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Location decisions of inward FDI in sub-national regions of a host country: Service versus manufacturing industries

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Abstract Built on the differences between services and manufacturing sectors, this study examines the general proposition that service and manufacturing multinational enterprises (MNEs) have different responsiveness to location-specific characteristics when conducting foreign direct investment (FDI), and that these differences influence their final locations in the sub-national regions of a host country. Using a full population of 1,212 and 6,199 inward FDI projects conducted by MNEs in manufacturing and services sectors, respectively, across 234 sub-national regions in Korea between 2000 and 2004, it finds that the location decisions made by service MNEs are more likely to be driven by demand-side considerations, whereas those made by manufacturing MNEs are more likely to be influenced by supply-side characteristics of sub-national regions. In addition, it shows that sub-national location decisions made by both high-tech and low-tech manufacturing MNEs consider the availability of local strategic assets within a focal region more importantly than that from its neighboring regions, suggesting the importance of intra-regional effects. Sub-national location decisions

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made by location-bound service MNEs exhibit the same intra-regional effects for local market potential; however, those by non-location-bound service MNEs consider the local market potential from neighboring regions more importantly than that within a focal region, suggesting the existence of inter-regional effects.

Keywords MNEs · Inward FDI · Service industries · Manufacturing industries · Location strategy · Sub-national regions

For the past two decades, services sector has played an increasingly important role in the creation of new jobs and wealth around the globe, thereby sustaining the world economy. Service firms have created the majority of jobs in advanced economies (Capar & Kotabe, 2003), with service activities accounting for between 50 and 80 % of total employment in most of the developing and developed countries (Gonzales, Jensen, Kim, & Kyvik-Nordas, 2012). As a result of the increased importance of services sector in the world economy, foreign direct investment (FDI) by service multinational enterprises (MNEs) has grown substantially in the world market across diverse services sector such as accounting, banking, consulting, advertising, insurance, and telecommunication industries, among others (Contractor, Kundu, & Hsu, 2003).

Reflecting on the recent trends of increased service-related FDI activities, a large volume of studies in the international business (IB) literature has investigated the foreign operations of service firms across diverse topics under the recognition that the major characteristics of services sector may be different from those of manufacturing sector. First, because service outputs are mostly intangible, service firms provide the outputs to their final customers through close but complex interactions in the downstream ends of value chains (Asakawa, Ito, Rose, & Westney, 2013; Capar & Kotabe, 2003; Contractor et al., 2003; Goerzen & Makino, 2007; Rugman & Verbeke, 2008). As a result, service firms require more intensive and extensive customization, localization, and cultural adaptation processes, which demand additional transaction costs from service firms, compared to their manufacturing counterparts. Second, many service outputs are produced and consumed in the same place and at the same time due to the non-storable and perishable characteristics of service inventories, which encourages service providers to choose locations in close geographic proximity to their final customers (Anand & Delios, 1997; Capar & Kotabe, 2003; Contractor et al., 2003; Goerzen & Makino, 2007; Lovelock & Yip, 1996).

Despite the abundant studies on service-related FDI activities and the fundamental differences between services and manufacturing sectors identified therein, as Knight (1999) and Merchant and Gaur (2008) have revealed, the literature on service business and/or service MNEs is still insufficient, and there has been a consistent call for more research in this relatively under-explored field (Capar & Kotabe, 2003; Goerzen & Makino, 2007; Hitt, Bierman, Uhlenbruck, & Shimizu, 2006). We observe two major gaps in the literature. First, our knowledge gap remains substantial regarding the international location strategies utilized in services sector by MNEs. Most studies on location strategies in the IB literature focus on manufacturing sector (e.g., Alcantara & Mitsuhashi, 2012; Ito & Rose, 2002; Mariotti & Piscitello, 1995; Sethi, Judge, & Sun, 2011; Shaver, 1998) with only several exceptions that explore services sector in a standalone manner (e.g., Keeble & Nachum, 2002; Nachum, 2000; Petrou, 2007; Rugman & Verbeke, 2008). They do not directly compare the different location

decision patterns of service MNEs vis-à-vis manufacturing MNEs within the same national and/or institutional contexts, and, as a result, we still do not fully understand how the differences between services and manufacturing sectors may affect foreign investors' final location decisions, which are accompanied by huge amounts of resource commitment in host countries.

Second, the fact that most of the previous research on MNE location strategies has adopted a country as a unit of analysis (e.g., Alcantara & Mitsuhashi, 2012; Ito & Rose, 2002; Nicholas, Purcell, & Gray, 2001; Petrou, 2007) rather than more refined sub-national regions of a host country represents another substantial gap in the literature (McCann & Mudambi, 2005). As Chan, Makino, & Isobe (2010) showed, it is the sub-national regions that are important when considering the final location decisions of MNEs within a host country, because they provide MNEs with unique opportunities to exploit and/or explore in a host country (Chan et al., 2010), different developmental stages of economic infrastructure and transactional conventions (Chan et al., 2010; Chung & Alcácer, 2002), the inconsistent formulation and implementation of political and governmental rules and policies (Chan et al., 2010; Meyer & Nguyen, 2005; Sethi et al., 2011; Zhou, Delios, & Yang, 2002), and the unique social values and/or cultural traditions that are different from region to region in a host country (Chan et al., 2010; Tung, 2008). Because the final locations that MNEs eventually choose for their FDI projects in foreign markets are specific sub-national regions rather than a single host country, intra-country heterogeneity at the level of sub-national regions may be at least as relevant and important a determinant for the location decisions of MNEs as inter-country heterogeneity at a country level (McCann & Mudambi, 2005).

To fill the knowledge gaps in the literature, this study explores the empirical questions of: (1) *whether and how MNEs conducting inward FDI projects exhibit different location decisions at sub-national regions of a host country depending on manufacturing* versus *services sectors where they operate*; and, (2) *if they are shown to be so, whether and how the heterogeneous characteristics of each industrial sector shape MNEs' sub-national location decisions in the host country that may be responsive to certain location-specific characteristics in the region*.

To answer the research questions, we conduct two-stage analyses in this study. In the first stage estimation, we compare how differently MNEs are responsive to supply- versus demand-side sub-national location-specific characteristics in a host country when they implement inward FDI projects in manufacturing versus service industries. The first-stage estimation results would suggest that the location decisions by MNEs in manufacturing (services) sector are more (less) influenced by supply-side considerations (i.e., resource-, efficiency- and/or strategic asset-seeking characteristics) than demand-side considerations (i.e., market-seeking characteristics) of the sub-national regions. In the second stage estimation, we delve into the impact of sectoral heterogeneity on MNEs' sub-national location decisions in a host country per each of manufacturing and service industries, since each sector actually spans a broad variety of sub-sectors with different characteristics rather than a unique and homogeneous category. For this purpose, we split the manufacturing FDI sample into high-tech versus low-tech manufacturing

sub-samples, because manufacturing MNEs operating in high-tech sector are equipped with advanced technological capabilities compared to their counterparts operating in low-tech sector (Chung & Alcácer, 2002). In addition, we split the service FDI sample into location-bound versus non-location-bound service sub-samples (Goerzen & Makino, 2007), since some services do require proximity with customers, but, for other services (e.g., consultancy, business services), the need for co-location with local customers has often been blurred due to their enhanced mobility with the development of information and communication technologies and transportation (Torre, 2008). As a result, empirical analyses in the second stage would examine (1) to what extent the location decisions by MNEs in high-tech versus low-tech manufacturing sectors are influenced by local innovative capabilities of sub-national regions in a host country, and (2) to what extent those by MNEs in location-bound versus non-location-bound services sectors are responsive to local market potential of sub-national regions in a host country.

We tackle these unexplored research questions with a full population of inward FDI projects across 234 county- and city-level sub-national regions in the Republic of Korea (hereafter Korea) for the following two reasons. First, Korea has been pursuing its remarkable economic development by designing and implementing strong public policy measures to attract inward FDI since the 1990s, coupled with its steady and persistent development of location-specific advantages for the past 40 years. Second, a database of all inward FDI projects into Korea is available from the Korean government, and this FDI database contains firm-level information, including each inward FDI project's exact location, with a substantial number of observations well-suited for the empirical investigation to be conducted in the current study. Therefore, Korea provides us with the significant and meaningful population of inward FDI projects by MNEs needed for the current empirical analyses.

