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No pain, yet gain?: Learning from vicarious crises in an international context

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ABSTRACT

An organizational crisis for other firms in the same industry as a focal firm leads to two major influences: the double-edged sword of learning spillovers and damage spillovers. To suggest optimal ways to promote effective vicarious learning, this study examines the mechanisms and timing of vicarious crises in the international context that yield significant learning spillover (i.e., prevention of future crises) with less damage spillover (i.e., performance downfall) to the focal firm. The results of data analyses of the fatal events in the global airline industry from 1994 to 2012 illustrate that a nonlocal alliance partner's crisis can prevent future crises for a focal firm without performance downfall. However, such significant learning effects take time to appear. On the other hand, a local competitor's crisis leads to prompt performance downfall of the focal firm without significant learning spillovers.

1. Introduction

One of the early arguments reported in the literature on organizational learning is that vicarious failures—others' negative outcomes—provide firms with an important opportunity to gain learning benefits (Argote, 2011; Madsen & Desai, 2010). It has been argued that this learning from vicarious failures is particularly effective when such failures are infrequent but have major consequences, such as product recalls, airline accidents, and industry disasters—in other words, when they are *organizational crises* (Pearson & Clair, 1998). This is because through vicarious crises, firms can learn about rare and critical failures without bearing direct pain (Nathan & Kovoor-Misra, 2002).

However, are experiences of vicarious crises actually a painless way to learn, as these studies assumed? Organizational crises are large-scale failures that threaten organizational survival (Carmeli & Schaubroeck, 2008). Hence, unlike ordinary vicarious failures such as operational errors or performance drops, this type of vicarious failure is accompanied by significant damage spillovers as well as learning spillovers. For example, after the 9/11 terrorist attacks, in addition to United Airlines and American Airlines, the entire global airline industry lost $15 billion and huge numbers of passengers. Similarly, after the Bhopal disaster, the chemical industry as a whole suffered from negative public assessments, i.e., publicity of “chemophobia.” This evidence suggests that a vicarious crisis is a double-edged sword: it causes both learning and damage spillovers.

Most prior studies on learning from vicarious failures have endeavored to explore the conditions that facilitate learning spillovers. However, although a firm learns significantly from a vicarious crisis, if it suffers greatly from the consequent damage spillover despite its innocence, the effectiveness of vicarious learning may be questionable. This raises the following research questions. Whose crises enable a focal firm to obtain greater learning spillover (i.e., prevention of future crises) and less damage spillover (i.e., performance downfall)? Are these influences consistent at all time points? If not, when can the focal firm expect both the increased learning spillover and the damage spillover mitigation? To examine these research questions, based on a review of prior mechanisms for vicarious learning, this study focuses on two representative sources of vicarious crises in an international context: crises for local competitors and those of nonlocal alliance partners. It then predicts how these crises affect a focal firm's future crisis and performance downfall, and how such influences appear dynamically over time.

This study is expected to make two remarkable contributions. First, by simultaneously focusing on learning and damage spillovers, this study examines effective organizational learning from vicarious failures based on a different approach from prior studies. Second, although organizational crises are frequently reported in the mass media, and their influence may be huge across countries, few studies have devoted attention to this type of organizational risk in the international context. The research findings will help to identify the ways in which firms should be more proactive when responding to organizational crises around the world.

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2. Theoretical background

2.1. Mechanisms for learning from vicarious crises

The term “organizational learning” refers to processes of making and updating routines in response to organizational experiences (Levitt & March, 1988). Large-scale failure events such as organizational crises have been considered to be prominent motivators of organizational learning. Firms experiencing crises tend to suffer great damage to their legitimacy and reliability, which triggers an extensive search for the causes of the crisis as well as useful solutions to repair damage. These processes lead to significant organizational changes in preexisting routines and affect subsequent performance improvement.

This organizational learning from crises is also possible from others' crises, albeit in a limited way. The knowledge from one firm's experiences can spill over to other firms through interfirm interactions (Banerjee, Prabhu, & Chandy, 2015; Tuschke, Sanders, & Hernandez, 2014; Yiu, Yuehua, & William, 2014). However, boundedly rational managers have a strong tendency to undersample failed others for learning (Denrell, 2003) and cannot attend to every failure in their vicinity (Mitsuhashi, 2012). Therefore, sources of vicarious learning from crises tend to be limited.

According to prior studies, significant sources of vicarious learning are based on two major mechanisms (see Table 1). The first is observation (i.e., observation-based learning). This mechanism was originally suggested by studies on population ecology, which view vicarious learning as a function of observation of other firms in the given population (e.g., Baum et al., 2000; Baum & Ingram, 1998). According to this literature, such observation relies greatly on a high interfirm similarity or commonality. Firms with a high degree of similarity tend to perceive each other as major competitors, and their competitors' performance strongly influences their own organizational performance. Thus, similar firms attract great attention even in ordinary situations, generating more chances for vicarious learning. For example, firms do not commit financial fraud when their peers with similar statuses are punished for fraud (Yiu et al., 2014), and organizational product launches are influenced by those of similar-sized peers (Srinivasan et al., 2007).

