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# **Concentrating or Dispersing? The Double-Edged Sword Effects of Supplier Concentration on Firm Financial and Innovation Performance**

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**Concentrating or Dispersing? The Double-Edged Sword Effects of Supplier Concentration**

## **on Firm Financial and Innovation Performance**

### **Abstract**

While firms often engage with multiple suppliers, prior research has paid limited attention to the performance consequences of supplier concentration. Drawing on transaction cost economics and the knowledge-based view, we propose differential influences of supplier concentration on different facets of firm performance. Based on a sample of listed manufacturing firms from 2012 to 2017 in China, our findings reveal that, whereas supplier concentration enhances the buyer firm's financial performance, it decreases the innovation performance. Further, organizational slack strengthens the effect of supplier concentration on financial performance and mitigates its negative impact on innovation performance. In addition, industry competition amplifies the effects of supplier concentration on financial and innovation performance. Overall, our study demonstrates the double-edged sword effects of supplier concentration and provides a holistic understanding of its performance implications.

**Key words:** supplier concentration; financial performance; innovation performance; organizational slack; industry competition

## Introduction

As suppliers can provide buyer firms with raw materials, valuable knowledge, and complementary technologies, leveraging supplier resources is vital to firm success (Sharma et al., 2019; Yan et al., 2017). *Supplier concentration* reflects the extent to which a buyer firm purchases the materials from a limited number of suppliers (Chen et al., 2020; Steven et al., 2014). By capturing the degree of concentration or dispersion of different suppliers, supplier concentration affects managerial complexity and coordination difficulties for the buyer firm, thereby carrying implications for firm operations and performance (Steven et al., 2014; Tang and Rai, 2012). In reality, divergent practices regarding the level of supplier concentration exist. For example, in the apparel industry, from 2013 to 2019, Lululemon procured materials from a larger number of suppliers and lowered the share of its biggest supplier by 8%; in contrast, for the same period, Nike reduced its supplier base and increased the share of the biggest supplier by 6% (Wright, 2017). It thus begets an important question: should buyer firms adopt a concentrated or dispersed supplier structure to achieve better performance?

A brief summary of previous supplier concentration studies (please see Table 1) reveals two important research gaps. First, as buyer firms increasingly turn to suppliers for a large share of their purchases as well as unique resources and knowledge, the design and management of the structure of supplier base becomes crucial in enabling firms to attain strategic goals and benefits (e.g., Kim, 2014; Kim et al., 2020). Consequently, it is imperative to understand whether and how supplier concentration influences the firm's ability to enhance performance (Dong et al., 2020). Few extant studies primarily took an economics-oriented view (e.g., transactional cost economics, TCE), suggesting that supplier concentration enables the focal firm to achieve low transaction costs and high operational efficiency (Chen et al., 2020; Steven et al., 2014; Tang and

Rai, 2012). Such economic focus overlooks the role of suppliers in providing a rich pool of knowledge, which is critical to firm innovation activities (Bellamy et al., 2014; Kim et al., 2020; Sharma et al., 2020). Research rooted in the knowledge-based view (KBV) has confirmed that a supplier network is a critical driver of firm innovation (Potter and Wilhelm, 2020).<sup>1</sup> Following the line of inquiry that underscores the implications of supplier concentration on the heterogeneity of knowledge-based resources, it is necessary to examine how supplier concentration may affect a buyer firm's innovation performance. This, in turn, can foster a holistic framework elucidating the influence of supplier concentration on different facets of firm performance.

\*\*\*Insert Table 1 about here\*\*\*

Second, while the dilemma of a firm's ability to manage its supplier base is discussed (Bellamy et al., 2014; Gao et al., 2015), the benefits and costs associated with supplier concentration have not fully accounted for the contextual characteristics that may affect the performance gains achieved from supplier concentration (Tang and Rai, 2012). Examining situational characteristics is important as it may constrain the benefits the focal buyer derive from supplier concentration, potentially resulting in suboptimal firm performance. In a related research stream, a significant number of prior studies investigate how the characteristics of external environments and exchange partners shape the effectiveness of other attributes of supplier network (Gao et al., 2015; Sharma et al., 2020). However, for the supplier concentration literature, prior studies mainly took a general view about its role and fail to explore important contingencies on the performance implications (Chen et al., 2020; Steven et al., 2014). Without

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<sup>1</sup> For example, Bellamy et al. (2014) show that a firm's supply network accessibility is positively associated with its innovation output. Gao et al. (2015) find that technological diversity of a supplier network increases a buyer firm's new product creativity. Sharma et al. (2020) suggest that while the horizontal and vertical complexity of a supply network have an inverted U-shaped relationship with a firm's innovation performance, spatial complexity is negatively related to innovation performance.

uncovering important contextual contingencies that may circumscribe or amplify the effects of supplier concentration, it is impossible to understand the theoretical mechanisms between supplier concentration and firm performance (Campbell et al., 2019).

In this study, we build on TCE and KBV to investigate the differential impacts of supplier concentration on firm financial and innovation performance. Drawing on the two theories, we further suggest that firm resources and external environment affect the value of supplier concentration on firm performance. In terms of firm resources, we consider organizational slack, which encompasses a firm's stock of flexible and potentially utilizable resources that can be redeployed to support organizational actions (George, 2005; Marlin and Geiger, 2015; Voss et al., 2008). Regarding external environment, we consider industry competition as it represents an important situational factor in the marketplace shaping firms' strategic behaviors (Bao et al., 2012; Lyu et al., 2022). *Industry competition* refers to the extent of competition a firm encounters in the product market (Porter, 1985).

The results of a sample of listed manufacturing firms in China from 2012 to 2017 provide support for our propositions. These findings generate important theoretical contributions. First, our study responds to the longstanding call to investigate how supplier concentration affects buyer firm decisions and outcomes (Patatoukas, 2012). Assessing two related but distinct performance outcomes allows for a deeper understanding of the effect of supplier concentration. In particular, our study highlights the double-edged sword effects of supplier concentration by showing its contrasting influences on financial and innovation performance, which enriches prior findings regarding its impact on operational efficiency.

Second, we identify the moderating effects of organizational slack and industry competition on the relationship between supplier concentration and firm performance. Our study thus

complements limited research on supplier concentration, provides a more nuanced understanding of the conditions when supplier concentration is likely to exert a positive or negative impact, and explicates the mechanisms for its effects on firm performance.

Third, we contribute to the literatures on TCE and KBV. Enriching prior TCE literature, our study identifies organizational slack and industry competition, as the micro- & macro-level factors, influence the focal firm's ability to deal with transactional risks in exchange relationships, thereby affecting the role of supplier concentration on financial performance. Likewise, extending the KBV literature, our research suggests that organizational slack and industry competition, as firm-level and environmental factors, affect resource commitment for the innovation process and influence the relationship between supplier concentration and innovation performance.

Overall, taking the main effects together with the moderating effects, our research provides a coherent theoretical framework to understand the importance of supplier concentration, as well as offers practical implications for managers about designing the structure of the supplier base. Specifically, our findings suggest that managers should understand the double-edge sword effects of supplier concentration, devise the supplier base according to their performance objectives, and match their supplier structure with their resource endowments and external environment to generate desirable outcomes.

## **Conceptual Framework**

### **Supplier concentration**

As buyer firms increasingly rely on suppliers' capabilities and resources to achieve competitive advantage (Kim et al., 2020; Wang et al., 2023), supplier concentration management carries strong implications for firm performance. However, to the best of our knowledge, extant research

on supplier concentration is rather limited, with several exceptions (e.g., Chen et al., 2020; Steven et al., 2014; Tang and Rai, 2012). The primary focus is on the implications of supplier concentration on operational efficiency. For instance, Tang and Rai (2012) reveal that supplier concentration amplifies the positive effect of process alignment on competitive performance and attenuates the competitive benefits that firms derive from partnering flexibility. Steven et al. (2014) show that supplier concentration enhances visibility and traceability and helps reduce product recalls. Chen et al. (2020) find that supplier concentration relates positively to cost elasticity.

Despite valuable insights, prior studies focused on the implications of supplier concentration on operational performance but overlooked other types of performance. In particular, financial performance assesses the fulfilment of a firm's main economic goals and has served as a prominent indicator in many strategic management and supply chain studies (Flynn et al., 2010; Gu et al., 2022; Rahman et al., 2022; Wagner et al., 2012). Further, given the fast-changing environment and increasingly intensified competition, firms must innovate continuously to stand out in the market (Sharma et al., 2020; Wang et al., 2020). Since suppliers represent an important external knowledge source that firms can leverage for innovation (Bellamy et al., 2014), it is necessary to consider how supplier concentration influences both financial and innovation performance.

### **Supply concentration and financial performance: A TCE view**

TCE is a prominent economics-oriented theory that guides the research of buyer–supplier relationships (Lumineau et al., 2022; Narayanan et al., 2015). TCE highlights the costs of engaging in transactions across organizational boundaries (Kim et al., 2020; Williamson, 1985). Opportunism and bounded rationality are two central elements of TCE (Grover and Malhotra,



2003; Narayanan et al., 2015; Sharma et al., 2020). While opportunism involves the risk of exchange partners attempting to maximize their self-interests at the expense of others', bounded rationality reflects limited cognitive capacity and carries the risk of uncertainty (Lu and Shang, 2017; Narayanan et al., 2015; Sharma et al., 2020). Specific exchange relationships may expose the firm to partners' opportunism and limit its cognitive capacity, which give rise to transaction costs and undermine the performance (Lanier et al., 2010; Steven et al., 2014). Thus, firms should manage such costs to achieve good financial performance (Ketchen and Hult, 2007).

According to TCE, supplier concentration influences whether the buyer firm can reduce transaction risks and achieve effective coordination with their suppliers, which fosters superior financial performance (Ketchen and Hult, 2007; Sharma et al., 2020). As low supplier concentration suggests that the buyer firm needs to manage different suppliers, managerial difficulty and complexity increase substantially due to bounded rationality (Cui and O'Connor, 2012). For each of its suppliers, a firm needs to invest exchange-specific resources, leading to higher risks and transaction costs (Grover and Malhotra, 2003; Yeung, 2008). Thus, a dispersed supplier structure (i.e., low supplier concentration) leads to complex coordination that is costly to manage (Lee et al., 2017). In contrast, with high supplier concentration, a buyer concentrates its procurement in a limited number of suppliers. In such case, the buyer does not need to invest more specific resources, which decreases transaction risks and coordination costs. Concentrated supply base can also reduce major suppliers' opportunism, which further decreases transactional costs and helps the buyer firm achieve good performance (Ak and Patatoukas, 2016).

