

Supplier Concentration and Financial Performance: The Moderating Role of IT-enabled Absorptive Capacity

Completed Research Paper

Meng Chen

Xinlin Tang

Hefu Liu

Jibao Gu

Abstract

Previous studies provide mixed insights on the relationship between supplier concentration and financial performance. To reconcile the conflicting perspectives, this study draws upon social capital theory and absorptive capacity literature to propose that IT-enabled absorptive capacity moderates the influence of supplier concentration on firm financial performance. Specifically, we distinguish IT-enabled potential absorptive capacity from IT-enabled realized absorptive capacity and examine their differential effects in moderating the supplier concentration-financial performance relationship. Using data collected from 908 manufacturing firms in two rounds, this study reveals that IT-enabled potential absorptive capacity positively moderates the supplier concentration-financial performance relationship whereas IT-enabled realized absorptive capacity negatively moderates the relationship. Theoretical contributions and managerial implications of the study are discussed.

Keywords: supplier concentration, IT-enabled absorptive capacity, social capital theory, financial performance

Introduction

As modern supply chain practices, such as supply base optimization, strategic partnerships, and long-term contracts, are extensively utilized, there has been a growing trend for firms to purchase more products from a selected small group of suppliers (Choi and Krause 2006; Sako et al. 2016; Wagner and Bode 2006), resulting in higher concentration of their supplier base (Sako et al. 2016; Wagner and Bode 2006). However, existing literature provides conflicting insights on the performance impact of supplier concentration (Moeen et al. 2013; Steven et al. 2014; Tang and Rai 2012; Wagner and Bode 2006). Some highlight the benefits of increased supplier concentration in cooperation and knowledge sharing on firm competitive advantage and performance (Tang and Rai 2012). Conversely, others suggest that increased supplier concentration may be associated with redundant and homogeneous knowledge which damages firm performance (Moeen et al. 2013; Wagner and Bode 2006). These

mixed arguments call for a fine-grained approach to reconcile the differences and explore contingencies that may shape the effect of supplier concentration on firm performance. In particular, information technology (IT) is widely recognized as playing a significant role in reaping benefits from suppliers (Liu et al. 2016; Rai and Tang 2014). IT enables the acquisition, assimilation, transformation, and exploitation of knowledge in the form of IT-enabled absorptive capacity (IT-AC) (Cui et al. 2018; Joshi et al. 2010; Liu et al. 2018). IT-AC can not only acquire and assimilate knowledge from suppliers but also complement knowledge derived from suppliers with novel knowledge from other sources (Tippins and Sohi 2003). Therefore, IT-AC may play a potential moderating role to leverage supplier concentration efficiently. Although the concept of IT-AC has been widely used in information system (IS) studies, theoretical and empirical research on how IT-AC influences the performance effects of supplier concentration remains scarce.

Additionally, previous literature suggests that absorptive capacity has different aspects that may impose differential influences on leveraging external knowledge (Jansen et al. 2005; Srivastava et al. 2015). Specifically, Srivastava et al. (2015, p. 347) suggested that “Failure to recognize differing aspects of absorptive capacity and their unique roles could lead to theoretical misspecifications and to empirical inconsistencies.” Therefore, we follow the literature on the absorptive capacity to decompose IT-AC into IT-enabled potential absorptive capacity (IT-PAC) and IT-enabled realized absorptive capacity (IT-RAC) (Joshi et al. 2010). While IT-PAC, which refers to a firm’s capability to employ IT-based resources in building knowledge acquisition and assimilation capability (Cui et al. 2018; Joshi et al. 2010), often includes knowledge management across organizational boundaries, IT-RAC, defined as a firm’s capability to employ IT-based resources in building knowledge transformation and exploitation capability (Cui et al. 2018; Joshi et al. 2010), are mainly internal focused (Yeoh 2009; Zahra and George 2002). The outward-oriented nature of IT-PAC enables firms to identify and evaluate suppliers’ knowledge and select the relevant knowledge for acquisition and assimilation (Jansen et al. 2005). In contrast, the inward-oriented nature of IT-RAC serves to constrain firms to internalize suppliers’ knowledge, which reduces the realization of the value of external knowledge (Gao et al. 2008; Jansen et al. 2005). In light of these significant differences, we empirically examine how IT-PAC and IT-RAC differentially moderate the relationship between supplier concentration and financial performance.

Drawing upon social capital theory (Davidsson and Honig 2003), we argue that IT-AC will moderate the impact of supplier concentration on financial performance. We posit that supplier concentration is a critical social capital that brings information benefits. Therefore, we hypothesize a positive link between supplier concentration and financial performance. We further propose that whether and how well the knowledge derived from suppliers is translated into financial performance depends on the firm’s IT-AC. Specifically, we hypothesize that IT-PAC positively moderates the supplier concentration-financial performance relationship whereas IT-RAC negatively moderates the relationship. We test the hypotheses with data collected from 908 manufacturing firms *in two rounds* in China. The empirical results provide support to our hypotheses of the moderating roles of IT-PAC and IT-RAC. Our theorizing and findings provide potential explanations for the mixed arguments in previous research on the performance impacts of supplier concentration. Furthermore, our results provide practical guidance on how managers can manipulate IT-ACAP to derive value from their suppliers.