This study extends the existing literature in several important ways. First, it provides an explanation for the location decisions of service MNEs that may be different from the decisions made by manufacturing MNEs under the same national contexts. Second, it empirically assesses the impact of intra-country regional heterogeneity on the location decisions made by service and manufacturing MNEs in a single host country by incorporating sub-national regions as a unit of analysis. Third, it considers the potential heterogeneity per each of manufacturing and services sectors that may further explain MNEs' sub-national location decisions in a host country in terms of intra- versus inter-regional spillover effects. Finally, it attempts to address the endogeneity issue of location-specific characteristics that may be determined by the final location decisions of both manufacturing and service MNEs in the sub-national regions of a host country. For this purpose, our empirical estimation adopts the system generalized method of moments (i.e., system GMM) that can address both the potential endogeneity of location-specific variables and measurement errors.

This paper will be presented as follows: the next section will establish our conceptual framework and hypotheses to be tested; the third section will provide a detailed description of the data, their sources, and the empirical models to be used; in the fourth section, the main results from empirical analyses will be discussed; and the final section

will conclude the paper with policy implications, limitations, and some directions for future research.

Conceptual framework and hypotheses

The conceptual framework of this paper is captured in Fig. 1. We posit that MNEs may possess different responsiveness to sub-national location-specific characteristics in a host country when making location decisions for their inward FDI projects depending on whether they are operating in manufacturing versus services sectors. In this process, the heterogeneous characteristics of MNEs' current industrial sectors (i.e., high-tech versus low-tech sectors for manufacturing MNEs and location-bound versus non-location-bound sectors for service MNEs) may moderate the MNEs' responsiveness to certain location-specific characteristics of sub-national regions when determining such location decisions of inward FDI projects.

Sub-national location decisions of manufacturing versus service MNEs

MNEs seek different types of complementary, location-bound resources from potential locational sites when they go abroad (Rugman, 1981, 2005). For example, Dunning (1998) suggested a classification of four key motives that encourage MNEs to conduct FDI projects in their host countries (Nachum & Zaheer, 2005): (1) resource-seeking; (2) market-seeking; (3) efficiency-seeking; and (4) strategic asset-seeking. It should be noted that, depending on whether MNEs operate in manufacturing or services sector, they may possess different motives for implementing their FDI projects in a host country (Li & Guisinger, 1992; Rugman & Verbeke, 2008) and, as a result, they may display a different level of responsiveness to each of the location-bound resources that are available from the sub-national regions of a host country.

In the case of manufacturing MNEs, the main objective of their foreign investment is to achieve the optimal allocation of a production process based on their global production networks (Kogut & Kulatilaka, 1994). In other words, their foreign investment decisions are more driven by the consideration of supply side rather than demand side. As such, they would like to locate in those regions of a host country that provide

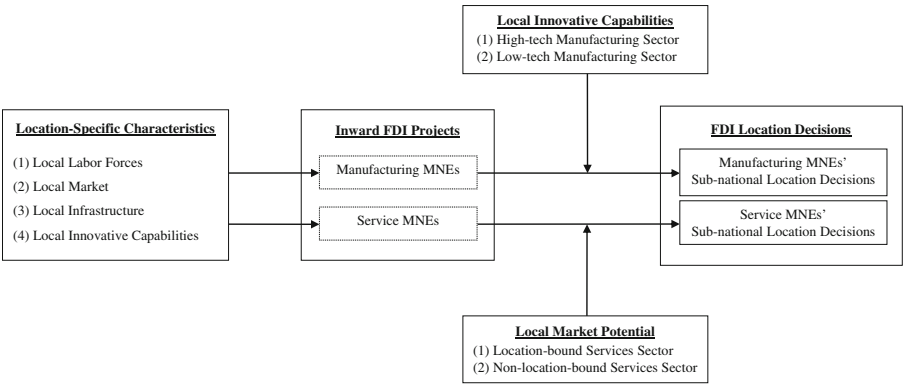

Fig. 1 Conceptual framework

attractive input-side intermediaries for their production process (e.g., access to labor, raw materials, components, and technology) and local infrastructure (e.g., transportation and power supply). In addition, by being located in regions that feature strong innovative capabilities, manufacturing firms may have easy access to state-of-the-art product and process knowledge that helps them remain competitive in their markets (Tallman, Jenkins, Henry, & Pinch, 2004). These arguments lead us to posit that the location decisions made by manufacturing MNEs, compared to those by service MNEs, will be more influenced by the expense of labor forces, the quality of local infrastructure, and/or the level of local innovative capabilities offered by each sub-national region in a host country than by demand-side factors.

In the case of service MNEs, on the other hand, they possess different characteristics from those of manufacturing MNEs, and, as a result, they may exhibit different responsiveness to the location-specific advantages of sub-national regions when making FDI decisions in a host country. First, compared to manufacturing MNEs, service MNEs are characterized by their strong orientation toward downstream activities, such as intensive customization and/or cultural adaptation processes, to address the specific needs of local customers rather than toward upstream activities, such as R&D or production activities (Capar & Kotabe, 2003; Contractor et al., 2003; Goerzen & Makino, 2007; Rugman, 2005). As such, service MNEs' foreign investment decisions, including location decisions, may be more driven by the consideration of demand side rather than supply side. Among a variety of reasons that encourage service firms to seek foreign expansion, the availability of new market opportunities and/or the purchasing power of potential local customers in foreign countries have been argued to be the most important in the literature (Campbell & Verbeke, 1994; Katrishen & Scordis, 1998; Kolstad & Villanger, 2008; Lovelock & Yip, 1996; UNCTAD, 2004). Second, service outputs are characterized by the inseparability of production, delivery, and consumption of services (e.g., Campbell & Verbeke, 1994; Rugman, 2005). Because most service outputs are consumed when and where they are produced, the geographic coincidence between the location of service firms and that of customers for the service outputs is very critical for service MNEs' successful foreign operations (Capar & Kotabe, 2003; Contractor et al., 2003; Goerzen & Makino, 2007; Rugman & Verbeke, 2008) compared to manufacturing MNEs'. This characteristic of the services sector makes the size of a local market and/or the purchasing power of local customers one of the important factors that service MNEs need to consider before making final location decisions in a host country. Both characteristics of service MNEs lead us to argue that the location decisions by service MNEs, compared to those by manufacturing counterparts, will be more influenced by the size of a local market and/or the level of local purchasing power in the sub-national regions of a host country than by supply-side considerations.

Based on the arguments discussed so far, we put forward the following two hypotheses on the difference between manufacturing versus service MNEs' location decisions in the sub-national regions of a host country.

Hypothesis 1 Sub-national location decisions by multinational enterprises in manufacturing sector are more influenced by localized input resources than by local market potential.

Hypothesis 2 Sub-national location decisions by multinational enterprises in services sector are more influenced by local market potential than by localized input resources.

Sub-national location decisions of high-tech versus low-tech manufacturing MNEs

MNEs face a liability of foreignness—firm-specific additional costs that result from their unfamiliarity with new business environments in foreign markets—when operating abroad (Dunning, 1993; Rugman & Verbeke, 2001; Zaheer, 1995); therefore, they need to possess some unique and hard-to-imitate tangible and/or intangible firm-specific advantages (FSAs) inside their firm boundaries to overcome the liability (Dunning, 1993; Rugman, 1981, 2005). Noticeably, the FSAs needed for the success of manufacturing MNEs are not necessarily the same as those required for the success of service MNEs. Compared to intangible capabilities in the customer-end activities of the value chain (i.e., downstream FSAs such as marketing skills and/or distribution channels) that are crucial for service MNEs' achieving customization, local adaptation, and/or national responsiveness, proprietary capabilities in the upstream activities of a value chain (i.e., upstream FSAs such as R&D and/or innovation capabilities) are essential for manufacturing MNEs due to their strategic orientation on supply-side product and production processes. The innovation literature argues that companies must first possess basic knowledge to further acquire additional new knowledge and information (Cohen & Levinthal, 1990). It implies that manufacturing MNEs in high technology sector may have a stronger incentive to be equipped with advanced technological capabilities than their counterparts in low technology sector (Chung & Alcácer, 2002). As a result, we argue that, compared to service MNEs, the industry-specific incentive to possess advanced technological capabilities may affect the relationship between manufacturing MNEs' location decisions and the level of local innovative capabilities displayed by each sub-national region in a host country.

