Article:
Wang, EY and Kafouros, M (2020) Location still matters! How does geographic configuration influence the performance-enhancing advantages of FDI spillovers? Journal of International Management, 26 (3). 100777. ISSN 1075-4253

https://doi.org/10.1016/j.intman.2020.100777

Location still matters! How does geographic configuration influence the performance-enhancing advantages of FDI spillovers?

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ABSTRACT

Although many studies on FDI spillovers either implicitly or explicitly consider the firm as a single-location entity, most countries are dominated by multi-location business groups that consist of several affiliates. Business groups and their affiliates operate in different subnational regions and vary in their responsibilities (i.e., R&D, manufacturing, and marketing & sales) as well as in their ability to coordinate internally and minimize spatial transaction costs. We argue that such variations in turn affect the ability of business groups to benefit from intra- and inter-regional FDI spillovers. We advance prior research by examining how the effects of FDI spillovers on the performance of indigenous business groups in China are influenced by 1) the location and the geographic dispersion of their portfolios of affiliates and 2) the responsibility of each affiliate. Our analysis shows that the geographic dispersion of business groups has a profound effect on how much they benefit from FDI spillovers. It also shows that business groups are particularly effective in exploiting FDI spillovers through affiliates with marketing & sales responsibilities, while affiliates with other responsibilities are not effective in doing so.

Keywords: FDI spillovers; multi-location enterprises; geographic dispersion; emerging markets; China.

Paper accepted for publication by Journal of International Management on 30 June 2020.

1. Introduction

Prior research has established that inward foreign direct investment (FDI) spillovers influence the competitiveness of indigenous firms (Eden, 2009). While prior studies focus on single-location recipients, most countries are dominated by multi-location business groups (Khanna and Palepu, 2000). This distinction is theoretically important because business groups differ from single-location firms in various ways, which in turn affect how (and how much) firms benefit from FDI spillovers. Business groups consist of portfolios of business affiliates that not only operate in geographically dispersed locations, but also differ in their responsibilities ranging from R&D and manufacturing to marketing & sales. Business groups are therefore often seen as an organizational space in which geographic boundaries are determined "either directly, as the geographic locus of particular functions, or indirectly, through customer-supplier relationships with other firms" (Dicken and Malmberg, 2001, p. 359).

Prior studies (Santangelo and Stucchi, 2018) provide valuable insights into how the ability to manage spatial transaction costs helps multi-location organizations expand in new markets. Yet, we know very little about how geographic dispersion into multiple locations and the allocation of certain responsibilities to each affiliate influence the ability of business groups to benefit from intra- and inter-regional FDI-related advantages. This gap in our understanding limits our ability to comprehend what contingencies influence the ability of indigenous business groups to exploit FDI spillovers and how organizations manage the marginal costs and benefits of geographic dispersion.

First, business groups locate their affiliates in different regions to exploit location-specific advantages. As such, they vary substantially in the *geographic dispersion* of their portfolios of affiliates, i.e., how widely they distribute their affiliates across the regions of a country. This requires the development of internal coordination and control capabilities to minimize spatial transaction costs (Jones and Hill, 1988) and maximize the benefits of operating in certain locations. Although business groups develop these capabilities primarily for managing their geographic dispersion, we argue that these capabilities also assist in exploiting FDI spillovers. Given that there are limitations in how many locations a business group can operate, we examine how a group's geographic dispersion enables it to benefit from FDI spillovers.

Second, many studies implicitly assume that all affiliates, regardless of their responsibilities, are equally able to exploit FDI spillovers. However, each business affiliate not

only operates in a different geographic market (Tsai, 2001), but also has specific responsibilities and objectives (R&D, manufacturing and marketing & sales). Additionally, FDI spillovers include technical knowledge (i.e., R&D and manufacturing related) but also non-technical knowledge pertaining to marketing & sales functions. While prior research acknowledges the different types of knowledge associated with spillovers (Kafouros and Buckley, 2008; Kafouros et al., 2012), it remains unclear how the key responsibility assigned to an affiliate influences the business group's ability to benefit from spillovers. By capturing all the business affiliates of a group along with their responsibilities, our research design enables us to identify how a business group's ability to improve its performance using FDI spillovers in different regions is affected by the value-generating responsibility of each affiliate.

We test our framework using a dataset of 636 affiliates that belong to 84 high-tech Chinese business groups. We show that although business groups benefit from intra-regional FDI spillovers, inter-regional FDI spillovers lead to performance gains only when a business group's affiliates are highly dispersed across regions. Furthermore, although it is often presumed that it is technical and R&D knowledge that drives gains from FDI spillovers, we show that business groups benefit more through certain types of affiliates but not so much from others.

Our analysis makes two distinct contributions. First, it advances the literature on multi-location organizations (e.g., Beugelsdijk and Mudambi, 2013; Santangelo and Stucchi, 2018) by explaining how business groups improve their performance by utilizing the capabilities they develop from geographic dispersion in order to exploit spillovers from intra- and inter-regional environments. Second, we contribute to the literature on FDI spillovers by explaining how the ability of indigenous business groups to enhance their performance using FDI spillovers in different sub-national regions is affected by 1) the geographic dispersion of their portfolios of affiliates and 2) the value-generating responsibility of each affiliate.

2. Theoretical background

2.1 Multi-location business groups and the responsibilities of their affiliates

Our framework relies on theoretical insights about multi-location enterprises (Beugelsdijk and Mudambi, 2013; Beugelsdijk et al., 2010). Multi-location business groups are characterized by (1) geographic dispersion (Santangelo and Stucchi, 2018), (2) organizational capabilities aimed at minimizing spatial transaction costs (Jones and Hill, 1988), and (3) an organization that

optimizes group-level performance, rather than that of a given affiliate (Dunning and Lundan, 2008). Accordingly, our theoretical reasoning relies on the view that variations in business group performance are driven by the spatial configuration (locations) of their affiliates and the responsibilities assigned to each affiliate.

Various considerations, including revenue generation, costs and risks influence the decision to locate affiliates in different regions (Delgado et al., 2010). Hence, the location choices and geographic dispersion of a business group's portfolio of affiliates influence significantly its ability to manage spatial transaction costs[1]. Furthermore, as business groups operate in different locations, they may exploit FDI spillovers that are specific to their portfolios of affiliates. Therefore, a central issue for business groups concerns the enhancement of their performance not only by developing internal coordination and control capabilities to minimize spatial transaction costs, but also by benefiting from intra- and inter-regional spillovers.

Affiliates of business groups are not completely independent entities. They have their own management teams and a certain degree of autonomy. However, given that they are owned and controlled by the group, they share assets, serve some of the strategic objectives of the group and can access and benefit from the capabilities of the group (Khanna and Palepu, 2000). Business groups assign different responsibilities and resources to each affiliate with the main objective to maximize the performance of the group as a whole. Accordingly, each affiliate is characterized by one (or in some instances more than one) of the following value-generating responsibilities: (1) R&D (or product development), (2) manufacturing (or production), and (3) marketing (or market servicing) & sales. These responsibilities not only change how each affiliate contributes to the group but also determine how much each affiliate (and therefore the entire group) benefits from FDI spillovers.

In summary, the assignment of responsibilities to affiliates together with their geographic

[1] According to Santangelo and Stucchi (2018, p.755), spatial transaction costs refer the "costs that increase with the degree of geographical dispersion of already integrated organizational units due to coordination difficulties, information asymmetries, and incentives misalignments (Jones & Hill, 1988). To limit these costs, geographically dispersed organizations develop templates to effectively arrange meetings, travels, visits, and virtual teams; information systems that ease information and knowledge exchange, and monitoring; and routines to align internal procedures to common best practices" .

configuration across regions determines how a business group exploits location-specific spillovers to improve its performance. A business group may benefit from FDI spillovers in terms of the commercialization and promotion of products and services through its marketing & sales affiliates, but it may also benefit from FDI spillovers in terms of innovation and production through its R&D and manufacturing affiliates.

2.2 Knowledge transfer in multi-location business groups

Business groups can access and transfer external knowledge across their affiliates. Affiliates can access and gradually accumulate different sets of knowledge that may either complement or augment those of other affiliates. Knowledge transfer within the business group creates synergies (Tanriverdi and Venkatraman, 2005) and helps affiliates and the entire group benefit from FDI spillovers in different areas (Liu et al., 2014). Hence, a business group can be seen as a vehicle for transforming location bound knowledge into internally transferable knowledge. Inter-connected affiliates enable the group to exploit such knowledge pools and combine them within one organization (Kafouros et al., 2012).

A number of mechanisms facilitate knowledge transfer in business groups. Given the importance of transferring knowledge across affiliates (Kogut and Zander, 1993), a group may encourage (e.g., by adopting certain reward systems) or even force its affiliates to share with each other the knowledge acquired from the regions in which they operate (Bertels et al., 2011). Knowledge may be transferred from one affiliate to other affiliates through channels such as exchange of employees (von Krogh et al., 2000; Macher and Mowery, 2003; Gertler, 2003), systematic communication and social networks (Hotho et al., 2011; Eapen, 2012). Such synergies in organizational learning and in accessing external knowledge (Kogut and Zander, 1993; Gupta and Govindarajan, 2000; Tsai, 2001) open up new opportunities for benefiting from FDI spillovers.

2.3 FDI spillovers

FDI spillovers include not only technical knowledge that foreign firms may bring to the host economy but also knowledge concerning key business functions including manufacturing, marketing and sales as well as operations concerning the commercialization of products and technologies. There are four key mechanisms through which FDI spillovers influence the

performance of indigenous businesses. First, foreign firms help indigenous businesses through "demonstration effects", which improve organizational routines and help them adopt best production and manufacturing practices (Blomström et al., 1999; von Zedtwitz et al., 2014). Second, the presence of foreign firms increases competitive pressure and may force other host market businesses to reduce organizational slack, adopt new technologies, use new knowledge and in turn become more efficient (Cantwell, 1989; Eden, 2009; Wang, 2010a). Third, indigenous businesses benefit from improvements and increased mobility in the labour market. This occurs when employees who were trained by foreign firms leave their jobs and work for other firms (Blomström and Kokko, 1998), bringing with them valuable knowledge about the development and promotion of products.

Fourth, vertical linkages motivate indigenous businesses to improve their performance to meet requirements for quality (Rodriguez-Clare, 1996) or to assimilate technologies from the intermediate products and services provided by foreign firms (Blomström et al., 1999). These mechanisms help indigenous business groups benefit from technical and non-technical knowledge from foreign firms. Because knowledge is integrated in local settings (Jaffe et al., 1993; Almeida and Kogut, 1999; Keller, 2002; Mariotti et al., 2010) and passes imperfectly from one region to another, indigenous businesses can access FDI spillovers when operating *within* the region where foreign firms are present, particularly when spillovers are strengthened by agglomeration effects. By contrast, such access is more challenging and can potentially be less beneficial when businesses are located outside of these regions.

Nevertheless, although FDI comes with the above advantages, its effects on the performance of indigenous businesses is not always positive. The positive effects of spillovers are confounded with negative effects (Kafouros and Buckley, 2008). FDI not only expands the pool of knowledge and technologies that indigenous businesses can access but also increases competitive rivalry. Stronger competition may in turn decrease the performance of indigenous businesses through direct market-stealing effects, indirect appropriation of value, and by forcing them to reduce output (Kafouros and Buckley, 2008). In such situations, the negative effects may dominate the potentially positive externalities associated with FDI.

3. Hypotheses

3.1 Intra- and inter-regional FDI spillovers

We argue that the location choices and spatial distribution of the affiliates of business groups change how much business groups benefit from FDI spillovers in their regions of operation (intra-regional spillovers) and in locations in which they do not have any affiliate (inter-regional spillovers).

The diffusion of knowledge associated with spillovers depends on employees, relationships and networks that are often spatially bound. There is also region-specific demand for labour with certain qualities (Beugelsdijk and Mudambi, 2013). Because a specialized talent pool can typically service firms within a particular region (Almeida and Kogut, 1999), both foreign and indigenous businesses locate their affiliates close to talent pools to capture such benefits (Breschi and Lissoni, 2011). Moreover, regional government agencies promote innovation by attracting FDI that depends on the specialized resources (Cantwell and Mudambi, 2005) offered within a region, resulting once again in strong advantages associated with intra-regional spillovers.

FDI spillovers also depend on demonstration effects, vertical linkages, and competition. The effectiveness of these mechanisms largely depend on the distance between a group's affiliates and foreign firms. Locating affiliates in the same region in which foreign firms operate increases the set of opportunities that affiliates (and the group as a whole) can utilize for exploiting external knowledge, for building vertical linkages and for learning through demonstration and competition. Other types of agglomeration advantages (Marshall, 1920; Delgado et al., 2010) may further help a business group benefit from intra-regional knowledge spillovers and exploit a region's advantages and opportunities when the group configures its affiliates around clusters. Given that the above spillover effects are local and specific to regions, we introduce the following baseline prediction:

Hypothesis 1a: Intra-regional FDI spillovers positively influence the performance of multi-location business groups.

While the above location-specific mechanisms give rise to intra-regional spillover benefits, their location-specific nature means that their advantages decline as distance increases. First, because knowledge clusters do not often change geographically (Breschi and Lissoni, 2009), the benefits induced by mobility are not significant beyond a region. Similalry, demonstration effects arising from the transfer of tacit knowledge (Polanyi, 1966) are also unlikely to occur beyond a region because experiencial processes that are enabled through either master-apprentice or

problem-solution contexts depend on spatial and social proximity (Gertler, 2003). Given that "tacit knowledge is an essential complement to explicit knowledge" (Gertler, 2003, p.78), vertical linkages that span across regions produce limited spillover-related benefits because distance prevents indigenous firms from building the routines and skills that are needed to acquire and transfer specific and explicit knowledge from foreign firms.