The second mechanism is networking (i.e., network-based learning). This mechanism is suggested by studies of network embeddedness, which claim that vicarious learning occurs through a transfer of knowledge between networking partners (Beckman & Haunschild, 2002; Tuschke et al., 2014). According to this literature, although networking partners retain separate businesses, they share resources and conduct joint activities on this basis. These joint activities allow the partners not only to refer to each other's experiences frequently without major effort, but also to exchange implicit and tacit knowledge (Uzzi, 1996), enabling significant learning from networking partners. Hence, R&D alliances lead to significant innovative outcomes (e.g., Ahuja, 2000), and successful or failed acquisition experiences of interlocking partners (e.g., Beckman & Haunschild, 2002) and multiunit firms (e.g., Baum et al., 2000) contribute to the success of a focal firm's acquisitions.

2.2. Sources of learning from vicarious crises in an international context

By regarding mechanisms as sources of vicarious learning in an international context, this study focuses on two types of other firms within an industry: *local competitors* and *nonlocal alliance partners*. The former refers to industry peers in the same country as a focal firm, whereas the latter refers to strategic alliance partners in other countries. Because of their strong commonalities in international businesses, local competitors are highly substitutable for each other with their international stakeholders, and they consider each other to be major competitors. Although this rivalry limits opportunities for cooperation, multiple local public sources, such as government agencies and the mass media, give these local competitors more opportunities to observe each other. Therefore, local competitors are a standard source of observation-based learning. A strategic alliance is the typical embedded interfirm relationship, and it enables firms to transfer tacit knowledge, even across country borders (Inkpen & Tsang, 2007). Although firms may have limited opportunities for public observation of other firms in different countries, nonlocal alliance partners are able to access key nonlocal knowledge for each other through cooperative interactions, which thereby become a representative source of network-based learning.

Using these two types of firms to test observation- and network-based learning is more advantageous than the alternatives. Previous research has proposed two specific conditions for significant vicarious learning, namely knowledge relevance and information availability between firms (e.g., Schwab, 2007). The local competitors and nonlocal alliance partners not only satisfy these two conditions, but also provide comparative mechanisms and influences. Learning from the former offers the focal firm similar or compatible knowledge through observations, whereas learning from the latter offers heterogeneous or complementary knowledge through networking activities. With this comparability, research can suggest the types of knowledge and mechanisms that are more effective for vicarious learning and that alleviate any of the compounded effects common to observation- and network-based learning in empirical analyses. Local alliance partners and nonlocal competitors are excluded as sources of vicarious learning in this study. This is justifiable because strong rivalries between local firms in international business may limit significant mutual network-based learning despite alliance partnerships, and nonlocal competitors may have little chance to observe or interact with each other, which deters vicarious learning.

Table 1
Examples of prior research on learning spillover.

Mechanisms	Sources	Examples of spillover experience/knowledge
Observation	Similar firms/competitors	Market operational and failure experiences (Baum & Ingram, 1998; Kim & Miner, 2007, etc.) Product development (Srinivasan, Haunschild, & Grewal, 2007, etc.), Foreign market experiences (Banerjee et al., 2015; Yang, Li, & Delios, 2015, etc.), Organizational accidents (Madsen, 2009; Mitsuhashi, 2012, etc.), Successful and failure events (Madsen & Desai, 2010, etc.); Adoption of practices/tactics (Haunschild & Miner, 1997; Simon & Lieberman, 2010, etc.), Product development (Srinivasan et al., 2007, etc.), Punishment (Yiu et al., 2014, etc.)
	Prominent firms	Adoption of practices/tactics (Haunschild & Miner, 1997), Punishment (Yiu et al., 2014)
Networking	Business group/consortium members	Foreign market experiences (Banerjee et al., 2015, etc.), Adoption of practices/tactics (Briscoe, Gupta, & Anner, 2015; Kraatz, 1998, etc.)
	Multiunit (chain) organizations	Market operational and failure experiences (Baum & Ingram, 1998; Chuang & Baum, 2003, etc.), Acquisitions (Baum, Li, & Usher, 2000, etc.), Adoption of practices/tactics (Simon & Lieberman, 2010, etc.)
	Collaboration partners (including buyer-supplier)	Technological knowledge (Ahuja, 2000; Schildt, Keil, & Maula, 2012; Vasudeva, Alexander, & Jones, 2015, etc.), Competitive skills (Hamel, 1991, etc.), Operational knowledge (Lui, 2009, etc.)
	Interlock partners	Acquisitions (Beckman & Haunschild, 2002; Haunschild & Beckman, 1998; Haunschild, 1993, etc.), Adoption of practices/tactics (Rao & Sivakumar, 1999, etc.), Foreign market experiences (Tuschke et al., 2014, etc.)

Given these findings, the hypotheses below concern which source of vicarious crises will generate greater learning spillover (hypothesis 1a) with less damage spillover (hypothesis 1b), and when this significant learning spillover with mitigated damage spillover will appear (hypothesis 2).