For manufacturing MNEs equipped with advanced technologies in high technology industries, they may prefer to locate in a sub-national region of a host country with strong local innovative capabilities. This is because they need to exploit the benefits of additional organizational learning based on the strong absorptive capacity they already achieved. Numerous studies built on the absorptive capacity concept have argued that technologically advanced firms have a superior ability to absorb more advanced technology (Cohen & Levinthal, 1990), and, as a result, they are more likely to locate their affiliates in those regions where innovation outputs are prominent. This argument is also consistent with the theories of economic agglomeration (Fujita, Krugman, & Venables, 1999) and localized knowledge spillovers (Audretsch & Feldman, 2004; Audretsch & Lehmann, 2005) that emphasize the influence of spatial clustering of related firms and knowledge on the location decisions of new participants in the cluster. For example, Silicon Valley tends to attract high technology firms over low technology firms in its own region, since the region has been characterized by the concentration of sophisticated high-tech firms. Therefore, sub-national location decisions made by high-tech manufacturing MNEs are more likely to be influenced by the availability of local innovative capabilities within their focal region.

Strong local innovative capabilities with prominent innovation outputs in a focal region may spill over to its neighboring regions across sub-national geographic borders

(Acs, Braunerhjelm, Audretsch, & Carlsson, 2009; Audretsch & Feldman, 2004; Audretsch & Keilbach, 2007). This possibility of inter-regional knowledge spillover indeed generates an alternative incentive for high-tech manufacturing MNEs to locate in the neighboring regions when implementing inward FDI projects in a host country. Nevertheless, the costs of transferring innovative new knowledge commonly increase with the geographic distance between the source of innovation and its recipient (Almeida & Kogut, 1997; Audretsch & Feldman, 1996), and, as a result, high-tech manufacturing MNEs are more likely to respond to the local innovative capabilities within a focal region (i.e., intra-regional effects) than that across neighboring sub-national regions (i.e., inter-regional effects).

For low-tech manufacturing MNEs, on the other hand, they are characterized as being not equipped yet with advanced technological capabilities, and, as a result, their tendency to learn by locating directly within innovative regions may not be strong compared to their counterparts in high-tech manufacturing sector. It is not only because low-tech manufacturing MNEs may not desire to acquire innovative capabilities from local regions, but also because they usually do not possess the necessary absorptive capacity to acquire the innovative capabilities available in these regions (Cohen & Levinthal, 1990). These characteristics of low-tech manufacturing MNEs may help them look for alternative regions for their affiliate locations, e.g., the neighboring regions of an innovative focal region, when implementing inward FDI projects in a host country. This argument is in line with the core-periphery argument (Knoben & Oerlemans, 2008; Van Dijk & Pellenbarg, 2000) and the edge city literature (Garreau, 1991; Medda, Nijkamp, & Rietveld, 1999); some urban areas such as a city center, although well-developed and highly innovative, may face serious congestion problems and high labor costs, and firms may locate in peripheral areas to minimize these negative spatial externalities without compromising their access to the innovative knowledge spillovers from such core areas. Therefore, low-tech manufacturing MNEs are likely to locate in the (less innovative) neighboring regions of a (highly innovative) focal region in a host country to exploit the double benefits of retaining their access to the localized innovative capabilities as well as minimizing such negative spatial externalities from an innovative focal region. As such, sub-national location decisions made by low-tech manufacturing MNEs are more likely to be influenced by the availability of local innovative capabilities from the neighboring regions of an innovative focal region (i.e., inter-regional effects) than that within the focal region (i.e., intra-regional effects).

These predictions signify an asymmetric relationship between high-tech versus low-tech manufacturing MNEs' location decisions in sub-national regions of a host country in relation to local innovative capabilities therein.

Hypothesis 3 Sub-national location decisions by multinational enterprises in high-tech manufacturing sector are more influenced by local innovative capabilities in a focal region than those from neighboring regions.

Hypothesis 4 Sub-national location decisions by multinational enterprises in low-tech manufacturing sector are more influenced by local innovative capabilities from neighboring regions than those in a focal region.

Sub-national location decisions of location-bound versus non-location-bound service MNEs

The necessity to possess advanced downstream FSAs in customer-end activities may also affect the relationship between service MNEs' location decisions and their responsiveness to the demand-side location-specific characteristics of sub-national regions in a host country. It should be noted that services sector spans a broad variety of sectors rather than a unique and homogeneous category, which may present the heterogeneous impacts of services sector with respect to service MNEs' internationalization including their location decisions in a host country. For example, some services do require proximity and interaction with local customers (e.g., retailing, restaurant, hospital, real estate, repair services) but for other services (e.g., wholesalers, transportation, telecommunication, finance/insurance, business services including consultancy, entertainment services) the need for permanent co-location between service MNEs and their customers has been overhauled, because proximity and interaction are often obtained through dedicated temporary inter-organizational routines characterized by the enhanced mobility of such services sector due to the development of information and communication technologies and transportation, irrespective of the service companies' geographical location (Torre, 2008). As such, when MNEs are operating in sticky and location-bound services sector that requires an intensive process of customization and adaptation with local customers, they may prefer to locate in proximate regions that help them penetrate into local customers of foreign markets directly compared to their counterparts operating in fungible and non-location-bound services sector. This argument implies that there may be heterogeneous impacts of services sector on service MNEs' location decisions in sub-national regions of a host country.

For location-bound service MNEs, they are more likely to enter large markets in city and/or urban areas to capture a wide range of customer bases rather than investing in smaller markets. This is because such MNEs' service outputs are consumed as soon as and in the same place as they are provided, and, as a result, the close locational proximity between service MNEs and their local customers facilitates an intensive process of customized and adapted service provision with a high level of interactions as a means of securing a competitive advantage position in a host country (Goerzen & Makino, 2007; Patterson & Cicic, 1995). Furthermore, since the level of agglomeration of competitors and other business partners in these areas is relatively high compared to small markets in rural and suburban areas, location-bound service MNEs may explore the opportunity to absorb better downstream FSAs from their competitors and peers by entering local markets of large size (Cohen & Levinthal, 1990). This characteristic of location-specificity suggests that such location-bound services are difficult to transfer across sub-national borders due to the sticky nature of localized transactions with local customers within a focal region (Goerzen & Makino, 2007; Patterson & Cicic, 1995). In other words, in highly location-bound services such as retailing, restaurant, hospital, real estates, and/or repair services, both suppliers and consumers of such services need to co-reside in the same focal region. As such, location-bound service MNEs are more likely to respond to local market potential within

a focal region (i.e., intra-regional effects) than that across neighboring sub-national regions (i.e., inter-regional effects).

In contrast, non-location-bound service MNEs may be more likely to avoid intense agglomeration in large markets in the city and urban areas, since the co-location of both suppliers and consumers in the same region is not required for providing such services, which are relatively easy to transfer across neighboring regions (Goerzen & Makino, 2007). It is particularly because non-location-bound services such as wholesales, transportation, telecommunication, finance/insurance, business services, consultancy, and/or entertainment services are characterized by enhanced mobility across regions with little face-to-face contacts between service providers and customers during service delivery (Patterson & Cicic, 1995). This characteristic of non-location-specificity may encourage such service MNEs to look for a focal large market's neighboring regions when locating their inward FDI projects in a host country: in line with the core-periphery argument and the edge city literature, non-location-bound service MNEs would like to minimize negative spatial externalities without compromising local market potential in a core urban region by locating in its neighboring peripheral regions (Garreau, 1991; Knoben & Oerlemans, 2008; Medda et al., 1999; Van Dijk & Pellenbarg, 2000). As such, non-location-bound service MNEs are more likely to respond to local market potential across neighboring sub-national regions (i.e., inter-regional effects) than that within a focal region (i.e., intra-regional effects).

Based on the arguments discussed so far, we suggest the following hypotheses on location-bound versus non-location-bound service MNEs' location decisions in sub-national regions of a host country in relation to local market potential therein.

Hypothesis 5 Sub-national location decisions by multinational enterprises in location-bound services sector are more influenced by local market potential in a focal region than that from neighboring regions.

Hypothesis 6 Sub-national location decisions by multinational enterprises in non-location-bound services sector are more influenced by local market potential from neighboring regions than that in a focal region.