### **Supplier concentration and innovation performance: A knowledge-based view**

The KBV treats knowledge as the most important strategic resource, especially for innovative activities (Grant, 1996; Kogut and Zander, 1992). Successful innovation depends on

novel knowledge acquisition as well as the creative combination of existing knowledge components (Jiang et al., 2022; Zhou and Li, 2012). However, for any given firm, its knowledge reservoir is limited in both depth and breadth. Hence, access to heterogeneous external knowledge, which rejuvenates a firm's internal knowledge base, is critical to its innovation and sustainable advantage (Amankwah-Amoah and Adomako, 2021; Kim et al., 2020; Vasudeva and Anand, 2011).

According to KBV, the supplier base structure (i.e., supplier concentration) influences the extent to which external knowledge is acquired and integrated through the supply chain (Lanier et al., 2010), which determines the buyer firm's innovation performance. Since knowledge resources are sticky and heterogeneously distributed, different suppliers possess a range of distinctive resources as well as diverse experiences and capabilities (Hagedoorn et al., 2018; Kim et al., 2020). With heterogeneous knowledge, highly dispersed suppliers (i.e., low supplier concentration) provide access to broad, diversified knowledge for innovation development (Kim et al., 2020), whereas high supplier concentration may make firms embedded into the limited information provided by the major suppliers and decrease the breadth and diversity of knowledge acquisition. The breadth of knowledge may facilitate the buyer firm to bring up more creative ideas and achieve valuable combinations, which in turn enhances innovation performance. However, high supplier concentration can help the focal buyer construct close relationships with major suppliers, which can increase the share and transfer of tacit knowledge between them and affect innovation performance.

### **The contingencies**

Both TCE and KBV highlight the boundary conditions of firms' strategic choices on performance implications. According to TCE, uncertainty heightens transaction costs, which

subsequently influences how the buyer firm's supplier base affects its financial performance (Flynn et al., 2016; Grover and Malhotra, 2003; Lu and Shang, 2017). Multiple sources of uncertainty exist, relating closely to both firm- and macro-level factors (Flynn et al., 2016; Gaur et al., 2011). Firm-level factors, likely resource and ability, determine whether the buyer firm can identify the specific situations associated with the exchange with the suppliers, deal with uncertainty to decrease the transactional costs and risks, and thus enhance the value from supplier concentration (Sharma et al., 2020). Macro-level factors, such as specific features of external environment, directly lead to uncertainty that highlights exchange parties' bounded rationality and prevents realizing full potential from supplier concentration (Flynn et al., 2016; Grover and Malhotra, 2003).

According to KBV, in addition to external knowledge resources, complementary resources internal to the firm are needed to deal with complex and unforeseen problems during innovation (Hoetker, 2005; Leiponen and Helfat, 2010). Such resources play a part in addressing knowledge deficiency for innovative idea generation and solutions (Laursen and Salter, 2006). Externally, market environment exerts pressures on firms to adjust the commitment to innovation (Ju et al., 2013). Surrounding environments also affect the motivation and efficiency of knowledge transfer between the buyer firm and its suppliers (Gao et al., 2015). Thus, external environment affects knowledge acquisition and integration associated with supplier concentration (Bao et al., 2012).

Hence, both firm- and macro-level factors may condition the efficacy of supplier concentration. For the firm-level moderator, we consider organizational slack, which represents important resources firms can leverage directly to support strategic actions, coordinate with suppliers, and realize the potential of supplier concentration (Carnes et al., 2019; Marlin and Geiger, 2015). Organizational slack includes available financial resources, unused capacity, and

underutilized research and development (R&D) employees (Symeou et al., 2019; Voss et al., 2008). The availability of slack resources provides flexibility for firm operations and assists the firm to manage uncertainty and complexity during coordination with the suppliers (Iyer and Miller, 2008; Nohria and Gulati, 1996). Moreover, slack resources facilitate expanded search and increase the exposure to external knowledge (Chen, 2008; Tyler and Caner, 2016), offering strong support for innovation.

For external environmental moderator, we include industry competition since it is one of the most important situational factors that shape firm decisions and behaviors (Bao et al., 2012; Lyu et al., 2022; Porter, 1985). Industry competition often takes the form of great rivalry among market players, fierce price wars, diverse product offerings, and added services (Porter, 1991). Industry competition forces inefficient firms to exit the market. Survival pressure strongly shapes firm operations and knowledge management (Bao et al., 2012; Gao et al., 2015; Zhou et al., 2014). Taken together, we examine the moderating effects of organizational slack and industry competition on the relationship between supplier concentration and firm performance and thus depict our conceptual model in Figure 1.

\*\*\* Insert Figure 1 here \*\*\*

## **Hypotheses**

### **Supplier concentration and financial /innovation performance**

Low supplier concentration means that a buyer firm procures materials and components equally from its suppliers, whereas high concentration means the buyer relies on a few suppliers for the majority of the procurement. We predict that high supplier concentration may lead to better financial performance. First, high supplier concentration can reduce transaction risks and coordination costs. Firms need to make specific investments and efforts to build and maintain the

relationships with major suppliers (Irvine et al., 2016; Kim and Zhu, 2018). Because specific investments are less transferable across different suppliers, the buyer firm needs to bear the associated transaction costs and uncertainties due to potential opportunism (Koka and Prescott, 2008; Lanier et al., 2010; Lu and Shang, 2017). With concentrated procurement from its major suppliers, the buyer firm can focus its attention and devote its resources to important relationships, which save substantial costs. Further, each supplier has its own unique culture, organizational processes, and routines (Kim and Zhu, 2018; Yli-Renko and Janakiraman, 2008). With a dispersed supplier structure, the buyer firm needs to manage and coordinate more buyer–supplier interfaces (Bode and Wagner, 2015; Choi and Krause, 2006), which leads to high managerial complexity and coordination difficulties (Jiang et al., 2010). In contrast, as supplier concentration increases, fewer suppliers account for a larger portion of a buyer firm’s total procurement, which significantly decreases the managerial burden and coordination costs (Ak and Patatoukas, 2016; Lu and Shang, 2017; Saboo et al., 2017).

Second, supplier concentration facilitates the building of close relationships and enhances operational efficiency. When a buyer firm concentrates its procurement in major suppliers, it increases the interactions between the firm and those suppliers (Rai and Tang, 2010). Under this situation, it is easier for them to develop mutual trust and maintain the commitment, which decreases major suppliers’ opportunism tendency (Jin and Wang, 2024; Tang and Rai, 2012). Further, major suppliers are more likely to work together with the firm and establish effective routines to streamline inventory and logistics management, which enhances operational efficiency (Steven et al., 2014). High supplier concentration thereby reduces transaction risks and coordination costs and improves operational efficiency, therefore enabling the buyer firm to achieve better financial performance.

**Hypothesis 1: Supplier concentration positively affects the buyer firm's financial performance.**

While supplier concentration likely boosts financial performance, we argue that it may inhibit the buyer firm's innovation performance. First, supplier concentration reduces the exposure to diverse information and constrains the possibility of new discoveries. Each important supplier can bring unique resources and knowledge to the focal firm (Cui and O'Connor, 2012). When supplier concentration is high, the buyer firm makes large purchases from a few suppliers and can more easily establish close relationships with these suppliers and achieve effective knowledge exchange (Rai and Tang, 2010). However, since the acquired knowledge is concentrated within a limited number of suppliers, it prevents the buyer firm from accessing diversified knowledge that is necessary for innovation (Lanier et al., 2010). Thus, with high supplier concentration, the buyer firm is locked into a restricted context with homogeneous knowledge, which constrains the breadth of perspectives and reduces the chance for "thinking outside the box" (Levinthal and March, 1993; Vasudeva and Anand, 2011).

Second, supplier concentration constrains diverse information transfer and decreases new knowledge combinations. When the buyer firm acquires wide-ranging knowledge, it is more likely to generate creative recombination, which contributes to innovation performance (Grant, 1996; Hagedoorn et al., 2018). When supplier concentration is low, the buyer firm procures equally from the suppliers, which provides the opportunity to generate diverse perspectives and makes it easier to synthesize knowledge to promote innovation (Cohen and Levinthal, 1990; Cui and O'Connor, 2012). With high supplier concentration, while the buyer can build a set of stable routines with major suppliers to generate quick responses, structured interactions likely filter out seemingly irrelevant but potentially valuable information for creative knowledge combinations. Therefore, high supplier concentration may harm innovation performance.

However, low supplier concentration may also lead to certain costs for the buyer firm in innovation development. When supplier concentration is high, frequent interactions between the buyer and its major suppliers facilitates the development of shared norms and trust, promoting tacit knowledge exchanges (Krolikowski and Yuan, 2017; Saboo et al., 2017; Tang and Rai, 2012) that may contribute to innovation. When supplier concentration is low, it increases the difficulty for the focal buyer to build cohesive ties with major suppliers, which may constrain the exchange of tacit knowledge (Krolikowski and Yuan, 2017; Wuyts and Dutta, 2014).

Taken together, while low supplier concentration may constrain the access of tacit knowledge from major suppliers, it increases the breadth in knowledge acquisition and integration for innovation development. According to prior studies (e.g., Cui and O'Connor, 2012; De Leeuw et al., 2014; Gao et al., 2015; Zhou and Li, 2012), heterogeneity and diversity of knowledge combination is more critical for innovation development. Given the trade-off in the benefits and costs, we propose that supplier concentration generates a net positive effect on firm innovation performance.

