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Knowledge spillovers through quality control requirements on innovation development of global suppliers: The firm size effects

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ABSTRACT

Customers' outsourcing relationships with global suppliers have received increasing attention in recent decades. However, how global suppliers of different firm sizes maintain innovation development under customer coercive pressure has received little empirical study to date. Applying theoretical insights from a coercive isomorphism perspective, this article empirically tests both the moderating effect of supplier firm size and the direct effects of customer quality control requirements, supplier R&D absorptive capacity, and supplier-customer relationship quality on the supplier's propensity to benefit from customer knowledge spillovers. Analyzing a sample of 266 global suppliers in China with hierarchical regression technique, our findings demonstrate that, for smaller suppliers, customer quality control requirements significantly enhance innovation development while having no impact on larger suppliers' innovation development. Our findings also show that supplier firm size moderates the effects of customer quality control requirements and supplier R&D absorptive capacity on supplier innovation development. This article sheds new light on how supplier firm size impacts supplier innovation development under customer coercive pressure.

1. Introduction

Throughout recent decades, outsourcing has become a priority for large multinational corporations (MNCs) to expand operations into the global market and boost supply chain efficiencies (e.g., Alcacer & Oxley, 2014; Kotabe, Mol, Murray, & Parente, 2012). Due to their prominent position in the global supply chain, large MNCs as global customers have become the primary movers and shakers of the global marketplace (e.g., Jaguli, Malek, & Palil, 2014). Globalization driven by large MNC outsourcing leads not only to an increase in global capital flows, but also to tremendous knowledge spillovers through supplier-customer relationships (e.g., Lin, Liu, & Zhang, 2009). With the increasing impact of large MNC outsourcing activities on global business, both academia and practitioners demonstrate a strong interest in understanding which factors lead to supplier capability development in innovation through relationships with large MNC customers (e.g., Gupta, 2008; Jaguli et al., 2014). Recent research demonstrates that both sizes and types of customers have significant impacts on supplier capability development (e.g., Alcacer & Oxley, 2014; Jean, Sinkovics, & Kim, 2010; Kang, Mahoney, & Tan, 2009; Lages, Silva, & Styles, 2009). For example, Kang et al. (2009) find that suppliers serving large customers experience significant improvements in several aspects of capability, such as production processes, quality control, and new product development. Alcacer and Oxley (2014) show that suppliers from developing countries demonstrate strong and unequivocal evidence of technological learning by serving branded customers in the mobile telecommunications industry.

Despite evidence of supplier learning through knowledge spillovers of large MNC customers (e.g., Kang et al., 2009; Wang & Wu, 2016), there is a scarcity of relevant empirical research on how suppliers of different firm sizes achieve innovation capability gains when they are under the coercive pressure of large MNC customers' quality control requirements. Prior research focuses mainly on whether knowledge spillovers of large MNCs have positive effects on the host economy or industries (Chung, Mitchell, & Yeung, 2003; Dietzenbacher, 2000). More recent research suggests that whether or not local firms benefit from large MNC sourcing activities depends on their absorptive capacity and their relationships with large MNC customers (e.g., Rodríguez-Castellanos, Hagemeister, & Ranguelov, 2010). Research demonstrates that some suppliers increase their innovation capability through relationships with large MNCs while other suppliers may fail to capture the opportunity to upgrade (Blalock & Simon, 2009; Chung et al., 2003). This mixed empirical evidence compounded by incomplete understanding about how coercive pressure and firm size play a role in

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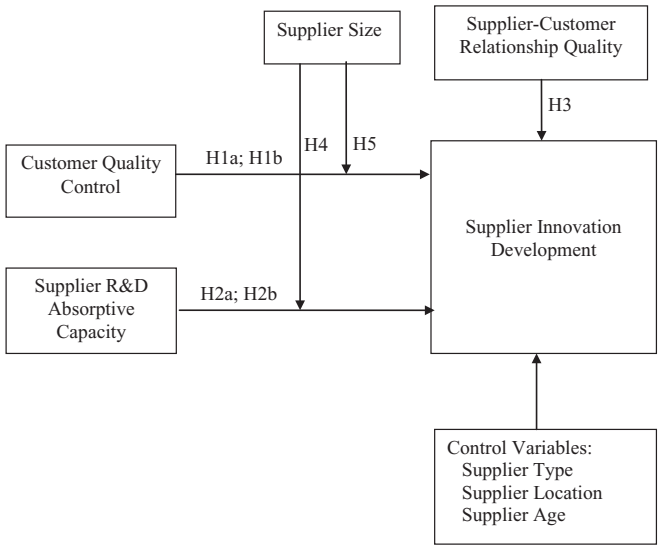

Fig. 1. The Model of customer quality control on supplier innovation development.

development of supplier innovation capacity has prompted us to explore the causes of supplier innovation development through a coercive isomorphism perspective, A coercive isomorphism perspective (e.g., DiMaggio & Powell, 1983; Kim, Lee, & Lee, 2017; Martínez-Ferrero & García-Sánchez, 2017), which focuses on the power relationships between organizations, states that dependent organizations in inter-organizational relationships with dominant organizations are homogenized through both formal and informal pressure from dominant organizations to adopt their practices and business procedures.

Drawing upon a coercive isomorphism perspective, we argue that customer quality control requirements, supplier research and development (R&D) absorptive capacity, and supplier-customer relationship quality have differential impacts on supplier innovation development depending on the size of the suppliers (See Fig. 1). We use a hierarchical regression technique and empirically examine our arguments with survey data collected through 266 global suppliers from a wide variety of industries in China, such as those supplying telecommunication equipment, office supplies or computers. Our multiple regression analysis reveals interesting findings. Specifically, our findings show that customer quality requirements positively impact innovation development of smaller suppliers, while simultaneously having no impact on innovation development of larger suppliers. Furthermore, we observe significant moderating effects of supplier firm size on supplier innovation development through both customer quality control requirements and supplier R&D absorptive capacity.

