management in their daily operations to better cope with crises in the future.

7.3 Limitations and Future Work

Several limitations of the current study provide more opportunities for future research. Firstly, based on the perspective of cross-border knowledge management, this study only explored the impact of unrelated diversification on the firm value in the context of a crisis. Future research can further explore the effects of related diversification on the crisis response by stakeholders, and discuss the differential effects of those two dimensions of diversification strategies in a crisis situation.

Secondly, in this study, we focused on how unrelated diversification, corporate transparency and attribution of knowledge deficiency jointly affect the firm value at the onset of a crisis. After this initial stage of a crisis, different intermediaries, such as news media, We-Media, and even the firms themselves, often provide investors with more crisis-related information (Lindell and Perry, 2012). Therefore, with the development of the crisis, how these independent variables in the current study interact with other factors to jointly influence the firm value deserves further systematic investigation in the future.

Finally, although in our analysis we have controlled for many variables related to the firm, crisis and industry, other variables can also drive the relationship between unrelated diversification and the firm value, which is worth further exploration in the future. For

instance, Purkayastha et al. (2012) argue that unrelated diversification may lead to firms' superior performance in emerging economies, while related diversification may result in corporate superior performance in developed economies. Additionally, future research could also explore the corporate crisis experience and how it affects the firm value (Wei et al., 2017). We speculate that whether a firm has had similar crises in the past may have an effect on stakeholders' perceptions of the firm at the onset of a crisis.

Note

1. Jensen and Meckling (1979) classify agency costs into monitoring costs, compliance costs, and residual costs. Monitoring costs refer to the expenditures of external shareholders in order to supervise the manager's excessive consumption or self-relaxation; compliance costs mean the self-restraint expenses incurred by managers in order to gain the trust of external shareholders (e.g., managers regular report to the shareholders on the operation); other losses due to inconsistent interests of shareholders and managers are residual costs.

2. https://www.sohu.com/a/345202947_239259

3. The reasons for choosing the 2008–2018 sample period are as follows. Firstly, the global crisis of 2007 was likely to lead to more restructurings or mergers among Chinese firms, which would constitute confounding events in this study. We thus avoided including the year 2007 in the sample. Secondly, after 2008, Chinese electronic news websites published information in a timelier manner than before, we therefore selected the sample period commencing from 2008. Thirdly, we expanded the previous research experience by Wei et al. (2017) which covered the period from 2008 to 2014 by providing continuity to 2018.

4. http://www.stats.gov.cn/tjsj/tjbz/201905/t20190522_1666232.html

5. Blau coefficient: $UD = 1 - \sum_{j=1}^{n} Pj^2$

where *Pj* is the proportion of the *j*th industry group sales in the total sales of the firm. The

larger values for the Blau coefficient reveal a less concentration of sales among industry

groups and represent a higher unrelated diversification level.

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Table 1. Descriptive statistics and bivariate correlations