Research design

Dependent variables

The data used in our estimation are the numbers of new inward FDI projects made by MNEs in manufacturing and service industries across 234 sub-national regions in Korea for the period of 2000–2004. Information on FDI in Korea is obtained from the Investment Notification Statistics Center (INSC) database (http://mgr.kisc.org/insc/), compiled and managed by the Korean Ministry of Trade, Industry & Energy (MOTIE). The database provides a full population of the inward FDI projects "newly" implemented in Korea per each year. During the 1990–2004 period, 22,182 notifications and 11,739 registrations of inward

FDI projects were reported in Korea and we obtain 1,212 and 6,199 cases of inward FDI in manufacturing industries (KSIC 15–37) and service industries (KSIC 50–95), respectively, in 2000–2004.

Six dependent variables are constructed. To compare different location decisions of inward FDI between manufacturing versus service MNEs, we use the logarithm of one plus the number of inward FDI in manufacturing industries $[\ln(FDI_M+1)_{i,t}]$ and that in service industries $[\ln(FDI_S+1)_{i,t}]$.[1] To compare different patterns of FDI location decisions among high-tech versus low-tech manufacturing MNEs, we spilt the manufacturing FDI sample into two industrial sub-samples because manufacturing MNEs operating in high-tech sector are equipped with advanced technological capabilities compared to their counterparts operating in low-tech sector (Chung & Alcácer, 2002). As a result, we use the logarithm of one plus the number of inward manufacturing FDI projects in high-tech industries $[\ln(FDI_{M,High-Tech}+1)_{i,t}]$ as a dependent variable for this sub-sample. High-tech manufacturing industries include both information and communication technology (ICT) manufacturing industries—suggested by the Organization for Economic Co-operation & Development (OECD) STI Committee—and knowledge-based manufacturing industries classified by the Korea Institute of Economics and Trade (KIET). For the other sub-sample, we use the logarithm of one plus the number of inward manufacturing FDI projects in low-tech industries $[\ln(FDI_{M,Low-Tech}+1)_{i,t}]$ as its dependent variable. Low-tech manufacturing industries are defined as the complementary set to those classified as high-tech. To compare different patterns of FDI location decisions among service MNEs with heterogeneous location-specificity, we spilt the service FDI sample into two sub-samples: location-bound and non-location-bound services sectors. Therefore, two dependent variables for service MNEs are the logarithm of one plus the number of inward service FDI projects in location-bound service industries $[\ln(FDI_{S,Location}+1)_{i,t}]$ and that in non-location-bound service industries $[\ln(FDI_{S,Non-location}+1)_{i,t}]$. Non-location-bound service industries include the following sectors based on 5-digit Korean Standard Industrial Classification (KSIC) codes: wholesales; transportation; telecommunication; finance and insurance; business services; entertainment, tourism, and sport-related services. Location-bound service industries are defined as the remaining industries that are not classified as non-location-bound service industries. For each of the dependent variables, we end up with 1,170 observations for the 5 years covered in this study (i.e., 234 sub-national regions × 5 years), because we adopt a sub-national region as a unit of analysis. 1,166 observations remain in the final dataset for regressions due to missing values for some independent variables

Independent and control variables

For the independent variables, a comprehensive set of four location-specific characteristics are captured for each focal region and each year (Dunning, 1998; Nachum & Zaheer, 2005). We employ the measures and proxies involving local wage level (resource-seeking FDI), local infrastructure (efficiency-seeking FDI), local innovativeness (strategic asset-seeking FDI), and local market size and purchasing power (local

[1] Upscaling of count variables by adding one is to keep data observations with zeros after taking logarithm (e.g., Crozet et al., 2004; Maitland, Rose, & Nicholas, 2005, among others).

market-seeking FDI). The local wage level is defined as monthly average wage per employee in region i and year t ($WAGE_{it}$).[2] The development level of local infrastructure is proxied by the total length of paved roads per square meter in region i and year t ($ROAD_{it}$), because it potentially leads to increased productivity and/or logistics efficiency for MNEs. The local innovativeness is measured by the number of patents registered per 1,000 people in region i and year t ($PATENT_{it}$). The local market size is represented by the gross regional product from manufacturing firms in region i and year t (GRP_{it}). The local purchasing power is measured by the local tax per capita collected (TAX_{it}).[3] To capture MNEs' responsiveness to certain location-specific characteristics from a focal region's neighboring regions, we utilize a first order contiguity "W" matrix. The cell (i, j) in the W matrix has a value of 1 if region i and region j are bordering each other, and a value of zero otherwise. Consequently, when the W matrix is (right-hand) multiplied by a vertical vector of sub-national location-specific characteristics, it generates a "contiguity-weighted average" of neighboring regions' location-specific characteristics.

For control variables, we incorporate an industrial complex dummy that indicates the existence of an industrial complex established by local governments to provide locational support for new firms in each region. As a result, this variable captures regional industrial policies/support measures initiated by local governments for accommodating newly created young firms, including foreign-owned firms, within their regions. In addition, we use regional and yearly dummies to control for unobservable region-specific fixed effects and unobservable time-specific effects, respectively, in our empirical estimations.

For all independent and control variables, we use government statistics on regional economies published by the Korean National Statistics Office (http://kosis.nso.go.kr/). We choose *ln*-transformed, 1-year lagged values of independent and control variables—except for dummies—to capture the decision making process of MNEs' location selection that is usually based on the most updated information on location-specific characteristics in sub-national regions of a host country available from the last year.

Econometric models: System GMM

Based on the conceptual framework and the dependent, independent, and control variables introduced in the previous sections, we specify three econometric models to test the suggested hypotheses empirically. The empirical model used in the first stage

[2] All monetary values in this paragraph are measured in million KRW (1 USD = 1,158.80 KRW in Nov. 2015).

[3] According to local government legislations in Korea, there are nine items on which local taxes are imposed: resident tax, property tax, automobile tax, and tobacco-consumption tax are four of the most prominent of the local taxes collected every year. As a result, the increased local tax collected is closely related to the increase of individuals' income-generating activities of the year in the region, which commonly result in individuals' decisions to live, to own properties, and to consume automobiles, tobaccos, etc. in the region of the year. As such, we expect that local tax per capita collected is highly correlated with individuals' purchasing power in the region of the year.

estimation is to test Hypotheses 1 and 2 on the difference between manufacturing versus service MNEs' location decisions in the sub-national regions of a host country:

$$\begin{aligned}\ln\left(FDI_l+1\right)_{i,t} &= \beta_0+\beta_1\ln WAGE_{i,t-1}+\beta_2\ln ROAD_{i,t-1}+\beta_3\ln PATENT_{i,t-1}\\ &+\beta_4\ln GRP_{i,t-1}+\beta_5\ln TAX_{i,t-1}\\ &+IndustryComplexDummy_{i,t}+u_i+v_t+\varepsilon_{it}\end{aligned}\tag{1}$$

where l stands for manufacturing or service industries; u_i and v_t capture region- and year-specific effects, respectively, and ε_{it} is an error term.

The empirical models used in the second stage estimation are to test (1) to what extent the location decisions by high-tech versus low-tech manufacturing MNEs are influenced by local innovative capabilities of sub-national regions in a host country (i.e., Hypotheses 3 and 4), and (2) to what extent those by location-bound versus non-location-bound service MNEs are affected by local market potential of sub-national regions in a host country (i.e., Hypotheses 5 and 6). Since we need to keep a common set of sub-national location-specific characteristics in a host country across the manufacturing and service sub-samples, we use the following specifications, respectively, in the second stage estimations.

$$\begin{aligned}\ln\left(FDI_j+1\right)_{i,t} &= \beta_0+\beta_1\ln WAGE_{i,t-1}+\beta_2\ln ROAD_{i,t-1}+\beta_3\ln PATENT_{i,t-1}\\ &+\beta_4\cdot W\cdot\ln PATENT_{i,t-1}+\beta_5\ln GRP_{i,t-1}+\beta_6\ln TAX_{i,t-1}\\ &+IndustryComplexDummy_{i,t}+u_i+v_t+\varepsilon_{it}\end{aligned}\tag{2}$$

where j stands for high-tech or low-tech manufacturing industries and location-bound or non-location bound service industries, and

$$\begin{aligned}\ln\left(FDI_k+1\right)_{i,t} &= \beta_0+\beta_1\ln WAGE_{i,t-1}+\beta_2\ln ROAD_{i,t-1}+\beta_3\ln PATENT_{i,t-1}\\ &+\beta_4\ln GRP_{i,t-1}+\beta_5\cdot W\cdot\ln GRP_{i,t-1}+\beta_6\ln TAX_{i,t-1}\\ &+\beta_7\cdot W\cdot\ln TAX_{i,t-1}+IndustryComplexDummy_{i,t}+u_i+v_t+\varepsilon_{it}\end{aligned}\tag{3}$$

where k stands for location-bound or non-location-bound service industries and high-tech or low-tech manufacturing industries.