2. Theory and hypotheses

Although there is a rich body of research on how suppliers accumulate capabilities and strengthen their competitive position through alliance partners, supplier-customer relationships, and inter-organizational product development teams (e.g., Fritsch & Meschede, 2001; Jean et al., 2010), how suppliers develop innovation capacity under coercive pressure has received little empirical study to date.

Coercive power is a central theme of asymmetric relationships and is considered crucial to understanding operational and social relationships in marketing channels (e.g., Frazier & Rody, 1991; Kiyak, Roath, & Schatzel, 2001; Kühne, Gellynck, & Weaver, 2013; Zhuang, Herndon, & Zhou, 2014). Research generally suggests that coercive power has negative ramifications on firm relationships (e.g., Leonidou, Talias, & Leonidou, 2008; Wang, Huo, Tian, & Hua, 2015). For example, findings show that coercive power negatively impacts cooperation (Skinner, Gassenheimer, & Kelley, 1992). Exercising coercive power increases relationship conflict (e.g., Leonidou et al., 2008) and the risk of opportunistic behaviors (e.g., Wang et al., 2015). Recently, Kim et al. (2017) demonstrate that coercive power impedes supplier performance improvement. The weaker firm in a coercive relationship perceives a high level of relational risk (Bazyar, Teimoury, Fesharaki, Moini, & Mohammadi, 2013).

Despite the common arguments of coercive power in a negative light, some research has suggested that coercive isomorphism has significant learning implications and can benefit the dependent party when the dependent party works closely with the dominant firm (e.g., Guler, Guillén, & Macpherson, 2002; Ramaseshan, Yip, & Pae, 2006; Yeung, Selen, Zhang, & Huo, 2009). Coercive isomorphism, originated in the social and political sciences (e.g., DiMaggio & Powell, 1983; Mizruchi & Fein, 1999), suggests that inter-organizational power structures define the interaction among hierarchical organizations. Coercive isomorphism implies the potential effect one firm (usually a large-sized customer) has over its partner firm (usually a small- or medium-sized supplier) in terms of decision-making and legal and technical adaptation; the asymmetric power relationships cause small or medium-sized suppliers to perceive coercive power from the large-sized customer as "legitimate" (Ramaseshan et al., 2006). Dependent firms constantly increase their compatibility with dominant firms under the direct or explicit imposition of legal and technical requirements as well as adapting their practices to conform to the requirements of dominant organizations.

Research demonstrates that coercive isomorphism drives adoption decisions of corporate social responsibility reporting among early adopters (Bhimani, Silvola, & Sivabalan, 2016). Zhao, Huo, Flynn, and Yeung (2008) show that coercive power enhances instrumental relationship commitment. Large MNCs are key actors responsible for coercive isomorphism in trade relationships, and coercive effects result in learning-based and competitive imitation of small- or medium-sized suppliers (Guler et al., 2002). Both the exercise of coercive power and the knowledge that it exists can influence and possibly improve the business processes of dependent parties.

Building on a coercive isomorphism perspective, we argue that supplier firm size has important implications for suppliers' innovation development in their relationships with large MNCs through customer quality control requirements, supplier R&D absorptive capacity, and supplier-customer relationship quality.

2.1. Customer quality control requirements

With the globalization of world economy, in outsourcing activities, customer quality control requirements play a vital role in securing the final quality of a product and fortifying relationships between suppliers and customers (e.g., Blalock & Simon, 2009; Jaguli et al., 2014). Quality control is incorporated into a product throughout the entire production process (Hung, Lien, Yang, Wu, & Kuo, 2011). Strict quality control requirements guarantee that desired products are produced as specified.

We argue that coercive pressure from large MNC customers through their quality control requirements on suppliers significantly impacts supplier innovation development. Customer quality control requirements act as a catalyst to improve supplier innovation development (Jaguli et al., 2014). Large MNCs exert explicit or implicit coercive power by requiring suppliers in the host countries to adhere to their quality control requirements in order to maintain their competitive position in the global marketplace. According to a coercive isomorphism perspective, suppliers, under the pressure of competition and penalties, are forced to follow those requirements and improve performance to keep up with the quality standards of large MNC businesses (Jaguli et al., 2014; Javorcik, 2004). Guler et al. (2002) show that large MNCs are key actors for the cross-national diffusion of quality control standards (ISO 9000 quality certificates). Javorcik (2004) reveals that the high-quality standards of large MNCs may induce suppliers to

purchase new equipment, use new technologies, and improve the timeliness of deliveries. Suppliers would risk facing the termination or suspension of supply relationships when they fail to meet large MNCs' quality control requirements (e.g., Bazyar et al., 2013). Such coercive pressure through quality control requirements forces suppliers to improve their quality practices not only to satisfy their current customers but also to build up their capability to serve other potential customers. Therefore, we argue that customer quality control requirements will positively impact supplier innovation development.

Hypothesis 1a. Customer quality control requirements will have a positive effect on supplier innovation development.

Furthermore, we argue that the effects of customer quality control requirements on supplier innovation development will be stronger for smaller suppliers than for larger suppliers for two reasons. First, due to asymmetric power relationships, smaller suppliers perceive the coercive power of large MNCs as "legitimate" and are more motivated to make changes to comply with customer quality control requirements (Ramaseshan et al., 2006). Smaller suppliers are in a life-and-death situation in their asymmetric relationships with large MNCs. The coercive pressure comes not only from large MNCs but also from other suppliers that compete for large MNCs business. The coercive pressure spurs smaller suppliers continuously to improve their innovation capability (e.g., Frazier & Rody, 1991; Ramaseshan et al., 2006). Failure to meet customer quality control standards may cause large MNCs to abandon the relationship and switch to alternative suppliers (Bazyar et al., 2013). In contrast, larger suppliers have better resources and relationship alternatives available to counter-balance coercive pressure from large MNCs. Larger suppliers are also slow to change due to their structural complexity (Hoisl, Gruber, & Conti, 2017).