**Hypothesis 2: Supplier concentration negatively affects the buyer firm's innovation performance.**

**Moderation effects of organizational slack**

Organizational slack includes a firm's stock of flexible and potentially utilizable resources (Voss et al., 2008). Slack resources can be easily deployed to support the pursuit of organizational goals (Carnes et al., 2019). Organizational slack can help lower the costs of strategic actions due to the ease of transformation and help the buyer firm respond and adapt to unexpected demand (George, 2005; Vanacker et al., 2017).

To facilitate value derived from supplier concentration, the focal firm needs to improve existing management systems to ensure effective coordination and integration with major

suppliers (Yang and Jiang, 2023). We argue that organizational slack strengthens the positive relationship between supplier concentration and financial performance. First, slack resources represent a firm's stock of currently uncommitted and flexible resources and cannot directly be committed to each major supplier, which requires more specific investments. In such circumstances, for low supplier concentration, while organizational slack can optimize the coordination with the suppliers, it cannot help the buyer firm decrease the transactional costs and absorb the benefits from highly disperse suppliers.

For high supplier concentration, while it reduces the managerial complexity and decreases transaction and coordination costs, firms still need to commit resources to optimize the system through which a buyer and its major suppliers cooperate to achieve better performance (Hitt et al., 2016; Liu et al., 2011). Because organizational slack can be easily transformed into actions, it facilitates the establishment of a dedicated function that manages the supplier relationships in an effective manner (Carnes et al., 2019). With an optimized buyer–supplier interface, the buyer can achieve the advantage in the reduction of the transaction and coordination costs from supplier concentration, leading to superior financial performance. In contrast, in face of resource constraints, the firm will find it difficult to improve the buyer–supplier interface and encounter more difficulties in coordinating with the major suppliers, reducing the cost advantage of supplier concentration. Under such circumstances, it may miss the opportunity to achieve better performance.

Second, slack resources can be deployed to address unexpected demands, deal with potential conflicts, and manage the coordination processes (Voss et al., 2008). Given the differences between suppliers and the buyer firm in terms of technology, product, or business, it may increase the cognitive burden and lead to misunderstanding about the exchange. Facing



unexpected challenges, slack resources provide the buyer firm with the flexibility to adjust its coordination process with its suppliers (Vanacker et al., 2017; Zhang et al., 2020). The coordination process between the buyer firm and its major suppliers becomes smoother and thus leads to the decrease in transactional costs, enhancing financial performance (Rai and Tang, 2010). Therefore, slack resources act as an enabling factor for leveraging the value of supplier concentration to foster financial returns.

**Hypothesis 3: The positive effect of supplier concentration on the buyer firm's financial performance becomes stronger when organizational slack is higher.**

Organizational slack is an important catalyst for firm innovation because it provides additional resources that enable firms to experiment with new ideas (Iyer and Miller, 2008; Nohria and Gulati, 1996). In the innovation process, organizational slack also provides the flexibility needed to adjust resource allocation (Nohria and Gulati, 1996; Voss et al., 2008). We argue that organizational slack enables a broad search for external information, which mitigates the negative impact of supplier concentration on innovation performance. First, organizational slack provides the firm with a pool of resources to explore new opportunities (Chen, 2008; Tyler and Caner, 2016). It can expand the breadth of firms' search activities and increase the variety of knowledge (Iyer and Miller, 2008; Vanacker et al., 2017). While supplier concentration locks the focal firm into homogeneous knowledge from its major suppliers, slack resources enhance the cognitive breadth and help the firm think outside the box (Cohen and Levinthal, 1990). The acquired diverse knowledge helps the firm overcome the limited scope of knowledge arising from supplier concentration, mitigating its negative effect on innovation.

Second, organizational slack allows a firm to expand its thinking beyond the status quo (Paeleman and Vanacker, 2015; Voss et al., 2008). The availability of slack resources (e.g., underutilized R&D facilities, available capital) offers the flexibility to facilitate strategic change

and enables the focal firm to explore new options (George, 2005). In this circumstance, slack resources help the buyer firm acquire more novel knowledge. While supplier concentration provides the buyer firm with limited knowledge, external information overcomes this limitation by generating new knowledge combinations and discovering innovation opportunities. With the support from slack resources, the buyer can undertake complex information processing when combining major suppliers' insights (Liu et al., 2011), mitigating the adverse effect of supplier concentration on innovation. Thus, we predict that:

**Hypothesis 4: The negative effect of supplier concentration on the buyer firm's innovation performance becomes weaker when organizational slack is higher.**

#### **Moderation effects of industry competition**

Industry competition is reflected by the number of competitors operating in a particular industry and characterizes the fundamental structure of the market (Porter, 1985). Intense industry competition reflects heavy pressures to achieve efficiency or differentiation, putting incapable firms into vulnerable positions (Ang, 2008; Jansen et al., 2006). Facing such pressures, firms need to act rapidly in response to competitive actions (Bao et al., 2012; Lyu et al., 2022; Porter, 1991).

We argue that industry competition strengthens the positive relationship between supplier concentration and financial performance. First, to maintain their advantages in a highly competitive market, firms need to operate in a more cost-efficient way (Davies and Walters, 2004; Porter, 1985). Otherwise, they will be driven out of the market. Supplier concentration helps the buyer firm overcome coordination difficulties and enjoy the cost advantage. Thus, firms with high levels of supplier concentration are more likely to maintain their market positions and enhance their financial performance in a highly competitive market.

Second, facing high competitive intensity, firms need to respond quickly to external demand

and inefficient firms may encounter the threat of exit. Supplier concentration facilitates the close link between the buyer firm and its major suppliers, which provides a reliable means through which the buyer can adapt to external competitive environment and alleviate relevant threats (Rai and Tang, 2010; Zhou et al., 2014). Thus, in a competitive market, supplier concentration becomes more important for better performance. Further, in a competitive market, product choices are abundant and only quality products can stand out (Porter, 1991). A concentrated supplier structure makes it easier for the buyer firm to manage product quality and enhance the operational efficiency to better serve customers (Chen et al., 2020; Steven et al., 2014). Thus, supplier concentration is more beneficial when industry competition is high.

**Hypothesis 5: The positive effect of supplier concentration on the buyer firm's financial performance becomes stronger when industry competition is higher.**

Industry competition makes market conditions change rapidly (Porter, 1985). As the number of firms in the market increases, they will compete for limited resources and knowledge (Ang, 2008). To survive the competition, firms need to act quickly by modifying and/or expanding current products or technologies (Jansen et al., 2006).

We argue that industry competition amplifies the negative relationship between supplier concentration and innovation performance. First, when industry competition is higher, the disadvantage of knowledge acquisition from high supplier concentration becomes more salient. In face of intensive competition, many rivals fight over limited resources and knowledge, which makes external knowledge obsolete quickly and reduces resource availability for firms' innovation activities (Ang, 2008; Jansen et al., 2006; Zhou et al., 2014). High supplier concentration restricts the buyer firm to access only specific knowledge from its major suppliers. With a concentrated supplier structure, in a competitive market, the inability to acquire novel knowledge derived from major suppliers becomes more problematic for generating innovation.

In such circumstances, acquiring diverse information and knowledge from different suppliers becomes more valuable and critical (Murray et al., 2011). With low supplier concentration, the buyer firm can make better use of diverse knowledge from different suppliers to address competitive threat, making the role of low supplier concentration on innovation performance more salient. In contrast, when competitive intensity is lower, the buyer firm is more likely to acquire relevant knowledge from other sources and mitigate the disadvantage of high supplier concentration.

Second, when industry competition is higher, the knowledge integration challenges from low supplier concentration can be mitigated. High market competition reduces the survival chances for all firms (Xu et al., 2019). To survive the competition, buyer–suppliers must act proactively and collaboratively (Huo et al., 2014). Industry competition acts as a catalyst that fosters collaboration and cohesion between the buyer and its suppliers. External competition encourages partners to work together, overcome challenges, and effectively assimilate and integrate their complex knowledge to achieve mutual adaptation (Ang, 2008; Gao et al., 2015; Terjesen et al., 2011). A serious concern for low supplier concentration is the challenge of diverse knowledge integration for new combinations (Jiang et al., 2010; Lee et al., 2017). Thus, when competition is intensive, low supplier concentration makes it easier for the buyer firm to absorb and integrate novel, distant knowledge, amplifying the benefits of low supplier concentration on innovation performance.

Overall, when industry competition is higher, the disadvantage associated with knowledge acquisition of high supplier concentration becomes more serious while the difficulties in knowledge integration of low supplier concentration can be mitigated. Therefore, we predict that:

**Hypothesis 6: The negative effect of supplier concentration on the buyer firm’s innovation performance becomes stronger when industry competition is higher.**

## Methodology

### Data Collection

To test our hypotheses, we collect data on manufacturing firms listed on the Shanghai and Shenzhen Stock Exchanges in China from 2012 through 2017. The China Securities Regulatory Commission (CSRC) requires all listed firms to disclose the procurement percentages of their top five suppliers and their basic information (e.g., supplier name) since 2012 (Chen et al., 2020). Thus, we choose 2012 as the starting year because the quality of data pertaining to our independent variable (i.e., supplier concentration) has improved significantly since then. We collected data mainly from the China Stock Market & Accounting Research (CSMAR) and WIND databases, which provide complete information about the listed firms and have been widely used in prior strategy and supply chain studies (Gu et al., 2022; Leung and Sharma, 2021; Xu et al., 2019). To help establish the causal effects, all explanatory variables are lagged by one year. After merging all data sources, we include 877 firms with 3,075 firm-year observations in our financial performance model; for the innovation performance model, the final sample consists of 2,890 firm-year observations from 858 firms, with the difference reflecting missing information on patents. We winsorize the variables at 1% to account for the influence of extreme values (Bendig et al., 2017).

### Measures

#### Dependent variables

There are two dependent variables in our study: financial performance and innovation performance. We use return on assets (ROA) to measure *financial performance* (Zhong et al., 2022). In consistent with prior studies, we calculate ROA as the ratio of operating income before

depreciation to the book value of total assets (e.g., Awaysheh et al., 2020; Flammer and Ioannou, 2021; Gan et al., 2020).