Although our hypotheses indicate a clear direction of causality from sub-national location-specific characteristics to MNEs' FDI location choices, unbiased and consistent estimations of the location-specific variables necessitate controlling for possible endogeneity problems. For example, local innovativeness, represented by the number of patents, may be attracted to certain geographic regions that provide the same opportunities that favor MNEs for their FDI projects especially operating in high-tech manufacturing sector. In addition, the increased level of local innovativeness may result in improved regional economic performance, which further enhances new opportunities for such MNEs' FDI projects. A lack of control for such potential endogeneity issues may generate biased and inconsistent empirical results.

The most common method of dealing with endogeneity is to find appropriate instrument variables (IVs) that must satisfy two requirements: first, they should be correlated with the endogenous variable(s) and, second, they should not be correlated with the error terms. The system generalized method of moments (GMM) suggested in

Blundell and Bond (1998) builds up a system of two equations, that is, one in its first-order difference equation and the other in its level equation, and it uses lagged first-order differences as IVs for the level equation and lagged levels as IVs for the first-order difference equation, respectively. Therefore, the use of IVs in the system GMM allows the consistent estimation of parameters even in the presence of endogenous right-hand-side variables (Bond, Hoeffler & Temple, 2001).[4]

Empirical results

The descriptive statistics and correlations for the variables introduced in the previous section are presented in Table 1. The maximum variance inflation factor (VIF) value of the variables in the table is 2.37 that is less than the popularly accepted critical value of 5 (e.g., Rogerson, 2001) in the literature, confirming that the interpretation of our results is not affected by multicollinearity. Table 2 summarizes the breakdown and percentage of high-tech versus low-tech manufacturing MNEs and those of non-location-bound versus location-bound service MNEs over the study period of 2000–2004. The table shows that 16.4 % of all inward FDI projects took place by MNEs in manufacturing sector over the 5-year period with those in high-tech manufacturing sector increased from 6.0 % in 2000 to 8.7 % in 2004. Regarding inward FDI projects in services sector, about 75 % of them were made by MNEs operating in location-bound services sector for the period, but those in non-location-bound services sector have increased from 6.3 % in 2000 to 10.3 % in 2004. To assess whether manufacturing and service MNEs make significantly different location decisions across the sub-national regions where they commence their foreign operations, we executed a χ^2 test over the locational distributions of inward FDI projects by sectors across 234 sub-national regions of Korea for 2000–2004. The χ^2 test results indicated that manufacturing and service MNEs execute statistically different location strategies in Korea ($p < .01$), providing evidence that sectoral heterogeneity plays an important role in determining the final locations of inward FDI projects by MNEs in sub-national regions within a host country.

Equations (1) – (3) are estimated by system GMM, and the results are reported in Tables 3, 4, and 5. As shown in the four bottom lines of each table, all models pass the specification tests of Hansen's *J*, Difference-in-Hansen, AR(1) and AR(2), indicating that a selected set of instrument variables are statistically valid and, as a result, that the potential endogeneity of location-specific characteristics are adequately addressed.

Regarding the effects of location-specific advantages on the location decisions of inward FDI made by MNEs in the sub-national regions of Korea, the system GMM regression results in Table 3 show that the applicability of Dunning's (1998) classification of FDI motives is heterogeneous depending on the types of sectors in which MNEs operate. In the case of manufacturing MNEs, their sub-national location decisions are generally shown to be more influenced by supply-side considerations than demand-side factors. First, the resource-seeking FDI argument is supported because the

[4] Following the recommendations in Roodman (2009), we conduct three sets of specification tests to assess whether a selected set of instrument variables (IVs) are valid in the system GMM implementation: (1) Hansen's *J* test; (2) Difference-in-Hansen test; and (3) AR(1) and AR(2) tests.

Table 1 Descriptive statistics and correlation matrix

	Mean	*S.D.*	*Min.*	*Max.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) $\ln(FDI_M+1)_{it}$	.40	.65	.00	3.64	1.00													
(2) $\ln(FDI_S+1)_{it}$	.78	1.11	.00	5.61	.62	1.00												
(3) $\ln(FDI_{M,High-Tech}+1)_{it}$	.19	.47	.00	3.00	.83	.57	1.00											
(4) $\ln(FDI_{M,Low-Tech}+1)_{it}$	.29	.51	.00	2.94	.91	.54	.56	1.00										
(5) $\ln(FDI_{S,Location}+1)_{it}$	.22	.50	.00	3.40	.53	.79	.54	.46	1.00									
(6) $\ln(FDI_{S,Non-Location}+1)_{it}$	.72	1.08	.00	5.51	.62	.99	.57	.55	.73	1.00								
(7) $\ln GRP_{i,t-1}$	13.27	1.87	5.74	17.54	.51	.34	.39	.46	.22	.34	1.00							
(8) $w \cdot \ln GRP_{i,t-1}$	13.41	1.24	10.42	16.97	.34	.29	.29	.27	.20	.28	.54	1.00						
(9) $\ln TAX_{i,t-1}$	−.86	.57	−5.14	2.41	.38	.45	.35	.33	.44	.44	.33	.31	1.00					
(10) $w \cdot \ln TAX_{i,t-1}$	−.85	.40	−3.67	.37	.33	.49	.32	.26	.41	.47	.29	.50	.55	1.00				
(11) $\ln PATENT_{i,t-1}$	.44	.49	.00	3.52	.57	.56	.55	.47	.55	.55	.42	.33	.54	.39	1.00			
(12) $w \cdot \ln PATENT_{i,t-1}$	.46	.35	.01	2.08	.45	.58	.44	.35	.47	.58	.26	.55	.40	.67	.47	1.00		
(13) $\ln WAGE_{i,t-1}$	.22	.32	−1.14	1.27	.27	.13	.21	.23	.11	.12	.68	.42	.41	.35	.34	.20	1.00	
(14) $\ln ROAD_{i,t-1}$	.21	1.42	−16.12	3.25	.38	.67	.31	.34	.47	.66	.27	.30	.23	.41	.35	.46	.11	1.00

$N = 1{,}166$

All correlation coefficients are significant at $p < .01$

Table 2 Inward FDI projects in manufacturing versus services sectors in Korea

Year	Manufacturing sector			Services sector			Total
	High-tech[a]	Low-tech	Sub-total	Non-location-bound[b]	Location-bound	Sub-total	
2000	129 (6.0)	184 (8.5)	313 (14.4)	137 (6.3)	1,718 (79.2)	1,855 (85.6)	2,168 (100)
2001	95 (6.3)	130 (8.6)	225 (14.9)	118 (7.8)	1,170 (77.3)	1,288 (85.1)	1,513 (100)
2002	77 (7.4)	129 (12.4)	206 (19.7)	114 (10.9)	724 (69.3)	838 (80.3)	1,044 (100)
2003	87 (7.4)	129 (11.0)	216 (18.4)	116 (9.9)	841 (71.7)	957 (81.6)	1,173 (100)
2004	131 (8.7)	121 (8.0)	252 (16.7)	156 (10.3)	1,105 (73.0)	1,261 (83.3)	1,513 (100)
Total	519 (7.0)	693 (9.4)	1,212 (16.4)	641 (8.6)	5,558 (75.0)	6,199 (83.6)	7,411 (100)

The number in each parenthesis indicates the percentage of each count's share in the total number of inward FDI projects per each year

[a] High technology manufacturing industries include the following sectors based on 5-digit KSIC codes: biotechnology; environmental; alternative energy; semi-conductor equipments and electronic components; audio and video; telecommunication equipment, computers and auxiliary devices; medical equipment; precise mechanics; optical and sophisticated parts and materials