Second, as Zhao (2006) points out, foreign multinationals (MNEs) use their internal network and certain types of complementaries to protect sensitive knowledge from leaking to firms in host countries. When this is coupled with indigenous firms' lack of proximity to observe foreign practices, routines and knowledge, vertical linkages may result in limited inter-regional FDI spillover benefits. Unlike foreign firms that compete in global markets and arbitrage host-market factors, indigenous business groups largely rely on their own market. In such situations, the market stealling effects of FDI can be significant inter-regionally, particularly when foreign firms appropriate value from a wider range of domains that are not spatially bound, e.g., they may crowd out indigenous business groups in a certain market segment that extends across multiple regions of a country.

In summary, the above arguments suggest that on the one hand there will be limited inter-regional spillover benefits and on the other hand there will be significant negative cross-regional competition effects. Accordingly, we expect the effects of inter-regional spillovers on the performance of indigenous groups to be negative:

Hypothesis 1b: Inter-regional FDI spillovers negatively influence the performance of multi-location business groups.

3.2 The role of geographic dispersion

Geographic dispersion is underpinned by a group's capability to coordinate, control and internally transfer knowledge and, therefore, minimize spatial transaction costs. Effective coordination and control requires communication, socialization and information processing capabilities as well as the capability to identify best practices and spread such tacit knowledge more widely within the group (Santangelo and Stucchi, 2018). When a business group expands geographically, adaptive processes enable it to learn how to manage dispersed operations. These may involve investment in knowledge enablers, training and development of conventions and procedures (Gertler, 2003). Therefore, increased geographic dispersion can gradually lead to

stronger capabilities that in turn help groups minimize spatial transaction costs.

We argue that some of these capabilities can also help the group benefit from FDI spillovers. More specifically, the group can utilize established routines and templates of coordination and control for (a) understanding the practices of foreign firms, (b) exploring ways to reduce organizational slack and compete with foreign firms, (c) identifying technologies that upgrade services, manufacturing and research, and (d) decoding the knowledge embodied in the activities, products and services of foreign firms. These advantages become stronger when a business group overcomes incentive misalignment (e.g., doubts of the relevance and importance of practices and signals from foreign firms) by using internal intellegence and by monitoring systems to fine-tune procedures and best practices. Hence, the relationship between FDI spillovers and business group performance becomes highly dependent on the group's degree of geographic dispersion.

Geographic dispersion enables a business group to gradually build stronger capabilities to minimize spatial transaction costs as discussed above. These capabilities, to a large extent, are attributed to the group's ability to generate tacit knowledge *locally* through more efficient routines and then geographically distribute such knowledge across the affiliates of the group (Gertler, 2003). This helps the group to better absorb FDI spillovers when inter-firm knowledge transfer opportunites arise, typically intra-regionally. By contrast, a lower degree of geographic dispersion corresponds to weaker capabilities to manage a spatially distributed organization and less efficient internal generation and transfer of tacit knowledge. These result in a lower degree of preparedness when indigenous business groups engage and interact with foreign firms. In such situations, the benefits of intra-regional FDI spillovers are expected to be weaker. Accordingly, we propose the following hypothesis:

Hypothesis 2a: The geographic dispersion of a multi-location business group positively moderates the relationship between intra-regional FDI spillovers and group performance.

Greater geographic dispersion allows a business group to absorb and benefit from FDI spillovers from other regions. By using its stronger internal tacit knowledge generation and transfer capabilities, the group can complement and facilitate the assimilation of codifiable (though not always already codified) inter-regional FDI knowledge. Business groups with a greater geographic dispersion may also engage with stronger communities and networks of

practitioners (Bunnell and Coe, 2001) that extend outside of the firm, across regional boundaries and even into rival foreign firms. Wider communities and networks enable business groups to better appropriate the benefits of FDI spillovers and hedge against competitive threats from FDI. By contrast, lower geographic dispersion may result in less effective absorption of inter-regional FDI knowledge by business groups, particularly when tacit knowledge and supporting routines and processes necessary to facilitate assimilation of such knowledge are lacking. Similarly, groups with a lower geographic dispersion may lack the networks that enable better search for FDI knowledge beyond their organizational boundaries. Hence, we propose:

Hypothesis 2b: The geographic dispersion of a multi-location business group positively moderates the relationship between inter-regional FDI spillovers and group performance.

Furthermore, we expect the moderating effect of geographic dispersion to differ in its magnitude for intra- and inter-regional spillovers. For a number of reasons, we expect these effects to be stronger for inter-regional rather than intra-regional spillovers.

First, greater geographic dispersion strengthens organizational learning by helping business groups identify distant knowledge (Kafouros et al., 2012). A wider scope or breadth leads to a wider range of actors and to an exploratory search behaviour that assists groups in identifying distant knowledge (Laursen and Salter, 2006). Such behaviour helps business groups build up an understanding of spillover-related advantages and opportunities in regions in which they do not have affiliates. For example, an exploratory search behaviour means that the group proactively seeks and tries to incorporate valuable knowledge and intelligence from foreign firms in other regions to differentiate its offerings, target new markets or segments, and better service new customers to increase sales. By contrast, the benefits of dispersion are less evident when the search is carried out towards foreign firms within the same region because agglomeration of economic activities results in all actors contributing to and drawing from the same local knowledge reservoir. In such situations, the marginal returns of exploiting local knowledge reservoirs within the same region diminish as newly created knowledge by the group benefits others in the same locality (Mariotti et al., 2010), rather than helping the group to gain competitive advantage through differentiation.

Second, business groups with greater geographic dispersion are better able to overcome spatial discontinuity (Beugelsdijk and Mudambi, 2013) and gain greater reputation and

legitimacy. As a result, they can attract talent from locations outside of the region in question, develop ties (through communities of practice) with foreign firms located in a wider set of locations, and create channels to access knowledge, products and services from foreign firms. Business groups with greater geographic dispersion therefore benefit more from inter-regional FDI spillovers than from intra-regional FDI spillovers because their networks and communities enable the groups to reach distant regions and source tacit knowledge that complements codifiable knowledge from FDI.

Third, greater geographic dispersion leads to a wider geographic coverage, and hence greater diversity in location-specific advantages (Almeida and Kogut, 1999; Cantwell and Mudambi, 2005; Mariotti et al., 2010) and in the firms' internal knowledge set (which is the result of capturing tacit knowledge from immediate regions; Maskell and Malmberg, 1999). Subsequently, although knowledge diversity facilitates the absorption of new knowledge, business groups with greater geographic dispersion (and therefore more diverse knowledge) may not benefit more from intra-regional FDI than from inter-regional FDI. This is because new knowledge from intra-regional FDI may strengthen the firm's existing knowledge set rather than further diversify it, whereas diverse knowledge is critical for indigenous firms to survive competition from FDI because of the stronger appropriability mechanisms foreign MNEs possess (Zhao, 2006).

By contrast, a lower degree of geographic dispersion means that business groups limit themselves to fewer regions. This, in turn, reduces the diversity of internal knowledge, the ease of identifying distant knowledge and the ability to overcome spatial discontinuity. Weaker capabilities limit the set of opportunities available to business groups for experimenting with and exploiting inter-regional spillovers, but these limitations will be greater for intra-regional spillovers because of the insufficient readiness to absorb knowledge when new opportunities arise. Furthermore, business groups with lower geographic dispersion have weaker exposure to the presence of foreign firms and to the advantages associated with foreign firms (Blomström and Kokko, 1998). Hence, lower geographic dispersion increases the costs of identifying distant knowledge from the same and other regions. Consequently, the effects of intra-regional spillovers on group performance are likely to be lower than those of inter-regional spillovers because it is difficult to find and absorb distant knowledge when the indigenous business group has weak knowledge creation and spatial dispersion capabilities. Hence, we propose:

Hypothesis 3: The geographic dispersion of a multi-location business group has a greater positive moderating effect on the relationship between inter-regional FDI spillovers and group performance than the relationship between intra-regional FDI spillovers and group performance.

3.3 The role of affiliate responsibilities

We expect the effects of FDI spillovers on business group performance to vary substantially depending on the value-generating responsibilities of their affiliates in each region. Business groups and their affiliates may benefit from spillovers by absorbing R&D-related knowledge, manufacturing-related knowledge and/or knowledge that is related to marketing & sales. However, we expect each responsibility to differ in how useful it is in helping the affiliates and the group to benefit from FDI spillovers.

First, we expect business groups to benefit strongly from FDI spillovers through their affiliates with R&D responsibilities. It has long been established in the international business literature that when MNEs enter into new markets, they bring advanced technologies with them to compete with indigenous rivals (Dunning and Lundan, 2008). As technology transfer favours innovation and R&D (Ning et al., 2016), business groups are better able to exploit the technical knowledge and advantages of FDI spillovers. They may achieve this through their affiliates with R&D responsibilities because R&D enhances absorptive capacity and the ability to assimilate external knowledge (Cohen and Levinthal, 1990; Eapen, 2012). Scientific knowledge and technologies that can be accessed through intra-regional spillovers can be a valuable input in the indigenous innovation process and, in turn, enhance business group performance. The above advantages are particularly important in emerging markets where R&D capabilities are not as advanced as they are in developed markets, even though this might make the integration of external technologies difficult (Eden, 2009; Kafouros and Wang, 2015).

Second, business groups may benefit from knowledge about the commercialization and marketing of certain products and technologies through their marketing & sales affiliates. Although this aspect of FDI spillovers has attracted little interest in the literature, a number of theoretical arguments underscore the potential of non-technical knowledge and spillovers in enhancing business group performance. According to the international business literature (Dunning and Lundan, 2008), inward FDI in a given region generates significant demand for

certain products and services from indigenous businesses. Business groups become the main beneficiaries of such demand-related FDI spillovers through their marketing & sales affiliates. Furthermore, although indigenous firms have a good understanding of local preferences, they can still learn a lot from foreign firms that have strong marketing teams that specialize in the commercialization and marketing of products and services in many countries. Such knowledge and experience can generate significant spillover benefits for the marketing & sales functions of indigenous affiliates and, in turn, increase the performance of the group. Nevertheless, as the marketing knowledge of foreign firms may not be fully applicable to local contexts, we expect the role of marketing & sales affiliates to be weaker than that of R&D affiliates.

A similar reasoning applies to the case of manufacturing responsibilities. Given that FDI, particularly in emerging markets such as China, focuses on manufacturing and production, it is likely that indigenous businesses benefit from spillovers through learning and knowledge about such functions. As discussed earlier, demonstration effects are one of the key mechanisms through which FDI spillovers influence the performance of indigenous businesses. For example, when MNEs enter host countries and place orders for the manufacturing of goods, they subsequently work with indigenous suppliers to improve routines, adopt best practices and improve the quality of outputs (Blomström et al., 1999; von Zedtwitz et al., 2014). Such demonstration effects help indigenous business groups and their affiliates become more competitive, reduce slack and improve performance (Eden, 2009). Nevertheless, especially for foreign MNEs from developed countries, manufacturing has not recently been the main focus of their strategy. Indeed, MNEs in many countries have been criticised that they have left their manufacturing capabilities to decline while firms from emerging countries have significantly improved such capabilities. We therefore expect the usefulness of affiliates with manufacturing responsibilities to be weaker than that of R&D and marketing & sales.

In summary, although affiliates enable indigenous business groups to learn and benefit from FDI spillovers, we expect such effects to differ depending on their responsibilities:

> **Hypothesis 4:** The responsibilities of affiliates moderate the relationship between intra-regional FDI spillovers and multi-location business groups' performance in such a way that the positive impact is greatest for R&D responsibilities, next greatest for marketing & sales responsibilities, and least for manufacturing responsibilities.

4. Methods

4.1 Sample and data

To test our hypotheses, we use data from a large emerging market, China. The economic environment in China is challenging for both domestic and foreign businesses because of its rapid evolution and unpredictability. China has experienced remarkable growth and transformation in both economic and technological terms since it first announced the "open door" reform in 1978 that attracted inward FDI. Although the country was initially a source of cheap labour and a manufacturing workshop for the world, China is starting to play a role in the global technological landscape (Zhao, 2006). Because of significant sub-national geographic diversity, spatial configurations vary considerably across indigenous business groups operating in the Chinese market. China's sub-national variations offer a valuable opportunity to examine indigenous business groups' location strategies, while its vast regional diversity enables the investigation of how business groups enhance performance by exploiting geographically dispersed FDI spillovers.

Our hypotheses are concerned with understanding the extent to which business groups differ in the way they benefit from FDI spillovers. Our analysis therefore requires data on business groups. We obtain such data from the Annual Reports of Industrial Enterprise Statistics (ARIES) compiled by the National Bureau of Statistics of China (NBS). The data are supplemented with information from various issues of the Statistical Yearbook of China (NBS, 1978-2008). ARIES provides detailed financial information for state-owned and private enterprises with annual turnover of over five million RMB. It provides the most comprehensive statistics collected by the NBS, accounting for about 90% of the total output in most industries. To test our hypotheses, we identified 84 indigenous business groups that reported data on the location and responsibilities of their 636 affiliates in China. Regional data from Statistical Yearbooks are used to collect inward FDI data. Information about business groups' configurations is collected from ARIES (for affiliates with over five million RMB annual sales) and through corporate websites and communications with affiliates (with less than five million RMB annual sales) that confirmed the configuration of the group.