We measure *innovation performance* as the number of invention patents for which a focal firm applied in a given year (Park et al., 2020). The Chinese National Intellectual Property Administration grants three kinds of patents, namely design, utility model, and invention patents. Of these three types, invention patents receive the most substantive and rigorous examination in terms of quality and novelty (Jia et al., 2019; Zhou et al., 2017). Thus, we use invention patents to measure innovation performance.

### **Independent variable**

Prior supplier concentration studies employ the Herfindahl–Hirschman index to measure a firm’s *supplier concentration*: they use the information on either the five largest suppliers (Chen et al., 2020) or the four largest suppliers (Tang and Rai, 2012) to compute the Herfindahl–Hirschman index. Following this line of research, we measure supplier concentration as the sum of the square of the share of procurement taken by the top five suppliers. The value of supplier concentration ranges from 0 to 1, where a lower value represents a dispersed supplier structure and a higher one indicates a concentrated supplier structure.

### **Moderators**

Organizational slack includes three types of firm resources: available, absorbed, and potential slacks (Tyler and Caner, 2016). Available slack equals the ratio of a firm’s current assets to its current liability, absorbed slack is calculated as the working capital-to-assets ratio, and potential slack is the ratio of equity to debt (Xu et al., 2019). We measure *organizational slack* as the sum of the standardized values of the three types (Tyler and Caner, 2016).

*Industry competition* is measured as one minus the sum of the square of the market share of all firms within the same industry, and we use 3-digit industry classifications regulated by the CSRC (Zhou et al., 2017).

### **Control variables**

We include a series of control variables. At the firm level, we control for *firm age* (natural logarithm of one plus the number of years since a focal firm's initial public offering) and *firm size* (the natural logarithm of one plus the number of employees), given that older or larger firms have more experience and resources they can use to enhance their financial and innovation performance (Zhou et al., 2014). We use *firm leverage* (a firm's long-term debts scaled by total assets) and *cash ratio* (cash obtained from sales of goods or rendering of services scaled by operating income) to account for firms' capital structure (Zhong, 2018). Previous studies show that increased leverage and cash holdings promote the efficiency of R&D spending on innovation (Jensen and Showalter, 2004; Lyandres and Palazzo, 2016). Cash holdings lead to high opportunity costs but can help firms address the external uncertainty, producing a contrastive effect on financial performance (Kim and Bettis, 2014).

We also control for *R&D intensity* (R&D expenditures scaled by sales revenue) and *advertising intensity* (advertising expenditures scaled by sales revenue), which affect firms' resource commitment to operation and innovation activities (Chan et al., 2001; Eberhart et al., 2004). Previous studies have shown that *state-owned enterprises* (SOEs) can acquire substantive resources from the government to support market expansion and invest in innovation activities (Zhou et al., 2017). We therefore include *SOE* (a dummy variable that equals 1 if a firm's ultimate controller is the government or its agencies and 0 otherwise).

Prior literature shows that ownership concentration influences firms' financial and innovation performance (Song et al., 2015; Thomsen and Pedersen, 2000), so we control for *biggest shareholder*, measured as the percentage of the equity share taken by the largest shareholder (Kato and Long, 2006). In addition, we include industry, year, and province dummy variables to mitigate the potential bias caused by omitted variables. Table A1 reports measures and data sources for the variables used in this study (please see Appendix A).

### **Endogeneity and Model Specification**

A firm may select its suppliers strategically (Riedl et al., 2013; Tang and Rai, 2012), so supplier concentration may be endogenous. Thus, we run the Durbin-Wu-Hausman (DWH) test and obtain significant results ( $F = 7.164, p < .01$ ), indicating the concern of endogeneity. To address the endogeneity problem, we employ a two-stage instrumental variable (IV) approach (Greene, 2003). In the first stage, we regress the endogenous variable (i.e., supplier concentration) on the IVs and the control variables; in the second stage, we use the predicted supplier concentration from the first stage as the independent variable to test all the hypotheses. Table A2 presents the results of the first-stage regression (please see Appendix B).

The instrumental variable must meet two criteria: relevance and exclusion (Ketokivi and McIntosh, 2017). Specifically, relevance implies that the IV should be highly correlated with the endogenous variable and exclusion requires that the IV should not theoretically correlate with the error term. Following prior research (e.g., Chen et al., 2020; Dhaliwal et al. 2016; Krolkowski and Yuan, 2017; Zhong et al., 2022; Zhou et al., 2022), we consider both *lagged one and two-year province supplier concentration (i.e., regional average supplier concentration)*, which are measured as average supplier concentration in other industries in the same province, as the IVs.<sup>2</sup>

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<sup>2</sup> To ensure the robustness of empirical results, we also adopt only one instrumental variable (i.e., lagged one-year province supplier concentrations) to retest the hypotheses and the results remain highly



Since the focal firm may mimic their peer firms in the same region to construct the supplier structure, *regional average supplier concentration* thus is highly correlated with a focal firm's supplier concentration. We conduct an under-identification test to check whether the instrument is relevant and correlated with the endogenous variable. The Kleibergen-Paap rk LM statistic (13.965) rejects the null hypothesis ( $p < .01$ ), suggesting that the IVs meet the relevance requirement. We also run a weak-identification test to evaluate the relevance strength of the IVs (Cragg and Donald, 1993). The result shows that the Kleibergen-Paap Wald  $F$ -statistics is 21.562, which exceeds the cut-off value of 11.52 (Stock and Yogo, 2005).<sup>3</sup> Further, to meet the exclusion condition, regional average supplier concentration should be uncorrelated with the error term of the regression. The regional-level instrument variables exclude firms in the same industry to reduce the mechanical relation with explained variables (Zhong et al., 2022; Zhou et al., 2022). In other words, after including the full set of control variables, regional average supplier concentration can influence firm performance only through our independent variable (i.e., supplier concentration) (Chen et al., 2020). We also run an over-identification test to find that the Hansen J statistic is 0.408 ( $p = 0.523$ ), suggesting that our IVs meet the exclusion requirement. In sum, these tests indicate that our IVs are appropriate.

For hypothesis testing, we run the two-stage IV model using the panel data with year, industry, and province dummies. In the second stage, we employ a zero-inflated negative binomial regression when estimating the innovation performance model for the following three reasons: (1) considering the nature of the count variable; (2) excessive zero value (i.e., 6.47% (189/2,890) are at the value of zero)<sup>4</sup>; (3) overdispersion in the dependent variable (i.e., the

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consistent.

<sup>3</sup> It indicates that it has no more than 10% of the bias of OLS estimates with one endogenous variable and two IVs (the critical value is 11.59 for 15% maximal bias, and 8.75 for 20% maximal bias).

<sup>4</sup> To check whether employ the standard negative binomial model or the zero-inflated negative binomial

standard deviation (358.244) is much bigger than the mean value (53.292)) (Hausman et al., 1984). The model estimates the number of patents using two processes: (1) a zero-inflated process (i.e., a logit model is adopted to explain excessive zeros) and (2) a count process (i.e., a negative binomial model). Therefore, zero counts are generated in two ways, respectively: (1) as the zero-inflated process is realized (i.e., when the logit model is realized at 0) and (2) as the count process is realized (i.e., when the logit model is realized at 1). In particular, the model is specified as below:

$$IP_{it} = \begin{cases} 0 & \text{with probability } \Lambda(Z_{it}\theta_1) \\ \text{Negative binomial } (IP_{it} = p|X_{it}) & \text{with probability } (1 - \Lambda(Z_{it}\theta_1)) \end{cases} \quad (1)$$

where *Negative binomial* ( $IP_{it} = p|X_{it}$ ) refers to the negative binomial regression model capturing the negative binomial count process,  $p$  refers to the number of invention patents for firm  $i$  in year  $t$ ,  $IP_{it}$  refers to innovation performance,  $X_{it}$  represents all explanatory variables to be included in this process.  $\Lambda((Z_{it}\theta_1))$  refers the logit zero-inflated process capturing the excessive zero observations,  $Z_{it}$  represents all explanatory variables to be included in this process, the vectors  $\theta_1$  represent the coefficients to be estimated in this model. According to prior research, the explanatory variables (e.g.,  $Z_{it}$  and  $X_{it}$ ) included in two different processes do not need to be the same (Ergün- Şahin et al., 2022). To avoid convergence problems and reduce complexity, we only select some important firm demographic characteristics variables (i.e., firm size, leverage, cash ratio, R&D intensity, advertising intensity and SOE) in the inflated process model (Cameron and Trivedi, 2009; Ergün- Şahin et al., 2022). We report the results of the count process model (i.e., negative binomial model results) in main analyses (see Table 3) and report the results of the zero-inflated process in Table A3 (see Appendix C).

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model, we run a Vuong test and find that the latter one is more suitable ( $z = 2.31, p < .05$ ).

We also use negative binomial regression, Poisson regression, and zero-inflated Poisson regression as the robustness checks and the results remain the consistent. To account for heteroscedasticity and the potential for non-independence across observations, we use Huber-White error settings for all models (Dencker and Gruber, 2015). We mean-center all continuous moderators to ease the explanations and reduce the likelihood of multicollinearity (Aiken and West, 1991). The variance inflation factor values range from 1.060 to 3.030, which are much smaller than the recommended cut-off value of 10 (Ryan, 1997). Thus, our models do not suffer from the multicollinearity problem.

## **Results**

Table 2 reports the means, standard deviations, and correlations. The correlation between supplier concentration and innovation performance is marginally negative ( $r = -.033, p < .10$ ), while the correlation with financial performance is positive ( $r = .097, p < .05$ ), in line with our expectations.

\*\*\*Insert Table 2 about here\*\*\*

## **Hypothesis testing**

Table 3 reports the results of our regression analyses. We use Models 1–5 to examine the relationship between supplier concentration and financial performance and Models 6–10 to test its effect on innovation performance. Models 1 and 6 are the baseline models with all control variables and moderators. Models 2 and 7 add the independent variable (i.e., supplier concentration). Models 3–4 and 8–9 include the interaction terms between each moderator and supplier concentration, respectively. Models 5 and 10 include the full models with all interactions.