3. Hypothesis

3.1. More effective sources of vicarious learning

3.1.1. Learning spillover

The focal firm can carefully observe crises for local competitors through common information channels in the local media and government agencies (Madsen, 2009). This observation may lead to effective learning because firms may consider that the background of these crises has common institutional or geographical elements in an identical country (Kim & Miner, 2007). Despite these possibilities, this study predicts that the learning spillovers from crises for nonlocal alliance partners will be more significant and influential than those from crises for local competitors for the following three reasons.

First, an organizational crisis tends to arise from unfamiliar and unexpected causes (Pearson & Clair, 1998). To prevent these events, firms should notice even weak cues that may imply potential threats in their future (Rerup, 2009). To be sensitive to these weak cues, firms need ample nonlocal knowledge based on an explorative search because such nonlocal knowledge will allow firms to respond to any diverse crisis with which they are not familiar. Indeed, Haunschild and Sullivan (2002) found that in the US airline industry, prior heterogeneity in the backgrounds of airline accidents is better for organizational learning in terms of decreasing subsequent accident rates. Hence, a crisis for nonlocal alliance partners characterized by heterogeneity and nonlocal knowledge may generate more beneficial knowledge for preventing future crises. On the other hand, firms may presume that they are already familiar with the backgrounds of crises for local competitors, which may lead them to conduct only a scant search. This scant searching is considered to be a critical barrier to learning from organizational crises (Smith & Elliott, 2007).

Second, to access sufficient knowledge of vicarious crises and learn effectively from them, firms need close communication with the stricken firms (Smith & Elliott, 2007). This is because the learning process from a crisis is less likely to be documented or encoded owing to its high complexity, and may largely rely on tacit or implicit knowledge as opposed to explicit information. Compared with observation, direct frequent communications and embedded joint activities with the stricken firm will be more effective for accessing such tacit or implicit knowledge (Lei, Slocum Jr., & Pitts, 1997). For example, in the global airline industry, when an airline experiences a fatal accident, its international codesharing partners also attend the scene of the accident and participate in postaccident processes. This ongoing pattern allows airlines to access deep and implicit information and greater knowledge about their partner's disruptions, which facilitates their own learning from that vicarious crisis.

Third, after a crisis, the stricken firms develop new and improve preexisting routines to prevent future crises. These routines include implicit knowledge such as cultural aspects or values that may help greatly but are less transferrable (Argote, 2011). Through postcrisis joint activities with the stricken alliance partners, the focal firm can experience implicit learning outcomes, which may make a greater contribution to preventing a future crisis for the focal firm than observations of the stricken firms. Hence,

Hypothesis 1a. A prior crisis for nonlocal alliance partners reduces the likelihood of a future crisis for the focal firm more than local competitors' crises do.

3.1.2. Damage spillover

Although the learning literature views vicarious crises as effective catalysts of greater learning, they may cause damage to assessments of the firm and thus cause performance downfall. An organizational assessment can be shared beyond organizational boundaries within the same category of customer perceptions (Zuckerman, 1999). According to Wiesenfeld, Wurthmann, and Hambrick (2008), organizational failures trigger the sense-making processes of their stakeholders to attribute meaning to them based on their own cognitive frameworks. During these processes, the heuristic judgment of the stakeholders allows them to conclude that other firms perceived as being in the same category as the failed one are also culpable for similar failures in the future. As a result, a stigma is often assigned to members of the perceived category of the stricken firm, regardless of their innocence (Hudson & Okhuysen, 2009).

The mechanisms for the categorization and common assessment of customers are strongly related to the aforementioned mechanisms for achieving vicarious learning, because they are also based on interfirm similarity or social connections (Vergne & Wry, 2014). If a firm shares a certain core character or has a certain type of social connection with the stricken firm, stakeholders are likely to consider it to belong to the same category and to assess it similarly (Greve, Kim, & Teh, 2016). Barnett and King (2008) found that a major crisis caused by one firm harms cumulative abnormal returns of other similar firms. Knittel and Stango (2014) also showed that the market value of firms falls dramatically after any celebrities whom they have sponsored are involved in a scandal.

Given this background, damage spillovers from both the stricken local competitors and nonlocal alliance partners may be possible. Nevertheless, this study proposes that local competitors produce more significant and influential damage spillover than nonlocal alliance partners for the following reasons. The categories of nationality are highly legitimatized by customers. The nationality is the core organizational information for international businesses, as well as an inherent and permanent characteristic (Vergne & Wry, 2014). Hence, the category boundary formed by nationality is very clear and stable, and an assessment spillover by customers based on this particular classification is likely.

By contrast, boundedly rational customers are less likely to recognize such specific interfirm relationships, particularly the cross-border relationships found in international business. Indeed, in the global airline industry, when customers are informed of a fatal accident involving an airline, their most likely focus is the country of the airline involved, rather than its networking partners. Furthermore, because customers tend to perceive a firm primarily through outputs such as products or services rather than through inputs such as operational processes (Diestre & Rajagopalan, 2014), they are less likely to be familiar with the specific networking partners of the stricken firm. Even if customers notice the relationship between the focal firm and the stricken partner, they may consider the categories established by cooperation networks to be fragile and less legitimate. This is because such categories are artificial, so they may collapse if the cooperation relationships change. Therefore,

Hypothesis 1b. A prior crisis for local competitors leads to performance downfall of a focal firm more than nonlocal alliance partners' crises do.