The business groups in our sample operate in 30 mainland provincial-level administrative regions, thus providing sufficient spatial variation. Our analysis focuses on business groups that compete in eight high-tech manufacturing industries, namely chemicals, pharmaceuticals, rubber

products, metal products, special equipment, electrical, electronic and communication equipment, instruments and meters, and office equipment. The sampling of business groups operating in knowledge intensive sectors enables us to examine groups with affiliates of a variety of responsibilities[2] as non-knowledge-intensive firms in emerging markets typically don't dedicate their affiliates to R&D - thus limiting the potential of observing multi-location business groups and affiliates with a full range of responsibilities. We collected data for 2002-2007, a period that has not suffered from a major economic downturn such as that triggered by the 2008 global financial crisis. The overall number of observations in our analysis is 482.

4.2 Dependent variable

Business Group Performance: Following the standard practice in the spillovers literature (Adams and Jaffe, 1996; Mairesse and Hall, 1996; Kafouros et al., 2012), the dependent variable of our analysis is the *productivity performance* of the entire business group. Following prior studies (Dutta et al., 2005; Kafouros et al., 2012), we constructed a measure of business group productivity performance by incorporating the annual output (i.e., sales) that each group can attain from a given level of inputs and resources (i.e., human resources, capital, and other intermediary inputs). Because our study aims to explain how variations in performance are associated with regional FDI spillovers and how this relationship is facilitated by affiliates with different responsibilities, we need to have a measure that captures variations in performance that cannot be explained by variations in the level of internal inputs.[3] Building upon established practice (Dutta et al., 2005), we adopt the stochastic frontier estimation approach (SFE; Aigner et

[2] Our sampled business groups consist of affiliates with a variety of responsibilities. For example, a biochemical business group has 6 affiliates – affiliate 1's responsibilities include research, development, production and sales; affiliate 2's responsibilities include design, research, assembly, and sales; affiliate 3's responsibility is sales; affiliate 4's responsibility is biochemical laboratory software development; affiliates 5 and 6 's responsibility is marketing and sales.

[3] A potential question is whether the performance measure should capture specific capabilities, knowledge and processes in R&D, manufacturing or marketing & sales that might be influenced by FDI spillovers. We view these properties as explanatory factors of the performance, rather than as part of the performance. Hence, affiliates with R&D, manufacturing or marketing & sales responsibilities will enter the equation as moderators during the testing of hypothesis 4, enabling us to examine the extent to which FDI spillovers are causing performance to change in the context of the activation of a particular responsibility of affiliates.

al., 1977; Meeusen and van den Broeck, 1977) to obtain each group's productivity performance. Specifically, we estimate a production function that predicts the $GroupSales_{kt}$ under the most efficient utilization of the group's inputs, with an error term that includes a random noise effect, v_{kt}, and an inefficiency effect, u_{kt}. Accordingly, we estimate the following equation:

$$GroupSales_{kt} = \beta_0 + \beta_1 GroupCapital_{kt} + \beta_2 GroupLabour_{kt} + \beta_3 GroupIntermediaryInputs_{kt} + \sum_{j=4}^{11} \beta_j IndustryDummies_{kt} + v_{kt} - u_{kt} \quad (1)$$

where $GroupSales_{kt}$is the the natural logarithm of sales of business group *k* in year *t*; $GroupCapital_{kt}$, $GroupLabour_{kt}$, and $GroupIntermediaryInputs_{kt}$ are the natural logarithm of the group's number of employees, total net fixed assets, and intermediary inputs, respectively; $IndustryDummies_{kt}$ are dummy variables with a value of 1 if the business group operates in a given industry, to control for the differing nature of industrial activities. We assume that the efficiency effects have a time-varying decay specification as follows:

$$u_{kt} = exp\{-\eta(t - T_k)\}u_k \quad (2)$$

where T_k is the last period in the kth group, η is the decay parameter; $u_k \overset{iid}{\sim} N^+(\mu, \sigma_u^2)$, $v_{kt} \overset{iid}{\sim} N(0, \sigma_v^2)$, and $E[v_{kt}u_k] = 0$. The actual group performance deviates from the frontier because of the joint effect of the radom noise and inefficiency. The *Business Group Performance* variable is calculated using Stata, which predicts the efficiency function that produces estimates of the technical efficiency with a higher value corresponding to greater performance.

4.3 Independent variables

<u>*FDI Spillovers*</u>: We constructed two key measures of FDI spillovers, *Intra-regional Spillovers* and *Inter-regional Spillovers*. To achieve this, we rely on FDI stock in sub-national regions in China at 2002 constant prices. Because the affiliates of some groups operate in multiple industries and have intra-group buyer-supplier ties, our measures include both intra- and inter-industry spillovers. We employ the commonly used perpetual inventory method (PIM) to depreciate (using a 10% rate) past FDI inflows in each region (Bellak and Cantwell, 2004).

According to the literature, spillovers can arise from a variety of activities of foreign firms. As innovative foreign products and processes are gradually adapted to the local markets (Mariotti et al., 2010), business groups may benefit from this process by deriving new technological combinations and sourcing new (marketing, manufacturing, and design)

knowledge (Martin and Eisenhardt, 2010). They may also benefit from R&D activities undertaken by foreign firms (Mariotti et al., 2010). When foreign firms invest to benefit from lower labour cost, they may still introduce efficient processes that are potentially beneficial to indigenous firms' manufacturing, marketing, and sales. Because these activities and processes cannot be directly observed using available data, we have chosen FDI stock as a proxy of the accumulated knowledge pools transferred to and developed by foreign firms in the host economy over time. As a robustness check, we used FDI flows as an alternative measure.

We first constructed location specific measures of spillovers according to the geographic configuration of each group. *Intra-regional Spillovers* is an aggregation of the inward FDI stock in the regions where the group's affiliates operate. To account for the fact that some affiliates have more than one responsibility, the estimation of this measure relies on the number of responsibilities rather than the number of affiliates in each region, i.e.,

$$intraFDI_{kt} = \sum_{r=1}^{30} Q_{ktr} FDI_{(t-1)r} \qquad (3)$$

where $FDI_{(t-1)r}$ is the inward FDI stock in a region *r* in year *t-1* (there are 30 Chinese sub-national regions in total); Q_{ktr} is the number of responsibilities the affiliates of business group *k* have in region *r* in year *t*. $intraFDI_{kt}$thus captures the *Intra-regional Spillovers* available in a given region *r*.

Inter-regional Spillovers is an aggregation of the inward FDI stock in the regions where the business group does not have any affiliates; following the established practice (e.g., Ning et al., 2016), this variable is weighted by a row standardized spatial weight matrix of 30 x 30 dimension, i.e.,

$$interFDI_{kt} = \sum_{r=1}^{30} \sum_{h=1}^{30} W_{h,r}\, FDI_{(t-1)r} P_{ktr} \qquad (4)$$

where P_{ktr} takes the value of 1 if business group *k* does not have any affiliates in region *r* in year *t* and the value of *0* otherwise; $\sum_{h=1}^{30} W_{h,r}$ denotes the *h, rth* element of the spatial weight matrix that is based on the inverse squared geographic distance to reflect the gravity type relationships among regions. We obtain geographic distance by measuring the motorway distance between two capital cities of the provinces / provincial-level administrative regions. Therefore, $interFDI_{kt}$ captures the the *Inter-regional Spillovers*. To control for the time that spillovers take to arise, we lagged all spillovers variables by one year in main results. As a robustness check, we also lagged spillovers variables by two, three, and five years.

Group Geographic Dispersion: This variable captures the extent to which a group's portfolio of affiliates is dispersed across different sub-national regions. To reflect how widely the group spreads its affiliates, geographic dispersion is constructed with the inverse of a Hirschman-Herfindahl concentration index over all regions in which the group operates (see Allayannis et al., 2001). Hence, the greater the value of the index, the more dispersed (greater number of regions in which the group's units are located) the group is. Specifically:

$$Group\ Geographic\ Dispersion_{kt} = 1 - \sum_{j=1}^{R_t} \left[\frac{(Number\ of\ affiliates)_{jt}}{(Total\ number\ of\ affiliates)_{kt}} \right]^2 \qquad (5)$$

where R_t is the total number of provincial regions in which business group *k* operates in year *t*. This measure has a value close to 1 if the group has affiliates in many regions and a value of 0 if the group has affiliates in only one region.

One of our concerns was that the size of larger groups might lead to higher levels of overall dispersion. To check whether group size is related to our construct, we examined the correlation between our measure and group size. We found the correlation coefficient to be low, suggesting that the geographic dispersion of a group is not driven by its size.

Responsibility Specific Intra-regional Spillovers: Our hypothesis 4 is concerned with how business groups are influenced by region specific spillovers through their affiliates' responsibilities. To achieve this, we create a construct of responsibility specific intra-regional spillovers:

$$intraFDI_{kt}^{m} = \frac{\sum_{r=1}^{30} Q_{ktr}^{m} FDI_{(t-1)r}}{intraFDI_{kt}} \qquad (6)$$

where *m* is the type of responsibility in question (i.e., *m* = R&D, manufacturing, marketing & sales); Q_{ktr}^{m} is the number of affiliates of business group *k* with responsibility *m* in region *r* in year *t*. Hence, $intraFDI_{kt}^{m}$, the responsibility m specific intra-regional spillovers variable, captures the effect of FDI spillovers on group *k* through affiliates with responsibility *m* in a region where the group operates.

Responsibility data are obtained from the affiliates and the associated groups' reporting on the affiliates' main business activities and responsibilities within a group. Specifically, we obtained the groups' reports on the activities being made responsible for each of their affiliates, e.g., whether the affiliate is responsible for R&D (including product development), manufacturing (including production and assembly), or marketing & sales (including market services). We then cross-checked this information with the reporting of the affiliates where

appropriate.

4.4 Control variables

Intra-regional Spillovers Excluding Responsibility-weighted Spillovers: To control for the fact that a business group's performance is influence by spillovers through other mandated activities in addition to the type of affiliate responsibility in question, we created a variable by deducting responsibility-weighted (specific) spillovers from the overall intra-regional spillovers, i.e., for a specific responsibility *m*, we have:

$$exclintraFDI_{kt}^{m} = intraFDI_{kt} - intraFDI_{kt}^{m} \qquad (7)$$

Group R&D Stock: We estimated each business group's R&D stock by employing the R&D spending of the group and the PIM method described above (Griliches, 1979; Kafouros and Buckley, 2008). This operationalization relies on the idea that the R&D stock that resides within a group depends on both current and past R&D expenditures. To account for the depreciation of old knowledge and technologies over time, we follow prior studies and depreciate the cumulative R&D expenditures using a 15% rate (Griliches, 1979; Kafouros and Buckley, 2008). This approach recognizes that although past R&D plays an important role, its impact on performance may not be as high as that of the ideas and technologies created more recently.

Number of Affiliates with a Specific Responsibility in a Group: To capture how business groups differ depending on the number of affiliates with specific type of responsibilities, we introduce a set of variables that are measured by the total number of affiliates in a group with a certain responsibility of R&D, manufacturing, and marketing & sales, respectively. The literature further suggests that affiliates engaged in different value-generating activities contribute to a group's performance (Birkinshaw et al., 1998; Cantwell and Piscitello, 1999).

Group Product Diversification: Product diversification may result in different innovation and performance outcomes, especially in organizations that have geographically distributed activities (Hitt et al., 1997; Kumar et al., 2012). To control for these effects, we followed previous studies and constructed a measure based on the number of key product segments in which the group competes. To check the robustness of our results we also used an entropy measure (Jacquemin and Berry, 1979).

Group Size: The effects of size are important as they may impact group performance directly and may further increase the likelihood that larger groups have greater dispersion. We

used the median of groups' sales to create a dummy variable that equals to one when the annual sales of the business group is above the median, and zero otherwise. The use of a continuous variable that relies on capital, number of employees, or sales was not possible since these effects are already incorporated in our measure of group performance.

Group Foreign Ownership: Foreign stakeholders may bring new resources and experience that lead to competitive advantages (e.g., Ray et al., 2004). Hence, foreign ownership may influence a group's performance. We control for foreign ownership using the ratio of foreign equity to total equity in each year.

Group State Ownership: China's economic reforms have profound impact on domestic firms' organizational configurations (Chang and Xu, 2008). Business groups with state ownership have different resource endowments (Ralston et al., 2006), and this may differentiate them from other firms. We control for state ownership using the ratio of state equity to total equity in each year.

Group Age: A group's age is measured using the number of years of establishment. Age may influence an organization's performance either positively or negatively depending on the way in which the organization enhance its core capabilities and limit organizational rigidities (Leonard-Barton, 1992).

Share of Employees with Masters or Higher Qualifications: The Chinese government conducted a census in 2004 to report the composition of labour force in industrial enterprises. Hence, this variable is measured by a percentage of employees with the qualifications over total number of employees in a group. People with different levels of educational background employed in a business group may contribute differently to group performance and talents with higher qualifications may help enhance performance.

Group's Region-specific GDP Per Capita: Regions in China differ in terms of macro-economic conditions that may in turn influences a group's performance. We control for this effect by using the average of GDP per capita in regions where the group operates.

Time and Industry Effects: As idiosyncrasies associated with time and industry-specific effects can affect group performance, we include a set of dummy variables to control for variations in terms of time (i.e., year) and industries. Because a group may operate in more than one industry, we assign multiple industry dummies to each group, with a value of 1 based on the group's reporting of major business activities.

5. Results

Table 1 presents descriptive statistics for the key variables. Because of the concern that the measure of intra-regional FDI spillovers may be endogenous and that region-specific factors may influence FDI into China, we employ the 3SLS estimation method which is considered to be superior to 2SLS and IV regression (Cuypers et al., 2017)[4]. The first stage model of the 3SLS analysis controlled for a number of factors that are specific to the regions in which the group operates. Such group's region-specific factors include *Regional Share of Tertiary GDP to Secondary GDP*, *Regional Retail Sales*, *Regional Total Number of Industrial Enterprises*, *Regional Total Outputs of Industrial Enterprises*, and *Regional Patent Stock* (total number of patents granted to enterprises operating in China); the results tables provide additional details of the instruments used. The Hansen-Sargan overidentification tests confirm that all models are identified. We also used panel least squares (PLS) with cross-sectional random effects to support the current findings[5].