\*\*\*Insert Table 3 about here\*\*\*

Hypothesis 1 posits that supplier concentration is positively associated with financial performance. The coefficient of supplier concentration is positive in Model 2 ( $b = .154, p < .01$ ) and Model 5 ( $b = .200, p < .01$ ), supporting Hypothesis 1. For the effect size, financial performance increases by 11.60% as supplier concentration increases from the mean to 1 SD above the mean. Hypothesis 2 discusses the relationship between supplier concentration and innovation performance. As the results reported in Table 3 show, the coefficient of supplier concentration is negative and significant (Model 7:  $b = -16.633, p < .01$ ; Model 10:  $b = -18.509, p < .01$ ), supporting Hypothesis 2. *Ceteris paribus*, when supplier concentration increases from the mean to 1 SD above the mean, innovation performance decreases by 48.59%.

Hypothesis 3 predicts that organizational slack strengthens the effect of supplier concentration on financial performance. The coefficient of the interaction between supplier concentration and organizational slack is positive (Model 3:  $b = .023, p < .01$ ; Model 5:  $b = .021, p < .05$ ), supporting Hypothesis 3. When a firm's organizational slack is low (i.e., 1 SD below the mean), financial performance increases by 8.98% as the supplier concentration changes from the mean to 1 SD above the mean, while financial performance increases by 17.45% if the firm's organizational slack is high (i.e., 1 SD above the mean).

Hypothesis 4 proposes that organization slack moderates the effect of supplier concentration on innovation performance. The coefficient of the interaction between supplier concentration and organizational slack is positive (Model 8:  $b = .498, p < .10$ ; Model 10:  $b = .626, p < .05$ ), supporting Hypothesis 4. When a firm's organizational slack is low, innovation performance decreases by 53.44% as supplier concentration changes from the mean to 1 SD above the mean, while innovation performance decreases by 48.10% when a firm's organizational slack is high.

Hypothesis 5 posits that industry competition strengthens the positive effect of supplier concentration on financial performance. The coefficient of the interaction between supplier concentration and industry competition is positive (Model 4:  $b = .884$ ,  $p < .05$ ; Model 5:  $b = .777$ ,  $p < .10$ ), supporting Hypothesis 5. When a firm operates in an industry with low competition, the financial performance increases by 10.27% as supplier concentration changes from the mean to 1 SD above the mean, while financial performance increases by 15.62% if a firm operates in an industry with intense competition.

Hypothesis 6 posits that the effect of supplier concentration on innovation performance becomes more negative when industry competition is high. The coefficient of the interaction between supplier concentration and industry competition is negative (Model 9:  $b = -53.167$ ,  $p < .01$ ; Model 10:  $b = -56.504$ ,  $p < .01$ ), thus supporting Hypothesis 6. For the effect size, as supplier concentration changes from the mean to 1 SD above the mean, innovation performance decreases by 46.16% if a firm operates in an industry with low competition, while if a firm operates in an industry with intense competition, innovation performance decreases by 58.95%.

### **Robustness checks**

We conduct a set of additional tests to check the robustness of our results, which are reported in the Appendix D.

First, we use the *market-to-book ratio* to replace *ROA* to measure financial performance. This factor is calculated as the book value of a firm's equity divided by the year-end market value of its equity (Wang and Qian, 2011). We use the new measure of financial performance to re-run the analyses and obtain consistent results (Table A4: Models 1–5). Second, we also employ the zero-inflated Poisson model to re-estimate the effect of supplier concentration on

innovation performance (Jiang et al., 2022).<sup>5</sup> The results, as presented in Table A4 of Appendix D (Models 6–10), are highly consistent with our main analyses.

Third, we use *equity-to-debt ratio* as an alternative measure of organization slack (Xu et al., 2019), which is calculated as the ratio of total equity to total debt. We re-run all tests and obtain consistent results (see Table A5 in the Appendix D). Fourth, since there are two dependent variables, we use a seemingly unrelated regression to estimate the two models simultaneously to account for the potential bias induced by contemporaneous correlation of error terms.<sup>6</sup> The results remain highly consistent (see Table A6 in the Appendix D).

Fifth, to account for the long-term effects of the independent variable and moderators on both financial and innovation performance, we lagged our explanatory variables for two years (i.e., t+2) and re-run our analysis (Cassiman and Veugelers, 2006; Li et al., 2022) (See Table A7 in Appendix D). For the innovation performance model, besides adopting the zero-inflated negative binomial model, we also use the standard negative binomial model, zero-inflated Poisson model, and standard Poisson model as alternative models (See Table A7 in Appendix D). The results remain consistent.

## Discussion

Building on TCE and KBV, we examine the effects of supplier concentration on the buyer firm's financial and innovation performance. Based on a sample of listed manufacturing firms in China from 2012 to 2017, we find that supplier concentration benefits the buyer firm's financial performance but hurts its innovation performance. Organizational slack strengthens the positive effect of supplier concentration on financial performance and mitigates its negative effect on

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<sup>5</sup> We also use the standard Poisson model and standard negative binomial model to re-estimate the effect of supplier concentration on innovation performance and the results keep consistent.

<sup>6</sup> Since the seemingly unrelated regression is not suitable for the count variable (Tchakoute Tchuigoua et al., 2020), we use a natural logarithm transformation for the number of invention patents.

innovation performance. Industry competition amplifies the positive and negative effects of supplier concentration on firm performance.

### **Theoretical contributions**

Our research provides several contributions to the literatures. First, our findings add to prior studies on supplier concentration by focusing on how it differentially affects different facets of firm performance. While researchers have long recognized the importance of supplier management (Choi and Krause, 2006; Yan et al., 2017), prior studies have largely focused on the dyadic buyer–supplier relationships or other network attributes (e.g., Bellamy et al., 2014; Sharma et al., 2020; Zhou et al., 2014). Extending this stream of research, we focus on the role of supplier concentration, a relatively underexplored attribute of network structure (Chen et al., 2020; Steven et al., 2014). Understanding the consequences of supplier concentration has significant theoretical value for the literature because in most cases every buyer firm engages with multiple suppliers. Specifically, our study indicates that proper supplier structure design carries strong implications for the buyer firm’s financial and innovation performance. It extends current knowledge of supplier concentration by revealing its double-edged effects on buyers’ financial and innovation performance. Prior studies have adopted mainly economics-oriented views to examine the effect of supplier concentration on operational efficiency (Chen et al., 2020; Steven et al., 2014; Tang and Rai, 2012), leaving the value of diverse knowledge from suppliers under-explored. Our study suggests that supplier concentration reduces transaction risks and coordination costs, thus in turn fosters financial performance. A concentrated supplier base, however, has a “dark side” by hurting the buyer firm’s innovation performance. Supplier concentration constrains the buyer firm’s ability to acquire diverse knowledge and generate new knowledge combinations that support innovation.

Second, our study identifies organizational slack and industry competition as important contingencies influencing the effects of supplier concentration. A joint examination of supplier concentration with the surrounding conditions of market environments and buyer characteristics helps clarify the value of supplier concentration for boosting superior firm performance (Gao et al., 2015; Irvine et al., 2016). In particular, our findings indicate that organizational slack and industry competition strengthen the effect of supplier concentration on financial performance. The findings also reveal that industry competition exacerbates the dark side of supplier concentration, while firms can attenuate the negative impact on innovation performance by increasing slack resources. In such case, it uncovers the contextual contingencies, substantiates the mechanisms linking supplier concentration to various firm performance, and identifies important limitations as well as strengths associated with supplier concentration. These findings answer the call for more research on the relationships between supplier concentration and the performance outcomes (Chen et al., 2020).

Furthermore, by confirming the moderation effect of organizational slack on the relationship between supplier concentration and firm performance, our study also contributes to the organizational slack literature. Prior studies have extensively examined the relationships between organizational slack and different facets of firm performance (Marlin and Geiger, 2015; Stan et al., 2014; Vanacker et al., 2017; Voss et al., 2008). However, the underlying mechanisms and empirical results remain inconclusive (Carnes et al., 2019). Extending previous research, our findings emphasize that organizational slack can be used to manage supplier base and enhance the effect of supplier concentration on firm financial and innovation performance. In particular, slack resources strengthen the efficiency advantage of supplier concentration in fostering superior performance. Slack resources also mitigate the issues related to limited knowledge



acquisition and integration from supplier concentration, thereby reducing the negative impact on innovation performance. These findings indicate that how the firm orchestrates and deploys the slack resources make a significant impact on critical strategic choices about supplier base and firm performance (Ndofor et al., 2011). Moreover, our study identifies the moderation effect of industry competition on the relationship between supplier concentration and firm performance. Prior studies have examined the direct influence of competition intensity on firm performance (Younge and Tong, 2018) and have considered industry competition as an important moderator of the effects of supplier network technological diversity (Gao et al., 2015) and buyer–supplier relational ties (Zhou et al., 2014). Our study takes this one step further to examine how industry competition moderates the roles of supplier concentration on various performance outcomes. In particular, we find that when competition is more intense, supplier concentration has a stronger positive impact on financial performance and a stronger negative effect on innovation performance.

Third, our research enriches the literatures on TCE and KBV. TCE posits that firms should manage transaction risks and coordination costs effectively to achieve better financial performance (Ketchen and Hult, 2007; Sharma et al., 2020). By applying and extending the arguments of TCE, our research highlights that higher supplier concentration helps the buyer reduce transaction risks and achieve effective coordination with the suppliers. According to TCE, multiple sources of uncertainty may affect transactional costs and risks (Flynn et al., 2016; Gaur et al., 2011). Extending the arguments, our research demonstrates that organizational slack and industry competition as the specific micro- & macro-level factors influence the focal firm's ability to deal with uncertainty, manage the exchange relationships, and achieve the value potential from supplier concentration. Furthermore, prior KBV literature has confirmed the

driving role of supplier network on firm innovation by providing knowledge-based resources (Bellamy et al., 2014; Potter and Wilhelm, 2020). Extending this line of enquiry, our research demonstrates that supplier concentration as a specific supplier network structure affects knowledge acquisition and utilization, which further influences firm innovation performance. In addition, extending the KBV literature, our findings suggest that firm-level and environmental factors both influence the availability of related knowledge committed to innovation and facilitate the innovation process (Zhou and Li, 2012).