Second, smaller suppliers benefit from the communication related to quality control requirements with large MNCs through a coercive isomorphism process (Guler et al., 2002). Quality control requirements outline clear guidelines as to how suppliers can meet the quality expectations of large MNCs. Large MNCs also assist smaller suppliers in meeting their quality expectations by providing support and transferring ideas since products of a higher standard provided by smaller suppliers are essential to large MNCs' global competitive position (Blalock & Simon, 2009). Findings with case studies (Jaguli et al., 2014) suggest that large MNCs' coercive pressures through quality control requirements are a channel for knowledge spillovers, which contribute to the improvement of supplier innovation capability. In contrast, larger suppliers are established firms that demonstrate strong innovative capabilities even before establishing relationships with large MNCs. The innovation capability improvement of large-sized suppliers through customer quality control requirements will not be as evident as that of smaller suppliers. Therefore, we propose the following:

Hypothesis 1b. Customer quality control requirements will have a stronger effect on supplier innovation development for smaller suppliers than for larger suppliers.

2.2. Supplier R&D Absorptive Capacity

Supplier R&D absorptive capacity reflects suppliers' capacity to reconfigure resources and coordinate internal processes promptly to identify, acquire, and apply external R&D knowledge for their own benefit (e.g., Xiong & Bharadwaj, 2011). Due to the global nature of competition, R&D absorptive capacity is critical for suppliers to win repeated contracts from large MNCs. Large MNCs bring advanced technological knowledge, production methods, and managerial practices when they enter an emerging market and establish relationships with local suppliers (e.g., Guler et al., 2002). Suppliers can learn from their customers, making the learning process mutually beneficial. Although large MNCs will likely choose to withhold certain sensitive technological information, they will be driven to transfer necessary knowledge and communicate quality control standards so that the finished products of local suppliers can meet the global industry criteria (Huang & Chu, 2010; Kylheiko, Jantunen, Puumalainen, Saarenketo, & Tuppura, 2011). Research has shown that R&D absorptive capacity in business-to-business relationships positively influences inter-organizational learning, transfer of knowledge, and firm innovation performance (e.g., Cohen & Levinthal, 1990; Hsu, Lien, & Chen, 2015; Rodríguez-Castellanos et al., 2010). Therefore, we argue that supplier R&D absorptive capacity will have positive effects on supplier innovation development.

Hypothesis 2a. Supplier R&D absorptive capacity will have a positive effect on supplier innovation development.

We argue that the effect of supplier R&D absorptive capacity on supplier innovation development will be stronger for larger suppliers than for smaller suppliers. Knowledge transfer that includes a mix of technical details and expert insight is a challenging process (e.g., Kohtamki & Bourlakis, 2012). The gains from the influx of new knowledge have not been evenly distributed across all suppliers. Research demonstrates that firm size positively affects innovation because large-sized firms have access to more resources and a broader knowledge base than small-sized firms (e.g, Hoisl et al., 2017). Larger suppliers with strong R&D absorptive capacity are more likely to mobilize their strategic resources and knowledge base to respond quickly, learn from customers, and accommodate customers' needs (e.g., Leiblein & Madsen, 2009; Yang, Phelps, & Steensma, 2010). Furthermore, larger suppliers who are more efficient in following customer requirements by absorbing advanced technological know-how about quality improvement have a better chance to secure customer orders, strengthen relationships with customers, and achieve innovation capability gains. Therefore, we argue the following:

Hypothesis 2b. Supplier R&D absorptive capacity will have a stronger effect on supplier innovation development for larger suppliers than for smaller suppliers.

2.3. Supplier-customer relationship quality

Supplier-customer relationship quality captures four dimensions of supplier-customer relationships: (1) The amount of information sharing in the relationship, (2) The communication quality of the relationship, (3) Long-term relationship orientation and (4) Satisfaction with the relationship (e.g., Lages, Lages, & Lagesc, 2005). Research demonstrates that supplier-customer relationships are valuable social capital that can enhance firm survival and performance (e.g., Lee, Han, Nam, & Rho, 2013; Xiong & Bharadwaj, 2011). In high-quality supplier-customer relationship situations, suppliers and customers maintain quality communication and are committed to long-term relationships. The ease of communication between suppliers and customers facilitates knowledge acquisition and transfer (Flatten, Engelen, Zahra, & Brettel, 2011; Mesquita, Anand, & Brush, 2008). Quality communication also enables customers and suppliers to be transparent in their negotiated outcomes (Jean et al., 2010). Furthermore, the guarantee of a long-term relationship as reflected in long-term orientation allows both suppliers and customers to make necessary technological investments for mutual goals (e.g., Selnes & Sallis, 2003). A strong relationship between suppliers and customers provides a good environment for suppliers to develop knowledge-based assets such as advanced product or process technologies (e.g., Kühne et al., 2013). Therefore, we argue that a higher level of supplier-customer relationship quality can lead to the development of shared knowledge and enable suppliers to leverage shared knowledge to enhance their innovative capabilities.

Hypothesis 3. Supplier-customer relationship quality will have a positive effect on supplier innovation development.

2.4. The moderating effect of supplier firm size

Firm size has both positive and negative implications for firm innovation development (e.g., Camison-Zomoza, Lapiedra-Alcamí, Segarra-Cipres, & Boronat-Navarro, 2004; Haveman, 1993; Minguela-Rata, Fernández-Menéndez, & Fossas-Olalla, 2014). On the one hand, from a transaction cost perspective, large firms have access to a broader knowledge base and more resources, both of which enable them to undertake more innovative projects and better cope with external pressures (Baker & Nelson, 2005; Hoisl et al., 2017). On the other hand, large firms commonly suffer from structural complexity and bureaucracy, which can lead to both slow responses to pressure for change and higher costs in innovation (e.g., Haveman, 1993). Structural complexity and bureaucracy in large firms also create communication barriers for learning and knowledge dissemination, which hinder innovation capacity development (e.g., Camison-Zomoza et al., 2004).