We calculated the variance inflation factor (VIF) for each variable to identify potential multicollinearity. We followed the common practice (Aiken and West, 1991) and mean-centered the interaction variables to alleviate potential multicollinearity problems and increase the interpretability of the interaction terms (Aiken and West, 1991). The average and maximum VIF for each individual model are reported in Tables 2-5. The VIF of each variable in a model is below the acceptable level (Neter et al., 1985)[6], indicating no serious problems of multicollinearity.

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[4] We conducted Durbin-Wu-Hausman test of endogeneity and the results verify the appropriate use of simultaneous equations with the existence of endogeneity (Gujarati 1997).

[5] Because we theorize that factors specific to business groups explain performance variations across business groups and our examination includes a time-invariant variable (*Share of Employees with Masters or Higher Qualifications*), we estimated the model using PLS with cross-sectional random effects. When we excluded this time-invariant variable and conducted the Hausman test, the outcome suggests that random effect model is appropriate. The PLS results are available upon request.

[6] Because it is sometimes argued that a threshold of VIF of 5 (rather than 10) is more appropriate, all our models except models 22-24 in Table 5 meet this requirement. For models 22-24, we excluded variables that have a VIF higher than 5 and re-ran the relevant models. The results (available upon request) remain similar, confirming that the findings are not affected.

Tables 2-4 report the main regression results for hypotheses H1a & H1b, H2a & H2b, H3, and H4, respectively, as well as a number of additional tests that will be discussed in Section 5.1. Table 5 reports the results of additionally analyses following H4.

--- Insert Tables 1, 2 and 3 about here ---

In Table 2 Model 1, the coefficient for *Intra-regional Spillovers* is positive and significant ($p<0.001$), supporting Hypothesis 1a and indicating that business groups enhance their performance by exploiting intra-regional spillovers. The coefficient of *Inter-regional Spillovers* is negative and significant ($p<0.001$), supporting Hypothesis 1b by showing that inter-regional spillovers have a significant effect on group performance but also highlighting that the inter-regional effect is different to the intra-regional effect. These results corroborate the view that spillovers are region-specific, i.e., on average business groups benefit from spillovers in regions in which their affiliates operate but do not always find spillovers from other regions beneficial.

To test Hypotheses 2a, 2b and 3 about the role of geographic dispersion, we used moderated regression analysis (Aiken and West, 1991) and entered a two-way interaction in Model 6 in Table 3. The coefficient for *Inter x Group Geographic Dispersion*, is positive and significant ($p>0.001$), while the coefficient for *Intra x Group Geographic Dispersion*, is negative and significant ($p>0.001$). We conducted a Wald test, which rejected the hypothesis that the two coefficients are not significantly different ($chi^2= 10.30$, Prob > $chi^2 = 0.0013$). These results support Hypotheses 2a, 2b and 3 by showing that geographic dispersion has a significant moderating effect and specifically a greater positive effect on the relationship between inter-regional FDI spillovers and group performance than the relationship between intra-regional FDI spillovers and group performance.

Hypothesis 4 tests how the geographic distribution of affiliates with specific responsibilities influences the way business groups enhance performance using intra-regional FDI spillovers. To test this hypothesis, we included responsibility-specific spillovers variables in Models 9-11 (Table 4), i.e., *R&D, Marketing & Sales, and Manufacturing Specific Intra-regional Spillovers*, respectively, while controlling for inter-regional spillovers effects. Because information on the number of affiliates with a certain responsibility is already incorporated in the construct of responsibility-weighted intra-regional spillovers, we included the number of affiliates with responsibilities other than the one in question into the model as control. The coefficient for *Marketing & Sales Specific Intra-regional Spillovers* is positive and significant ($p>0.01$), while

the coefficient for *Manufacturing Specific Intra-regional Spillovers* is negative and significant ($p>0.05$). The coefficient for *R&D Specific Intra-regional Spillovers* is insignificant. The results show that business groups benefit from intra-regional spillovers through affiliates with marketing and sales responsibilities but not through the other two types, hence not providing full support to Hypothesis 4.

Additionally, because the measure of responsibility specific intra-regional spillovers is a ratio over the total, it is not possible to include all 3 constructs into one final model. We therefore included variables *Intra Excluding R&D (Marketing & Sales, or Manufacturing) Presence-weighted Spillovers* to control for the influence of other responsibility related effects in each step of the modelling.

5.1 Additional analyses

In addition to testing the main hypotheses, we conducted several tests to investigate whether the results are influenced by other factors beyond those in the hypotheses. The literature emphasized absorptive capacity, especially internal R&D stock, as a dominant driver for emerging market businesses to benefit from FDI spillovers (e.g., Eapen, 2012). To test if business groups with higher R&D stock benefit more from intra- and inter-regional spillovers, we introduced interaction terms between the individual spillover constructs and *Group R&D stock*. The results in Table 3 (Model 7) show that R&D stock alone does not determine whether and how groups benefit from intra- or inter-regional spillovers.

Although Hypothesis 4 is concerned with how groups' distribution of affiliate responsibilities changes the way intra-regional spillovers influence group performance, one may expect to see whether such responsibility distribution also affects how inter-regional spillovers influence group performance. We have taken three steps to approach this issue. First, for a given responsibility (e.g., R&D), we examined if intra-regional spillovers excluding those weighted by R&D responsibility (i.e., the variable *Intra Excluding R&D Presence-weighted Spillovers*) has an effect on group performance. Models 9-11 in Table 4 confirm that these coefficients are all significant and positive, suggesting the existence of effects from FDI in regions where the group has other responsibilities presence (in this example, affiliates with sales & marketing and manufacturing responsibilities) but not the presence of the responsibility in question (i.e., the R&D responsibility).

Second, in the same models, the coefficients of *Inter-regional Spillovers* are significant throughout but remain negative, similar to the results of Hypothesis 1b. They therefore complement the above finding by showing that group performance is negatively influenced by FDI in regions in which it does not have any affiliate at all. Third, we further interacted the measure of responsibility-specific intra-regional spillovers with geographic dispersion, and then with inter-regional spillovers. The results of the additional interactions are reported in Table 5. The patterns emerging from Models 15-24 remain similar to the pattern of results in Table 4, i.e., Marketing & Sales Specific Spillovers remain largely positive in the final interaction, while Manufacturing Specific Spillovers remain negative, and R&D Specific Spillovers remain insignificant.

--- Insert Table 5 about here ---

We also considered whether the results are robust when spillovers take longer time to arise. We lagged spillovers variables by 1, 2, 3, and 5 years. The results are shown in Table 2 Models 2-4 and confirm that the findings remain the same, but the coefficients appear to become smaller as the number of lagged years increases. Similarly, we test the lagged spillovers in other models. The full set of results are available upon request.

In the main estimation, we used FDI stock as basis for measures of spillovers and considered the advantages of using stocks over flows data because accumulated FDI data allow for capturing the activities, processes, and knowledge accumulated through FDI over a long period of time till the observational year while flow data allows observing only annual changes. Nonetheless, we estimated models using the ratio of FDI inflow over GDP. The results, which are reported in Model 5 of Table 2 (for spillovers lagged by 1 year), show that the pattern of intra vs. inter-regional effects remain similar. Additionally, as there is a disparity in the respective magnitudes of the measures of the intra- and inter-regional spillovers (primarily due to the way in which these measures are constructed), we have investigated if such disparity may drive the contrasting results of intra- and inter-regional spillovers. We standardized the intra- and inter-regional spillovers measures using the number of standard deviations below or above the mean values. The results remain similar to the main results.

Furthermore, we considered whether the results for Hypothesis 4 are robust to alternative measures of *Responsibility Specific Intra-regional Spillovers*. To achieve this, we measured the constructs alternatively by calculating the amount of responsibility-weighted spillovers per

(R&D, marketing & sales, and manufacturing) affiliate. Correspondingly, the control variables of intra-regional spillovers via other responsibilities are also calculated in a per affiliate manner. The results in Models 12-14 in Table 4 yield a similar pattern to that of the main results, showing that Marketing and Sales Specific Spillovers remain to be most beneficial among all. Finally, we considered the factors that may shape a group's location decisions and how they may affect a group's performance. We have therefore tested whether variations in *Group Geographic Dispersion* are explained by variations in *Business Group Performance*. The results (not presented here but available upon request) confirm that there is no reverse causality.

6. Discussion and conclusion

6.1 Theoretical contributions

There has been a long tradition to pursue a general theory of the enterprise (Casson, 1987) by incorporating spatial variations and insights from economic geography. Our study contributes to this stream of academic endeavour by specifying how the effects of FDI spillovers on the performance of indigenous business groups are affected by groups' decisions to operate in certain locations. Specifically, unlike prior research that focused on single-unit firms, our analysis captures all the affiliates of a multi-location business group and their specific responsibilities. This research design enables us to specify how the ability of multi-location enterprises to enhance their performance using FDI spillovers is affected by 1) the geographic configuration of their portfolios of affiliates and 2) the responsibility of each affiliate. Our analysis makes two distinct contributions.

First, prior research has highlighted the advantages of FDI spillovers (Blomström and Kokko, 1998; Eden, 2009; Wang, 2010a) and the benefits of business groups (Khanna and Palepu, 2000; Tanriverdi and Venkatraman, 2005). However, it has not sufficiently considered the implications of the fact that multi-location business groups configure their portfolios of affiliates differently and how such variations in geographic configuration may affect their ability to benefit from FDI spillovers. This omission is important as it hinders understanding of why FDI spillovers might be beneficial to some indigenous businesses and not to others. Our analysis enhances knowledge of the spatial dimension of spillovers (Doh and Hahn, 2008; Ouyang and Fu, 2012) by demonstrating that the ability of indigenous groups to benefit from FDI spillovers depends on the *geographic dispersion* of their portfolios of affiliates. This analysis adds to the

literature by showing that the effects of FDI spillovers on performance are contingent upon firm-level heterogeneity that goes beyond innovative and learning capabilities.

Building on insights from research on geographic dispersion (Santangelo and Stucchi, 2018), our analysis suggests that geographic dispersion has a greater positive moderating effect on the relationship between inter-regional FDI spillovers and group performance than between intra-regional FDI spillovers and group performance. This analysis helps us understand how business groups may optimize the performance-enahncing effects of FDI spillovers. It also implies that prior mixed results might be driven by the fact that some firms benefit from spillovers arising from a region without being located there whereas other firms are not able to do so (Acs et al., 2002; Wang and Lin, 2013). In other words, such conflicting findings may be explained by the fact that previous research failed to consider whether the firms are part of groups that operate in multiple regions and cover a larger geographic area.

Second, our analysis takes into account that each business affiliate not only operates in a region, but also has specific responsibilities. Consideration of such responsibilities helps us advance the spillovers literature by explaining why two business groups that operate in similar locations and access similar spillovers benefit *differently* from such spillovers. Distinguishing between the responsibilities of affiliates is also important because FDI spillovers incorporate not only technical knowledge about R&D and manufacturing but also non-technical knowledge about marketing & sales functions. Although technical and R&D knowledge is considered major gains from FDI spillovers, particularly in emerging markets (e.g., Yang, 2020), our empirical findings indicate that marketing & sales affiliates are more effective than R&D and manufacturing affiliates in enabling groups to exploit spillovers. Hence, locating affiliates near MNEs without careful consideration of affiliate responsibilities will not optimize performance gains of spillovers. From this point of view, orchestrating carefully the role of each affiliate and the spatial distribution of affiliates with different roles according to the type of knowledge being diffused from the activities of MNEs in each location is a fruitful avenue for enhancing group performance. In incorporating the role of the responsibility of affiliates, our study shifts the research agenda from the question “do indigenous businesses benefit from FDI spillovers?” to “what kind of responsibilities are more effective in exploiting FDI spillovers?”.

6.2 Managerial and policy implications

A deeper understanding of the contingencies identified in this study may help managers of multi-location organizations to better assess the implications of their location choices and re-evaluate ways to optimize spatial configurations to enhance performance. More specifically, managers should adopt a multi-dimensional spatial strategy by integrating all three aspects: the locations of their affiliates, the geographic dispersion of their portfolios of affiliates, and the responsibilities that are assigned to these affiliates. These three aspects together determine the extent to which organizations can capture gains of FDI spillovers in the region where the group has affiliates and also beyond.

A second practical ramification of our findings is that when managers make decisions about their portfolios of affiliates, they should collect information about the type and volume of FDI in each region and not only locate their affiliates in regions that attract FDI but also carefully define the roles of their affiliates in a way to best facilitate the assimilation of different types of knowledge (R&D, marketing & sales, manufacturing) brought by FDI in each region. Although the specific activities of MNEs that each region attracts is beyond their control, this practice will ensure that business groups will be better able to absorb relevant technical or non-technical knowledge through dedicated affiliates.

Finally, the policy implications of our analysis relate to the evolving role of FDI in emerging markets. Governments in emerging markets attract MNEs to invest in specific regions with the expectation that local businesses will become technologically and economically stronger (Wang, 2010b). However, because firm heterogeneity is prevalent in emerging markets, our analysis shows that the magnitude and complexity of the effects of emerging market government's developmental strategies using inward FDI cannot be ascertained until we understand *how* indigenous business groups learn and benefit from the presence of MNEs, and how they may configure their portfolios of affiliates in a way that optimize such FDI-induced learning opportunities across regions. Projection of policy effectiveness (e.g., Chen et al., 2016; Ning et al., 2016) in emerging markets therefore requires in-depth investigation of indigenous businesses' heterogeneity and its influence on the mechanisms of a policy. From this point of view, it appears that policies that encourage indigenous business to build internal spatial networks and spread their affiliates across multiple regions are more effective in stimulating FDI spillovers compared with policies that do not consider such spatial dimensions.