### **Managerial Implications**

Buyer firms often face the dilemma of whether to rely on a few major suppliers or to build a more widely dispersed supplier base. Our findings carry importance implications for how to design the structure of supplier base and the consequent effect on firm performance. Our findings suggest that managers ought to understand the double-edge sword effects of supplier concentration, and accordingly adjust the supplier structure to align with their desired performance objectives.

*Be cautious of the double-edge sword effects of supplier concentration.* When firms aim for superior financial performance, they can concentrate their procurement efforts in a limited number of suppliers, thereby reducing transaction costs and addressing coordination challenges. However, if innovation is the primary objective, it is advisable for firms to establish a dispersed supplier base, as this approach allows them to acquire diverse information and generate fresh ideas. For instance, Xiaomi, the Chinese smartphone manufacturer who recently makes strides in the electric vehicle industry, has sustained its innovative edge by working with a broad array of suppliers.

*Taking resource and environment factors into consideration.* To generate superior

performance, firms should match their supplier structure with their resource endowments and the external environment. When a firm possesses slack resources, it can capitalize on them by increasing supplier concentration, thereby achieving superior financial performance. Additionally, by accumulating more slack resources, the firm can mitigate the negative consequences of a concentrated supplier base on innovation performance. Consider the case of Apple, which exhibit a high concentration among its major suppliers. The company's significant slack resources not only contribute to boosting the impact of supply concentration on financial performance, but also serve as a buffer against potential risks. Specifically, slack resources enable Apple to maintain flexibility in its innovation efforts, even with a concentrated supplier base, ensuring that it can continue to introduce new and innovative products into the market. Furthermore, firms should understand how to leverage the benefits of supplier concentration in a competitive environment. In industries with intense competition, concentrating procurement efforts on a selected few suppliers can be an effective strategy to promote financial performance. Yet, to foster superior innovation performance, firms should exercise caution and avoid excessive levels of supplier concentration in such competitive markets.

### **Limitations and Future Research**

Our study must be viewed in light of its limitations, which suggests several avenues for future research. First, our research context is China, whose unique features may limit the generalizability of our findings. China has been transitioning from a centrally planned economy to a market economy, so its unique culture and legal system may affect how buyer firms manage and utilize their supplier relationships, consequently shaping the role of supplier concentration. Future research could collect data from other countries to validate our findings.

Second, while our study focuses on supplier concentration, other network attributes (e.g.,

network brokerage, interconnections) also matter. We are unable to consider these network characteristics because our datasets do not provide such information. Future research may consider these network attributes and explore their joint effects with supplier concentration. Furthermore, in this study, we assume the heterogeneity among all the suppliers but do not capture the unique feature of each supplier. Future research can integrate the nature and structure of the supplier base to examine their implications on firm performance.

Third, according to TCE and KBV, we argue that supplier concentration affects transaction costs and knowledge integration, which in turn influences financial and innovation performance separately. However, we do not measure and examine the mediation mechanisms, which can be addressed in future research. Moreover, according to TCE and KBV, we focus on the moderating roles of organizational slack and industry competition. Further studies could consider other contextual factors (e.g., environmental turbulence, relational strength between suppliers) in moderating the effect of supplier concentration (Bellamy et al., 2014). Related future research could also examine the contingent effects of supplier characteristics, such as resource heterogeneity and organizational types.

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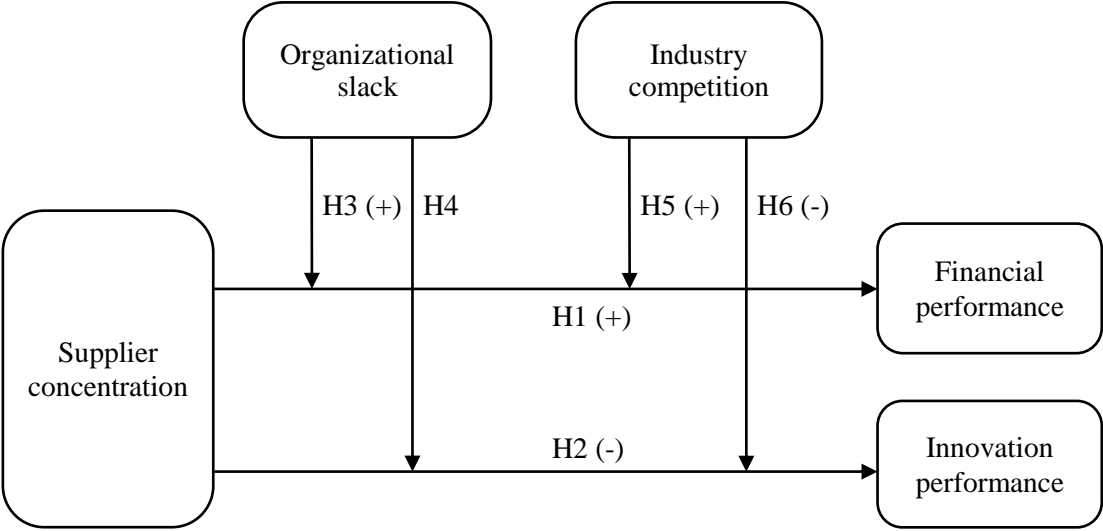
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**FIGURE 1** Conceptual Model

**TABLE 1** A brief summary on supplier concentration related studies

<b>Study</b>	<b>Data</b>	<b>IV</b>	<b>Mo</b>	<b>DV</b>	<b>Key findings related to supplier concentration</b>
Chen et al. (2020)	4,530 firm-year obs. of Chinese listed firms	<b>Supplier-base concentration</b>	--	Cost elasticity	There is a positive association between supplier-base concentration and cost Elasticity.
Steven et al. (2014)	165 firms in US	Outsourcing intensity Offshore outsourcing intensity; Offshoring intensity; <b>Supplier concentration</b> National concentration	Interaction	Product recalls	Supplier concentration leads to few product recalls. However, it exacerbates the impact of outsourcing on product recalls.
Molinaro et al. (2022)	324 manufacturing plants from 15 countries	Supplier development; supplier involvement; operational coordination with suppliers; E-information sharing with supplier.	Mo: <b>Supply base concentration</b>	Buyer's efficiency and innovation	Supply base concentration strengthens the effects of supplier development and operational coordination with suppliers on buyer efficiency and innovation.
Tang and Rai (2012)	318 firms in US	Process alignment and partnering flexibility	Mo: <b>Supplier portfolio</b>	Competitive performance	Concentrated relationship portfolios amplify the positive effect of process alignment on competitive performance and attenuate the competitive benefits that firms derive from partnering flexibility.
Rai and Tang (2010)	318 firms in US	IT integration; IT reconfiguration	Mo: <b>Inter-organizational relationship (IR) portfolio concentration</b>	Process alignment; Process flexibility	IR portfolio concentration suppresses the positive effect of IT integration and amplifies the positive effect of IT reconfiguration on competitive process capabilities (i.e., process alignment, offering flexibility, and partnering flexibility).
Our Model	902 listed firms in China	<b>Supplier concentration</b>	Mo: Organizational slack; industry competition	Financial performance; Innovation performance	Supplier concentration enhances a firm's financial performance but decreases the firm's innovation performance. Organizational slack strengthens the effect of supplier concentration on financial performance and mitigates its negative impact on innovation performance; industry competition strengthens the effects of supplier concentration on financial and innovation performance.

Notes: IV = independent variable; Mo = Moderator; Me = Mediator; DV = dependent variable

**TABLE 2** Basic Descriptive Statistics and Correlations

<b>Variables</b>	<i>Mean</i>	<i>S.D.</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Financial performance	0.064	0.045	1												
(2) Innovation performance	53.292	358.244	0.025	1											
(3) Supplier concentration	0.053	0.093	0.097	-0.033	1										
(4) Organizational slack	0.212	2.171	-0.222	-0.056	-0.006	1									
(5) Industry competition	0.922	0.061	-0.156	0.042	-0.171	0.095	1								
(6) Firm age	2.290	0.511	0.096	0.039	0.031	-0.223	0.020	1							
(7) Firm size	7.834	1.034	0.228	0.223	-0.179	-0.384	-0.100	0.275	1						
(8) Cash ratio	0.972	0.185	0.080	0.016	0.035	0.133	-0.041	-0.004	-0.035	1					
(9) Firm leverage	0.050	0.073	-0.089	0.087	0.028	-0.292	-0.015	0.179	0.266	-0.063	1				
(10) R&D intensity	0.038	0.028	-0.265	0.051	-0.127	0.324	0.200	-0.156	-0.166	-0.001	-0.154	1			
(11) Advertising intensity	0.007	0.018	-0.020	-0.031	-0.058	0.237	0.017	0.016	0.043	0.184	-0.110	-0.032	1		
(12) SOE	0.289	0.453	0.053	0.077	0.007	-0.204	0.013	0.507	0.282	-0.059	0.194	-0.054	-0.064	1	
(13) Biggest shareholder	33.698	14.406	0.125	-0.031	-0.018	-0.022	-0.078	-0.149	0.182	0.047	-0.029	-0.051	0.117	0.071	1

Notes: We obtained 3,075 observations of financial performance.

Missing values regarding patents limited us to 2,890 observations of innovation performance.

The correlation is significant at 5% level if its absolute value is above 0.035 (two-tailed).