These two hypotheses suggest that *a vicarious crisis for a nonlocal alliance partner is a more effective source of learning than one for a local competitor* because the learning spillovers from it are significant, but the damage spillovers are less so.

3.2. A more effective time point for vicarious learning

Prior studies on organizational learning have tested how cumulative organizational failures at time t–1 produce learning outcomes at time t,

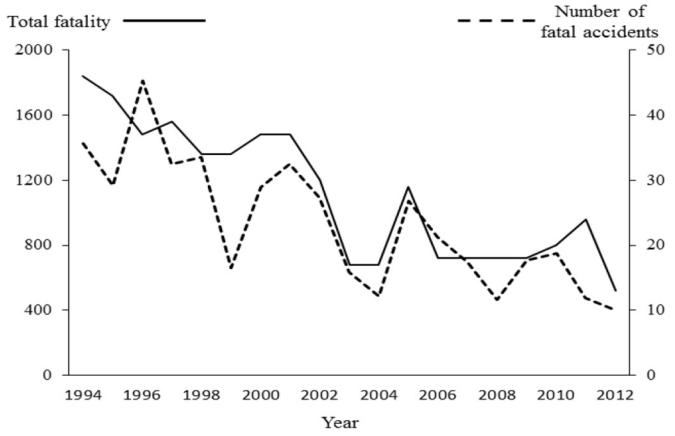

Fig. 1. Trends in fatal accidents in the global airline industry.

based on an assumption in empirical research that the influences of an event at time t–1 are significant at time t. However, for the learning from vicarious crises, such prompt learning is questionable. First, organizational crises tend to have highly complex causes, and their learning processes are characterized by high ambiguity (Rerup, 2009). This requires more time for firms to create, store, and routinize knowledge from such failures at the organizational level. Second, vicarious learning requires two-step learning processes: the first is learning by the stricken firm, and the second is a spillover of lessons to the focal firm. Thus, vicarious learning processes for the focal firm are likely to be suspended until the stricken firm learns from its complex failure. The transference per se will also be tardy because such knowledge cannot be easily encoded (Zander & Kogut, 1995).

By contrast, damaging assessment spillovers will be more compelling in the immediate aftermath but will weaken over time. This is because the customers are intuitors rather than evaluators, so their vicarious assessment process is very straightforward and does not require much time (Greve et al., 2016). Furthermore, the mass media, which are the major information source for customers, most actively publicize information shortly after the crisis, but become less active over time.

These arguments imply that effective learning from vicarious crisis cannot be achieved promptly because the learning benefits will appear after the damage spillovers have occurred, as in the following hypothesis.

Hypothesis 2. After a vicarious crisis for local competitors or nonlocal alliance partners, prompt prevention of a future crisis for the focal firm is unlikely, whereas rapid performance downfall is likely. That is, it takes time for the focal firm to achieve significant learning spillover from a vicarious crisis with the damage spillover mitigation.

4. Methodology

4.1. Empirical context

To define an organizational crisis empirically, this study used data from fatal events (accidents and incidents) of passenger airlines that occurred in the global airline industry from 1994 to 2012. Nonfatal events are excluded from consideration, according to Pearson and Clair's (1998) definition of an organizational crisis.

Two major reasons motivated the particular choice of this context. First, aircraft carriers are typical High Reliability Organizations (HROs), which are highly sensitive to any kind of failure because these may cause loss of human life. Ordinarily they seek to detect weak signals, train employees to look for anomalies, and empower them to respond appropriately when problems are discovered (Roberts & Bea, 2001). These conditions give the firms high motivation for and ability in vicarious learning, which is consistent with an assumption of this study. Second, because of its highly public nature, a fatal event in this context arouses broader social concerns across countries. Furthermore, customers of global airlines are not limited to a domestic area but are spread around the world. These conditions provide a favorable setting for tests on damage spillover in the international context.

To define nonlocal alliances, this study focused on codesharing alliances in the global airline industry. Codesharing is a type of alliance between two international airlines to operate routes jointly using one partner's flights to achieve operational efficiency (Gleave, 2007). Although global airlines form diverse types of nonlocal alliances, codesharing alliances are most appropriate for testing hypotheses. Because of joint operations between the codesharing partners, the partner's fatal accidents can directly threaten the focal firm's operations. This makes firms react sensitively to fatal accidents by their codesharing partners. Furthermore, because the major purpose of codesharing between global airlines is to connect routes where one airline does not fly, codesharing normally takes the form of nonlocal alliances, with very few exceptions.

4.2. Sample and data

The initial sample included all international scheduled passenger airlines. However, because of the limited accessibility of data on codesharing alliances, as well as demographic or financial information on global airlines, the final sample was limited to 72 major international scheduled airlines from 47 countries.