The negative effects of inter-regional FDI spillovers emphasize the importance of building

resilient and more integrated internal spatial networks. Stronger appropriability mechanisms deployed by foreign MNEs in emerging markets (Zhao, 2006) generate significant difficulties for indigenous businesses to assimilate foreign knowledge and without being at proximal distance, the learning effects diminish. As such, competition and market stealing effects outweigh the benefits of inter-regional FDI spillovers. To address this challenge, managers should focus on fostering stronger communities of practice (Bunnell and Coe, 2001) and knowledge enablers (von Krogh et al., 2000) while policy support should be on developing learning within and across regional innovation systems.

6.3 Limitations and directions for future research

Our findings have a number of limitations, some of which offer opportunities for future research. First, this is a single country study. Although China is one of the largest emerging markets and its regional diversity helps us test our hypotheses, future research may extend the current study by testing this framework for other emerging markets. Cross-country evidence will be particularly valuable because institutions differ across emerging markets, and emerging markets are of different sizes (Guimón et al., 2018). Consequently businesses' heterogeneity, location choices and the way learning occurs in other contexts may also vary (e.g., Awate et al., 2018; Garrone et al., 2018; Sinkovics et al., 2018). Hence, cross-country analysis can assist us in theorizing how indigenous businesses learn and benefit from the presence of foreign MNEs.

Second, although our analysis captures the responsibilities of each business affiliate, limitations in data availability do not allow us to examine firm-region-time variations. Data constraints also prevent us from identifying and examining whether the affiliates of business groups have established contractual and/or collaborative relationships with foreign MNEs, which may in turn facilitate stronger spillover effects. Future research may extend the current study by examining contracts between indigenous business groups and foreign MNEs and other agreements such as alliances and joint ventures. This approach may also allow future research to identify which of the mechanisms and channels, through which spillovers occur, matter the most.

Third, our sample are indigenous business groups that have not internationalized. The negative effects of geographic dispersion on group performance points to the possibility that the domestic market poses certain constraints by limiting dispersion (as opposed to multi-national firms that can optimize geographical expansion internationally). Future studies will benefit from

investigating the conditions of domestic dispersion optimisation and the implications for multi-location firms that internationalize. Equally, our study does not capture other aspects of organizational diversity (e.g., the degree of affiliate autonomy) that may change the effectiveness of affiliates and groups in benefiting from spillovers. Examining the role of such aspects can also be a fruitful avenue for future research.

Finally, our data cover a period of rapid transformation in China, especially the emergence of a new middle class (Farrell et al., 2006). This represents a shift in the nature of inward FDI as MNEs increasingly focused on marketing and sales to Chinese consumers. This contrasts with earlier studies (e.g., Bell and Pavitt, 1993) that considered how firms in developing countries could catch up, accumulate technology and grow during a period that was characterized by a plethora of low-cost suppliers and a less affluent middle class. Although technological catch-up is beyond the scope of this study, future research can explore spatial and functional interactions between multi-location indigenous and foreign firms as well as the temporal dynamics of these interactions.

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Table 1 Descriptive statistics and correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	**Business Group Performance**	1																			
2	**Group Sales**	**0.53**	**1**																		
3	**Group Capital**	**0.19**	**0.79**	**1**																	
4	**Group Labour**	**0.18**	**0.83**	**0.86**	**1**																
5	**Group Intermediary Inputs**	**0.45**	**0.98**	**0.77**	**0.81**	**1**															
6	**Intra-regional Spillovers (Intra)**	**0.26**	**0.45**	**0.41**	**0.45**	**0.42**	**1**														
7	**Inter-regional Spillovers (Inter)**	0.05	**0.39**	**0.42**	**0.39**	**0.41**	**0.43**	1													
8	**R&D Specific Intra-regional Spillovers**	0.05	0.04	0.04	-0.03	0.04	-0.09	-0.03	1												
9	**Marketing & Sales Specific Intra-regional Spillovers**	-0.08	**-0.09**	-0.07	-0.02	**-0.10**	0.03	**-0.17**	**-0.55**	1											
10	**Manufacturing Specific Intra-regional Spillovers**	**-0.25**	**-0.12**	0.01	0.06	**-0.13**	**-0.27**	**-0.22**	**-0.44**	**0.67**	1										
11	**Intra Excluding R&D Presence-weighted Spillovers**	-0.04	-0.01	0.00	0.06	-0.02	**0.52**	**0.19**	0.06	-0.05	**-0.20**	1									
12	**Intra Excluding Marketing & Sales Presence-weighted Spillovers**	**0.10**	**0.12**	**0.09**	**0.13**	**0.11**	**0.55**	**0.14**	0.02	-0.04	-0.08	**0.74**	1								
13	**Intra Excluding Manufacturing Presence-weighted Spillovers**	0.03	0.05	0.04	0.08	0.04	**0.66**	**0.22**	**0.09**	-0.07	**-0.19**	**0.84**	**0.83**	1							
14	**Group Geographic Dispersion**	**0.19**	0.03	**-0.10**	**-0.10**	0.03	**0.12**	**-0.40**	**-0.11**	0.07	**-0.29**	**-0.19**	**-0.16**	**-0.15**	1						
15	**No. of R&D Affiliates in A Group**	**0.21**	**0.62**	**0.69**	**0.63**	**0.60**	**0.51**	**0.53**	**0.32**	**-0.19**	**-0.22**	**0.23**	**0.12**	**0.18**	**-0.19**	1					
16	**No. of Marketing & Sales Affiliates in A Group**	**0.21**	**0.55**	**0.60**	**0.58**	**0.53**	**0.53**	**0.37**	**-0.31**	**0.47**	0.07	-0.02	**0.19**	0.03	0.00	**0.58**	1				
17	**No. of Manufacturing Affiliates in A Group**	**-0.10**	**0.36**	**0.55**	**0.53**	**0.36**	**0.26**	**0.54**	-0.08	**-0.17**	**0.17**	**0.19**	**0.24**	**0.14**	**-0.33**	**0.53**	**0.43**	1			
18	**Group's Region-specific GDP Per Capita**	**-0.09**	-0.02	0.06	0.03	-0.01	-0.08	**0.10**	**0.09**	0.04	**0.20**	**0.10**	0.09	**0.12**	**-0.46**	**0.12**	0.00	**0.14**	1		
19	**Group R&D Stock**	**0.39**	**0.55**	**0.47**	**0.43**	**0.53**	**0.28**	**0.35**	0.08	**-0.18**	**-0.11**	-0.01	0.01	0.00	0.04	**0.48**	**0.33**	**0.13**	**0.09**	1	
20	**Group Size**	**0.41**	**0.79**	**0.59**	**0.63**	**0.79**	**0.36**	**0.44**	0.05	**-0.17**	**-0.25**	0.00	0.01	0.04	0.06	**0.49**	**0.34**	**0.28**	-0.08	**0.47**	1
21	**Group Age**	**0.14**	**0.33**	**0.43**	**0.43**	**0.31**	**0.26**	**0.29**	0.03	**0.10**	0.02	**0.12**	**0.14**	**0.13**	**-0.25**	**0.30**	**0.28**	**0.25**	**0.22**	**0.31**	**0.29**
22	**Group Product Diversification**	0.01	0.00	-0.04	-0.07	0.02	-0.03	0.06	0.04	-0.04	0.06	**-0.12**	-0.08	-0.07	0.05	-0.02	-0.01	-0.04	0.04	**0.12**	0.02
23	**Group Foreign Ownership**	**0.34**	**0.42**	**0.32**	**0.29**	**0.40**	**0.18**	-0.02	0.08	-0.05	-0.08	**-0.11**	0.02	-0.05	**0.21**	**0.14**	**0.19**	0.06	**-0.13**	**0.17**	**0.35**
24	**Group State Ownership**	0.00	**0.24**	**0.34**	**0.37**	**0.24**	**0.19**	**0.34**	0.06	-0.05	-0.08	**0.14**	**0.11**	0.09	**-0.31**	**0.38**	**0.25**	**0.28**	**0.14**	**0.18**	**0.28**
25	**Share of Employees with Masters or Higher Qualifications**	**0.35**	**0.28**	**0.14**	**0.10**	**0.27**	0.07	0.01	**0.30**	**-0.22**	**-0.38**	-0.03	**-0.14**	-0.01	**0.15**	**0.33**	0.01	**-0.17**	0.06	**0.39**	**0.33**
26	**Group's Region-specific Share of Tertiary GDP to Secondary GDP**	**-0.25**	**-0.15**	-0.02	**-0.11**	**-0.12**	**-0.52**	0.08	**0.13**	-0.08	**0.15**	**-0.31**	**-0.31**	**-0.31**	**-0.45**	0.06	-0.08	**0.11**	**0.46**	0.00	**-0.13**
27	**Group's Region-specific Retail Sales**	**0.25**	**0.49**	**0.46**	**0.48**	**0.46**	**0.88**	**0.47**	**-0.13**	**0.10**	**-0.22**	**0.20**	**0.22**	**0.35**	**0.23**	**0.54**	**0.63**	**0.22**	**-0.09**	**0.39**	**0.42**
28	**Group's Region-specific Patent Stock**	**0.25**	**0.45**	**0.42**	**0.45**	**0.42**	**0.88**	**0.46**	-0.08	**0.09**	**-0.19**	**0.29**	**0.30**	**0.44**	**0.12**	**0.53**	**0.56**	**0.21**	**0.11**	**0.36**	**0.37**
29	**Group's Region-specific Total Output of Industrial Enterprises**	**0.28**	**0.44**	**0.38**	**0.42**	**0.41**	**0.91**	**0.35**	**-0.13**	**0.12**	**-0.20**	**0.29**	**0.32**	**0.44**	**0.27**	**0.44**	**0.54**	**0.14**	0.00	**0.34**	**0.37**
30	**Group's Region-specific Number of Industrial Enterprises**	**0.29**	**0.47**	**0.40**	**0.43**	**0.45**	**0.91**	**0.36**	**-0.15**	**0.12**	**-0.23**	**0.24**	**0.28**	**0.39**	**0.32**	**0.46**	**0.58**	**0.15**	**-0.14**	**0.34**	**0.40**
31	**Intra Weighted by Group Regional R&D Presence per R&D Affiliate**	0.07	-0.08	**-0.14**	-0.09	-0.09	**0.51**	-0.02	**0.28**	**-0.18**	**-0.28**	**0.47**	**0.62**	**0.67**	0.06	**-0.18**	**-0.20**	**-0.19**	-0.03	**-0.11**	-0.05
32	**Intra Weighted by Group Regional Marketing & Sales Presence per Sales Affiliate**	-0.01	**-0.17**	**-0.22**	**-0.12**	**-0.19**	**0.56**	-0.01	-0.07	**0.14**	**-0.11**	**0.69**	**0.51**	**0.75**	0.04	**-0.15**	**-0.21**	**-0.21**	0.01	**-0.18**	**-0.11**
33	**Intra Weighted by Group Regional Manufacturing Presence per Manufacturing Affiliate**	**0.12**	**-0.18**	**-0.28**	**-0.19**	**-0.20**	**0.43**	-0.10	0.05	-0.08	-0.07	**0.62**	**0.58**	**0.55**	**0.12**	**-0.25**	**-0.34**	**-0.43**	-0.09	**-0.24**	**-0.17**
34	**Intra-regional Spillovers (Intra) (measured by FDI inflow)**	**0.23**	**0.59**	**0.60**	**0.59**	**0.57**	**0.88**	**0.60**	**-0.15**	0.04	**-0.22**	**0.32**	**0.33**	**0.42**	-0.02	**0.70**	**0.72**	**0.47**	-0.05	**0.38**	**0.48**
35	**Inter-regional Spillovers (Inter) (measured by FDI inflow)**	0.06	**0.40**	**0.41**	**0.39**	**0.41**	**0.46**	**1.00**	-0.04	**-0.17**	**-0.24**	**0.21**	**0.16**	**0.24**	**-0.38**	**0.53**	**0.37**	**0.53**	0.08	**0.34**	**0.44**
36	**Intra-regional Spillovers (Intra) (lag 2 years)**	**0.26**	**0.44**	**0.40**	**0.44**	**0.42**	**1.00**	**0.43**	**-0.09**	0.04	**-0.28**	**0.53**	**0.56**	**0.66**	**0.11**	**0.50**	**0.52**	**0.26**	-0.07	**0.27**	**0.35**
37	**Inter-regional Spillovers (Inter) (lag 2 years)**	0.07	**0.40**	**0.40**	**0.39**	**0.41**	**0.48**	**1.00**	-0.03	**-0.17**	**-0.25**	**0.23**	**0.19**	**0.27**	**-0.37**	**0.52**	**0.37**	**0.52**	0.08	**0.34**	**0.44**
38	**Intra-regional Spillovers (Intra) (lag 3 years)**	**0.26**	**0.44**	**0.40**	**0.44**	**0.41**	**1.00**	**0.42**	**-0.10**	0.04	**-0.27**	**0.53**	**0.56**	**0.67**	**0.11**	**0.49**	**0.52**	**0.26**	-0.05	**0.27**	**0.34**
39	**Inter-regional Spillovers (Inter) (lag 3years)**	0.07	**0.40**	**0.40**	**0.39**	**0.41**	**0.48**	**1.00**	-0.03	**-0.17**	**-0.25**	**0.23**	**0.19**	**0.27**	**-0.37**	**0.52**	**0.37**	**0.52**	0.08	**0.34**	**0.44**
40	**Intra-regional Spillovers (Intra) (lag 5 years)**	**0.26**	**0.44**	**0.39**	**0.44**	**0.41**	**0.99**	**0.41**	**-0.11**	0.06	**-0.25**	**0.54**	**0.57**	**0.67**	**0.11**	**0.48**	**0.51**	**0.25**	-0.01	**0.26**	**0.34**
41	**Inter-regional Spillovers (Inter) (lag 5years)**	0.07	**0.40**	**0.40**	**0.39**	**0.41**	**0.48**	**1.00**	-0.03	**-0.17**	**-0.25**	**0.23**	**0.19**	**0.27**	**-0.37**	**0.52**	**0.37**	**0.52**	0.08	**0.34**	**0.44**
	N	482	482	482	482	482	482	482	469	482	344	482	482	482	482	482	482	482	482	482	482
	Mean	0.43	528797.70	183344.10	977.87	340337.20	40700000	1851157	0.33	0.43	0.36	8565367	9995929	5871432	0.40	3.62	5.49	2.79	31203.27	47759.54	0.53
	SD	0.12	1595134	636931.70	1703.54	962672.90	39300000	2588902	0.17	0.18	0.11	8477522	8460600	4091872	0.29	3.61	5.80	3.86	10902.60	173166.90	0.50
	Min	0.20	4212.84	219	21	2610.31	3792869	0	0.01	0.04	0.05	279848.80	790534.50	279848.80	0	1	1	0	6063.38	0	0
	Max	0.85	20000000	5747463	9807	9526562	224000000	14200000	0.91	0.92	0.63	58400000	57700000	21700000	0.96	18	28	18	71637.50	1809882	1

Notes: Pearson Correlations (two-tailed); figures in bold if $p<0.05$. For ease of reading, mean and standard deviation are statistics of variables in original form while correlations are calculated for variables in models, i.e., with logarithm (inverse hyperbolic sine) transformation (expect dummies).