**TABLE 3** Effects of Supplier Concentration on Financial Performance (t+1) and Innovation Performance (t+1)

Dependent variables	Financial performance					Innovation performance				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Firm age	0.005** (0.002)	0.004* (0.002)	0.004* (0.002)	0.004* (0.002)	0.004* (0.002)	0.158** (0.058)	0.247** (0.058)	0.244** (0.059)	0.255** (0.059)	0.252** (0.059)
Firm size	0.008** (0.001)	0.009** (0.001)	0.009** (0.001)	0.010** (0.001)	0.009** (0.001)	0.750** (0.023)	0.618** (0.028)	0.612** (0.028)	0.602** (0.028)	0.594** (0.028)
Cash ratio	0.010* (0.004)	0.010* (0.004)	0.011** (0.004)	0.010* (0.004)	0.010* (0.004)	0.060 (0.135)	0.034 (0.133)	0.035 (0.133)	0.034 (0.132)	0.034 (0.132)
Firm leverage	-0.135** (0.010)	-0.134** (0.010)	-0.133** (0.010)	-0.134** (0.010)	-0.133** (0.010)	1.020** (0.358)	1.034** (0.351)	1.042** (0.351)	1.017** (0.349)	1.027** (0.349)
R&D intensity	-0.235** (0.030)	-0.197** (0.033)	-0.188** (0.033)	-0.179** (0.033)	-0.174** (0.034)	10.230** (1.097)	6.469** (1.161)	6.663** (1.166)	5.846** (1.167)	6.048** (1.170)
Advertising intensity	0.006 (0.048)	0.042 (0.049)	0.052 (0.049)	0.050 (0.049)	0.059 (0.050)	-2.952* (1.434)	-6.240** (1.472)	-6.015** (1.478)	-6.161** (1.472)	-5.880** (1.479)
SOE	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.189** (0.068)	0.154* (0.067)	0.150* (0.067)	0.149* (0.067)	0.144* (0.067)
Biggest shareholder	0.015** (0.005)	0.017** (0.005)	0.017** (0.005)	0.017** (0.005)	0.017** (0.005)	0.006** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)
<b>Moderators</b>										
Organizational slack	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.042** (0.013)	-0.041** (0.013)	-0.045** (0.013)	-0.042** (0.013)	-0.047** (0.013)
Industry competition	-0.139* (0.054)	-0.124* (0.054)	-0.126* (0.054)	-0.126* (0.054)	-0.128* (0.054)	-3.548+ (2.015)	-3.908+ (2.038)	-3.843+ (2.037)	-3.739+ (2.027)	-3.633+ (2.026)
<b>Independent variable</b>										
Supplier concentration (SC)		0.154** (0.052)	0.152** (0.052)	0.208** (0.058)	0.200** (0.058)		-16.633** (1.938)	-16.757** (1.942)	-18.277** (1.933)	-18.509** (1.936)
<b>Interactions</b>										
SC x organizational slack			0.023** (0.008)		0.021* (0.008)			0.498+ (0.288)		0.626* (0.294)
SC x industry competition				0.884* (0.403)	0.777+ (0.405)				-53.167** (14.220)	-56.504** (14.298)
Constant	0.042** (0.010)	0.039** (0.010)	0.039** (0.010)	0.037** (0.010)	0.038** (0.010)	-4.267** (0.338)	-3.092** (0.362)	-3.066** (0.362)	-2.901** (0.363)	-2.856** (0.363)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,075	3,075	3,075	3,075	3,075	2,890	2,890	2,890	2,890	2,890
R <sup>2</sup> /Chi2	0.320	0.322	0.324	0.324	0.325	2788	2867	2870	2881	2886

Notes: Robust standard errors in parentheses. \*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two-tailed).

## APPENDIX A

**TABLE A1** Measurements and Data Sources

<b>Variable</b>	<b>Measurement</b>	<b>Data sources</b>
Financial performance	Ratio of operating income before depreciation to the total assets.	CSMAR
Innovation performance	The number of invention patents the firm applied in a given year.	CSMAR
Supplier concentration (SC)	Calculated as the sum of a firm's top five suppliers' squared share of procurement in a given year (i.e., the Herfindahl-Hirschman Index of supplier concentration).	CSMAR (Financial footnotes)
Organizational slack	Sum of the standardized values of three types of slacks: (1) available slack (i.e., the ratio of current assets to current liability); (2) absorbed slack (i.e., the working capital-to-assets ratio); (3) potential slack (i.e., the equity-to-debt ratio).	CSMAR
Industry competition	Calculated as one minus the sum of the squared sales ratio for all firms within the same industry.	CSMAR
Firm age	The natural logarithm of one plus the number of years since a firm's IPO (i.e., $\ln(\text{number of years} + 1)$ ).	CSMAR
Firm size	The natural logarithm of one plus a firm's number of employees (i.e., $\ln(\text{number of employees} + 1)$ ).	CSMAR
Cash ratio	Cash received from sales of goods or rendering of services scaled by operating income.	CSMAR
Firm leverage	Long-term debt scaled by total assets.	CSMAR
R&D intensity	Ratio of R&D expenditure to sales.	WIND
Advertising intensity	Ratio of advertising expenditure to sales.	CSMAR
SOE (state-owned enterprise)	Dummy variable indicating whether a firm's ultimate controller is the government or its agencies, valued at 1 if it is and 0 otherwise.	CSMAR
Biggest shareholder	Percentage of the equity share of the largest shareholder.	CSMAR



## APPENDIX B

**TABLE A2** First-Stage Regression Results

<b>Dependent variable</b>	<b>Supplier concentration (t)</b>
Regional average supplier concentration (t-1)	0.700** (0.092)
Regional average supplier concentration (t-2)	0.170* (0.086)
Firm age	0.007* (0.003)
Firm size	-0.007** (0.001)
Cash ratio	0.007 (0.009)
Firm leverage	0.043+ (0.024)
R&D intensity	-0.199** (0.046)
Advertising intensity	-0.212** (0.071)
SOE	-0.001 (0.004)
Biggest shareholder	0.001 (0.001)
Constant	0.132** (0.034)
Year and Province fixed effects	<i>Yes</i>
Observations	3,075
$R^2$	0.501

*Notes:* All explanatory variables are lagged by one year.

Robust standard errors are reported in parentheses.

\*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two tailed).

APPENDIX C

TABLE A3. Zero-Inflated Negative Binomial Model Results

Count process	Model 1	Model 2	Model 3	Model 4	Model 5
Firm age	0.158** (0.058)	0.247** (0.058)	0.244** (0.059)	0.255** (0.059)	0.252** (0.059)
Firm size	0.750** (0.023)	0.618** (0.028)	0.612** (0.028)	0.602** (0.028)	0.594** (0.028)
Cash ratio	0.060 (0.135)	0.034 (0.133)	0.035 (0.133)	0.034 (0.132)	0.034 (0.132)
Firm leverage	1.020** (0.358)	1.034** (0.351)	1.042** (0.351)	1.017** (0.349)	1.027** (0.349)
R&D intensity	10.230** (1.097)	6.469** (1.161)	6.663** (1.166)	5.846** (1.167)	6.048** (1.170)
Advertising intensity	-2.952* (1.434)	-6.240** (1.472)	-6.015** (1.478)	-6.161** (1.472)	-5.880** (1.479)
SOE	0.189** (0.068)	0.154* (0.067)	0.150* (0.067)	0.149* (0.067)	0.144* (0.067)
Biggest shareholder	0.006** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)
<b>Moderators</b>					
Organizational slack	-0.042** (0.013)	-0.041** (0.013)	-0.045** (0.013)	-0.042** (0.013)	-0.047** (0.013)
Industry competition	-3.548+ (2.015)	-3.908+ (2.038)	-3.843+ (2.037)	-3.739+ (2.027)	-3.633+ (2.026)
<b>Independent variable</b>					
Supplier concentration (SC)		-16.633** (1.938)	-16.757** (1.942)	-18.277** (1.933)	-18.509** (1.936)
<b>Interactions</b>					
SC x organizational slack			0.498+ (0.288)		0.626* (0.294)
SC x industry competition				-53.167** (14.220)	-56.504** (14.298)
Constant	-4.267** (0.338)	-3.092** (0.362)	-3.066** (0.362)	-2.901** (0.363)	-2.856** (0.363)
<b>Inflate process</b>					
Firm size	-0.604** (0.103)	-0.558** (0.109)	-0.564** (0.110)	-0.513** (0.111)	-0.515** (0.112)
Cash ratio	0.602 (0.473)	0.605 (0.473)	0.558 (0.475)	0.593 (0.473)	0.544 (0.476)
Firm leverage	0.144 (1.189)	0.188 (1.189)	0.138 (1.196)	0.077 (1.190)	0.001 (1.200)
R&D intensity	-20.461** (4.847)	-18.801** (4.993)	-19.126** (4.973)	-17.238** (5.077)	-17.481** (5.050)
Advertising intensity	9.493+ (5.157)	10.757* (5.249)	10.328* (5.242)	11.521* (5.292)	11.100* (5.277)
SOE	0.622* (0.243)	0.615* (0.243)	0.632** (0.244)	0.621* (0.242)	0.639** (0.243)
Industry, year and province dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,890	2,890	2,890	2,890	2,890
Chi2	2788	2867	2870	2881	2886

Notes: Robust standard errors in parentheses. \*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two-tailed).