Theoretical Background and Hypotheses Development

Social capital refers to “the ability of actors to extract benefits from their social structures, networks, and memberships” (Davidsson and Honig 2003, p. 307). Previous research suggests that social capital is a powerful predictor of firm performance because it brings information and solidarity benefits and encourages collaboration and knowledge sharing (Chen et al. 2018; Lawson et al. 2008). Social capital theory has been used widely to investigate questions related to firm actions and performance (Chen et al. 2018; Horn et al. 2014; Hughes and Perrons 2011). For example, Lawson et al. (2008) find that social capital is positively associated with firm performance improvements. Wu (2008) find that social capital can contribute to information sharing and thus enhances competitiveness improvement.

According to social capital theory, we suggest that concentrated relationships with major suppliers are social capital for the firm (Hughes and Perrons 2011; Schwieterman et al. 2018b). Supplier concentration captures the number and relative importance of major suppliers in a firm's supply base (Tang and Rai 2012). Supplier concentration reflects the processes in which firms interact, exchange information, and build relationships with suppliers based on interdependencies and exchanges (Sako et al. 2016; Tang and Rai 2012). A concentrated supplier base facilitates closer and mutually beneficial social interactions as well as intense communication with major suppliers (Moeen et al. 2013).

Supplier Concentration

Recent literature has recognized the importance of supplier concentration on economic actions and outcomes (Kim and Davis 2016; Sako et al. 2016; Tang and Rai 2012). Steven et al. (2014) study the role of supplier concentration in product recalls and find that outsourcing to a smaller supply reduces recalls at a low level of outsourcing. Kim and Davis (2016) explore the impact of supplier concentration on supply chain sustainability and find that supplier concentration reduces the likelihood to declare products conflict-free. Casalin et al. (2017) examine the impact of supplier concentration on inventory holdings and find that supplier concentration helps reduce a firm's inventory holdings. Schwieterman et al. (2018a) explore the influence of supplier concentration on credit risks and find that supplier concentration is not significantly related to credit rating. Tang and Rai (2012) examine and find the significant moderating effect of supplier concentration on the relationship between supplier-facing processes capabilities and competitive performance. While extant empirical studies on supplier concentration indicate the potential performance impact of supplier concentration, empirical studies that directly examine the performance impact of supplier concentration remain scant.

Extant literature also provides mixed perspectives on the performance impact of supplier concentration (Moeen et al. 2013; Tang and Rai 2012). Some scholars suggest that increased supplier concentration can improve cooperation and knowledge sharing and thus contributes to firm performance (Tang and Rai 2012). Conversely, others argue that increased supplier concentration may lead to redundant and homogeneous knowledge, which damages firm performance (Moeen et al. 2013; Wagner and Bode 2006). These mixed perspectives call for empirical examination on the effect of supplier concentration on firm performance.

Supplier Concentration and Financial Performance

Grounded on social capital theory, we propose that increased supplier concentration facilitates financial performance. First, increased supplier concentration enables firms to work closely with a few selected suppliers, which facilitate communication and the exchange of high-quality contextual knowledge (Tang and Rai 2012). Firms and their suppliers can have a better understanding of each other's capabilities and develop mutually adapted the inter-connected processes (Rai and Tang 2010). Such knowledge and understanding help the firm develop production plans, reduce production costs and improve product quality (Wong et al. 2011), which increase revenues while reducing costs. Second, a concentrated supply base facilitates firm profitability through the sharing of proprietary and implementable knowledge components from suppliers (Gao et al. 2015). Working closely with a small group of suppliers cultivates trust and mutual commitment (Tang and Rai 2012), which facilitate the transfer of technology and knowledge (Cuervo-Cazurra and Anrique Un 2010). In this vein, firms can access valuable knowledge to improve product and process innovation (Trantopoulos et al. 2017; Zhou and Wu 2010) and thus maximize efficiencies in costs and revenues, which finally increases financial performance. Thus, we posit that increased supplier concentration contributes to a firm's financial performance.

H1: Supplier concentration is positively related to financial performance.

Moderating role of IT-AC

Social capital theory highlights the importance of complementary capabilities (Adler and Kwon 2002). Adler and Kwon (2002) pointed out that while a firm's own capability is not constitutive of its social capital, such capability can become a critical complement to obtain value from social capital. Firms, therefore, need to develop relevant capabilities to amplify the benefits of social capital. Following this logic line, we propose IT-AC to be the complementary ability that moderates the relationship between supplier concentration and financial performance.

The literature on absorptive capacity (Zahra and George 2002) identifies two aspects of IT-AC: IT-PAC and IT-RAC. IT that supports acquisition and assimilation of external knowledge provides IT-PAC, whereas IT that supports knowledge transformation and exploitation provides IT-RAC (Joshi et al. 2010). Joshi et al. (2010) suggested that IT-PAC and IT-RAC are two inter-related but distinct aspects that are required to create and utilize knowledge. IT-PAC focuses on knowledge acquisition and assimilation from external sources (Joshi et al. 2010). Firms with strong IT-PAC are more likely to recognize the value of external knowledge and efficiently acquire and assimilate external knowledge to create value (Cui et al. 2018). On the other hand, IT-RAC indicates a firm's capability to leverage IT to transform and exploit the existing and newly assimilated knowledge (Joshi et al. 2010). IT-RAC enables firms to efficiently apply their own knowledge to improve performance (Cui et al. 2018). By overly focusing on internal knowledge management, a firm with superior IT-RAC is likely to fall into a familiarity trap (Ahuja and Lampert 2001; Jansen et al. 2005). Thus, a firm may ignore the knowledge obtained from other sources (Srivastava et al. 2015; Zhou and Wu 2010). Consequently, we propose IT-PAC and IT-RAC differently moderate the effect of supplier concentration on financial performance.