Variables	Mean	StDev	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. CAR[3]	-0.020	0.056														
2. CAR[7]	-0.026	0.079	0.811** (0.000)													
3. Profitability	0.094	0.153	-0.176* (0.012)	-0.126 (0.072)												
4. TobinQ	2.901	1.975	-0.071 (0.312)	-0.115* (0.103)	0.255** (0.000)											
5. Leverage	0.477	0.208	0.119** (0.090)	0.198** (0.005)	-0.223** (0.000)	-0.385** (0.000)										
6. Firm size	9.550	0.648	0.078 (0.269)	0.071 (0.315)	0.010 (0.891)	-0.176* (0.012)	0.259** (0.000)									
7. Number of fatality	2.281	10.567	-0.181** (0.010)	-0.234** (0.001)	0.103 (0.143)	-0.066 (0.350)	-0.091 (0.197)	0.137 (0.051)								
8. Product harms	0.108	0.312	-0.103 (0.143)	-0.071 (0.317)	0.008 (0.143)	0.002 (0.980)	-0.095 (0.179)	0.000 (0.998)	-0.075 (0.285)							
9. Technical accidents	0.191	0.395	0.022 (0.758)	0.094 (0.184)	-0.024 (0.729)	-0.128 (0.068)	0.127 (0.071)	0.078 (0.271)	0.233** (0.001)	-0.170* (0.015)						
10. Organizational Misdeeds	0.182	0.387	0.019 (0.792)	0.017 (0.811)	0.000 (0.999)	0.167* (0.018)	0.103 (0.143)	-0.083 (0.237)	0.102 (0.147)	-0.165* (0.019)	-0.230** (0.001)					
11. Return on industry assets	0.058	0.034	-0.153* (0.030)	-0.121 (0.085)	0.221** (0.002)	0.299** (0.000)	-0.366* (0.000)	-0.051 (0.471)	0.022 (0.750)	0.187** (0.007)	-0.041 (0.562)	-0.128 (0.069)				
12. Market share	4.147	7.555	0.145* (0.039)	0.094 (0.182)	0.138* (0.050)	-0.051 (0.473)	0.200** (0.004)	0.541** (0.000)	0.064 (0.364)	0.104 (0.142)	-0.066 (0.352)	-0.040 (0.568)	0.010 (0.892)			

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
13. Corporate transparency	0.984	0.497	-0.025 (0.724)	-0.054 (0.442)	-0.020 (0.775)	0.090 (0.201)	-0.023 (0.743)	-0.045 (0.526)	-0.009 (0.897)	-0.003 (0.964)	-0.085 (0.227)	0.186** (0.008)	0.172* (0.014)	0.043 (0.544)		
14. Unrelated diversification	0.290	0.332	0.172* (0.014)	0.153* (0.029)	-0.151* (0.031)	-0.084 (0.232)	0.234** (0.001)	-0.015 (0.834)	-0.104 (0.140)	-0.034 (0.625)	0.064 (0.367)	-0.002 (0.972)	0.158* (0.024)	-0.192** (0.006)	0.001 (0.985)	
15. Attribution of knowledge deficiency	2.251	0.711	-0.152* (0.030)	-0.171* (0.015)	-0.040 (0.575)	0.025 (0.718)	0.041 (0.560)	-0.031 (0.658)	0.039 (0.584)	0.122 (0.082)	-0.173* (0.014)	0.426** (0.000)	-0.130 (0.064)	0.063 (0.369)	0.136 (0.053)	0.013 (0.849)

Note: n = 203, p-value are in parentheses.

Table 2. Regressions of crisis-related cumulative abnormal returns (3-day CAR)

Variables	Model 1	p-value	Model 2	p-value	Model 3	p-value	Model 4	p-value	Model5	p-value
(Constant)	0.017 (0.095)	0.861	-0.042 (0.094)	0.659	-0.036 (0.092)	0.694	-0.026 (0.093)	0.776	-0.022 (0.090)	0.812
Profitability	-0.165 (0.073)	0.025	-0.167 (0.071)	0.020	-0.152 (0.069)	0.030	-0.165 (0.070)	0.019	-0.150 (0.068)	0.029
Tobin's Q	-0.006 (0.079)	0.936	-0.015 (0.077)	0.848	-0.036 (0.075)	0.636	-0.028 (0.076)	0.717	-0.048 (0.074)	0.522
Leverage	-0.031 (0.083)	0.703	-0.087 (0.082)	0.290	-0.135 (0.082)	0.101	-0.109 (0.081)	0.180	-0.155 (0.081)	0.056
Firm size	-0.009 (0.084)	0.918	-0.038 (0.082)	0.646	-0.029 (0.080)	0.714	-0.037 (0.080)	0.642	-0.029 (0.078)	0.709
Number of fatality	-0.200 (0.072)	0.006	-0.161 (0.071)	0.024	-0.169 (0.069)	0.015	-0.175 (0.070)	0.013	-0.182 (0.068)	0.008
Product harm	-0.367 (0.231)	0.113	-0.236 (0.230)	0.307	-0.247 (0.224)	0.272	-0.268 (0.226)	0.237	-0.278 (0.221)	0.209
Technical accidents	0.142 (0.188)	0.452	0.101 (0.184)	0.583	0.156 (0.180)	0.387	0.092 (0.180)	0.612	0.146 (0.177)	0.410
Organizational misdeed	-0.023 (0.191)	0.906	0.262 (0.208)	0.209	0.179 (0.204)	0.382	0.223 (0.205)	0.279	0.143 (0.201)	0.479
Return on industry assets	-0.101 (0.076)	0.187	-0.124 (0.076)	0.108	-0.144 (0.075)	0.055	-0.128 (0.075)	0.091	-0.148 (0.073)	0.046
Market share	0.208 (0.084)	0.014	0.281 (0.084)	0.001	0.292 (0.082)	0.000	0.283 (0.083)	0.001	0.293 (0.081)	0.000