We argue that the positive relationship between customer quality control requirements and supplier innovation development is stronger for small suppliers than for large suppliers. From the perspective of coercive isomorphism, coercive pressure through quality control requirements enhances small suppliers' relationship commitment and provides incentives for small suppliers to change their current business practices (e.g., Guler et al., 2002; Kohtamki & Partanen, 2016). Small suppliers are more motivated to improve innovation under large MNCs' coercive pressure since they depend on large MNCs' business for revenue (Jean, Chiou, & Sinkovics, 2016). In such asymmetric relationships, large MNCs also have less concern about transferring knowledge to suppliers when knowledge spillovers take the form of quality control requirements and when the transfer of quality control knowledge is mutually beneficial (Jean, Sinkovics, & Hiebaum, 2014). Furthermore, from a transaction cost perspective, access to critical resources and knowledge from external, more technologically advanced MNCs benefits those small suppliers who typically do not have the internal resources and capabilities for making the relationship-specific investment and upgrading their innovation capability (e.g., Liu, Wang, & Wei, 2009; Motohashi & Yuan, 2010). While small suppliers develop improved processes and capabilities through coercive isomorphism, large MNCs reap benefits through quality products produced with small suppliers' enhanced capabilities. However, when supplier firm size increases, suppliers are in a more balanced power relationship with large MNCs (Ramaseshan et al., 2006). Internal resources and the knowledge base available in large suppliers make them less responsive to change when encountering large MNCs' quality control requirements (Haveman, 1993). Furthermore, structural complexity and bureaucracy in large suppliers impede the communication of external knowledge from MNCs, thus leading to a lower level of innovation capacity gains (Hoisl et al., 2017). Therefore, we hypothesize the following:

Hypothesis 4. Supplier firm size negatively moderates the relationship between customer quality control requirements and supplier innovation development. Specifically, the smaller the supplier firm size, the stronger the positive effect of customer quality control requirements on supplier innovation development.

Suppliers' R&D absorptive capacity reflects their ability to acquire new technological know-how. To maintain their competitive position in the global marketplace, large MNCs are driven to share instructions and know-how about quality control requirements with suppliers (e.g., Guler et al., 2002). Large suppliers with strong R&D absorptive capacity are more likely to develop a common language and shared experience with their large MNC customers than small suppliers (e.g., Baker & Nelson, 2005). Furthermore, from a transaction cost perspective, large suppliers with strong R&D absorptive capacity are in a better situation to mobilize their resources to make relationship-specific investments for innovation improvement. Large suppliers can also leverage their internal knowledge base to absorb the external knowledge from large MNC customers, improve existing supply practices, and achieve innovation capability improvement (e.g., Hoisl et al., 2017). Strong R&D absorptive capacity in large suppliers facilitates their learning and enables them to recognize and synthesize knowledge embedded in their relationships with large MNCs (Jaguli et al., 2014). Absorption of embedded knowledge in customer relationships helps large suppliers build up innovation capability to meet customers' needs (e.g., Camison-Zomoza et al., 2004; Minguela-Rata et al., 2014). Therefore, we argue the positive relationship between supplier R&D absorptive capacity and supplier innovation development is stronger for large suppliers than for small suppliers.

Hypothesis 5. Supplier firm size positively moderates the relationship between supplier R&D absorptive capacity and supplier innovation development. Specifically, the larger the supplier firm size, the stronger the positive effect of supplier R&D absorptive capacity on supplier innovation development.

3. Methods

3.1. Sample

We empirically tested our hypotheses using survey data collected through 266 global suppliers in nine cities around the east and west coast of China's Pearl River Delta, one of the key global manufacturing centers in China. This sample provides a good setting for empirical studies regarding the firm size effect of supplier-customer knowledge spillovers for two reasons. First, research demonstrates that large MNCs investment in China is characterized by uneven geographic distribution, where coastal provinces attract the majority of large MNCs' outsourcing contracts (Cheung & Lin, 2004). Second, manufacturing firms in China have a great variation in size and manufacturing capacities, which provide a good fit for our research questions.

We randomly collected information on 500 suppliers in the Pearl River Delta area, contacting each of the 500 suppliers and conducted the survey by different means (including telephone, E-mail or interview) depending on circumstance. The final valid surveys consist of 266 suppliers, a response rate of 53.2% (266 out of 500 firms). Among the firms surveyed, 13 are material suppliers, 106 are component suppliers, and 147 are original equipment manufacturers (OEMs). Table 1 provides the detailed respondent profile.

3.2. Measures

We used five-point Likert scales to measure the key constructs: innovation development, customer quality control requirements, supplier-customer relationship quality, and supplier R&D absorptive

Table 1
Supplier profile details.

Respondent profile	Frequency	Percentage	Cumulative percentage
Scale			
1. 0 < employees ≤ 20	1	0.38	0.38
2. 20 < employees ≤ 300	116	43.61	43.98
3. 300 < employees ≤ 1000	67	25.19	69.17
4. Employees > 1000	82	30.83	100
Location			
1. East coast of the Pearl River Delta area	203	76.32	76.32
2. West coast of the Pearl River Delta area	63	23.68	100
Type of suppliers			
1. Material suppliers	13	4.89	4.89
2. Component suppliers	106	39.85	44.74
3. Original equipment manufacturers (OEMs)	147	55.26	100

Table 2
Descriptive statistics, Cronbach alpha, and correlations among variables.