Table 1 Descriptive statistics and correlations (continued)

		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
21	**Group Age**	1																				
22	**Group Product Diversification**	**-0.13**	1																			
23	**Group Foreign Ownership**	**0.13**	0.01	1																		
24	**Group State Ownership**	**0.35**	-0.04	0.00	1																	
25	**Share of Employees with Masters or Higher Qualifications**	-0.03	0.09	-0.03	0.09	1																
26	**Group's Region-specific Share of Tertiary GDP to Secondary GDP**	-0.06	0.01	**-0.30**	**0.10**	**0.13**	1															
27	**Group's Region-specific Retail Sales**	**0.28**	0.01	**0.18**	**0.16**	**0.14**	**-0.38**	1														
28	**Group's Region-specific Patent Stock**	**0.34**	0.01	**0.12**	**0.17**	**0.14**	**-0.34**	**0.95**	1													
29	**Group's Region-specific Total Output of Industrial Enterprises**	**0.28**	0.02	**0.22**	**0.11**	**0.10**	**-0.54**	**0.95**	**0.95**	1												
30	**Group's Region-specific Number of Industrial Enterprises**	**0.23**	0.02	**0.23**	**0.12**	**0.12**	**-0.58**	**0.95**	**0.90**	**0.97**	1											
31	**Intra Weighted by Group Regional R&D Presence per R&D Affiliate**	0.03	-0.01	0.06	-0.07	-0.04	**-0.45**	**0.25**	**0.32**	**0.39**	**0.35**	1										
32	**Intra Weighted by Group Regional Marketing & Sales Presence per Sales Affiliate**	0.08	-0.07	-0.08	-0.04	**-0.10**	**-0.50**	**0.30**	**0.38**	**0.45**	**0.39**	**0.73**	1									
33	**Intra Weighted by Group Regional Manufacturing Presence per Manufacturing Affiliate**	0.07	-0.07	0.10	**-0.17**	**-0.24**	**-0.63**	**0.15**	**0.22**	**0.34**	**0.29**	**0.73**	**0.85**	1								
34	**Intra-regional Spillovers (Intra) (measured by FDI inflow)**	**0.31**	-0.02	**0.19**	**0.32**	**0.12**	**-0.30**	**0.85**	**0.80**	**0.78**	**0.82**	**0.15**	**0.20**	0.06	1							
35	**Inter-regional Spillovers (Inter) (measured by FDI inflow)**	**0.28**	0.06	-0.01	**0.33**	0.00	0.03	**0.48**	**0.47**	**0.38**	**0.39**	0.01	0.03	-0.05	**0.61**	1						
36	**Intra-regional Spillovers (Intra) (lag 2 years)**	**0.27**	-0.03	**0.16**	**0.18**	0.07	**-0.51**	**0.88**	**0.88**	**0.90**	**0.90**	**0.51**	**0.57**	**0.44**	**0.87**	**0.46**	1					
37	**Inter-regional Spillovers (Inter) (lag 2 years)**	**0.28**	0.06	-0.01	**0.33**	0.00	0.01	**0.50**	**0.49**	**0.40**	**0.40**	0.04	0.06	-0.01	**0.61**	**1.00**	**0.48**	1				
38	**Intra-regional Spillovers (Intra) (lag 3 years)**	**0.27**	-0.03	**0.17**	**0.19**	0.06	**-0.52**	**0.87**	**0.88**	**0.90**	**0.90**	**0.52**	**0.58**	**0.45**	**0.87**	**0.45**	**1.00**	**0.47**	1			
39	**Inter-regional Spillovers (Inter) (lag 3 years)**	**0.28**	0.06	-0.01	**0.33**	0.00	0.01	**0.50**	**0.49**	**0.40**	**0.40**	0.04	0.06	-0.01	**0.61**	**1.00**	**0.48**	**1.00**	**0.47**	1		
40	**Intra-regional Spillovers (Intra) (lag 5 years)**	**0.28**	-0.03	**0.17**	**0.19**	0.04	**-0.54**	**0.85**	**0.87**	**0.90**	**0.89**	**0.52**	**0.59**	**0.46**	**0.86**	**0.43**	**0.99**	**0.46**	**1.00**	**0.46**	1	
41	**Inter-regional Spillovers (Inter) (lag 5years)**	**0.29**	0.06	-0.01	**0.33**	0.00	0.01	**0.50**	**0.49**	**0.40**	**0.40**	0.04	0.06	-0.01	**0.61**	**1.00**	**0.48**	**1.00**	**0.47**	**1.00**	**0.46**	1
	N	482	482	482	482	482	482	482	482	482	482	469	482	344	482	482	482	482	482	482	482	
	Mean	14.08	1.52	0.29	0.13	0.04	1.53	19165.78	165442.70	67972.20	77588.41	4323893	3914364	5674932	4.28	4.25E+10	17.04	32.80	3.48E+07	4.17E+17	3.07E+07	3.44E+17
	SD	12.23	0.76	0.37	0.25	0.06	0.52	19383.39	193939.90	81090.20	85398.01	3717144	3116503	5457995	3.78	6.72E+10	0.87	11.08	3.47E+07	7.37E+17	3.23E+07	6.16E+17
	Min	1.17	1	0	0	0	0.42	1861.30	7885.36	5213.33	8038	41932.56	133261.30	790534.60	0.64	0.61	15.05	14.91	3.16E+06	2.68E+06	2.58E+06	1.98E+06
	Max	55.50	3	1	1	0.34	3.02	105682.70	1562520	575279.20	501624	2.13E+07	1.44E+07	2.89E+07	19.92	3.55E+11	19.16	42.97	1.98E+08	4.33E+18	1.91E+08	3.90E+18

Notes: Pearson Correlations (two-tailed); figures in bold if $p<0.05$. For ease of reading, mean and standard deviation are statistics of variables in original form while correlations are calculated for variables in models, i.e., with logarithm (inverse hyperbolic sine) transformation (expect dummies).

Table 2 Regression results – Hypotheses H1a & H1b (dependent variable: Business Group Performance)

	Main results	**Additional analysis**			
	Spillovers lagged 1 year	**Spillovers lagged 2 years**	**Spillovers lagged 3 years**	**Spillovers lagged 5 years**	**Spillovers measured by FDI flow, lagged 1 year**
	1	2	3	4	5
H1a: Intra-regional Spillovers (Intra)	**0.062*** (-0.014)**	**0.061*** (-0.015)**	**0.060*** (-0.015)**	**0.058*** (-0.014)**	**0.104*** (0.025)**
H1b: Inter-regional Spillovers (Inter)	**-0.004*** (-0.001)**	**-0.004*** (-0.001)**	**-0.004*** (-0.001)**	**-0.003*** (-0.001)**	**-0.005*** (0.001)**
Group's Region-specific GDP Per Capita	-0.073** (-0.029)	-0.073** (-0.029)	-0.076*** (-0.029)	-0.084*** (-0.029)	-0.073* (0.030)
Group Geographical Dispersion	-0.110** (-0.052)	-0.095* (-0.052)	-0.097* (-0.052)	-0.102* (-0.052)	-0.103+ (0.053)
Group R&D stock	0.009*** (-0.002)	0.009*** (-0.002)	0.009*** (-0.002)	0.009*** (-0.002)	0.008*** (0.002)
Group Size	0.118*** (-0.026)	0.114*** (-0.026)	0.113*** (-0.026)	0.112*** (-0.026)	0.108*** (0.027)
Group Age	0.015 (-0.017)	0.015 (-0.017)	0.015 (-0.017)	0.015 (-0.017)	0.018 (0.017)
Group Product Diversification	-0.019 (-0.022)	-0.019 (-0.022)	-0.019 (-0.022)	-0.019 (-0.022)	-0.014 (0.022)
Group Foreign Ownership	0.015*** (-0.002)	0.015*** (-0.002)	0.015*** (-0.002)	0.015*** (-0.002)	0.015*** (0.003)
Group State Ownership	-0.009*** (-0.003)	-0.009*** (-0.003)	-0.009*** (-0.003)	-0.009*** (-0.003)	-0.010*** (0.003)
Share of Employees with Masters or Higher Qualifications	0.017*** (-0.003)	0.018*** (-0.003)	0.018*** (-0.003)	0.018*** (-0.003)	0.017*** (0.003)
Industry effects	Included	Included	Included	Included	Included
Year effects	Included	Included	Included	Included	Included
Constant	-1.102*** (-0.389)	-0.982** (-0.383)	-0.932** (-0.376)	-0.802** (-0.358)	-0.108 (0.321)
N	482	482	482	482	482
R^2	0.403	0.400	0.402	0.405	0.372
χ^2 , p value	326.5, 0	321.5, 0	322.4, 0	324, 0	309.7, 0
Hansen-Sargan overidentification statistic, p value	0.105, 0.75	0.007, 0.93	0.028, 0.87	0.128, 0.72	0.153, 0.70
Average VIF	1.86	1.86	1.86	1.86	1.90
Max VIF	3.96	3.95	3.95	3.95	3.97
First stage model below:					
Business Group Performance	0.168 (-0.456)	-0.38 (-0.618)	-0.366 (-0.639)	-0.363 (-0.690)	-3.336** (1.256)
Group's Region-specific Patent Stock	0.278*** (-0.046)	0.335*** (-0.050)	0.297*** (-0.052)	0.204*** (-0.056)	0.208* (0.083)
Group's Region-specific Total Output of Industrial Enterprises					0.514*** (0.096)
Group's Region-specific Number of Industrial Enterprises	0.651*** (-0.047)	0.622*** (-0.053)	0.669*** (-0.055)	0.781*** (-0.059)	

Group's Region-specific GDP Per Capita	-0.198*** (-0.057)	-0.242*** (-0.068)	-0.174** (-0.070)	0.014 (-0.075)	-0.611*** (0.147)
Group Geographical Dispersion	-0.666*** (-0.076)	-0.673*** (-0.085)	-0.659*** (-0.088)	-0.598*** (-0.095)	-0.926*** (0.192)
Group R&D stock	-0.007 (-0.004)	-0.004 (-0.006)	-0.005 (-0.006)	-0.007 (-0.006)	0.033** (0.012)
Group Size	-0.053 (-0.053)	-0.011 (-0.066)	-0.009 (-0.068)	0.001 (-0.074)	0.444** (0.140)
Group Age	-0.032 (-0.027)	-0.012 (-0.030)	-0.007 (-0.031)	0.005 (-0.034)	-0.019 (0.065)
Group Product Diversification	-0.061* (-0.035)	-0.077* (-0.040)	-0.078* (-0.041)	-0.085* (-0.044)	-0.160+ (0.086)
Group Foreign Ownership	0.005 (-0.008)	0.012 (-0.011)	0.013 (-0.011)	0.014 (-0.012)	0.062** (0.022)
Group State Ownership	0.006 (-0.006)	0 (-0.007)	0.001 (-0.008)	0.001 (-0.008)	-0.009 (0.015)
Share of Employees with Masters or Higher Qualifications	-0.001 (-0.010)	0.009 (-0.013)	0.007 (-0.014)	0.002 (-0.015)	0.066* (0.028)
Industry effects	Included	Included	Included	Included	Included
Year effects	Included	Included	Included	Included	Included
Constant	9.676*** (-0.560)	9.192*** (-0.642)	8.358*** (-0.663)	6.053*** (-0.715)	-2.535* (1.228)

Notes: standard errors are in parentheses. †, *, ** and *** denote significance at the 10%, 5%, 1%, and 0.1% levels respectively. N=482 (84 business groups). All models are 3SLS estimations. The endogenous variables are relevant Intra-regional Spillovers and Business Group Performance. Because the endogenous variables change with each model, the relevant Group's Regional Specific controls in the first stage of models of 3SLS vary.