	Model 1	Model 2	p	Model 3	p	Model 4	p	Model 5	p
Corporate transparency (CT)		-0.053 (0.069)	0.439	-0.065 (0.067)	0.339	-0.079 (0.068)	0.249	-0.089 (0.067)	0.184
Unrelated diversification (UD)		0.181 (0.071)	0.011	0.246 (0.072)	0.001	0.177 (0.069)	0.012	0.240 (0.070)	0.001
Attribution of knowledge deficiency (AD)		-0.207 (0.076)	0.007	-0.154 (0.076)	0.045	-0.215 (0.075)	0.005	-0.163 (0.075)	0.031
UD*CT				0.237 (0.072)	0.001			0.231 (0.071)	0.001
UD*AD						-0.201 (0.071)	0.005	-0.195 (0.070)	0.006
R^2	0.120	0.180		0.225		0.214		0.256	
R^2 adj	0.074	0.124		0.167		0.155		0.196	
F-statistic	2.615**	3.201**		3.897**		3.650**		4.291**	

Note: n = 203, Values in table are unstandardized regression coefficients. Standard errors are in parentheses
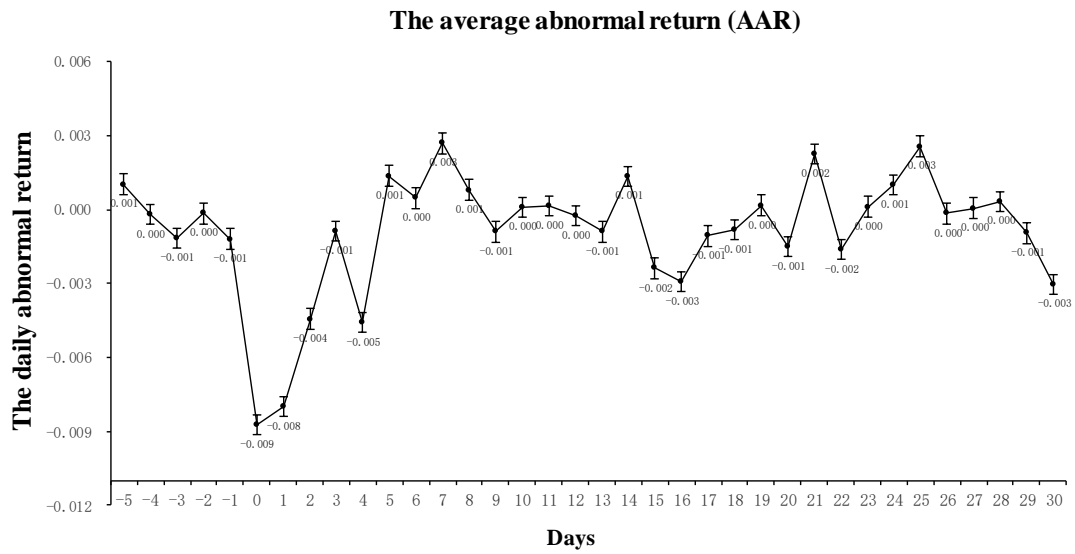
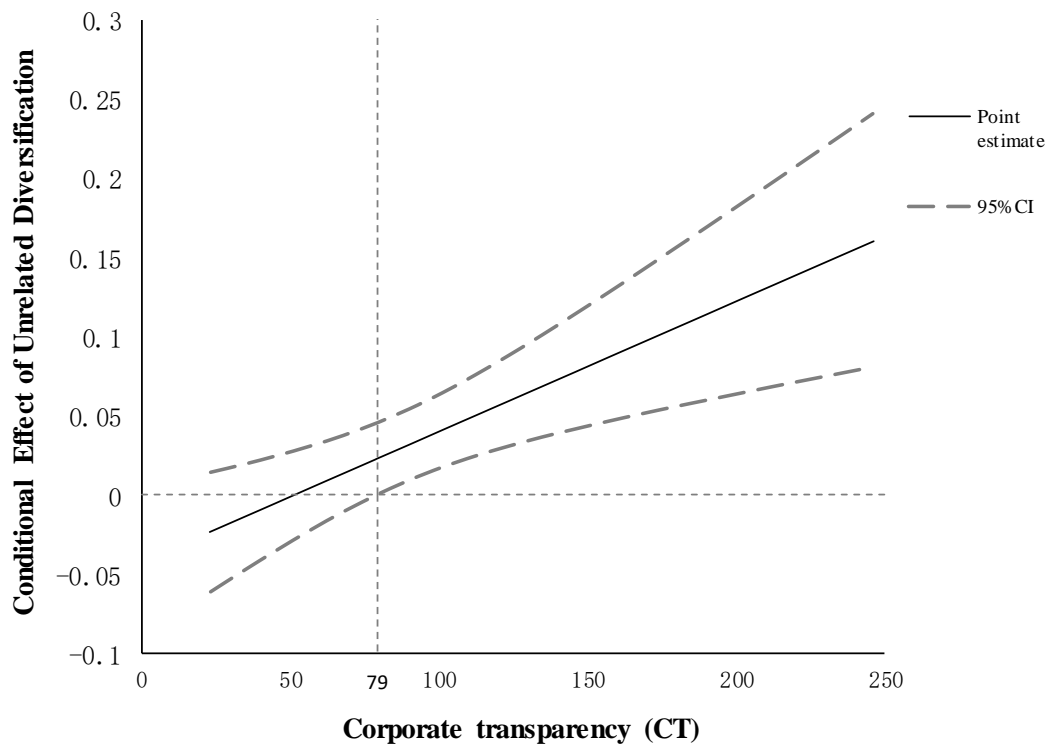Figure 1. Stock market responses to firm crisis (95% confidence interval in brackets)

Figure 2. The conditional effect of unrelated diversification on Crisis-CAR as a

function of corporate transparency. *Note*. Following the Johnson–Neyman technique

(Hayes, 2017; Spiller et al., 2013), the two dashed curves represent the boundary of

95% confidence interval (95% CI Upper Limit and 95% CI Lower Limit). The solid

line in the middle reveals the point estimate of conditional effect of unrelated

diversification. The vertical dashed line represents the critical point (i.e., 79) of

moderating effect of corporate transparency on the positive effect of unrelated

diversification on Crisis-CAR. The horizontal dashed line represents the critical point

(i.e., 0) of the positive effect of unrelated diversification on Crisis-CAR. The both

dashed lines intersect at the dashed curve of 95% CI Lower Limit and reveals that the

positive effect of unrelated diversification on Crisis-CAR will be strengthened when