We posit that IT-PAC could further enhance the positive effect of supplier concentration on financial performance. IT-PAC enables firms to acquire and assimilate knowledge from diverse fields (Cui et al. 2018). For instance, retrieval technologies such as query software and search engines enable firms to identify, collect and extract knowledge from diverse external knowledge sources (Joshi et al. 2010). Databases and data warehouses strengthen knowledge assimilation by supporting the integration of knowledge into organizational memory (Trantopoulos et al. 2017). IT-PAC enhances firms' understanding of knowledge accessed from a concentrated supplier base, which thus improves financial performance. Additionally, IT-PAC helps expand the scope of information search beyond the existing supply base (Joshi et al. 2010) and brings additional new heterogeneous knowledge from customers, universities, and competitors. The infusion of new knowledge helps deepen understanding of the acquired knowledge from suppliers and generate novel solutions and make decisions with complete understanding. For example, firms can identify not only the contextual knowledge or proprietary technical knowledge from suppliers but also knowledge of market and technology trends to re-range production plan and facilitate product innovation. Firms are likely to improve their financial performance by achieving cost efficiency and increasing revenue through innovation. These arguments support a positive moderating effect of IT-PAC on the relationship between supplier concentration and financial performance. Formally,

H2: IT-PAC positively moderates the relationship between supplier concentration and financial performance.

In contrast to IT-PAC, we suggest that IT-RAC may impose a negative effect on the performance impact of supplier concentration. IT-RAC encourages the transformation and exploitation of existing and newly assimilated knowledge (Cui et al. 2018; Joshi et al. 2010). For instance, business intelligence tools enable the transformation of existing data and knowledge into new insights and understandings (Saldanha et al. 2017). Decision support systems (e.g., expert systems) allows exploiting knowledge embedded in IT systems even without fully understanding (Joshi et al. 2010). However, IT-RAC limits a firm's motivation to reach out and acquire new knowledge because of the familiarity trap (Ahuja and Lampert 2001). Previous literature suggests familiarity trap results from the refining and improving existing knowledge and precludes a firm from exploring new knowledge (Ahuja and Lampert 2001). The more established and proven is the knowledge supported by IT-RAC, the more internal resistance a firm will face in leveraging new knowledge (Srivastava et al. 2015;

Zhou and Wu 2010). IT-RAC, therefore, is likely to make a firm inward-oriented and cause firms to become blind to the changing environment (Cohen and Levinthal 1990). The familiarity trap caused by IT-RAC reduces the likelihood of a firm to transform and incorporate new knowledge obtained from suppliers into its existing knowledge body, thus limits the value that can be generated from a concentrated supplier base. Even though supplier concentration provides firms with contextual knowledge and proprietary technical knowledge, the attractiveness of such deep knowledge from suppliers would decrease as IT-RAC would support the efficient use of existing knowledge (Srivastava et al. 2015). In this vein, IT-RAC would limit firms to utilize the deep knowledge from suppliers to improve operational efficiency and innovativeness required to achieve high financial performance. Accordingly,

H3: IT-RAC negatively moderates the relationship between supplier concentration and financial performance.

Research Method

Sampling

To test the hypotheses, data were collected from firms in China's Yangtze River delta area. This area is one of the most active and mature in China. We collaborated with a local government institution that is responsible for industry development and informationization to collect data. A survey instrument was developed jointly with the institution to gain a comprehensive understanding of firm operations in the delta area, which can be used to provide a reference for governmental policy-making. The institution obtained a sample of 1200 firms from the local government. These firms meet either of the characteristics of "specialization, elaboration, differentiation, and innovation". Data were collected in two rounds. In the first round, which was in March 2017, data were collected on firm operations of the year 2016, including IT usage, IT investment, supply chain management practices, R&D investment and other financial data. 1167 firms responded to the survey. One year later, financial data of the year 2017 were collected. The institution obtained a sample of 1700 firms from the government. This sample includes additional 500 firms that are selected as "specialization, elaboration, differentiation, and innovation" firms in the year 2017. 1668 firms participated in the second round of data collection. We then manually collected the information on firms' founding year and industry classifications from Qixinbao (<http://www.qixin.com>), which provides detailed business registry information. After merging the three data sets and dropping observations with missing data, we obtained a sample of 908 firms. Table 1 summarizes the industry distribution, total assets, and firm age of our sampled firms.