Variable	Mean	Std. Dev.	Cronbach alpha	KMO	1	2	3	4	5	6	7	8
1.Supplier innovation Development (SID)	4.011	0.662	0.736	0.678	1							
2.Supplier-Customer Relationship Quality(SCRQ)	3.953	0.655	0.798	0.740	0.644[c]	1						
3. Supplier R&D Absorptive Capacity(SRDAC)	4.092	0.684	0.787	0.746	0.684[c]	0.703[c]	1					
4. Customer Quality Control Requirements (CQCR)	4.020	0.687	0.712	0.673	0.543[c]	0.545[c]	0.630[c]	1				
5. Supplier size	2.865	0.862			0.265[c]	0.161[c]	0.236[c]	0.312[c]	1			
6. Supplier type	2.504	0.591			0.069	−0.048	0.030	0.025	0.216[c]	1		
7. Supplier location	1.237	0.426			−0.0006	0.056	0.022	0.027	−0.056	0.109[a]	1	
8. Supplier age	13.962	6.593			0.176[c]	0.093	0.133[b]	0.100	0.488[c]	0.138[b]	0.112[a]	1

Note. N = 266. Significance levels are based on two-tailed tests for all models and coefficients.
[a] $p < 0.1$.
[b] $p < 0.05$.
[c] $p < 0.01$.

capacity. Adapting Dietzenbacher's (2000) scale, we measured supplier innovation development with a three-item scale. The scale is anchored at each end with the terms “Not at all” or “to a great extent,” and includes the following three items: Through supplying inputs to the global customer, our firm makes continual improvements in 1) product design and development, 2) product quality innovation, 3) innovation in production system.

Adapting the scale from Lages et al. (2009), we measured supplier-customer relationship quality with a five-item scale. The scale is anchored at each end with the terms “strongly disagree” or “strongly agree.” The scale captures four dimensions of supplier-customer relationships, including information sharing, communication quality, long-term orientation, and satisfaction. The following is a sample item: “Both our firm and our global customer are satisfied with the collaboration relationship.”

We developed a three-item scale to measure customer quality control requirements. The scale is anchored at each end with the terms “strongly disagree” or “strongly agree.” and includes the following three items: 1) our global customer has strict requirements on our firm's production management system, 2) our global customer has strict requirements on the speed of our new product introductions, and 3) our global customer has strict requirements on our equipment and production technology.

Adapting the scale by Flatten et al. (2011), we measured supplier R&D absorptive capacity with a four-item scale, which is anchored at each end with the terms “strongly disagree” or “strongly agree,” and includes the following four items: 1) Our firm is able to respond to the global customers' requests and adopt new technology quickly, 2) Our firm is able to respond to the global customers' requests and develop new products quickly, 3) Our firm is able to respond to the global customers' requests and improve product design with new equipment quickly, and 4) In our firm, we have frequent information and knowledge sharing across different departments.

We used the total number of employees to measure firm size. According to the “Announcement on Printing and Distributing Provisional Regulations on the Standard for Determining Small and Medium-sized Enterprises” formulated by China's National Bureau of Statistics in 2011 (e.g., Lee & Xin, 2015), Chinese enterprises are categorized into four sizes based on the total number of their employees: large enterprises (over 1000 employees), medium enterprises (300–1000 employees), small enterprises (20–300 employees), and micro-sized enterprises (lower than 20 employees). Following the formulation, we represented firm size by an ordinal variable: 1 when the firm has < 20 employees, 2 when the firm has employees between 20 and 300, 3 when the firm has employees between 300 and 1000, and 4 when the firm has > 1000 employees.

We included three control variables in our regression analyses: supplier firm location, types of suppliers, and supplier firm age. We controlled two categories of firm location: the east coast and the west coast of the Pearl River Delta area since these two categories of firm location have different clusters of enterprises and manufactured products. The east coast cities, including Guangzhou, Shenzhen, Dongguan, and Huizhou, have more enterprises with foreign direct investment and a majority of export-oriented manufactured products. In contrast, the west coast cities, including Foshan, Zhaoqing, Zhuhai, Zhongshan, have more Chinese-owned enterprises and a majority of their manufactured products are targeted at the Chinese domestic market. According to new economic geography theories on firm location (e.g., Amiti & Smarzynska Javorcik, 2008), the different compositions of enterprises and manufactured products between the east and west coast cities create differences in MNC customers' market access, supplier access, trade costs and factor costs, all of which have important implications for MNC customers' outsourcing relationships with suppliers. We also controlled three types of suppliers (material suppliers, component suppliers, and original equipment manufacturers), as these three supplier types are under different degrees of quality control requirements in their relationships with MNC customers (Charterina, Basterretxea, & Landeta, 2016). We controlled supplier firm age by the difference between the survey year and the firm's founding year.

4. Analysis and results

Table 2 contains the descriptive statistics, correlations, and Cronbach alpha coefficients of the variables.

4.1. Construct validity and reliability

Before performing the regression analysis, we tested the reliability and validity of the scales. The Cronbach alpha coefficients were all > 0.7 thresholds, revealing that the reliability of the scale is within an acceptable level. We used factor analysis to construct validity of the scale. The Kaiser-Meyer-Olkin (KMO) values of all the variables were over 0.6. The Bartlett's Test of Sphericity for all the items was significant ($p < 0.001$). Hence, the construct validity of the scale is satisfactory.

4.2. Hypothesis testing and results

We empirically tested the hypothesized relationships using a hierarchical regression technique. We tested the first three hypotheses with four hierarchical regression models. Table 3 contains the findings of the models. To eliminate the influence of multicollinearity on our results, we centered independent and moderating variables. We also tested the variance inflation factor (VIF) values. The results shown in Table 3 indicate that the VIF values in each regression model were < 3, which were well below the guideline of 10 suggested by Chatterjee (2012). Thus, the results revealed that significant multicollinearity did not exist in the present models.

Table 3
Results of Hierarchical Regression Analysis (H1a, H1b, H2a, H2b, and H3).