the value of corporate transparency high than 79 (i.e., the number of company

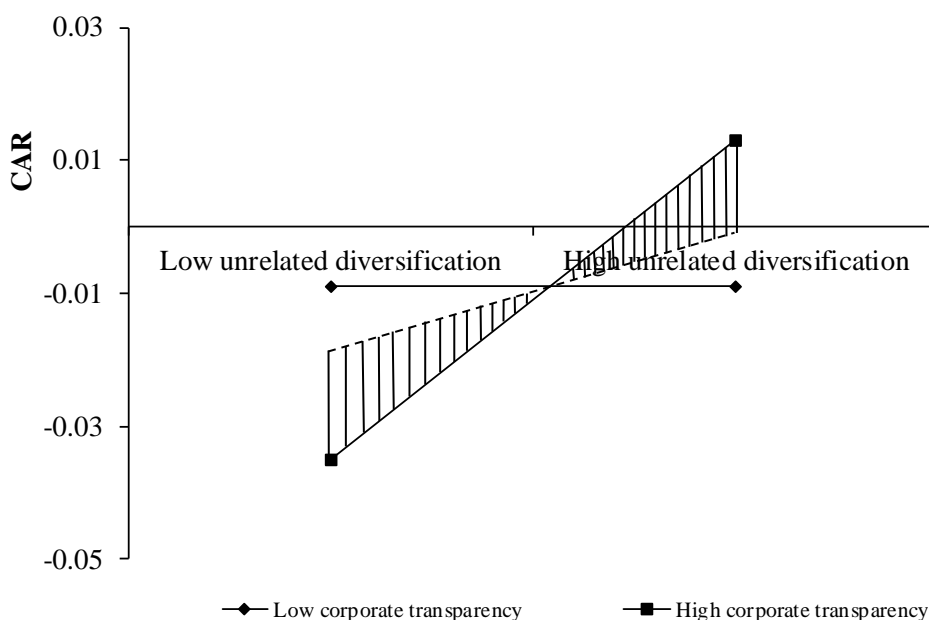announcements in the year before the crisis was greater than 79).

Figure 3. The moderating effect of corporate transparency on unrelated diversification.

Note. The two solid lines represent the lowest (=23) and highest (=246) levels of

corporate transparency. The middle dashed line represents the switching point of

corporate transparency (=79) below which the effect of unrelated diversification is

positive and significant ($p < .05$), but above which the effect of unrelated

diversification is not significant ($p > .1$). This is done using the Johnson–Neyman

technique (Hayes, 2017; Spiller et al., 2013). The shaded area thus represents the

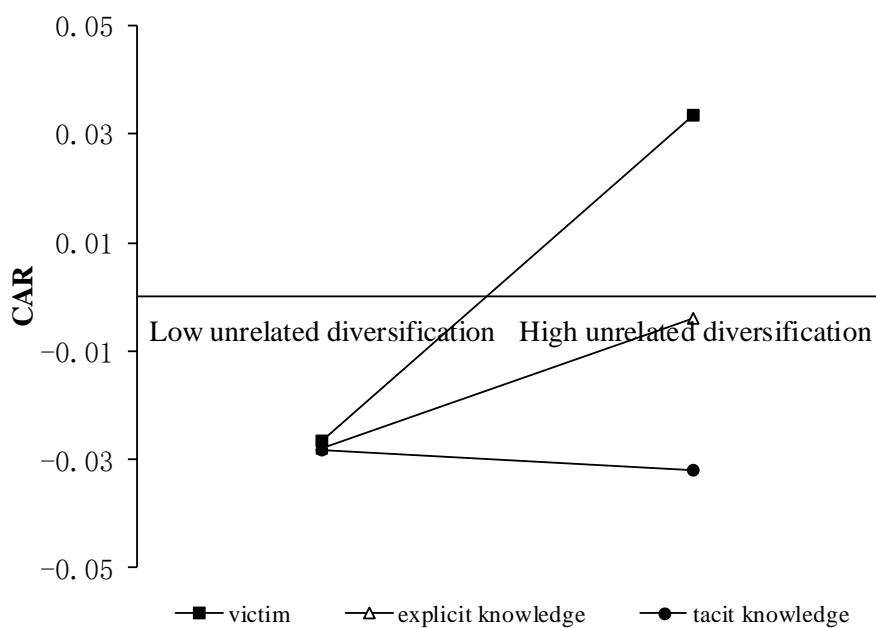Johnson-Neyman region of significance.

Figure 4. The interaction effect of unrelated diversification and attribution of

knowledge deficiency on Crisis-CAR.