Table 1. Profile of Sample (908 firms)

Industry code and name	N	Percent (%)	Industry code and name	N	Percent (%)
Consumer Products (C13-C15, C17-24)	196	21.59	Machinery (C34-C37)	259	28.52
Petroleum and Chemical (C25-C29)	179	19.71	Electronics (C38-C39)	157	17.29
Mineral (C30-C33)	100	11.01	Others (C40, C42)	17	1.87
Total assets (One thousand RMB)	N	Percent (%)	Firm age (year)	N	Percent (%)
<50,000	205	22.58	< 5	31	3.41
50,000-100,000	228	25.11	5-9	305	33.59
100,000-200,000	227	25.00	10-24	549	60.46
>=200,000	248	27.31	>=25	23	2.53

Note: Chinese two-digit industry codes (GB/T 4754—2011)

Measures

Financial performance. We used return on assets (ROA) calculated as earnings before interest and taxes divided by the average total assets, to measure financial performance. ROA is a standard accounting measure of financial performance, which focuses on overall performance (Karahanna and Preston 2013). ROA is also more stable than sales growth and return on sales in measuring financial performance owing to the influence of managers' short-run activities and the environmental uncertainty in emerging economies (Xie et al. 2016). In our research, financial performance is lagged one year relative to the independent variables.

Supplier concentration. Supplier concentration reflects the number and relative importance of major suppliers in a firm's supply base (Steven et al. 2014; Tang and Rai 2012). We followed prior research (Tang and Rai 2012) and employed Herfindahl index to operationalize supplier concentration as the ratio of firm i 's purchase across its top four suppliers in the year 2016, as described below:

$$SC_i = \sum_{j=1}^J (\text{Purchase}_{ij})^2,$$

where Purchase_{ij} is the ratio of firm i 's purchases from each supplier j ($J \leq 4$) to its total purchases.

IT-PAC and IT-RAC. IT-PAC refers to a firm's ability to implement IT-based resources to acquire and assimilate external knowledge (Cui et al. 2018; Joshi et al. 2010). To build the IT-PAC variable, we adapted measurements of Joshi et al. (2010) and focused on the response in the survey (yes/no) about the deployment of systems for (1) data reading technology (e.g., query software, search engines, and expert finder), (2) databases (e.g., database, repository, and data warehouses), (3) document management systems (e.g., asset management systems and content management systems), and (4) enterprise applications (e.g., enterprise resource planning, customer relationship management system, and supplier management system). IT-PAC is then operationalized as a variable that summarizes the four IT applications by adding the four binaries for data reading technology, databases, document management systems, and enterprise applications (Joshi et al. 2010; Saldanha et al. 2017; Trantopoulos et al. 2017).

IT-RAC refers to a firm's ability to implement IT-based resources to transform and exploit knowledge (Cui et al. 2018; Joshi et al. 2010). We adapted measurements of Joshi et al. (2010) and focused on the response (yes/no) about the deployment of the systems for (1) business analytics (e.g., analytical software developed by FineBI, SAP and IBM), (2) data mining (e.g., text and semantic analysis), and (3) decision support system (e.g., case-based reasoning and expert systems). IT-RAC is then operationalized as a variable that summarizes the three IT applications by adding the three binaries for business analytics, data mining, and decision support system (Joshi et al. 2010; Saldanha et al. 2017; Trantopoulos et al. 2017).

Control variables. We controlled for variables that might influence financial performance, including *firm size*, operationalized as the natural logarithm of total assets; *firm age*, measured by the natural logarithm of the number of years from the founding year to the year 2016; *operating margins*, measured by total profits divided by total sales; *IT intensity*, measured by IT expenditures scaled by total assets; and *R&D intensity*, measured by R&D expenditures scaled by total assets. Finally, we controlled for industry effects at the two-digit industry level.

Analysis and Results

Model Specification

To estimate the effect of supplier concentration on financial performance and the moderating effects of IT-PAC and IT-RAC on the supplier concentration-financial performance relationship, we employed the hierarchical regressions and moderated hierarchical regressions. The following is the model,

$$FP_{2017} = \beta_0 + \beta_1 SC + \beta_2 IT-PAC + \beta_3 IT-RAC + \beta_4 SC \times IT-PAC + \beta_5 SC \times IT-RAC + \beta_6 Size + \beta_7 Age + \beta_8 OM + \beta_9 ITI + \beta_{10} RD + \text{Industry Effects} + \varepsilon,$$

where FP is financial performance of the year 2017, SC is supplier concentration, IT-PAC is IT-enabled potential absorptive capacity, IT-RAC is IT-enabled realized absorptive capacity, Size is firm size, Age is firm age, OM is operating margin, ITI is IT intensity, and RD is R&D intensity. Additionally, we used robust standard errors to correct for heteroscedasticity.

Results

Table 3 shows the descriptive statistics and correlations for the variables. The variance inflation factor (VIF) test show that the VIF values range from 1.04 to 1.18 with an average of 1.12, which indicates that multicollinearity is not a serious concern in our regression analysis (Hair et al. 2010).