[b] Non-location-bound service industries include the following sectors based on 5-digit KSIC codes: wholesales; transportation; telecommunication; finance and insurance; business services; entertainment, tourism, and sport-related services

coefficient of the per employment monthly wage (i.e., cost of local labor forces) is statistically significant with an expected negative sign ($p < .01$) from the first column of Table 3. It implies that a 1 % decrease of labor costs in sub-national regions is likely to increase the number of manufacturing MNEs' FDI cases implemented therein by .24 % with 99 % confidence.[5] Second, the same column in Table 3 confirms that the strategic asset-seeking FDI argument is strongly supported: the coefficient for the number of patents per 1,000 people (i.e., local innovative capabilities) is positive with a significant sign ($p < .01$). We interpret this result as indicating that a 1 % increase of local patent outputs is likely to increase the number of manufacturing MNEs' inward FDI projects therein by .65 % with 99 % confidence. Third, the results in the same column show that the efficiency-seeking FDI argument is supported, because the coefficient for the length of paved roads (i.e., local infrastructure) is statistically significant with a positive sign ($p < .01$). However, the results in the last column of Table 3 also show that the location decisions made by service MNEs are positively related to the quality of local infrastructure offered by sub-national regions in a host country ($p < .01$). Since z tests confirm the significance of difference between these two coefficients ($p < .01$), the impact of efficient local infrastructure on sub-national location decisions of inward FDI projects is stronger for service MNEs than for manufacturing counterparts due to service MNEs' effective interactions with and/or their final delivery of service outputs to the local customers in sub-national regions. Considering all this evidence, Hypothesis 1 is partially supported.

[5] Since our econometric equations are log-log models, their estimated coefficient represents elasticity between relevant variables with all the other variables in each model held constant.

Table 3 System GMM results: Manufacturing versus service MNEs

	Manufacturing MNEs	Service MNEs
Hypothesized variables		
ln $GRP_{i,t-1}$	.11*** [.03]	.18* [.10]
ln $TAX_{i,t-1}$	.03 [.07]	.41*** [.16]
ln $WAGE_{i,t-1}$	−.24*** [.08]	−1.18 [1.51]
ln $PATENT_{i,t-1}$	.65*** [.24]	.23 [.27]
ln $ROAD_{i,t-1}$	.06*** [.02]	.46*** [.05]
Control variables		
Industrial complex	Yes	Yes
Time dummies	Yes	Yes
Fixed effects	Yes	Yes
Constant	−1.13*** [.30]	−1.05 [1.30]
F statistics	14.12***	24.27***
Number of instruments	20	20
Hansen's *J* test	(.58)	(.42)
Difference-in-Hansen test	(.45)	(.37)
AR(1)	(.00)	(.00)
AR(2)	(.91)	(.44)

N = 1,166

Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$

Numbers in [ ] and ( ) are standard errors and p-values, respectively

In the case of service MNEs, however, their sub-national location decisions are shown to be more influenced by demand-side considerations than supply-side factors: the local market-seeking FDI argument is supported from the last column of Table 3. First, the coefficient for the gross regional product (i.e., local market size) is positive with a significant sign ($p < .10$). We interpret this result as indicating that a 1 % increase of gross regional product in sub-national regions is likely to increase the number of service MNEs' FDI projects located therein by .18 % with 90 % confidence.[6] Second, the coefficient for the local tax per capita collected (i.e., the level of purchasing power of local customers) is statistically significant with an expected positive sign ($p < .01$) from the last column of Table 3. This result also implies that a 1 % increase of local customers' purchasing power in sub-national regions is likely to accommodate a .41 %-increased

[6] The results in the first column of Table 3 show that the location decisions made by manufacturing MNEs are also positively related to the local market size available in sub-national regions of a host country ($p < .01$). We conducted z tests under a null hypothesis that the coefficient of ln $GRP_{i,t-1}$ for manufacturing MNEs (i.e., $\beta = .11$) and that for service MNEs (i.e., $\beta = .18$) are equal. The test results did not reject the null hypothesis ($p < .51$), indicating that the difference in the coefficient sizes is statistically insignificant. However, when interpreting the results, the size of corresponding samples needs to be considered, since the number of service FDI observations is 6,199 which is more than 5 times the 1,212 manufacturing FDI observations. As a result, when there is a 1 % increase of gross regional product in sub-national regions, it will increase the number of service MNEs located therein by 11.16 firms (=6,199 × .18%) which is substantially greater than 1.33 manufacturing MNEs (=1,212 × .11%).

Table 4 System GMM results: High-tech versus low-tech manufacturing MNEs

	High-tech manufacturing MNEs	Low-tech manufacturing MNEs	Location-bound service MNEs	Non-location-bound service MNEs
Hypothesized variables				
$\ln PATENT_{i,t-1}$	.40** [.16]	.39* [.23]	.17 [.30]	.39 [.36]
$\mathbf{w} \cdot \ln PATENT_{i,t-1}$	.39** [.20]	.01 [.15]	.33 [.21]	.76*** [.23]
$\ln GRP_{i,t-1}$	.06*** [.02]	.08*** [.02]	.02 [.04]	.14 [.13]
$\ln TAX_{i,t-1}$	.01 [.13]	.06 [.06]	.17* [.09]	.32* [.17]
$\ln WAGE_{i,t-1}$	−.12 [.07]	−.12* [.06]	−.13 [.13]	−.34 [.30]
$\ln ROAD_{i,t-1}$	−.02 [.02]	.04* [.02]	.08*** [.02]	.25*** [.06]
Control variables				
Industrial complex	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes
Constant	−.66** [.31]	−.69*** [.26]	.03 [.45]	−.80 [1.60]
F statistics	5.46***	13.12***	6.37***	13.81***
Number of instruments	26	26	26	26
Hansen's *J* test	(.43)	(.76)	(.44)	(.24)
Difference-in-Hansen test	(.51)	(.29)	(.29)	(.27)
AR(1)	(.00)	(.00)	(.00)	(.00)
AR(2)	(.11)	(.52)	(.21)	(.63)

$N = 1{,}166$

Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$

Numbers in [ ] and ( ) are standard errors and *p*-values, respectively

number of service MNEs' FDI projects implemented therein with 99 % confidence. Considering all these pieces of evidence, Hypothesis 2 is supported.

The system GMM regression results in Table 4 suggest evidence of intra-regional effects on the relationship between local innovative capabilities of each region and location decisions made by high-tech versus low-tech manufacturing MNEs. First, for high-tech manufacturing MNEs, the coefficient for the number of patents per 1,000 people in a focal region (i.e., $\ln PATENT_{i,t-1}$) has a positive and significant sign ($p < .05$) from the first column of Table 4, indicating that a 1 % increase of patent outputs in a focal sub-national region is likely to increase the number of high-tech manufacturing MNEs' FDI projects located within the same region by .40 % with 95 % confidence. Regarding the coefficient for the patent outputs in the focal region's neighboring regions (i.e., $W \cdot \ln PATENT_{i,t-1}$), the same column shows that it also has a positive and significant sign ($p < .05$), implying that a 1 % increase of patent outputs in a focal region's neighboring regions is likely to increase the number of high-tech manufacturing MNEs' FDI projects within the focal region by .39 % with 95 % confidence. Although the size of intra-regional effects is greater than that of inter-regional effects with all the other locational characteristics held constant, the significance of difference in the size of two coefficients is not statistically supported. Thus, Hypothesis 3 is partially supported.

Second, for low-tech manufacturing MNEs, although marginally significant, the coefficient for the number of patents per 1,000 people in a focal region (i.e., $\ln PATENT_{i,t-1}$) shows a positive sign ($p<.10$) from the second column of Table 4. It implies that a 1 % increase of patent outputs in a focal region is likely to enhance the number of low-tech manufacturing MNEs' FDI projects within the same region by .39 % with 90 % confidence. However, the same column shows that the coefficient for the patent outputs in the neighboring regions (i.e., $W \cdot \ln PATENT_{i,t-1}$) is statistically insignificant. Considering both pieces of evidence, we conclude that sub-national location decisions by low-tech manufacturing MNEs are likely to be influenced by local innovative capabilities in a focal region (i.e., intra-regional effects), not by those from neighboring regions (i.e., inter-regional effects), with all the other locational characteristics held constant. Thus, these results do not support Hypothesis 4.

The last two columns in Table 4 show that the local innovative capabilities represented by patent outputs are mostly irrelevant for service MNEs' sub-national location decisions with an exception of the inter-regional effects from neighboring regions on non-location-bound service MNEs ($p<.01$). It may be because most of non-location-bound services are knowledge-intensive services using the information and communications technology (ICT) as their business infrastructure: however, due to their characteristic of non-location-specificity, non-location-bound service MNEs may not be subject to locating in the innovative focal region directly; instead, they are attracted to its neighboring regions to exploit the benefits of retaining relevant spatial externalities while minimizing negative spatial externalities from the innovative focal region.

