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Impact of Data Breach on IT Investment: Moderating Role of Buyer-supplier Relationship

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1. INTRODUCTION AND RESEARCH QUESTIONS

Data security issues may occur during the process of digitalization, causing economic and reputation losses that can even threaten firms' survival. According to failure learning theory, the data breach event sends a signal to firms that their IT capabilities need improvement to deal with data security threats. Although IT investment improves firms' IT capabilities, new IT implementation may increase data workload and data security risks. Firms may be more risk-averse after data breaches and prefer a more conservative IT investment approach, such as adopting a tight IT investment budget. The relationship between data breach and IT investment has not been explored. A firm's IT investment behavior after data breaches may be affected by its position in the supply chain. Compared with principal customers, dependent suppliers are upstream in a supply chain relationship and are less affected by financial constraints and pressures from stakeholders. Firms playing the role of dependent suppliers in a buyer-supplier relationship will increase their IT investments to ensure data security after data breaches. The study empirically analyzes the relationship between data breaches and IT investment and examines the moderating effects of the buyer-supplier relationship based on failure learning theory.

2. THEORY AND RESEARCH FRAMEWORK

Drawing on the failure learning theory, firms will conduct a comprehensive analysis of their own IT assets, threats, and vulnerabilities after suffering from data breach events. When firms find that the causes for IT failure are the defective or back-ward IT framework, firms will make decisions to improve the present situation, e.g., updating the security management process and IT architecture. Data breach reflects the potential weaknesses of a firm's IT. In this case, firms may invest more resources to fix the IT loopholes, enhance the stability of information systems, and prevent data breach problems that may occur in the future. Hence, we hypothesize: data breaches will increase a firm's IT investments.

A firm’s position in the supply chain network (i.e., principal customer or dependent supplier) may moderate the relationship between data breaches and IT investments. According to failure learning theory, a firm’s behavior after IT failures is affected by the firm’s sensitivity to data breaches (opportunity to learn) and the resources needed to solve the failures (ability to learn). When a firm plays the role of principal customer in the buyer-supplier relationship, it is in a dominant position and has stronger bargaining power compared with its buyer. The higher the level of dependence the firm has on its customers, the more resources the firm has to invest in the supply chain relationship. In this case, the firm has a high level of financial constraints. When firms have financial constraints, they may not have enough available resources to fix existing data deficiencies after experiencing a data breach event. Therefore, we propose the following research hypothesis: H2a: When a firm is a dependent supplier in the buyer-supplier relationship, the positive impact of data breaches on the firm's IT investment is weakened. Firms playing a role as principal customers in a buyer-supplier relationship have fewer financial constraints. These firms can ask their suppliers to take on the operational costs through using market power and thus have enough investments for their data security management. In addition, firms playing a role as principal customers directly face end consumers, who are highly concerned about IT security and privacy. Firms as principal customers are more likely to increase their IT investments after a data breach event. Thus, we put forward the below research hypothesis: H2b：

When a firm is a principal customer in the buyer-supplier relationship, the positive effect of data breaches on firm's IT investment is strengthened.

We collected firms' financial information from the Compustat database and data breach information from the PRC and ITRC databases. We obtained information on firms' IT investments from the CI-Tech database and supplemented missing data by searching firms' websites and other sources. In total, we obtained 13,068 firm-year observations, including 938 data breaches and 512 different firms, with 179 firms experiencing multiple data breaches from 2009 to 2016.

3. RESULTS AND MAJOR FINDINGS

This study observed some valuable and interesting findings: (1) firms increase their IT investments after a data breach event. (2) The positive influence of data breach on IT investment is weakened for firms playing the role of dependent suppliers. (3) When a firm is a principal customer, the positive influence of data breach on IT in-vestment is strengthened.

Table 1. Impact of data breach on IT investment

	Dependent variable：IT Investment			
	Model 1	Model 2	Model 3	Model 4
Data breach	0.321***	0.219***	0.365***	0.263***
	[0.069]	[0.081]	[0.079]	[0.092]
Data breach × Principal customer		0.222**		0.216**
		[0.102]		[0.103]
Data breach × Dependent supplier			-0.214*	-0.202*
			[0.121]	[0.121]
Principal customer	-0.053	-0.075*	-0.054	-0.075*
	[0.039]	[0.040]	[0.039]	[0.040]
Dependent supplier	0.056	0.056	0.066*	0.065*
	[0.040]	[0.040]	[0.040]	[0.040]
Controls	Included	Included	Included	Included
Firm fixed	Included	Included	Included	Included
Year fixed	Included	Included	Included	Included
Observations	11039	11039	11039	11039
Adj R^2	0.460	0.460	0.460	0.460

4. CONTRIBUTIONS

Our findings contribute significantly to the literature on failure learning and supply chain management. We explore the impact of data breaches on IT investment based on failure learning theory, with data breaches being a typical IT failure in the firm's digitalization process. Our findings confirm that failure learning can improve firms' operations. This study also adds boundary conditions for failure learning. We prove that a firm's failure learning process is affected by the buyer-supplier relationship.

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