Variables	Dependent variable: supplier innovation development							
	Full sample Model 1		Full sample Model 2		Firm size = 1&2 Model 3		Firm size = 3&4 Model 4	
	β	VIF	β	VIF	β	VIF	β	VIF
Supplier type	0.054 [0.074]	1.03	0.063 [0.054]	1.08	0.032 [0.098]	1.07	0.113* [0.064]	1.10
Supplier location	−0.039 [0.081]	1.02	−0.061 [0.065]	1.05	−0.077 [0.090]	1.05	−0.063 [0.086]	1.07
Supplier age	0.017*** [0.006]	1.03	0.006 [0.005]	1.36	−0.012 [0.010]	1.04	0.011** [0.006]	1.13
Supplier size			0.036 [0.042]	1.53	0.837*** [0.138]	1.09	0.031 [0.084]	1.20
Customer Quality Control Requirements (CQCR)			0.080** [0.036]	1.83	0.163*** [0.057]	1.73	0.030 [0.045]	1.72
Supplier R&D Absorptive Capacity (SRDAC)			0.245*** [0.046]	2.41	0.110 [0.074]	2.14	0.305*** [0.060]	2.62
Supplier-Customer Relationship Quality (SCRQ)			0.203*** [0.042]	2.08	0.190*** [0.060]	1.73	0.217*** [0.057]	2.36
R^2	0.034		0.545		0.436		0.614	
Adjusted R^2	0.022		0.533		0.400		0.595	
F	3.198**		53.315***		12.040***		48.719***	

Note. N = 266. Standard errors in brackets. Significance levels are based on two-tailed tests for all models and coefficients.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.001$.

Table 4
Results of Hierarchical Regression Analysis (H4 and H5).

Variables	Dependent variable: supplier innovation development							
	Model 5		Model 6		Model 7		Model 8	
	β	VIF	β	VIF	β	VIF	β	VIF
Supplier type	0.068 [0.053]	1.06	0.069 [0.054]	1.07	0.059 [0.054]	1.07	0.064 [0.054]	1.07
Supplier location	−0.066 [0.064]	1.05	−0.067 [0.064]	1.06	−0.058 [0.063]	1.05	−0.065 [0.063]	1.06
Supplier age	0.007 [0.004]	1.29	0.007 [0.004]	1.29	0.007 [0.004]	1.29	0.007 [0.004]	1.29
Supplier size	0.030 [0.068]	1.37	0.029 [0.069]	1.38	0.040 [0.068]	1.38	0.034 [0.068]	1.38
Customer Quality Control Requirements (CQCR)	0.085** [0.036]	1.78	0.085** [0.036]	1.78	0.089** [0.035]	1.79	0.094*** [0.035]	1.80
Supplier R&D Absorptive Capacity (SRDAC)	0.245*** [0.047]	2.41	0.245*** [0.047]	2.41	0.239*** [0.047]	2.42	0.235*** [0.046]	2.43
Supplier-Customer Relationship Quality (SCRQ)	0.203*** [0.042]	2.08	0.203*** [0.042]	2.08	0.195*** [0.042]	2.10	0.194*** [0.042]	2.10
Size_ CQCR			−0.005 [0.029]	1.03			−0.067* [0.036]	1.63
Size_SRDAC					0.061** [0.031]	1.04	0.101*** [0.038]	1.66
R^2	0.544		0.544		0.551		0.557	
Adjusted R^2	0.531		0.530		0.537		0.541	
F	53.207***		47.230***		51.805***		46.848***	

Note. N = 266. Standard errors in brackets. Significance levels are based on two-tailed tests for all models and coefficients. Firms are divided into two groups (small-sized and large-sized).
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.001$.

Model 1 is the basic model which contains only three control variables (supplier type, supplier location and supplier age). Model 2 introduces the three key variables: customer quality control (CQCR), supplier R&D absorptive capacity (SRDAC), and supplier-customer relationship quality (SCRQ). The R^2 shows a large increase from .034 in Model 1 to .545 in Model 2. Model 2 findings show that customer quality control requirements significantly impact supplier innovation development ($\beta = .080$, $p < .05$), which supports Hypothesis 1a. The findings also show that supplier R&D absorptive capacity has a significant effect on supplier improvement in innovation capability ($\beta = 0.245$, $p < .01$). These highly significant findings support Hypothesis 2a, indicating that suppliers who have a high level of R&D absorptive capacity demonstrate better innovation development. Furthermore, the findings show that supplier-customer relationship quality significantly impacts supplier improvement in innovation capability ($\beta = .203$, $p < .01$). The finding indicates that supplier innovation development is boosted when suppliers maintain high-quality relationships with customers. These significant findings also support Hypothesis 3.

Model 3 and Model 4 are set up to test Hypotheses 1b and 2b. Specifically, Model 3 examines how the three key variables impact innovation development of smaller suppliers (firms of size 1 and size 2), while Model 4 examines how the three key variables impact innovation development of larger suppliers (firms of size 3 and size 4). The findings of Model 3 show that customer quality control requirements significantly impact innovation development of smaller suppliers ($\beta = .163$, $p < .01$), while supplier R&D absorptive capacity has no relationship with innovation development of smaller suppliers. Model 4, which tests the hypothesized relationships for larger suppliers, demonstrates different results. Specifically, supplier R&D absorptive capacity significantly impacts innovation development of larger suppliers ($\beta = .305$, $p < .01$), while customer quality control requirements have no relationship with innovation development of larger suppliers. The findings of Model 3 and Model 4 prove that customer quality control requirements have stronger effects on innovation development of smaller suppliers than that of larger suppliers, which supports Hypothesis 1b. The findings of Model 3 and Model 4 also prove that supplier R&D absorptive capacity has stronger effects on innovation development of larger suppliers than that of smaller suppliers, which supports Hypothesis 2b.

To test the moderating effects of supplier firm size, we set suppliers into two groups: small suppliers (firms of size 1 and size 2) and large

suppliers (firms of size 3 and size 4). We develop four more hierarchical regression models to examine the interaction effects of supplier firm size on supplier innovation development through customer quality control requirements and supplier R&D absorptive capacity. Table 4 contains the findings of the four models.