To define vicarious crises for these sample firms, I identified all fatal events in the industry during the sample period, regardless of cause. This is because global airlines are typical HROs, which are designed and trained to respond to any kind of unexpected failure (Roberts & Bea, 2001); hence, they should consider all fatal events to be critical crises from which they should learn. During the sample period, 606 fatal events were experienced by 472 airlines in 112 countries. Fig. 1 shows the trend in fatal accidents throughout the industry. The dotted line indicates the annual number of fatal accidents, and the bold line represents the total annual number of fatalities from these accidents. Of all these events, 276 fatal events for 221 airlines in 36 countries were identified as crises for local competitors, and 96 fatal events for 66 airlines in 43 countries were identified as crises for nonlocal alliance partners of the sample firms.

Accident data were collected from two sources: *Safety Review* issued by *Flight International* magazine and the *Aviation Safety Networks* website (https://aviation-safety.net/). The data on codesharing were mainly drawn from the *Alliance Survey* in the *Airline Business* magazine. *Air Transport World* and *IATA World Air Transport Statistics* were accessed to gather demographic data and financial information regarding these sample firms.

4.3. Measures

4.3.1. Dependent variables

Two dependent variables were used to test the proposed hypotheses. To test learning spillover of the focal firm (*subsequent crisis*), I counted the number of fatal accidents that the focal firm experienced at time t. To test damage spillover (*subsequent performance*), the load factors—the ratios of seat capacity reserved by passengers to the total aircraft capacity at time t—were used. Load factors indicate actual flight use by customers of the focal airline relative to planned flight use (Mitsuhashi & Min, 2016). Hence, this indicator effectively captures unexpected losses in customer demand for the focal firm. All independent and control variables were lagged one year from these dependent variables.

4.3.2. Independent variables

This study has two independent variables: *crises for local competitors*, which is defined as the number of fatal accidents by other firms of the

same nationality as the focal firm, and *crises for nonlocal alliance partners*, which is defined as the number of fatal accidents experienced by its cross-border codesharing alliance partners. A simple count of these vicarious fatal events would result in a wrong estimate because, as mentioned above, learning spillovers rely on the degree to which the two firms are similar (Baum & Ingram, 1998) or embedded with each other (Inkpen & Tsang, 2007). Hence, two kinds of weighting for each vicarious fatal accident were designed to reflect these arguments. The first kind, accident severity determined by the number of accident fatalities—designated *w*—is common to both independent variables and reflects the saliency of the event. The second kind is the individual weights for each independent variable. The interfirm similarity between the focal firm and a stricken local competitor, measured by the difference in firm age (*w1*), was weighted for crises for local competitors. The interfirm embeddedness between the focal firm and a stricken nonlocal alliance partner, measured by their alliance duration (*w2*), was weighted for crises for nonlocal alliance partners. The values of *w*, *w1*, and *w2* are skewed, so these weights were log-transformed. Reflecting these weights, each crisis for local competitors was calculated as $w \cdot \frac{1}{w1}$ and each crisis befalling cross-border alliance partners was calculated as $w \cdot w2$.

To test the influences of certain specific events, prior studies on organizational learning have used cumulative experiences of those events and considered their depreciation over time. To reflect these traditions of the literature (Haunschild & Sullivan, 2002), this study ran an analysis using: (1) only fatal accidents by other firms at time t–1, (2) a rolling window of the most recent fatal accidents by other firms over three or five years without depreciation weight, and (3) the same rolling window considering depreciation weights (i.e., 1, 2/3, and 1/3 for the previous three years, and 1, 4/10, 3/10, 2/10, and 1/10 for the previous five years). A five-year window without depreciation weight was then adopted because it showed the best model fit. Hence, to test hypotheses 1a and 1b, this study aggregated the numbers of vicarious crises in the previous five years.

Hypothesis 2 tests the time point effects for learning and damage spillovers from vicarious crises. To examine these effects, the accumulated vicarious crises over the previous five years were extended to those over six years with the following two time windows: t–1 to t–3 and t–4 to t–6. This study used these aggregated counts over multiple years, not a single year, to reflect the strong assumption in the learning literature that organizational learning is a function of an accumulation of organizational experiences (Levitt & March, 1988). As hypothesized, if the learning spillovers (damage spillovers) of the vicarious crises appear slowly (promptly), the effects of learning spillovers (damage spillovers) should be more significant in the latter (former) window than in the former (latter) window.

4.3.3. Control variables

To control influences at the industry or country level, I added two control variables. *Crises for irrelevant others*, which are neither local competitors nor nonlocal alliance partners of the focal firm, may affect the focal firm's crises and performance. Hence, I controlled for the number of crises befalling those other firms. Because airlines in countries having a large number of airlines have more potential sources for learning and damage spillovers, I entered the *total number of local competitors* by using the number of the firms listed under SIC code 4512 (Air transportation, scheduled) in the focal firm's country.