**APPENDIX D TABLE A4.** Robustness Check: Alternative Measures of Financial Performance and Innovation Performance

Dependent variables	Financial performance (Market-to-book ratio)					Innovation performance (Zero-inflated Poisson model)				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Firm age	0.405** (0.067)	0.353** (0.068)	0.344** (0.068)	0.340** (0.067)	0.334** (0.067)	-0.433** (0.008)	-0.184** (0.008)	-0.185** (0.008)	-0.129** (0.008)	-0.123** (0.008)
Firm size	-0.533** (0.032)	-0.427** (0.037)	-0.432** (0.037)	-0.411** (0.036)	-0.417** (0.036)	1.077** (0.003)	0.723** (0.004)	0.706** (0.004)	0.696** (0.004)	0.674** (0.004)
Cash ratio	-0.028 (0.139)	-0.038 (0.138)	-0.013 (0.135)	-0.050 (0.138)	-0.026 (0.135)	1.115** (0.020)	1.134** (0.020)	1.123** (0.020)	1.144** (0.020)	1.141** (0.020)
Firm leverage	-2.854** (0.305)	-2.805** (0.304)	-2.778** (0.302)	-2.790** (0.304)	-2.767** (0.301)	0.346** (0.041)	-0.093* (0.042)	-0.105* (0.042)	-0.122** (0.042)	-0.153** (0.043)
R&D intensity	1.093 (1.268)	4.470** (1.434)	4.864** (1.439)	5.205** (1.427)	5.478** (1.431)	6.741** (0.119)	-1.083** (0.139)	-0.460** (0.139)	-2.001** (0.138)	-1.515** (0.138)
Advertising intensity	6.890** (1.978)	10.048** (2.087)	10.503** (2.109)	10.419** (2.064)	10.793** (2.088)	-3.173** (0.300)	-12.213** (0.310)	-10.936** (0.309)	-11.808** (0.299)	-10.600** (0.296)
SOE	0.051 (0.071)	0.057 (0.071)	0.056 (0.070)	0.066 (0.070)	0.064 (0.070)	0.730** (0.008)	0.535** (0.008)	0.548** (0.008)	0.471** (0.008)	0.476** (0.008)
Biggest shareholder	0.004* (0.002)	0.006** (0.002)	0.006** (0.002)	0.006** (0.002)	0.006** (0.002)	-0.011** (0.000)	-0.011** (0.000)	-0.011** (0.000)	-0.011** (0.000)	-0.010** (0.000)
<b>Moderators</b>										
Organizational slack	0.133** (0.018)	0.137** (0.018)	0.130** (0.018)	0.137** (0.018)	0.130** (0.018)	-0.089** (0.003)	-0.119** (0.003)	-0.083** (0.003)	-0.128** (0.003)	-0.096** (0.003)
Industry competition	2.336 (2.065)	3.473 (2.123)	3.517+ (2.123)	3.181 (2.115)	3.258 (2.119)	4.109** (0.284)	0.599* (0.276)	0.667* (0.275)	-0.334 (0.280)	-0.400 (0.279)
<b>Independent variable</b>										
Supplier concentration (SC)		13.773** (2.747)	13.674** (2.722)	16.113** (2.519)	15.727** (2.515)		-34.454** (0.296)	-32.645** (0.292)	-36.135** (0.268)	-34.917** (0.264)
<b>Interactions</b>										
SC x organizational slack			1.008* (0.457)		0.934* (0.468)			3.425** (0.083)		3.272** (0.067)
SC x industry competition				38.338* (15.905)	33.498* (15.908)				-145.345** (2.008)	-155.824** (2.078)
Constant	4.364** (0.354)	3.569** (0.381)	3.594** (0.379)	3.404** (0.382)	3.449** (0.381)	-6.409** (0.053)	-4.365** (0.057)	-4.241** (0.057)	-4.085** (0.056)	-3.906** (0.057)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,075	3,075	3,075	3,075	3,075	2,890	2,890	2,890	2,890	2,890
R <sup>2</sup> /Chi <sup>2</sup>	0.381	0.394	0.396	0.395	0.398	462873	478846	480146	482722	484440

Notes: Robust standard errors in parentheses. \*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two-tailed).

**TABLE A5** Robustness Check: Alternative Measures of Organization Slack

Dependent variables	Financial performance	Innovation performance
	Model 1	Model 2
Firm age	0.006** (0.002)	0.254** (0.059)
Firm size	0.010** (0.001)	0.599** (0.028)
Cash ratio	0.011** (0.004)	0.022 (0.132)
Firm leverage	-0.139** (0.011)	0.949** (0.356)
R&D intensity	-0.185** (0.033)	5.493** (1.141)
Advertising intensity	0.031 (0.049)	-6.564** (1.468)
SOE	-0.000 (0.002)	0.150* (0.067)
Biggest shareholder	0.000** (0.000)	0.005** (0.002)
<i>Moderators</i>		
Equity-to-debt ratio	-0.002** (0.000)	-0.033** (0.010)
Industry competition	-0.041 (0.062)	-3.743+ (2.026)
<i>Independent variable</i>		
Supplier concentration (SC)	0.207** (0.058)	-18.351** (1.937)
<i>Interactions</i>		
SC x equity debt ratio	0.023** (0.006)	0.353+ (0.214)
SC x industry competition	0.706+ (0.403)	-53.795** (14.256)
Constant	0.037** (0.011)	-2.858** (0.364)
Industry dummies	Yes	Yes
Year dummies	Yes	Yes
Province dummies	Yes	Yes
Observations	3,075	2,890
$R^2/Chi2$	0.333	2882

Notes: Robust standard errors in parentheses. \*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two-tailed).

**TABLE A6. Seemingly Unrelated Regression Model**

Dependent variables	Financial performance					Innovation performance				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Firm age	0.006** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005* (0.002)	0.061 (0.055)	0.100+ (0.055)	0.096+ (0.055)	0.113* (0.055)	0.110* (0.055)
Firm size	0.008** (0.001)	0.009** (0.001)	0.009** (0.001)	0.009** (0.001)	0.009** (0.001)	0.673** (0.025)	0.584** (0.028)	0.581** (0.028)	0.566** (0.028)	0.560** (0.028)
Cash ratio	0.011** (0.004)	0.011** (0.004)	0.012** (0.004)	0.011** (0.004)	0.012** (0.004)	-0.118 (0.121)	-0.115 (0.120)	-0.103 (0.120)	-0.108 (0.120)	-0.093 (0.120)
Firm leverage	-0.130** (0.011)	-0.129** (0.011)	-0.129** (0.011)	-0.129** (0.011)	-0.129** (0.011)	1.058** (0.320)	0.999** (0.317)	1.011** (0.317)	0.979** (0.317)	0.993** (0.316)
R&D intensity	-0.230** (0.031)	-0.187** (0.033)	-0.180** (0.033)	-0.172** (0.034)	-0.168** (0.034)	12.043** (0.915)	9.242** (0.983)	9.432** (0.986)	8.433** (1.010)	8.581** (1.010)
Advertising intensity	0.016 (0.049)	0.057 (0.050)	0.065 (0.050)	0.063 (0.050)	0.070 (0.050)	-2.454+ (1.458)	-5.061** (1.487)	-4.818** (1.489)	-5.420** (1.488)	-5.162** (1.489)
SOE	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.119+ (0.061)	0.117+ (0.061)	0.116+ (0.060)	0.109+ (0.060)	0.106+ (0.060)
Biggest shareholder	0.000+ (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.002 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)
Organizational slack	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.012 (0.013)	-0.015 (0.013)	-0.018 (0.013)	-0.015 (0.013)	-0.019 (0.013)
Industry competition	-0.064 (0.062)	-0.047 (0.062)	-0.047 (0.062)	-0.052 (0.063)	-0.052 (0.062)	-1.781 (1.872)	-2.869 (1.860)	-2.883 (1.859)	-2.587 (1.858)	-2.574 (1.856)
Supplier concentration (SC)		0.181** (0.053)	0.177** (0.053)	0.226** (0.059)	0.215** (0.059)		-11.596** (1.575)	-11.713** (1.575)	-14.164** (1.746)	-14.569** (1.750)
SC x organizational slack			0.020* (0.009)		0.019* (0.009)			0.596* (0.265)		0.722** (0.267)
SC x industry competition				0.734* (0.369)	0.623+ (0.378)				-41.719** (12.315)	-46.000** (12.401)
Constant	0.060** (0.011)	0.056** (0.011)	0.057** (0.011)	0.054** (0.011)	0.055** (0.011)	-3.294** (0.326)	-3.054** (0.325)	-3.045** (0.324)	-2.951** (0.325)	-2.930** (0.325)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,890	2,890	2,890	2,890	2,890	2,890	2,890	2,890	2,890	2,890
R <sup>2</sup>	0.340	0.342	0.344	0.343	0.344	0.408	0.419	0.420	0.422	0.423

Notes: Robust standard errors in parentheses. \*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two-tailed).

**TABLE A7. Robustness Check:** Effects of Supplier Concentration on Financial Performance (t+2) and Innovation Performance (t+2)

Dependent variables	Financial Performance (t+2)	Innovation Performance (t+2)			
		ZINB	SNB	ZIP	SP
Firm age	0.004* (0.002)	0.232** (0.080)	0.255** (0.089)	-0.121 (0.189)	-0.106** (0.009)
Firm size	0.010** (0.001)	0.542** (0.049)	0.543** (0.049)	0.605** (0.134)	0.611** (0.005)
Cash ratio	0.008 (0.005)	-0.002 (0.169)	-0.001 (0.170)	0.781* (0.304)	0.774** (0.023)
Firm leverage	-0.116** (0.013)	0.829+ (0.496)	0.778 (0.496)	-0.718 (1.327)	-0.738** (0.053)
R&D intensity	-0.133** (0.040)	5.594** (1.655)	5.420** (1.654)	-2.944 (2.887)	-2.622** (0.160)
Advertising intensity	0.049 (0.060)	-4.994* (2.212)	-5.160* (2.200)	-10.421+ (5.652)	-10.482** (0.352)
SOE	0.000 (0.002)	0.186* (0.092)	0.190* (0.091)	0.650** (0.181)	0.640** (0.010)
Biggest shareholder	0.020** (0.006)	0.005+ (0.002)	0.005* (0.002)	-0.012+ (0.006)	-0.012** (0.000)
<b>Moderators</b>					
Organizational slack	-0.002** (0.000)	-0.054** (0.017)	-0.052** (0.017)	-0.124* (0.061)	-0.124** (0.004)
Industry competition	-0.065 (0.078)	-4.563 (3.476)	-4.512 (3.456)	0.449 (4.312)	0.576 (0.362)
<b>Independent variable</b>					
Supplier concentration (SC)	0.233** (0.068)	-16.817** (3.238)	-17.015** (3.258)	-32.741** (7.043)	-32.942** (0.308)
<b>Interactions</b>					
SC x organizational slack	0.025* (0.010)	0.330+ (0.192)	0.329+ (0.196)	2.663** (0.924)	2.750** (0.083)
SC x industry competition	0.967+ (0.511)	-48.364* (22.243)	-48.989* (22.410)	-139.945** (40.084)	-139.496** (2.350)
Constant	0.029* (0.013)	-1.824** (0.488)	-2.180** (0.483)	-2.737** (0.900)	-2.870** (0.066)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,184	2,053	2,053	2,053	2,053
R <sup>2</sup> /Chi2	0.315	1,463	1,480	1,927	325,490

Notes: Robust standard errors in parentheses. \*\*  $p < 0.01$ , \*  $p < 0.05$ , +  $p < 0.10$  (two-tailed).

ZINB, SNB, ZIP and SP represent zero-inflated negative binomial regression, standard negative binomial regression, zero-inflated Poisson regression and standard Poisson regression respectively.