Table 3. Descriptive Statistics and Correlations

	Variables	Mean	S.D.	Min	Max	1	2	3	4
1	Financial performance	0.106	0.123	-0.122	1.021	1.000			
2	Supplier concentration	0.165	0.141	0.000	0.775	-0.050	1.000		
3	IT-PAC	2.350	1.735	0.000	4.000	-0.014	-0.079*	1.000	
4	IT-RAC	0.629	0.969	0.000	3.000	-0.029	-0.028	0.509***	1.000
5	Firm size	11.63	1.042	8.703	14.84	-0.119***	-0.105**	0.093**	0.046
6	Firm age	2.362	0.449	1.099	4.159	-0.052	-0.090**	-0.005	-0.052
7	Operating margins	0.045	0.136	-2.327	0.604	0.309***	-0.071*	-0.003	0.040
8	IT intensity	0.004	0.0120	0.000	0.181	0.067*	-0.020	0.013	0.084*
9	R&D intensity	0.042	0.0450	0.000	0.371	0.089**	0.003	0.024	0.058

Table 3. continued

	Variables	5	6	7	8	9
5	Firm size	1.000				
6	Firm age	0.146***	1.000			
7	Operating margins	0.056	-0.001	1.000		
8	IT intensity	-0.106**	0.061	0.022	1.000	
9	R&D intensity	-0.285***	0.055	-0.005	0.282***	1.000

Note: N = 908, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 presents the results of our regression estimates. Model 1 is the baseline model with the control variables. Firm size is negatively related to financial performance ($\beta = -0.013$, s.e. = 0.005, $p = 0.005$) and operating margins is positively related to financial performance ($\beta = 0.286$, s.e. = 0.085, $p = 0.001$). Other variables are not significantly related to financial performance. Model 2 examines the direct effect of supplier concentration on financial performance, which tests H1. The results show that supplier concentration is not significantly related to financial performance ($\beta = -0.030$, s.e. = 0.029, $p = 0.295$), which refusing H1. This suggests that supplier concentration may not directly influence financial performance. Model 3 included supplier concentration, IT-PAC, and IT-RAC. None of supplier concentration ($\beta = -0.030$, s.e. = 0.029, $p = 0.316$), IT-PAC ($\beta = 0.002$, s.e. = 0.003, $p = 0.439$) or IT-RAC ($\beta = -0.008$, s.e. = 0.005, $p = 0.093$) are significantly related to financial performance. Model 4 tests the moderating effects of IT-PAC and IT-RAC hypothesized in H2 and H3. The results show that the interaction term of supplier concentration and IT-PAC is positively related to financial performance ($\beta = 0.054$, s.e. = 0.020, $p = 0.008$), thus supporting H2. The interaction term of supplier concentration and IT-RAC is negatively related to financial performance ($\beta = -0.079$, s.e. = 0.035, $p = 0.023$), supporting H3.

Table 4. Results of Regression Analysis

	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Supplier concentration (SC)		-0.030 (0.029)	-0.030 (0.029)	-0.109** (0.039)
IT-PAC			0.002 (0.003)	-0.007 (0.004)
IT-RAC			-0.008 (0.005)	0.004 (0.007)
IT-PAC \times SC				0.054** (0.020)
IT-RAC \times SC				-0.079* (0.035)
Firm size	-0.013** (0.005)	-0.013** (0.005)	-0.013** (0.005)	-0.014** (0.005)
Firm age	-0.010 (0.009)	-0.011 (0.009)	-0.012 (0.009)	-0.013 (0.009)
Operating margins	0.286*** (0.085)	0.284*** (0.085)	0.287*** (0.085)	0.293*** (0.079)
IT intensity	0.354 (0.437)	0.347 (0.435)	0.394 (0.431)	0.408 (0.429)
R&D intensity	0.161 (0.096)	0.159 (0.097)	0.163 (0.096)	0.152 (0.094)
Constants	0.266*** (0.057)	0.277*** (0.056)	0.277*** (0.057)	0.300*** (0.058)
Industry effect	Yes	Yes	Yes	Yes
N	908	908	908	908
R ²	0.139	0.140	0.142	0.151
Adjusted R ²	0.107	0.107	0.108	0.115
F	17.276	25.704	17.218	4.903

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Robust standard errors (S.E.) reported in parentheses

To further explore the moderating effect IT-PAC and IT-RAC, we plotted the interaction figures at the low, medium, and high values of IT-PAC and IT-RAC, which are identified based on the minimum, mean, and maximum values of the variables, respectively. A similar method can also be found in Wang et al. (2018). Figure 1a and 1b show how low, medium, and high degrees of IT-PAC and IT-RAC moderate the supplier concentration–financial performance relationship, respectively. Figure 1a indicates that IT-PAC weakens the supplier concentration–financial performance relationship. At low levels of IT-PAC, supplier concentration is significantly and negatively related to

financial performance ($\beta = -0.158$, s.e. = 0.046, $p = 0.001$), however, the supplier concentration–financial performance turns to be positive but insignificant at high levels of IT-PAC ($\beta = 0.060$, s.e. = 0.052, $p = 0.253$). This means that supplier concentration could harm financial performance if firms lack IT-PAC. IT-PAC can infuse new external knowledge to overcome the dark side of over-embeddedness caused by supplier concentration. Figure 1b shows that IT-RAC strengthens the relationship between supplier concentration and financial performance. At low levels of IT-RAC, supplier concentration has a positive but insignificant relationship with financial performance ($\beta = 0.019$, s.e. = 0.042, $p = 0.644$), however, the supplier concentration–financial performance relationship becomes significantly negative at high levels of IT-RAC ($\beta = -0.217$, s.e. = 0.077, $p = 0.005$). This means that superior IT-RAC could make firms to suffer more risks rather than obtain benefits from supplier concentration. This is mainly because IT-RAC leads to a familiarity trap, which further dampens the information benefits of supplier concentration and strengthens the lock-in effect caused by over-embeddedness.