Control variables at the organizational level were also included to consider each airline's demographic characteristics, including *age* and *size of fleet* (number of aircraft) possessed by the airline. In the semi-structured interviews, it was mentioned that global airline consortiums provide their members with learning opportunities for safety and security skills; therefore, the analysis also included a dichotomous variable to indicate whether the airline has *consortium membership*, such as *Star Alliance*, *Skyteam*, or *Oneworld*. *Network centrality* in codesharing networks was included by calculating eigenvector centrality. This variable controls for not only different damage spillovers depending on organizational status, but also the total opportunities for network-based learning available to the focal firm. Because one's own failure experiences are also important for learning vicariously from others' failures (Madsen & Desai, 2010), the cumulative numbers of fatal (*own crises*) as well as nonfatal accidents (*own minor accidents*) that each focal firm experienced in the previous five years were included. Finally, the variable *crises for nonlocal firms in local area* was included by counting the number of fatal accidents by other nonlocal firms that occurred in the local area in the previous five years, because these cases may bias the analysis results for observation-based learning. All cumulative values about fatal accident in control variables were weighted by the number of fatalities in the aforementioned manner.

4.4. Model estimation

The first dependent variable—number of subsequent fatal accidents—is a zero-inflated count value. Therefore, a zero-inflated negative binomial model (ZINB) may generate a better estimation. To test the appropriateness of the ZINB model, I applied the Vuong test. The test results showed that the Vuong *Z*-score has a positive value, indicating that the ZINB model is more appropriate than the standard negative binomial model. The other dependent variable—subsequent load factors—is a value between zero and one. Hence, the estimation used a general linear model (GLM) with a logit link and a Bernoulli variance function, which is a generalized approach for fractional dependent variables (Adegbesan & Higgins, 2011). The data have a panel structure, so I ran all models with cluster-robust standard errors for the firms to control for correlation across firms over time.

One underlying assumption of this study is that the incidence of global airline accidents and airline performance are influenced by other airlines' prior accidents. That assumption may be questionable if each focal firm has the inherent geographical or political disadvantages of its country, or if unusual industry events such as the 9/11 terrorist attacks occur in the relevant year. Hence, I included year and country dummy variables in all models.

5. Analysis results

Table 2 shows the descriptive statistics for the major variables. The correlations between the variables are generally low, indicating that multicollinearity was not a problem in the analysis.

Table 3 shows the results of the regression based on the ZINB and the GLM to test the hypotheses. Models 1, 2, and 3 show the results for learning spillovers (i.e., the focal firm's subsequent crises), whereas models 4, 5, and 6 show the results for damage spillovers (i.e., the focal firm's subsequent performance). Models 1 and 4 include only the control variables. In these models, crises for irrelevant others increase the likelihood of the focal firm experiencing subsequent crises ($p < 0.01$) and decrease its performance ($p < 0.001$). Because this variable reflects the industrial climate for organizational crises, the former effect may result from confounding by external factors that cause crises in the industry, and the latter may reflect reduced customer demand caused by such crises. These models also show that the focal firms' prior crises reduce the incidence of subsequent crises ($p < 0.05$), but harm their performance ($p < 0.05$), which is consistent with conventional wisdom.

Models 2 and 5 include prior crises for local competitors and nonlocal alliance partners. According to these models, significant learning spillover is only likely from crises for nonlocal alliance partners ($p < 0.05$ in Model 2), and significant damage spillover only comes from crises for local competitors ($p < 0.05$ in Model 5). These results offer a clear comparison of the effects of these two forms of vicarious crises, supporting hypotheses 1a and 1b.

Models 3 and 6 indicate the results of the examinations of time-point effects to test hypothesis 2. These models show the influences of

Table 2
Descriptive statistics and correlations ($N = 1120$).

	Variables	Mean	SD	1	2	3	4	5	6	6	7	8	9	10	11
1	Subsequent crises	0.04	0.21												
2	Subsequent performance	0.72	0.06	−0.10											
3	Crises for irrelevant others	25.83	8.53	0.14	−0.43										
4	Total number of local competitors^{L}	1.57	1.11	0.01	0.24	−0.09									
5	Age	55.53	25.42	−0.04	0.16	−0.18	0.06								
6	Size of fleet	116.42	144.08	0.08	0.35	−0.09	0.63	0.17							
7	Consortium membership	0.42	0.49	−0.03	0.38	−0.35	0.14	0.26	0.34						
8	Network centrality	0.08	0.10	−0.02	0.14	−0.19	0.04	0.11	0.12	0.34					
9	Crises for nonlocal firms in local area	0.19	0.52	0.01	−0.05	0.13	0.10	0.01	0.12	−0.07	−0.10				
10	Own minor failures	1.70	2.00	0.10	0.05	0.14	0.35	0.06	0.48	0.07	0.04	0.13			
11	Own crises	0.69	1.91	0.07	−0.09	0.14	0.09	−0.05	0.26	−0.01	0.06	0.00	0.24		
12	Crises for local competitors	2.92	7.91	0.03	0.07	0.07	0.55	0.02	0.44	−0.06	−0.11	0.04	0.33	0.15	
13	Crisis for nonlocal alliance partners	7.37	9.75	−0.06	0.06	0.02	0.03	0.04	0.12	0.21	0.21	0.04	0.13	−0.01	−0.01

1. ^{L} indicates log-transformed values.
2. Estimates of dummy variables for *years* and *countries* were performed but are not shown because of space limitations.
3. Independent variables are weighted.

organizational crises occurring from time t–1 to t–3 and t–4 to t–6, respectively. According to these results, on the one hand, the aforementioned significant learning spillovers from crises for nonlocal alliance partners do not appear promptly, but require more time to appear (see Model 3). On the other hand, significant damage spillovers from crises for local competitors appear promptly, but disappear at subsequent time points (see Model 6). These results support hypothesis 2.