The system GMM regression results in Table 5 suggest evidence for significant intra-regional (and inter-regional) effects of local market potential on sub-national location decisions made by location-bound (and non-location-bound, respectively) service MNEs. First, for location-bound service MNEs, the coefficient for the gross regional product in a focal region (i.e., $\ln GRP_{i,t-1}$) has a positive and significant sign ($p<.10$). This result indicates that a 1 % increase of local market size in a focal sub-national region is likely to increase the number of location-bound service MNEs' FDI projects implemented within the same region by .03 % with 90 % confidence. However, the coefficient for the gross regional product in the focal region's neighboring regions (i.e., $W \cdot \ln GRP_{i,t-1}$) is shown to be insignificant from the same column. Local customers' purchasing power (represented by local tax per capita collected) also generates a similar picture to location-bound service MNEs' sub-national location decisions. The coefficient for the local tax per capita collected in a focal region (i.e., $\ln TAX_{i,t-1}$) has a positive and significant sign ($p<.01$), implying that a 1 % increase of local customers' purchasing power in a focal region is likely to increase the number of location-bound service MNEs' FDI projects implemented within the same region by .20 % with 99 % confidence: however, the coefficient for that in the focal region's neighboring regions (i.e., $W \cdot \ln TAX_{i,t-1}$) is shown to be insignificant. Considering all these pieces of evidence, we conclude that sub-national location decisions by location-bound service MNEs are influenced by local market potential in a focal region (i.e., intra-regional effects), not by that from neighboring regions (i.e., inter-regional effects), with all the other locational characteristics held constant. Thus, it supports Hypothesis 5.

Table 5 System GMM Results: Location-bound versus non-location-bound service MNEs

	Location-bound service MNEs	Non-location-bound service MNEs	High-tech manufacturing MNEs	Low-tech manufacturing MNEs
Hypothesized variables				
$\ln GRP_{i,t-1}$	.03* [.02]	.15 [.14]	.07*** [.02]	.05 [.03]
$\mathbf{w} \cdot \ln GRP_{i,t-1}$	−.002 [.02]	.03 [.13]	.05 [.06]	−.04 [.02]
$\ln TAX_{i,t-1}$	.20*** [.07]	.11 [.11]	.23 [.33]	−.07 [.07]
$\mathbf{w} \cdot \ln TAX_{i,t-1}$	−.03 [.07]	.28** [.14]	−.51 [.57]	.05 [.05]
$\ln WAGE_{i,t-1}$	−.21*** [.06]	−1.46*** [.55]	−.23* [.14]	−.16*** [.06]
$\ln PATENT_{i,t-1}$	.23 [.17]	1.09*** [.33]	.48* [.25]	.73** [.30]
$\ln ROAD_{i,t-1}$	.10*** [.00]	.30*** [.05]	.06 [.05]	.04*** [.02]
Control variables				
Industrial complex	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes
Constant	−.07 [.36]	−1.43 [1.93]	−1.64 [1.07]	−.21 [.47]
F statistics	6.64***	17.64***	3.65***	12.32***
Number of instruments	29	29	29	29
Hansen's *J* test	(.51)	(.18)	(.41)	(.29)
Difference-in-Hansen test	(.35)	(.22)	(.20)	(.35)
AR(1)	(.00)	(.00)	(.00)	(.00)
AR(2)	(.22)	(.75)	(.13)	(.62)

$N = 1{,}166$

Significance levels: * $p < .10$, ** $p < 0.05$, *** $p < 0.01$

Numbers in [ ] and ( ) are standard errors and *p*-values, respectively

Second, for non-location-bound service MNEs, both coefficients for the gross regional product in a focal region (i.e., $\ln GRP_{i,t-1}$) and its neighboring regions (i.e., $W \cdot \ln GRP_{i,t-1}$) are shown to be statistically insignificant from the second column of Table 5. Regarding the impact of local customers' purchasing power on non-location-bound service MNEs' sub-national location decisions, the coefficient for the local tax per capita collected in a focal region (i.e., $\ln TAX_{i,t-1}$) is insignificant: however, that in the focal region's neighboring regions (i.e., $W \cdot \ln TAX_{i,t-1}$) shows a positive and significant sign ($p < .05$), indicating that a 1 % increase of local customers' purchasing power in the neighboring regions is likely to increase the number of non-location-bound service MNEs' FDI projects located in the focal region by .28 % with 95 % confidence. Considering these pieces of empirical evidence, we conclude that, with all the other locational characteristics held constant, sub-national location decisions by non-location-bound service MNEs are influenced by the local customers' purchasing power from neighboring regions (i.e., inter-regional effects), partially supporting Hypothesis 6.

The last two columns in Table 5 show that, *ceteris paribus*, the demand-side local market potential may not be meaningful for most of the manufacturing MNEs' sub-

national location decisions. One exception is the intra-regional effects of local market size on high-tech manufacturing MNEs' sub-national location decisions with all the other locational factors held constant. It may be not only because high-tech manufacturing MNEs do not require scale-intensive manufacturing, but also because they need access to sophisticated human capital that is available in big cities. Both forces are likely to encourage them to penetrate into urban areas of a large market size.

We address three key issues for robustness checks.[7] First, we use the average amounts of FDI as dependent variables in the regressions to check potential size effects of inward FDI projects on their sub-national location choices as reported in Table 6. Second, we exclude three regions of the capital city Seoul in the regressions of Table 7, since a substantial portion of all inward FDI projects (i.e., 30.18 % of the full sample including both manufacturing and service FDI) were established in the regions[8] that account for less than .1 % of the entire landmass of Korea. Third, we also use an alternative time lag of 2-years for subnational location-specific characteristics in the regressions of Table 8. As seen from the tables, all of the robustness tests produced qualitatively similar results to our main findings.

Discussion

Built on the different characteristics between service and manufacturing sectors identified in the literature, this study investigated whether and how service MNEs implement location strategies in sub-national regions of a host country that may be different from those implemented by manufacturing MNEs with a full population of inward FDI projects in Korea. In addition, it examined the sectoral heterogeneity of manufacturing versus service MNEs that may affect their final location decisions in the sub-national regions of a host country. Our empirical findings showed that MNEs operating in different types of sectors are likely to be influenced by different sets of location-specific characteristics that sub-national regions of a host country provide when determining location sites for their inward FDI projects. Manufacturing MNEs would be more likely to seek the benefits of cheap labor forces, advanced local infrastructure, and local innovative capabilities from sub-national regions of Korea than their service counterparts who would be more likely to seek large local markets and local customers possessing strong purchasing power. Our results also suggested that MNEs' responsiveness to the location-specific advantages of sub-national regions of a host country may be affected by heterogeneous industry effects. Both high-tech and low-tech manufacturing MNEs were shown to be more related to local innovative capabilities within their focal region than those from neighboring regions, suggesting a possibility of intra-regional knowledge spillover effects. Location-bound service MNEs, on the other hand, were also shown to be attracted to the local market potential within their focal region: however, non-location-bound service MNEs were more affected by the

[7] In Tables 6, 7, and 8, we opted not to report the effects of local innovative capabilities on location-bound versus non-location-bound service MNEs and those of local market potential on high-tech versus low-tech manufacturing MNEs, since they were shown to be mostly irrelevant for the corresponding sample's sub-national location decisions as reported in Tables 4 and 5, respectively, above.

[8] They are Jung, Yongsan, and Kangnam that attracted more than 500 inward FDI projects in the study period.