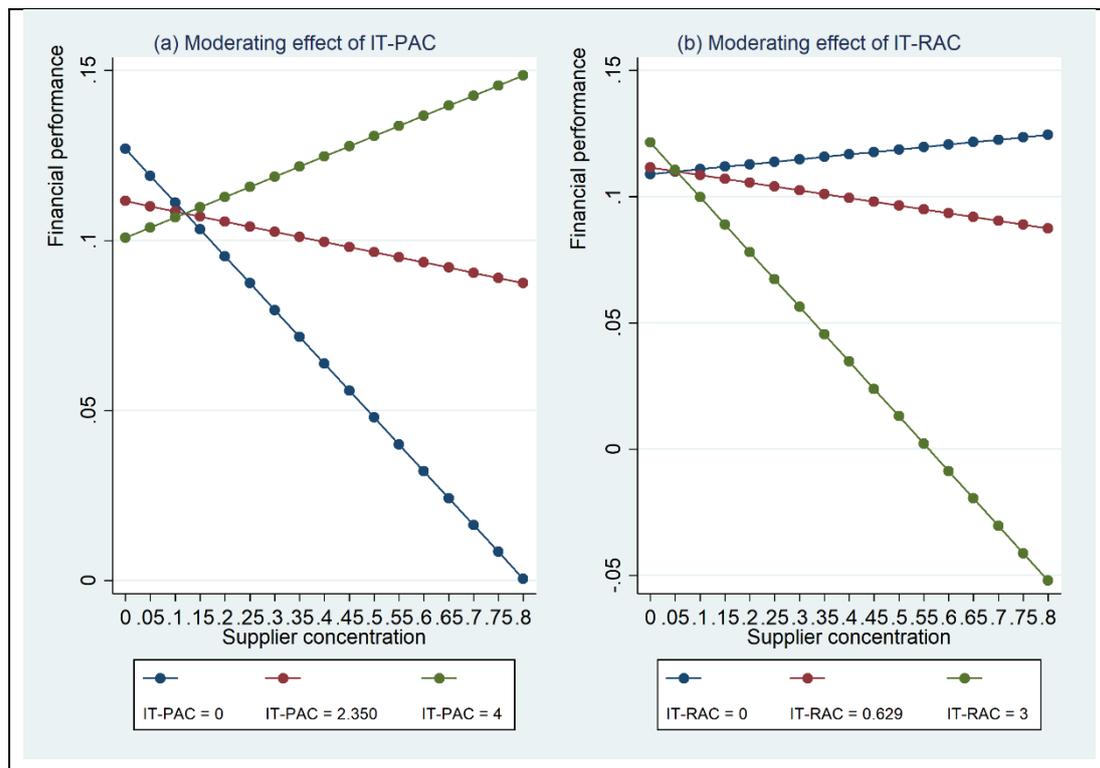


Figure 1. Moderating Effects of (a) IT-PAC and (b) IT-RAC

Discussion

Theoretical and Practical Implications

Prior literature suggests that a concentrated supplier base brings both benefits and risks (Moeen et al. 2013; Sako et al. 2016; Steven et al. 2014; Tang and Rai 2012), and its overall impact on firm performance might be contingent. Grounded on social capital theory and absorptive capacity literature, we examine how IT-AC, as a complementary capability, moderates the influence of supplier concentration on financial performance. Additionally, we distinguish the differential roles of IT-PAC and IT-RAC in leveraging knowledge from suppliers.

Our study contributes to the literature by investigating the contingent role of IT-AC on the relationship between supplier concentration and financial performance. Drawing on the prior literature on social capital theory, absorptive capacity, and information systems, we argue that IT-AC, as a complementary capability, influences the absorption of knowledge from suppliers. Although existing

literature provides mixed insights on the influence of supplier concentration (Moeen et al. 2013; Steven et al. 2014; Tang and Rai 2012; Wagner and Bode 2006), few studies have explicitly examined the financial value of a concentrated supply base. Our empirical study finds a negative but insignificant relationship between supplier concentration and financial performance; however, such a relationship depends on the level of IT-AC. Specifically, we distinguish between IT-PAC and IT-RAC and recognize that IT-PAC and IT-RAC operate in different ways and influence differently a firm's likelihood of benefiting from external knowledge. IT-PAC facilitates the infusing of new knowledge into the firm through knowledge acquisition and assimilation (Cui et al. 2018), which alleviates the negative influence of supplier concentration. In contrast, IT-RAC results in a familiarity trap and prevents the infusion of new knowledge (Srivastava et al. 2015; Zhou and Wu 2010), thus further strengthening the negative influence of supplier concentration. Thus, the performance implications of supplier concentration are very different depending on the nature and extent of IT-AC.

This study offers two practical implications. First, firms should consider both the benefits and risks of a concentrated supplier base. While modern supply chain practices bring the benefits of working closely with a selected small group of suppliers (Choi and Krause 2006; Wagner and Bode 2006), our empirical results suggest that increased supplier concentration might lead to over-embeddedness and negatively affect financial performance. With full comprehension of the financial consequence of increased supplier concentration, firms can set rational expectations and thus reduce potential risks associated with a concentrated supplier base. Second, firms should recognize the differential impacts of IT-PAC and IT-RAC on the relationship between supplier concentration and financial performance. An appreciation of the roles of IT-AC helps firms to mindfully invest and deploy IT to support absorptive capacity. The appropriate investment in IT-RAC and IT-PAC is important for enhancing financial performance by leveraging a concentrated supplier base.