Table 3 Regression results – Hypotheses H2a & H2b and H3 (dependent variable: Business Group Performance)

	Main results	Additional analysis	
		Moderating role of R&D stock	**Moderating role of R&D stock (for spillovers lagged 2 years)**
	6	7	8
H1a: Intra-regional Spillovers (Intra)	0.050*** (-0.016)	0.109*** (-0.022)	0.122*** (-0.024)
H1b: Inter-regional Spillovers (Inter)	-0.004*** (-0.002)	-0.007*** (-0.001)	-0.006*** (-0.002)
H2a and H3: Intra x Group Geographic Dispersion	-0.170*** (-0.056)		
H2b and H3: Inter x Group Geographic Dispersion	0.015** (-0.006)		
Intra x Group R&D Stock		-0.003 (-0.002)	-0.003 (-0.002)
Inter x Group R&D Stock		0 (0.000)	0 (0.000)
Group's Region-specific GDP Per Capita	-0.086*** (-0.029)	-0.069*** (-0.017)	-0.067*** (-0.018)
Group Geographic Dispersion	-0.165*** (-0.062)	-0.167*** (-0.056)	-0.166*** (-0.058)
Group R&D stock	0.008*** (-0.002)	0.008*** (-0.002)	0.008*** (-0.002)
Group Size	0.092*** (-0.027)	0.126*** (-0.026)	0.123*** (-0.026)
Group Age	0.035** (-0.017)	0.012 (-0.017)	0.008 (-0.017)
Group Product Diversification	-0.013 (-0.021)	-0.018 (-0.022)	-0.017 (-0.022)
Group Foreign Ownership	0.015*** (-0.002)	0.014*** (-0.003)	0.015*** (-0.003)
Group State Ownership	-0.009*** (-0.003)	-0.009*** (-0.003)	-0.009*** (-0.003)
Share of Employees with Masters or Higher Qualifications	0.021*** (-0.003)	0.018*** (-0.003)	0.018*** (-0.003)
Industry effects	Included	Included	Included
Year effects	Included	Included	Included
Constant	-0.701* (-0.415)	-1.895*** (-0.334)	-1.942*** (-0.333)
N	482	482	482
R^2	0.420	0.384	0.372
χ^2 , p value	351.7, 0	323.6, 0	315.9, 0
Hansen-Sargan overidentification statistic, p value	2.382, 0.12	1.217, 0.88	0.223, 0.90
VIF average	2.05	1.88	1.88
VIF maximum	4.25	3.98	3.98
First stage model below:			
Business Group Performance	0.626 (-0.580)	-14.581* (-8.480)	-24.072 (-16.533)
Group's Region-specific Share of Tertiary GDP to Secondary GDP		-3.753** (-1.464)	-5.341* (-2.809)

Group's Region-specific Patent Stock	0.320*** (-0.054)		
Group's Region-specific Number of Industrial Enterprises	0.585*** (-0.049)		
Intra x Group Geographic Dispersion	-0.094 (-0.171)		
Inter x Group Geographic Dispersion	0.018* (-0.010)		
Group Geographic Dispersion	-0.672*** (-0.088)	-0.899 (-0.846)	-1.4 (-1.335)
Group R&D stock	-0.011** (-0.005)	0.140* (-0.075)	0.217 (-0.141)
Group Size	-0.120** (-0.056)	1.570* (-0.884)	2.44 (-1.633)
Group Age	-0.028 (-0.036)	0.294 (-0.313)	0.447 (-0.473)
Group Product Diversification	-0.043 (-0.036)	-0.622 (-0.490)	-0.969 (-0.809)
Group Foreign Ownership	-0.001 (-0.011)	0.193 (-0.130)	0.327 (-0.246)
Group State Ownership	0.01 (-0.006)	-0.08 (-0.078)	-0.151 (-0.138)
Share of Employees with Masters or Higher Qualifications	-0.006 (-0.015)	0.317* (-0.191)	0.521 (-0.364)
Industry effects	Included	Included	Included
Year effects	Included	Included	Included
Constant	10.231*** (-0.573)	6.599 (-6.301)	-0.459 (-12.153)

Notes: standard errors are in parentheses. †, *, ** and *** denote significance at the 10%, 5%, 1%, and 0.1% levels respectively. N=482 (84 business groups). All models are 3SLS estimations. The endogenous variables are relevant Intra-regional Spillovers and Business Group Performance. Because the endogenous variables change with each model, the relevant Group's Regional Specific controls in the first stage of models of 3SLS vary.

Table 4 Regression results - Hypothesis H4 (dependent variable: Business Group Performance)

	Main results			**Alternative Measures of Intra Weighted by Group Regional Responsibility Presence**		
	9	10	11	12	13	14
H4: R&D Specific Intra-regional Spillovers	**0.147 (0.121)**					
H4: Marketing & Sales Specific Intra-regional Spillovers		**0.263** (0.082)**				
H4: Manufacturing Specific Intra-regional Spillovers			**-0.569* (0.250)**			
Intra Weighted by Group Regional R&D Presence per R&D Affiliate				**0.093* (0.036)**		
Intra Weighted by Group Regional Marketing & Sales Presence per Marketing & Sales Affiliate					**0.145*** (0.036)**	
Intra Weighted by Group Regional Manufacturing Presence per Manufacturing Affiliate						**0.051+ (0.030)**
Intra Excluding R&D Presence-weighted Spillovers	0.046** (0.015)			0.006 (0.021)		
Intra Excluding Marketing & Sales Presence-weighted Spillovers		0.056*** (0.014)			-0.052* (0.023)	
Intra Excluding Manufacturing Presence-weighted Spillovers			0.067*** (0.020)			0.075*** (0.022)
Inter-regional Spillovers (Inter)	-0.005** (0.002)	-0.004** (0.002)	-0.005* (0.002)	-0.004* (0.002)	-0.002 (0.002)	-0.003 (0.002)
Inter x Group Geographic Dispersion	0.015* (0.006)	0.016** (0.006)	-0.020* (0.009)	0.006 (0.007)	0.006 (0.006)	-0.033*** (0.009)
Group Geographic Dispersion	-0.216*** (0.061)	-0.205** (0.062)	-0.193** (0.070)	-0.090 (0.066)	-0.087 (0.062)	-0.085 (0.065)
Group's Region-specific GDP Per Capita	-0.074* (0.029)	-0.073* (0.029)	-0.119*** (0.032)	-0.072* (0.031)	-0.080* (0.031)	-0.099** (0.032)
No. of R&D Affiliates in A Group		0.010 (0.019)	-0.082** (0.026)			
No. of Marketing & Sales Affiliates in A Group	0.054*** (0.016)		0.126*** (0.028)			
No. of Manufacturing Affiliates in A Group	-0.011*** (0.002)	-0.009*** (0.002)				
Group R&D stock	0.008*** (0.002)	0.009*** (0.002)	0.008*** (0.002)	0.012*** (0.002)	0.014*** (0.002)	0.010*** (0.002)
Group Size	0.126*** (0.026)	0.129*** (0.026)	0.106*** (0.031)	0.124*** (0.029)	0.139*** (0.029)	0.135*** (0.032)
Group Age	0.017 (0.016)	0.013 (0.017)	0.043* (0.019)	0.015 (0.018)	-0.003 (0.019)	0.017 (0.019)
Group Product Diversification	-0.016 (0.021)	-0.018 (0.021)	0.035 (0.025)	-0.027 (0.024)	-0.026 (0.023)	0.016 (0.026)
Group Foreign Ownership	0.016*** (0.003)	0.017*** (0.002)	0.006* (0.003)	0.015*** (0.003)	0.019*** (0.003)	0.008* (0.003)
Group State Ownership	-0.010*** (0.003)	-0.010** (0.003)	-0.010** (0.003)	-0.007* (0.003)	-0.007* (0.003)	-0.008* (0.003)
Share of Employees with Masters or Higher Qualifications	0.015*** (0.004)	0.017*** (0.004)	0.016*** (0.005)	0.016*** (0.004)	0.019*** (0.004)	0.017*** (0.004)
Industry effects	Included	Included	Included	Included	Included	Included
Year effects	Included	Included	Included	Included	Included	Included
Constant	-0.905* (0.420)	-1.076** (0.381)	-0.633 (0.509)	-1.576** (0.502)	-1.310** (0.435)	-1.907*** (0.472)
N	469	482	344	469	482	344

Number of Business Groups	80	84	59	80	84	59
R^2	0.438	0.426	0.521	0.341	0.316	0.501
χ^2, p value	366.6, 0	357.8, 0	385.2, 0	295.2, 0	291.9, 0	351.4, 0
Hansen-Sargan overidentification statistics, p value	1.055, 0.30	2.019, 0.16	0.161, 0.69	0.007, 0.93	2.387, 0.12	0.012, 0.91
Average VIF	2.07	2.10	2.39	1.96	2.00	2.20
Max VIF	4.25	4.29	4.81	3.85	4.04	4.79
First stage model below:						
Business Group Performance	0.788**	-0.043	0.271+	-4.390	-14.718	-3.637*
	(0.277)	(0.186)	(0.146)	(3.403)	(11.908)	(1.760)
Group's Region-specific Patent Stock	0.080***	0.041**	0.031*			
	(0.018)	(0.014)	(0.014)			
Group's Region-specific Number of Industrial Enterprises	0.102***	0.202***	0.141***			
	(0.020)	(0.017)	(0.021)			
Group's Region-specific Share of Tertiary GDP to Secondary GDP				-1.619***	-3.494+	-1.336***
				(0.489)	(2.026)	(0.220)
Group's Region-specific Retail Sales				0.174	0.388	-0.535***
				(0.120)	(0.549)	(0.110)
Intra Excluding R&D Presence-weighted Spillovers	-0.220***			0.281*		
	(0.020)			(0.122)		
Intra Excluding Marketing & Sales Presence-weighted Spillovers		-0.229***			0.143	
		(0.008)			(0.322)	
Intra Excluding Manufacturing Presence-weighted Spillovers			-0.207***			1.013***
			(0.030)			(0.210)
Inter-regional Spillovers (Inter)	0.003+	-0.004***	-0.002+	-0.026	-0.062	-0.014
	(0.002)	(0.001)	(0.001)	(0.016)	(0.054)	(0.011)
Inter x Group Geographic Dispersion	-0.013+	-0.000	0.007	0.027	0.129	-0.151*
	(0.007)	(0.004)	(0.005)	(0.040)	(0.140)	(0.072)
Group Geographic Dispersion	-0.015	-0.211***	-0.203***	-1.569**	-3.063	-0.448+
	(0.071)	(0.049)	(0.029)	(0.580)	(2.531)	(0.266)
No. of R&D Affiliates in A Group		-0.009	0.013			
		(0.010)	(0.017)			
No. of Marketing & Sales Affiliates in A Group	-0.099***		-0.023			
	(0.018)		(0.021)			
No. of Manufacturing Affiliates in A Group	0.013***	0.003				
	(0.004)	(0.002)				
Group R&D stock	-0.006*	-0.002	-0.001	0.026	0.110	0.019
	(0.003)	(0.002)	(0.001)	(0.035)	(0.111)	(0.018)
Group Size	-0.119**	-0.016	-0.033	0.296	1.400	0.277
	(0.043)	(0.027)	(0.021)	(0.402)	(1.374)	(0.261)
Group Age	-0.017	0.012	-0.016	0.060	0.307	0.180*
	(0.015)	(0.009)	(0.011)	(0.097)	(0.217)	(0.085)
Group Product Diversification	0.003	-0.023*	-0.005	-0.015	-0.428	0.119
	(0.020)	(0.012)	(0.012)	(0.144)	(0.430)	(0.108)
Group Foreign Ownership	-0.008	-0.002	-0.002	0.069	0.172	-0.012
	(0.005)	(0.003)	(0.002)	(0.053)	(0.172)	(0.015)
Group State Ownership	0.011**	0.001	0.001	-0.053	-0.124	-0.048*
	(0.004)	(0.002)	(0.002)	(0.033)	(0.103)	(0.020)
Share of Employees with Masters or Higher Qualifications	-0.001	-0.004	-0.012***	0.133+	0.322	0.049
	(0.005)	(0.003)	(0.004)	(0.069)	(0.252)	(0.034)
Industry effects	Included	Included	Included	Included	Included	Included
Year effects	Included	Included	Included	Included	Included	Included
Constant	2.907***	1.620***	2.291***	6.942+	-0.038	0.652
	(0.453)	(0.283)	(0.433)	(4.001)	(8.561)	(4.323)

Notes: standard errors are in parentheses. †, *, ** and *** denote significance at the 10%, 5%, 1%, and 0.1% levels respectively. Because not all business group's affiliates have reported their responsibilities, the sample size varies slightly between models. All models are 3SLS estimations. The endogenous variables are relevant mandate-specific intra-regional spillovers and Business Group Performance. Because the endogenous variables change with each model, the relevant Group's Regional Specific controls in the first stage of models of 3SLS vary.