Model 5 examines the direct effects of the three key variables on supplier innovation development. The findings of Model 5 confirm the significant main effects of customer quality control requirements, supplier R&D absorptive capacity, and supplier-customer relationship quality on supplier innovation development. Model 6 and Model 7 in Table 4 include each of the interaction terms, Size × CQCR and Size × SRDAC respectively. Model 8 is the full model, which includes all the variables and two interaction effects. The findings show that Model 8 represents the best model since the R^2 increased from .544 in Model 5 to .557 in Model 8. The findings of Model 8 show support for all previous significant direct main effects. The findings also show that supplier firm size negatively moderates the effect of customer quality control requirements on supplier innovation development ($\beta = -.067$, $p < .1$). These findings provide only marginal support for Hypothesis 4. Model 8 also shows that supplier firm size positively moderates the effect of supplier R&D absorptive capacity on supplier innovation development ($\beta = .101$, $p < .01$), which provides support for Hypothesis 5.

We plot the two interaction effects in Figs. 2 and 3. Fig. 2 shows the negative moderating impact of supplier firm size, suggesting that the relationship between customer quality control requirements and supplier innovation development is strengthened when supplier firm size is small. In addition, Fig. 3 shows the positive moderating impact of supplier firm size on the relationship between supplier R&D absorptive capacity and supplier innovation development, suggesting that the relationship between supplier R&D absorptive capacity and supplier innovation development is strengthened when supplier firm size is large.

5. Discussion and conclusions

5.1. Theoretical implications

Drawing on a coercive isomorphism perspective, we investigate how supplier firm size affects supplier innovation development through customers' quality control requirements, supplier R&D absorptive capacity, and supplier-customer relationships. Consistent with previous research (e.g., Lee et al., 2013; Rodríguez-Castellanos et al., 2010), our findings show that suppliers that maintain quality relationships with customers have better gains in innovation development.

More importantly, our findings show that supplier firm size plays an important role in determining supplier innovation development under coercive pressure. Previous research shows mixed empirical findings on whether suppliers increase their innovation capability through relationships with large MNCs (e.g., Blalock & Simon, 2009; Chung et al., 2003). Through examining power relationships between suppliers and customers, our findings reveal that firm size plays a critical role in explaining why some suppliers under coercive pressure develop their innovation capability through relationships with large MNCs while other suppliers fail to attain an innovation upgrade. While both customer quality control requirements and supplier R&D absorptive capacity positively impact supplier innovation development, their effects on supplier innovation development vary depending on the size of suppliers. Specifically, smaller suppliers achieve significant innovation capacity improvement through customer quality control requirements. This important empirical finding challenges the long-standing negative ramifications of coercive power on channel relationships (e.g., Leonidou et al., 2008; Wang et al., 2015) and significantly extends the understanding of how innovation diffuses in asymmetric channel relationships. In contrast, larger suppliers benefit more from their R&D absorptive capacity for innovation development than smaller suppliers. This finding conforms to transaction cost theory and is consistent with previous research (e.g., Cohen & Levinthal, 1990; Hsu et al., 2015; Rodríguez-Castellanos et al., 2010), suggesting that larger firms equipped with strong R&D absorptive capacity have better chances to improve their innovation capacity through mobilizing their resources for relationship-specific investment.

Our research also demonstrates the moderating effects of supplier firm size on supplier innovation development through customer quality control requirements and supplier R&D absorptive capacity. We find that supplier firm size negatively moderates the relationship between customer quality control requirements and supplier innovation development. Specifically, the smaller the supplier firm size, the stronger the positive effect of customer quality control requirements on supplier innovation development. Consistent with a coercive isomorphism perspective (e.g., DiMaggio & Powell, 1983; Martínez-Ferrero & García-Sánchez, 2017), our findings indicate that coercive pressure through customer quality control requirements is an effective way to boost innovation development of small suppliers when they are in asymmetric relationships with large MNCs. In contrast, when suppliers are in a more balanced relationship with large MNCs, the effect of coercive isomorphism is less strong. As with supplier R&D absorptive capacity, supplier firm size plays a positive moderating effect on supplier innovation development. The findings indicate that large suppliers who can mobilize resources and quickly both respond to customers' innovation and technological demands and adapt their technology to

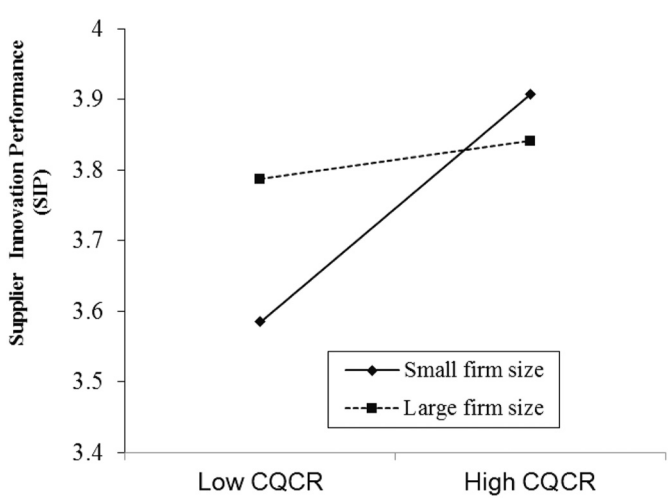

Fig. 2. The Moderating Effect of Firm size on the Relationship between Customer Quality Control Requirements (CQCR) and Supplier Innovation Development (SID).