Limitations

Like any study, our study has several limitations. First, we collected data from manufacturing firms in China. China is the "manufacturing factory" of the world and launches the "Internet plus" strategy to encourage firms' digital transformation. The context of China may be different from other areas, which may limit the generalizability of our findings. We encourage future studies to replicate our research in other areas to bring more insightful understanding. Second, our sampled firms are characterized by either feature of "specialization, elaboration, differentiation, and innovation". These firms are unique in some ways. Future studies could examine other firm contexts. Third, our measurement of IT-AC includes seven types of IT usage. In light of the fast and continuing development of IT (Trantopoulos et al. 2017), future studies could deploy an even more comprehensive conceptualization of IT-AC to explore its role in value creation and financial performance. Fourth, we only consider the complementary role of IT-AC. Future studies could expand the scope of our study by investigating the moderating effects of other IT-related factors, such as IT integration and IT flexibility.

Acknowledgments

This work was supported by the National Natural Science Foundation of China (NSFC: 71622009, 71571169, and 71571177), the Fundamental Research Funds for the Central Universities (WK2040160028), and the China Scholarship Council (CSC: 201706340023).

References

- Adler, P. S., and Kwon, S.-W. 2002. "Social Capital: Prospects for a New Concept," *Academy of Management Review* (27:1), pp. 17-40.
- Ahuja, G., and Lampert, C. M. 2001. "Entrepreneurship in the Large Corporation: A Longitudinal Study of How Established Firms Create Breakthrough Inventions," *Strategic Management Journal* (22), pp. 521-543.

- Casalin, F., Pang, G., Maioli, S., and Cao, T. 2017. "Inventories and the Concentration of Suppliers and Customers: Evidence from the Chinese Manufacturing Sector," *International Journal of Production Economics* (193), pp. 148-159.
- Chen, M., Liu, H., Wei, S., and Gu, J. 2018. "Top Managers' Managerial Ties, Supply Chain Integration, and Firm Performance in China: A Social Capital Perspective," *Industrial Marketing Management* (74), pp. 205-214.
- Choi, T. Y., and Krause, D. R. 2006. "The Supply Base and Its Complexity: Implications for Transaction Costs, Risks, Responsiveness, and Innovation," *Journal of Operations Management* (24:5), pp. 637-652.
- Cohen, W. M., and Levinthal, D. A. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation," *Administrative Science Quarterly* (35:1), pp. 128-152.
- Cuervo-Cazurra, A., and Annique Un, C. 2010. "Why Some Firms Never Invest in Formal R&D," *Strategic Management Journal* (31), pp. 759-779.
- Cui, T., Wu, Y., and Tong, Y. 2018. "Exploring Ideation and Implementation Openness in Open Innovation Projects: It-Enabled Absorptive Capacity Perspective," *Information & Management* (55:5), pp. 576-587.
- Davidsson, P., and Honig, B. 2003. "The Role of Social and Human Capital among Nascent Entrepreneurs," *Journal of Business Venturing* (18:3), pp. 301-331.
- Gao, G. Y., Xie, E., and Zhou, K. Z. 2015. "How Does Technological Diversity in Supplier Network Drive Buyer Innovation? Relational Process and Contingencies," *Journal of Operations Management* (36), pp. 165-177.
- Gao, S., Xu, K., and Yang, J. 2008. "Managerial Ties, Absorptive Capacity, and Innovation," *Asia Pacific Journal of Management* (25:3), pp. 395-412.
- Hair, J. F., Anderson, R. E., Babin, B. J., and Black, W. C. 2010. *Multivariate Data Analysis (7th Ed.)*. Englewood Cliffs: Prentice-Hall.
- Horn, P., Scheffler, P., and Schiele, H. 2014. "Internal Integration as a Pre-Condition for External Integration in Global Sourcing: A Social Capital Perspective," *International Journal of Production Economics* (153), pp. 54-65.
- Hughes, M., and Perrons, R. K. 2011. "Shaping and Re-Shaping Social Capital in Buyer-Supplier Relationships," *Journal of Business Research* (64:2), pp. 164-171.
- Jansen, J. J., Van Den Bosch, F. A., and Volberda, H. W. 2005. "Managing Potential and Realized Absorptive Capacity: How Do Organizational Antecedents Matter?," *Academy of Management Journal* (48:6), pp. 999-1015.
- Joshi, A. M., Chi, L., Datta, A., and Han, S. 2010. "Changing the Competitive Landscape: Continuous Innovation through IT-Enabled Knowledge Capabilities," *Information Systems Research* (21:3), pp. 472-495.
- Karahanna, E., and Preston, D. S. 2013. "The Effect of Social Capital of the Relationship between the Cio and Top Management Team on Firm Performance," *Journal of Management Information Systems* (30:1), pp. 15-56.
- Kim, Y. H., and Davis, G. F. 2016. "Challenges for Global Supply Chain Sustainability: Evidence from Conflict Minerals Reports," *Academy of Management Journal* (59:6), pp. 1896-1916.
- Lawson, B., Tyler, B. B., and Cousins, P. D. 2008. "Antecedents and Consequences of Social Capital on Buyer Performance Improvement," *Journal of Operations Management* (26:3), pp. 446-460.
- Liu, H., Wei, S., Ke, W., Wei, K. K., and Hua, Z. 2016. "The Configuration between Supply Chain Integration and Information Technology Competency: A Resource Orchestration Perspective," *Journal of Operations Management* (44), pp. 13-29.
- Liu, Y. J., Armstrong, D. J., and Riemenschneider, C. 2018. "The Relationship between Information Systems (Is) Assets, Organizational Capabilities, and IS-Enabled Absorptive Capacity in Us State Information Technology Departments," *Communications of the Association for Information Systems* (42:1), pp. 125-146.
- Moeen, M., Somaya, D., and Mahoney, J. T. 2013. "Supply Portfolio Concentration in Outsourced Knowledge-Based Services," *Organization Science* (24:1), pp. 262-279.
- Rai, A., and Tang, X. 2010. "Leveraging IT Capabilities and Competitive Process Capabilities for the Management of Interorganizational Relationship Portfolios," *Information Systems Research* (21:3), pp. 516-542.