Table 5 Regression results – additional analyses (dependent variable: Business Group Performance)

	R&D Specific Intra-regional Spillovers			Marketing & Sales Specific Intra-regional Spillovers			Manufacturing Specific Intra-regional Spillovers			
	15	16	17	18	19	20	21	22	23	24
R&D Specific Intra-regional Spillovers x Group Geographic Dispersion x Inter			0.021 (0.046)							
R&D Specific Intra-regional Spillovers x Group Geographic Dispersion		0.134 (0.530)	-0.265 (0.802)							
R&D Specific Intra-regional Spillovers	-0.111 (0.314)	-0.033 (0.302)	0.247 (0.539)							
Marketing & Sales Specific Intra-regional spillovers x Group Geographic Dispersion x Inter						0.075*** (0.019)				
Marketing & Sales Specific Intra-regional Spillovers x Group Geographic Dispersion					-0.662+ (0.348)	-0.854* (0.360)				
Marketing & Sales Specific Intra-regional Spillovers				0.190 (0.161)	0.233 (0.170)	0.412* (0.190)				
Marketing & Sales Specific Intra-regional Spillovers x Group Geographic Dispersion x Inter									-0.251* (0.109)	-0.215* (0.106)
Manufacturing Specific Intra-regional Spillovers x Group Geographic Dispersion								-0.677 (0.441)	0.072 (0.584)	-0.371 (0.541)
Manufacturing Specific Intra-regional spillovers							-0.540* (0.250)	-0.588* (0.241)	-1.003** (0.369)	-0.897* (0.358)
Intra Excluding R&D Presence-weighted Spillovers x Group Geographic Dispersion	-0.216* (0.085)	-0.178** (0.055)	-0.176** (0.056)							
Intra Excluding R&D Presence-weighted Spillovers	0.014 (0.030)	0.022 (0.025)	0.039 (0.035)							
Intra Excluding Marketing & Sales Presence-weighted Spillovers x Group Geographic Dispersion				-0.134+ (0.071)	-0.210*** (0.057)	-0.185** (0.058)				
Intra Excluding Marketing & Sales Presence-weighted Spillovers				0.053** (0.017)	0.036* (0.015)	0.048** (0.015)				
Intra Excluding Manufacturing Presence-weighted Spillovers x Group Geographic Dispersion							0.070 (0.058)	0.028 (0.063)	0.053 (0.066)	0.036 (0.064)
Intra Excluding Manufacturing Presence-weighted Spillovers							0.071*** (0.020)	0.066*** (0.019)	0.046+ (0.024)	0.040+ (0.024)
Inter x Group Geographic Dispersion	0.023*** (0.006)	0.022*** (0.007)	0.024*** (0.007)	0.020*** (0.006)	0.022*** (0.006)	0.015* (0.006)	-0.024* (0.010)	-0.021* (0.010)	-0.028** (0.011)	
Inter-regional Spillovers (Inter)	-0.002 (0.003)	-0.003 (0.002)	-0.004 (0.003)	-0.004* (0.002)	-0.003+ (0.002)	-0.002 (0.002)	-0.006* (0.002)	-0.007** (0.002)	-0.005+ (0.003)	-0.006* (0.002)
No. of R&D Affiliates in A Group				0.006 (0.019)	0.011 (0.019)	-0.018 (0.020)	-0.080** (0.026)	-0.071** (0.027)	-0.087** (0.029)	
No. of Marketing & Sales Affiliates in A Group	0.051** (0.019)	0.055*** (0.016)	0.060*** (0.017)				0.124*** (0.027)	0.126*** (0.027)	0.160*** (0.035)	0.113*** (0.028)
No. of Manufacturing Affiliates in A Group	-0.012*** (0.002)	-0.012*** (0.002)	-0.012*** (0.002)	-0.008** (0.002)	-0.009*** (0.002)	-0.006* (0.002)				
Group's Region-specific GDP Per Capita	-0.098** (0.030)	-0.095** (0.030)	-0.087** (0.033)	-0.076** (0.029)	-0.081** (0.029)	-0.094** (0.029)	-0.115*** (0.032)	-0.114*** (0.032)	-0.137*** (0.034)	-0.136*** (0.034)
Group Geographic Dispersion	-0.215*** (0.061)	-0.220*** (0.061)	-0.228*** (0.061)	-0.214** (0.066)	-0.214** (0.065)	-0.172** (0.063)	-0.186** (0.070)	-0.212** (0.069)	-0.271*** (0.080)	-0.272*** (0.080)
Group R&D stock	0.007*** (0.002)	0.008*** (0.002)	0.008*** (0.002)	0.008*** (0.002)	0.008*** (0.002)	0.008*** (0.002)	0.009*** (0.002)	0.009*** (0.002)	0.010*** (0.002)	0.009*** (0.002)
Group Size	0.089** (0.031)	0.095*** (0.028)	0.105** (0.032)	0.115*** (0.027)	0.100*** (0.026)	0.099*** (0.026)	0.113*** (0.032)	0.109*** (0.032)	0.122*** (0.033)	0.128*** (0.033)
Group Age	0.044* (0.020)	0.041* (0.019)	0.031 (0.026)	0.023 (0.019)	0.030+ (0.018)	0.030+ (0.018)	0.037+ (0.019)	0.037+ (0.019)	0.034+ (0.020)	0.030+ (0.018)
Group Product Diversification	-0.019 (0.021)	-0.020 (0.021)	-0.014 (0.024)	-0.017 (0.021)	-0.018 (0.021)	-0.026 (0.021)	0.035 (0.025)	0.041 (0.025)	0.035 (0.026)	0.046+ (0.026)
Group Foreign Ownership	0.017*** (0.003)	0.016*** (0.003)	0.016*** (0.003)	0.016*** (0.003)	0.017*** (0.003)	0.016*** (0.003)	0.007* (0.003)	0.007* (0.003)	0.008* (0.003)	0.009** (0.003)
Group State Ownership	-0.008* (0.003)	-0.009** (0.003)	-0.010** (0.004)	-0.009** (0.003)	-0.008** (0.003)	-0.007* (0.003)	-0.010** (0.003)	-0.009** (0.003)	-0.010** (0.003)	-0.012*** (0.003)
Share of Employees with Masters or Higher Qualifications	0.022** (0.007)	0.020*** (0.006)	0.016+ (0.009)	0.019*** (0.004)	0.021*** (0.004)	0.026*** (0.004)	0.015** (0.005)	0.015** (0.005)	0.010+ (0.006)	0.006 (0.006)
Industry effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	-0.005 (0.772)	-0.197 (0.675)	-0.664 (0.971)	-0.924* (0.414)	-0.609 (0.391)	-0.691+ (0.386)	-0.776 (0.519)	-0.674 (0.510)	-0.036 (0.650)	-0.034 (0.648)
N	469	469	469	482	482	482	344	344	344	344
Number of Business Groups	80	80	80	84	84	84	59	59	59	59
R^2	0.460	0.462	0.448	0.439	0.446	0.464	0.525	0.526	0.503	0.499
χ^2, p value	401.1, 0	402.3, 0	392, 0	380.4, 0	387.6, 0	414.5, 0	389.6, 0	395.9, 0	379.5, 0	371.1, 0
Hansen-Sargan overidentification statistics, p value	1.836, 0.18	2.045, 0.15	1.816, 0.40	2.672, 0.10	0.284, 0.59	0.552, 0.46	0.006, 0.94	0.007, 0.93	0.509, 0.50	0.160, 0.70
Average VIF	2.14	2.21	2.22	2.17	2.27	2.31	2.44	2.47	2.55	2.07
Max VIF	4.38	4.39	4.40	4.31	4.31	4.42	4.99	5.17	5.60	5.24
First stage model below:										

Business Group Performance	0.200	0.127	0.130	-0.804	-1.033+	-1.009+	0.274+	0.302+	0.413*	0.402*
	(0.249)	(0.215)	(0.203)	(0.546)	(0.590)	(0.596)	(0.161)	(0.167)	(0.172)	(0.172)
Group's Region-specific Share of Tertiary GDP to Secondary GDP	-0.039+	-0.055**	-0.048*	-0.096**	-0.126***	-0.126**				
	(0.023)	(0.020)	(0.019)	(0.034)	(0.036)	(0.046)				
Group's Region-specific Retail Sales	0.000***	0.000***	0.000+	0.000***	0.000***	0.000***				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
Group's Region-specific Patent Stock							0.031*	0.033*	0.043*	0.041*
							(0.015)	(0.015)	(0.017)	(0.017)
Group's Region-specific Number of Industrial Enterprises							0.141***	0.152***	0.123***	0.123***
							(0.021)	(0.022)	(0.027)	(0.026)
R&D Specific Intra-regional Spillovers x Group Geographic Dispersion x Inter			-0.073***							
			(0.009)							
R&D Specific Intra-regional Spillovers x Group Geographic Dispersion		1.569***	1.445***							
		(0.143)	(0.136)							
Marketing & Sales Specific Intra-regional Spillovers x Group Geographic Dispersion x Inter						0.018				
						(0.040)				
Marketing & Sales Specific Intra-regional Spillovers x Group Geographic Dispersion					1.182***	1.202***				
					(0.324)	(0.308)				
Manufacturing Specific Intra-regional Spillovers x Group Geographic Dispersion x Inter									-0.108**	-0.109**
									(0.040)	(0.038)
Manufacturing Specific Intra-regional Spillovers x Group Geographic Dispersion								0.958***	1.279***	1.281***
								(0.272)	(0.285)	(0.307)
Intra Excluding R&D Presence-weighted Spillovers x Group Geographic Dispersion	-0.173***	0.056	0.049							
	(0.046)	(0.042)	(0.040)							
Intra Excluding R&D Presence-weighted Spillovers	-0.126***	-0.113***	-0.087***							
	(0.012)	(0.010)	(0.010)							
Intra Excluding Marketing & Sales Presence-weighted Spillovers x Group Geographic Dispersion				-0.406***	-0.274*	-0.267*				
				(0.099)	(0.134)	(0.127)				
Intra Excluding Marketing & Sales Presence-weighted Spillovers				-0.113***	-0.075***	-0.075***				
				(0.020)	(0.022)	(0.022)				
Intra Excluding Manufacturing Presence-weighted Spillovers x Group Geographic Dispersion							-0.010	0.048	0.042	0.045
							(0.031)	(0.030)	(0.034)	(0.033)
Intra Excluding Manufacturing Presence-weighted Spillovers							-0.208***	-0.216***	-0.211***	-0.209***
							(0.032)	(0.033)	(0.039)	(0.036)
Inter x Group Geographic Dispersion	-0.009	-0.010+	-0.009+	0.009	0.009	0.006	0.008	0.005	0.006	0.006
	(0.007)	(0.006)	(0.005)	(0.012)	(0.013)	(0.010)	(0.006)	(0.006)	(0.007)	(0.007)
No. of R&D Affiliates in A Group				0.002	0.001	-0.008	0.013	0.002	0.004	
				(0.022)	(0.024)	(0.026)	(0.017)	(0.016)	(0.018)	
No. of Marketing & Sales Affiliates in A Group	-0.058**	-0.036*	-0.022				-0.024	-0.029	-0.027	-0.024
	(0.019)	(0.017)	(0.016)				(0.023)	(0.023)	(0.027)	(0.021)
No. of Manufacturing Affiliates in A Group	0.004	0.002	0.003	-0.004	-0.003	-0.001				
	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.004)				
Inter-regional Spillovers (Inter)	0.007***	0.005***	0.004***	-0.000	-0.003	-0.003	-0.002	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Group Geographic Dispersion	0.048	0.023	0.026	-0.108	-0.167	-0.151	-0.202***	-0.179***	-0.156***	-0.156***
	(0.061)	(0.053)	(0.050)	(0.115)	(0.125)	(0.109)	(0.029)	(0.030)	(0.034)	(0.033)
Group R&D stock	-0.002	-0.001	-0.002	0.002	0.004	0.004	-0.001	-0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
Group Size	-0.068*	-0.043	-0.044+	0.046	0.098	0.095	-0.035	-0.032	-0.039	-0.038
	(0.031)	(0.027)	(0.026)	(0.067)	(0.070)	(0.069)	(0.024)	(0.024)	(0.026)	(0.026)
Group Age	0.019	0.015	0.025*	0.062**	0.053*	0.053+	-0.016	-0.017	-0.021+	-0.021+
	(0.014)	(0.012)	(0.011)	(0.022)	(0.026)	(0.027)	(0.011)	(0.011)	(0.012)	(0.011)
Group Product Diversification	0.005	-0.010	-0.017	-0.020	-0.024	-0.025	-0.005	-0.013	-0.019	-0.019
	(0.016)	(0.013)	(0.013)	(0.026)	(0.029)	(0.032)	(0.012)	(0.013)	(0.014)	(0.015)
Group Foreign Ownership	0.001	0.000	-0.001	0.005	0.007	0.006	-0.002	-0.002	-0.002	-0.002
	(0.004)	(0.004)	(0.003)	(0.008)	(0.009)	(0.008)	(0.002)	(0.002)	(0.002)	(0.002)
Group State Ownership	0.007*	0.006*	0.005*	-0.004	-0.007	-0.007	0.001	0.001	0.002	0.002
	(0.003)	(0.003)	(0.002)	(0.006)	(0.006)	(0.006)	(0.002)	(0.002)	(0.002)	(0.002)
Share of Employees with Masters or Higher Qualifications	0.014**	0.012**	0.013**	0.014	0.017	0.017	-0.012***	-0.013***	-0.015***	-0.015***
	(0.005)	(0.005)	(0.004)	(0.011)	(0.012)	(0.014)	(0.004)	(0.004)	(0.004)	(0.003)
Industry effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	2.726***	2.431***	1.984***	1.645*	0.885	0.923	2.308***	2.337***	2.523***	2.487***
	(0.320)	(0.278)	(0.271)	(0.655)	(0.665)	(0.616)	(0.482)	(0.489)	(0.523)	(0.499)

Notes: standard errors are in parentheses. †, *, ** and *** denote significance at the 10%, 5%, 1%, and 0.1% levels respectively. Because not all business group's affiliates have reported their responsibilities, the sample size varies slightly between models. All models are 3SLS estimations. The endogenous variables are relevant mandate-specific intra-regional spillovers and Business Group Performance. Because the endogenous variables change with each model, the relevant Group's Regional Specific controls in the first stage of models of 3SLS vary.