For further comparisons, the analyses included time-point effects for

Table 3
Analysis results for learning and damage spillovers.

Variables	Learning spillovers			Damage spillovers		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Year/country dummies	Included	Included	Included	Included	Included	Included
Crises for irrelevant others	0.093**	0.140**	0.111**	−0.018***	−0.015***	−0.018***
	(0.03)	(0.05)	(0.04)	(0.00)	(0.00)	(0.00)
Total number of local competitors^{L}	1.557	0.559	−0.385	0.044	0.047	0.048
	(1.17)	(0.56)	(2.66)	(0.04)	(0.04)	(0.04)
Age	−0.014	−0.018	−0.015	−4.E–04	−3.E–04	−3.E–04
	(0.01)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)
Size of fleet	0.006*	0.008	0.009***	5.E–04**	5.E–04**	5.E–04**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Consortium membership	0.114	0.090	0.431	0.062†	0.062†	0.049
	(0.58)	(0.61)	(0.80)	(0.03)	(0.03)	(0.03)
Network centrality	−0.418	0.321	−0.607	−0.225	−0.227†	−0.245
	(1.54)	(1.89)	(2.30)	(0.15)	(0.14)	(0.15)
Crises for nonlocal firms in local area*	−0.336	−0.332	−0.274	−0.013	−0.017	−0.022
	(0.46)	(0.38)	(0.59)	(0.03)	(0.02)	(0.02)
Own minor accidents*	0.031	0.049	0.067	0.004	0.002	0.004
	(0.07)	(0.08)	(0.11)	(0.01)	(0.01)	(0.01)
Own crises^{Z}*	−0.296*	−0.427*		−0.022*	−0.025*	
	(0.13)	(0.21)		(0.01)	(0.01)	
Own crises$_{t-1\ to\ t-3}^{Z}$			−0.445**			−0.021*
			(0.14)			(0.01)
Own crises$_{t-4\ to\ t-6}^{Z}$			−0.064			−0.013†
			(0.12)			(0.01)
Crises for local competitors^{Z}*		−0.102			−0.037*	
		(0.29)			(0.02)	
Crises for local competitors$_{t-1\ to\ t-3}^{Z}$			0.049			−0.028*
			(0.16)			(0.01)
Crises for local competitors$_{t-4\ to\ t-6}^{Z}$			0.053			−0.017
			(0.18)			(0.01)
Crises for nonlocal alliance partners^{Z}*		−0.582*			−0.001	
		(0.28)			(0.02)	
Crises for nonlocal alliance partners$_{t-1\ to\ t-3}^{Z}$			−0.038			0.004
			(0.24)			(0.01)
Crises for nonlocal alliance partners$_{t-4\ to\ t-6}^{Z}$			−2.194**			0.003
			(0.82)			(0.01)
Constant	−23.736***	−23.649***	−10.454***	1.434***	1.284***	1.417***
	(1.34)	(1.98)	(1.45)	(0.13)	(0.11)	(0.13)
Log pseudolikelihood	−122.72	−121.14	−93.09	−443.68	−443.65	−413.68
N	1120	1120	1048	1120	1120	1048

1. ^{L} and ^{Z} indicate log-transformed and standardized values, respectively.
2. * considered a five-year time lag in models 1, 2, 4, and 5, and a six-year time lag in models 3 and 6 for correct control of tests for hypothesis 2.
Standard errors are in parentheses; † $p < 0.1$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

the focal firm's direct crisis experiences. The results show that both direct learning and performance damage from a firm's own crises tend to appear promptly but weaken over time. The coefficients for the focal firm's direct crisis are smaller than those for vicarious effects. However, when I reran the regressions after removing the weights for each variable, the direct effects were greater than the indirect effects by a factor of 3.06 for learning spillovers and 2.85 for damage spillovers.

The results of these analyses suggest that firms can achieve significant learning spillover by mitigating damage spillover when they collaborate with nonlocal firms that have experienced organizational crises in the past. Such nonlocal alliance partners would have introduced useful training courses, crisis management policies, and organizational cultures to prevent future crises. Through collaborations with other such firms, firms can benchmark management practices and experience the cultures that could prevent future crises. These collaborations will not lead to significant damage spillover because their customers are less likely to place firms in the same category as their stricken nonlocal alliance partners.

The robustness of these results was checked in several ways, as follows. First, to test learning spillovers, I reran the regressions by applying a zero-inflated Poisson model instead of the ZINB model. Second, to test damage spillovers, I employed the generalized estimating equation instead of the GLM because it is a generalization of the GLM and effective for controlling for repeated measures data. The results of these analyses reproduced those shown in Table 3, proving the robustness of the results shown above.