- Rai, A., and Tang, X. 2014. "Research Commentary—Information Technology-Enabled Business Models: A Conceptual Framework and a Coevolution Perspective for Future Research," *Information Systems Research* (25:1), pp. 1-14.
- Sako, M., Chondrakis, G., and Vaaler, P. M. 2016. "How Do Plural-Sourcing Firms Make and Buy? The Impact of Supplier Portfolio Design," *Organization Science* (27:5), pp. 1161-1182.
- Saldanha, T. J., Mithas, S., and Krishnan, M. 2017. "Leveraging Customer Involvement for Fueling Innovation: The Role of Relational and Analytical Information Processing Capabilities," *MIS Quarterly* (41:1), pp. 267-286.
- Schwieterman, M. A., Goldsby, T. J., and Croxton, K. L. 2018a. "Customer and Supplier Portfolios: Can Credit Risks Be Managed through Supply Chain Relationships?," *Journal of Business Logistics* (39:2), pp. 123-137.
- Schwieterman, M. A., Goldsby, T. J., Rungtusanatham, M. J., and Knemeyer, A. M. 2018b. "Supply Chain Portfolio Characteristics: Do They Relate to Post-Ipo Financial Performance?," *Transportation Journal* (57:4), pp. 429-463.
- Srivastava, M. K., Gnyawali, D. R., and Hatfield, D. E. 2015. "Behavioral Implications of Absorptive Capacity: The Role of Technological Effort and Technological Capability in Leveraging Alliance Network Technological Resources," *Technological Forecasting and Social Change* (92), pp. 346-358.
- Steven, A. B., Dong, Y., and Corsi, T. 2014. "Global Sourcing and Quality Recalls: An Empirical Study of Outsourcing-Supplier Concentration-Product Recalls Linkages," *Journal of Operations Management* (32:5), pp. 241-253.
- Tang, X., and Rai, A. 2012. "The Moderating Effects of Supplier Portfolio Characteristics on the Competitive Performance Impacts of Supplier-Facing Process Capabilities," *Journal of Operations Management* (30:1-2), pp. 85-98.
- Tippins, M. J., and Sohi, R. S. 2003. "IT Competency and Firm Performance: Is Organizational Learning a Missing Link?," *Strategic Management Journal* (24:8), pp. 745-761.
- Trantopoulos, K., Krogh, G. v., Wallin, M., and Woerter, M. 2017. "External Knowledge and Information Technology: Implications for Process Innovation Performance," *MIS Quarterly* (41:1), pp. 287-300.
- Wagner, S. M., and Bode, C. 2006. "An Empirical Investigation into Supply Chain Vulnerability," *Journal of Purchasing and Supply Management* (12:6), pp. 301-312.
- Wang, R., Wijen, F., and Heugens, P. P. 2018. "Government's Green Grip: Multifaceted State Influence on Corporate Environmental Actions in China," *Strategic Management Journal* (39:2), pp. 403-428.
- Wong, C. Y., Boon-itt, S., and Wong, C. W. Y. 2011. "The Contingency Effects of Environmental Uncertainty on the Relationship between Supply Chain Integration and Operational Performance," *Journal of Operations Management* (29:6), pp. 604-615.
- Wu, W.-p. 2008. "Dimensions of Social Capital and Firm Competitiveness Improvement: The Mediating Role of Information Sharing," *Journal of Management Studies* (45:1), pp. 122-146.
- Xie, X., Huo, J., Qi, G., and Zhu, K. X. 2016. "Green Process Innovation and Financial Performance in Emerging Economies: Moderating Effects of Absorptive Capacity and Green Subsidies," *IEEE Transactions on Engineering Management* (63:1), pp. 101-112.
- Yeoh, P.-L. 2009. "Realized and Potential Absorptive Capacity: Understanding Their Antecedents and Performance in the Sourcing Context," *Journal of Marketing Theory and Practice* (17:1), pp. 21-36.
- Zahra, S. A., and George, G. 2002. "Absorptive Capacity: A Review, Reconceptualization, and Extension," *Academy of Management Review* (27:2), pp. 185-203.
- Zhou, K. Z., and Wu, F. 2010. "Technological Capability, Strategic Flexibility, and Product Innovation," *Strategic Management Journal* (31:5), pp. 547-561.