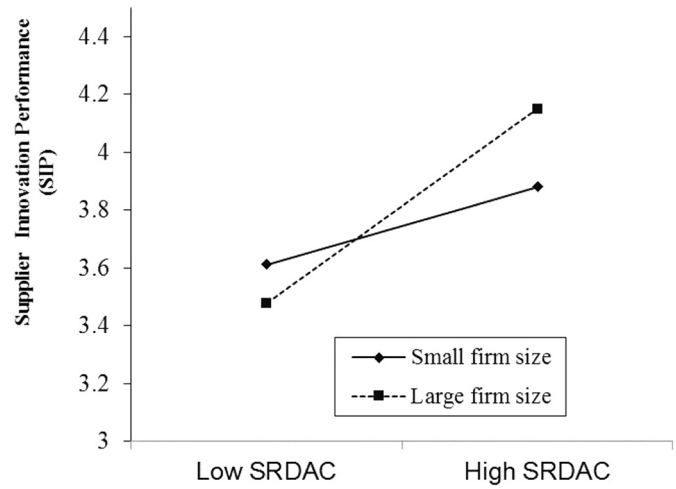

Fig. 3. The Moderating Effect of Firm Size on the Relationship between Supplier R&D Absorptive Capacity (SRDAC) and Supplier Innovation Development (SID).

cater to customers' needs have a better chance to develop their innovation capability. In contrast, small suppliers, even with strong R&D absorptive capacity, achieve less innovation capacity gain due to resource limitation.

Because our study is the first to adopt a coercive isomorphism perspective and empirically examine the effect of knowledge spillovers by considering the power relationships between large MNCs and suppliers of different sizes, our findings enrich existing literature on business-to-business knowledge spillovers by shedding new light on how supplier firm size impacts innovation development of suppliers under customer coercive pressure in the global supply chain. With a case study method, Jaguli et al. (2014) find that large MNCs' high quality and standard requirements facilitate vertical spillovers from large MNCs to local suppliers in Malaysia. Consistent with their qualitative findings through case studies, our empirical findings show that customers' quality control requirements play a critical role in the knowledge spillover process in global supply relationships, especially for small suppliers in asymmetric power relationships with large customers. When small suppliers work closely with large MNCs, technological spillovers from quality control requirements by large MNCs drive technological advancement of small suppliers. Furthermore, the extent to which suppliers benefit from their R&D absorptive capacity also depends on their firm size. Large suppliers have better chances to achieve higher levels of innovation development when they are equipped with stronger R&D absorptive capacity than small suppliers.

5.2. Managerial implications

It is well recognized that large MNCs' outsourcing activities generate knowledge spillovers that can be beneficial to the development of the host country (e.g., Chung et al., 2003; Dietzenbacher, 2000). However, attempts to find empirical evidence of spillover effects through quality control requirements at the firm level are rare. This is surprising given that quality control is one of the top concerns of large MNCs when they develop relationships with global suppliers (Guler et al., 2002).

Our findings offer several important practical insights that can guide managerial decision-making for both outsourcing activities and relationship maintenance in the global supply chain. From the customers' perspective, our study shows that large MNCs' outsourcing activities affect suppliers not only through social capital brought by business relationships but also through an impact on the quality control of suppliers' input production process. Coercive isomorphism through higher quality control standards exerted by large MNCs can be mutually beneficial for both large MNCs and small suppliers. On one hand, large MNCs have the incentive to apply stringent quality control requirements for their global suppliers, as large MNCs can benefit from improved supplier innovation capability. On the other hand, quality control requirements provide strong incentives for small suppliers to upgrade their production system and technology. By leveraging large MNCs' spillovers through quality control requirements, small suppliers can achieve innovation upgrading. However, when dealing with larger suppliers in more balanced power relationships, large MNCs need to note that coercive isomorphism through quality control requirements is not an effective strategy to motivate suppliers' innovation development effort. When the goal of large MNCs is to secure quality inputs and induce large suppliers' continuous innovative activities, MNCs need to evaluate the R&D absorptive capacity of large suppliers before entering into relationships.

From the suppliers' perspective, it is important to note that suppliers do not benefit equally from relationships with large MNCs. Differences in supplier firm size may enable some suppliers to benefit more than others through quality control requirements and supplier R&D absorptive capacity. While coercive pressure has significant learning implications for small suppliers, large suppliers benefit more from strong R&D absorptive capacity. Specifically, small suppliers can boost their innovation capacity through working closely with large MNC customers and commit their effort to meet the stringent quality control standards of their customers. In contrast, since coercive pressure has minimal effects on large suppliers, large suppliers who intend to develop their innovation capacity in relationships with large MNCs need to devote resources to relationship-specific investments and enhance their R&D absorptive capacity.

5.3. Limitations and future research

Our study contributes to a better understanding of how knowledge spillovers from large MNCs impact innovation development of global suppliers. We acknowledge that our study has limitations. First, the empirical setting of the study is in those coastal provinces in China which have attracted the majority of large MNC outsourcing contracts for more than two decades. Due to the scale and history of outsourcing activities in the area, supplier-customer relationships are more mature than those of other emerging countries or areas. Whether the findings on supplier reactions to customer quality control pressure in this unique setting are generalizable to other emerging countries needs further cross-country empirical study. Second, our findings are based on subjective measures from the perspective of the suppliers. Including both objective measures and subjective measures from the perspective of the customers in future research can further enhance the validity of the study.

Despite empirical limitations, this study opens important avenues for future theoretical exploration. One important opportunity for further research is to examine how relationship length impacts supplier innovation development under coercive pressure, since relationship length has important implications for knowledge spillover processes in supply chain relationships. Relationship length may also capture the longitudinal evolution of power dynamics in supply chain relationships. Furthermore, researchers need to explore supplier and customer network relationships to explain performance implications of customer knowledge spillover process. Supplier innovation development has not only economic performance implications, but also social and environmental performance impacts (Ghadimi, Azadnia, Heavey, Dolgui, & Can, 2016). How innovation development influences a firm's economic, social, and environmental performance requires more research attention. Finally, supplier learning has received increasing attention in supply-customer relationships (e.g., Alcacer & Oxley, 2014). However, little research has explored how large MNCs as customers learn from their outsourcing activities. Future research in this direction will undoubtedly shed new light on how the dynamics of supplier-customer relationships can produce a win-win situation for supplier-customer relationship development.

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Conflicts of interest

The authors declare no conflict of interest.

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