To gain more insight into the analysis results, I conducted the following additional tests. Although HROs have a strong motivation for learning from vicarious crises regardless of their cause, customers may react differently to fatal events, depending on their cause. Hence, I decomposed the vicarious crises into those caused by security (i.e., hijackings and criminal incidents) and safety problems, and reran the regressions. The results were inconsistent with the original analyses. First, all the results for learning spillover based on this decomposition were insignificant. This may imply that firms learn (or do not learn) from vicarious crises regardless of whether the crises are caused by security or safety problems. Second, the focal firms' performance is not influenced by crises for nonlocal alliance partners regardless of whether they are caused by security or safety factors; however, their performance significantly decreases with crises for local competitors caused by safety problems, but increases with those caused by security problems. These results may indicate that the stigma of local competitors' crises mainly results from safety issues, and that a local competitor's security crisis may give the focal firm unexpected opportunities to take its market share.

6. Discussion

The findings of the present study contribute to the previous literature in multiple ways. First, to suggest effective ways for learning from vicarious crises, this study examined the conditions that lead to significant learning spillovers with reduced or no damage spillover. This approach has rarely been applied in prior studies, but should be important for the organizational crises that accompany huge damage spillovers. In addition, the two mechanisms for vicarious learning—namely observation- and network-based learning—have developed separately over a long period in population ecology and network embeddedness, and far too little research has attempted to synthesize these two mechanisms. Hence, this study suggests a different perspective to test effective learning from vicarious crises, based on a comprehensive discussion of mechanisms for vicarious learning.

Second, it is notable that this study focuses on the time consumed by organizational learning from failures. One puzzle in the literature on organizational learning that remains unsolved is why firms cannot learn from prior failures. Although some previous studies have viewed the time depreciation of learning outcomes as a disturber of learning from failures (e.g., Madsen, 2009), few have focused on the time consumed by learning. The results of this study imply that the time spent learning from failures may vary, depending on the characteristics of the failures or the way of learning. This will open up the future study of time-consumption effects in learning from failures.

Third, the results of this study show that vicarious learning in an international context may be different from that in a domestic area. While some prior studies, using the context of domestic industries, have shown significant crisis prevention effects from a local competitor's crisis (e.g., Kim & Miner, 2007), the results of the present study find their effects to be insignificant. This may imply that vicarious learning from organizational crises in international contexts occurs through limited mechanisms such as network-based learning or the acquisition of nonlocal knowledge. These implications extend the emerging studies on crisis management in international business.

Finally, the conventional wisdom in category studies is that a negative event in other relevant firms harms the focal firm's performance because of the damaged assessment spillover. Against this argument, the results of this study suggest that a crisis for a cross-border alliance partner has insignificant effects on a focal firm's performance. Two possible effects may offset damage spillovers and lead to these results. First, some customers may simply switch from the stricken alliance partner to the focal firm after the partner's crisis because of weak categorization of these firms. Second, the alliance partner's crisis may facilitate proactive responses from the focal firm, which may prevent the performance downfall of the focal firm. Although these results run counter to some prior findings, they provide critical implications for category studies by showing high complexity in the categorization influences that the prior studies may have neglected.

In addition to these theoretical contributions, the findings of the present study offer some practical implications for organizational managers. First, although managers can easily observe the crises that have occurred in their local areas, they should notice that such observation does not necessarily mean that they will learn from these crises. Furthermore, because local competitors' crises can harm their performance immediately, managers should respond to these local firms' crises, not merely spectate. Second, firms may consider terminating their alliances with the stricken partner because of concerns about spillover of a damaging reputation (Yu, Sengul, & Lester, 2008). However, based on the findings of this study, a partners' crisis should be recognized more as a learning opportunity than a reputational threat. If managers terminate such alliances, they may miss forthcoming learning benefits from the stricken alliance partner.

It should be noted that the present study has several limitations. First, with a single type of organization (i.e., HROs) and tests of the hypotheses used only in a single industry (i.e., the global airline industry), the findings may be applicable only to limited areas. For example, this study excluded crises for local alliance partners as a source of vicarious learning. This exclusion may not be detrimental to the results in the context of global airline industry because forming code-sharing alliances with other local international airlines is rare. However, in some international industries, firms may actively and extensively cooperate with local alliance partners to compete with their common nonlocal rivals. Future studies should seek to replicate the findings of this study in different contexts.

Second, although this study assumed that firms cannot learn significantly from the vicarious crises for nonlocal competitors, there may be exceptional cases. For example, crises for nonlocal competitors with high status in the industry may have significant spillover influences on the entire industry, including the focal firm. Future research will be beneficial if it explores the types of potential vicarious crises that may lead to significant learning by the focal firm from these crises for nonlocal competitors.

Third, because this study relied to a large degree on quantitative analysis, it provides only a limited reflection of less observable factors such as organizational culture (Lei et al., 1997), despite its importance.

Additional work based on a balanced methodology is needed in future research.

Nevertheless, I believe that the findings of this study contribute to the literature on organizational learning and crises by showing how organizations can benefit or suffer from others' crises in terms of learning and damage spillovers.

Declarations of interest

None.

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