Table 6 Robustness test results I: Average amount of FDI

	Manufacturing MNEs	Service MNEs	High-tech manufacturing MNEs	Low-tech manufacturing MNEs	Location-bound service MNEs	Non-location-bound service MNEs
Hypothesized variables						
$\ln PATENT_{i,t-1}$	3.03* [1.83]	.03 [.69]	11.41* [6.44]	2.81 [3.06]	.22 [.38]	2.38** [1.16]
$\mathbf{w} \cdot \ln PATENT_{i,t-1}$			−3.73 [4.93]	.07 [1.11]		
$\ln GRP_{i,t-1}$	2.14** [.99]	1.12* [.64]	−.16 [.99]	1.06* [.61]	.16** [.07]	.62 [.47]
$w \cdot \ln GRP_{i,t-1}$					−.01 [.08]	−.41 [.51]
$\ln TAX_{i,t-1}$	−.002 [.52]	1.07*** [.39]	−2.58 [1.72]	.14 [.78]	.86*** [.20]	.04 [.35]
$w \cdot \ln TAX_{i,t-1}$					−.14 [.43]	.95* [.54]
$\ln WAGE_{i,t-1}$	−6.77* [3.80]	−4.50* [2.50]	3.20 [4.07]	−6.95* [4.15]	−.79*** [.26]	−2.96 [2.28]
$\ln ROAD_{i,t-1}$	−.35 [.38]	.63*** [.18]	.08 [1.97]	−.04 [.16]	.29*** [.07]	.61*** [.18]
Control variables						
Industrial complex	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−24.96** [11.94]	−10.50 [7.926]	−1.60 [11.29]	−12.54* [6.74]	−.37 [1.54]	−.09 [7.11]
F statistics	12.52***	17.38***	1.96**	14.47***	10.83***	29.06***
Number of instruments	21	20	25	26	29	29
Hansen's *J* test	(.43)	(.66)	(.63)	(.25)	(.69)	(.41)
Difference-in-Hansen test	(.38)	(.59)	(.84)	(.77)	(.22)	(.37)
AR(1)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
AR(2)	(.55)	(.71)	(.11)	(.30)	(.88)	(.94)

$N = 1{,}166$

Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$

Numbers in [ ] and ( ) are standard errors and *p*-values, respectively

Table 7 Robustness test results II: Without three sub-national regions in Seoul

	Manufacturing MNEs	Service MNEs	High-tech manufacturing MNEs	Low-tech manufacturing MNEs	Location-bound service MNEs	Non-location-bound service MNEs
Hypothesized variables						
ln $PATENT_{i,t-1}$	.60*** [.22]	.23 [.25]	.70* [.40]	.45* [.24]	.23 [.15]	1.18*** [.34]
$\mathbf{w} \cdot \ln PATENT_{i,t-1}$			.59** [.29]	−.02 [.15]		
ln $GRP_{i,t-1}$	.11*** [.03]	.17* [.09]	−.23 [.20]	.07*** [.02]	.03* [.02]	.13 [.14]
$\mathrm{w} \cdot \ln GRP_{i,t-1}$					.01 [.02]	.04 [.13]
ln $TAX_{i,t-1}$	.02 [.06]	.30** [.12]	−.76** [.31]	.03 [.05]	.12** [.05]	.03 [.11]
$\mathrm{w} \cdot \ln TAX_{i,t-1}$					−.08 [.12]	.20** [.13]
ln $WAGE_{i,t-1}$	−.24*** [.08]	−1.05 [.65]	.44 [.51]	−.13** [.06]	−.17*** [.06]	−1.51*** [.56]
ln $ROAD_{i,t-1}$	.06*** [.02]	.42*** [.04]	.09 [.07]	.03 [.02]	.10*** [.02]	.29*** [.05]
Control variables						
Industrial complex	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−1.15*** [.28]	−1.01 [1.13]	1.65 [2.14]	−.66*** [.25]	−.27 [.37]	−1.38 [1.91]
F statistics	13.81***	25.55***	2.33***	12.81***	6.37***	17.53***
Number of instruments	20	20	26	26	29	29
Hansen's *J* test	(.73)	(.46)	(.72)	(.88)	(.44)	(.21)
Difference-in-Hansen test	(.62)	(.46)	(.73)	(.61)	(.59)	(.24)
AR(1)	(.00)	(.00)	(.01)	(.00)	(.00)	(.00)
AR(2)	(.79)	(.45)	(.10)	(.55)	(.18)	(.85)

N = 1,151

Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$

Numbers in [ ] and ( ) are standard errors and p-values, respectively

Table 8 Robustness test results III: Two-year lag for hypothesized variables

	Manufacturing MNEs	Service MNEs	High-tech manufacturing MNEs	Low-tech manufacturing MNEs	Location-bound service MNEs	Non-location-bound service MNEs
Hypothesized variables						
$\ln PATENT_{i,t-2}$	.37*** [.10]	−.45 [.31]	.20*** [.06]	.30 [.19]	.32** [.14]	.28 [.30]
$\mathbf{w} \cdot \ln PATENT_{i,t-2}$			.16** [.07]	.21 [.13]		
$\ln GRP_{i,t-2}$	.06*** [.02]	.17*** [.05]	.04*** [.01]	.13** [.05]	−.17 [.17]	.23 [.15]
$w \cdot \ln GRP_{i,t-2}$					.01 [.04]	−.16 [.12]
$\ln TAX_{i,t-2}$	.07 [.10]	−.20 [.36]	.09 [.07]	−.12 [.41]	.17* [.09]	−.60 [.46]
$\mathbf{w} \cdot \ln TAX_{i,t-2}$					.07 [.06]	.54*** [.14]
$\ln WAGE_{i,t-2}$	−.17** [.07]	−.07 [.21]	−.19*** [.05]	−.92** [.38]	.44 [.51]	−.14 [.20]
$\ln ROAD_{i,t-2}$	.11*** [.02]	.47*** [.11]	.01 [.01]	.06** [.03]	.16*** [.04]	.24** [.11]
Control variables						
Industrial complex	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−.59*** [.22]	−1.52** [.60]	−.43*** [.16]	−1.80* [.97]	2.31 [1.56]	.35 [1.00]
F statistics	9.90***	8.16***	6.97***	7.19***	5.42***	8.99***
Number of instruments	17	16	18	18	20	20
Hansen's *J* test	(.84)	(.29)	(.22)	(.44)	(.29)	(.11)
Difference-in-Hansen test	(.78)	(.66)	(.35)	(.16)	(.55)	(.40)
AR(1)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
AR(2)	(.27)	(.26)	(.85)	(.21)	(.34)	(.25)

$N = 933$

Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$

Numbers in [ ] and ( ) are standard errors and *p*-values, respectively

local market potential from neighboring regions than that within the focal region, suggesting a possibility of inter-regional market spillover effects.

Contributions

This study contributes to the advancement of location theories and practices by MNEs in the following ways. First, it provides a theoretical explanation of the location decisions of service MNEs that may be different from those of manufacturing MNEs under the same national contexts. Based on Dunning's (1998) classification of four location-specific advantages that attract MNEs' inward FDI projects, our findings show that the location decisions made by MNEs may be driven by (1) regional differences across sub-national regions of a host country and (2) heterogeneous characteristics of industrial sectors where MNEs operate, the combination of which further suggests the intra-regional versus inter-regional knowledge and/or market spillover effects on their sub-national location decisions. Second, it also provides an empirical test of the potential impact of intra-country regional differences on the location selections of service and manufacturing MNEs in the context of a single host country. The econometric method of the system GMM was attempted to address the endogeneity issue of location-specific characteristics in the empirical estimations.

Limitations and future research directions

This paper has several limitations that need to be complemented and improved by future studies. First, although Korea is well-suited for investigating our research questions, it is an empirical study of a single country. Because we analyzed the location decisions made by service versus manufacturing inward FDI projects implemented in sub-national regions of a host country, the choice of a single country was indispensible. However, there is no doubt that the main findings from this paper need to be replicated in, compared to, and generalized for different contexts of other countries. Second, we used an administrative region as the unit of analysis in this paper. The administrative purposes of sub-national regions in a country may not necessarily coincide with the criteria for the determination of economic activities by companies, including the location decisions made by service and/or manufacturing MNEs. Therefore, an important interconnection among neighboring sub-national regions may have been sacrificed for the convenience of data collection in the current study. Third, MNEs' sub-national location decisions may be influenced by different location-specific factors when they choose different entry modes such as greenfield versus M&As in foreign direct investment, international joint venture, license, or any other modes. The limited availability of our data on MNEs' entry modes did not allow us to address this issue in the current study. Fourth, we utilized classifications of high-tech versus low-tech manufacturing sectors in the study based on detailed 5-digit Korean Standard Industrial Classification (KSIC) codes: however, such grouping may not coincide with firm-specific attributes, since there may be significant variations in R&D and/or technological capabilities of individual firms even within the same category of industries. There is still much to be investigated about the issue of location strategies chosen by service versus manufacturing MNEs, and we hope others will join us in this important line of research in the future.

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