

Geography of Multinational Corporations and Functional Specialization in Chinese Cities

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Abstract

There has been a transformation of urban structure from mainly sectoral to functional specialization. This transformation is inextricably interrelated with changes in firms' organization. Some cities host upstream functions of the value chain while others attract production and assembly. This paper investigates the tendency toward functional specialization in Chinese cities by exploring divisions in multinational corporations' (MNC) business operations in China. Based on data from Fortune Global 500 MNCs during 1979-2008, the study finds that MNCs have gradually expanded in China, both functionally and geographically. In that process, similar functions tend to agglomerate in certain cities while complementary functions co-agglomerate in others. The analysis indicates that Chinese cities may start to move toward functional specialization, with upstream functions clustering in the top tier cities of the political and economic urban hierarchy.

Keywords: Functional Specialization; Functional Location; Multinational Corporations; China

1. Multinational Corporations and Functional Location

There has been a transformation of urban structure from mainly sectoral to functional specialization in developed economies (Duranton and Puga 2005). This transformation is inextricably interrelated with changes in corporations' organization. As production and transportation technologies make progress, firms are able to separate functions along the value chain and locate their functions in different cities (Defever 2006). Major cities in China are making efforts to upgrade their industrial infrastructure and courting high value-added businesses to sustain urban development (He et al. 2011). The question is whether major Chinese cities are moving toward functional specialization as are their western counterparts?

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Multinational corporations (MNCs) have been key players in production fragmentation. They not only separate functions globally but also within their home and host countries (Defever 2006; Enright 2009). Functional fragmentation will certainly bring efficiency and advantages but also mean additional coordination costs. MNCs would concentrate similar functions in certain cities when advantages exceed costs, resulting in functional specialization. However, if coordination costs are very high, a MNC may choose to concentrate diverse functions within a city. Consequently, the functional locational strategy of MNCs provides a valuable perspective in seeking evidence of functional specialization in Chinese cities.

Using data on investments from fortune global 500 MNCs in China (excluding those headquartered in mainland China) during 1979-2008, this study will describe the locational patterns of MNC activities and examine the locations of different activities in China and then explore the importance of functional externalities in the locational choices of MNCs. This study finds that similar functions tend to agglomerate in certain cities. High-level functions such as regional headquarters and R&D centers are substantially agglomerated in first tier cities. Consequently, the empirical results show some evidence of functional specialization at the top of Chinese urban hierarchy.

2. Literature Review: Functional Locations of Multinational Corporations

MNCs often encounter substantial psychic distance when expanding internationally. The psychic distance can be overcome by acquiring local knowledge or developing greater capability to do business in foreign markets. As a consequence, MNCs invest multiple times within the same host country. This kind of sequential investment is particularly common in China (Cui 1998). For instance, Cheung and Leung (2007) found that transnational advertising agencies increase their involvement in China over time and the majority of agencies went through four stages: an introductory stage, a direct participation or involvement stage, the establishment of a joint venture stage and a network expansion stage. Through the sequential entry, MNCs learn local knowledge, develop organizational capabilities and build up localized business ties. A side-effect of sequential entry of MNCs is intra-firm clustering in certain places (Chung and Song 2004).

MNCs however invest on an activity-by-activity basis. Initial investment may fund offices while later investments might be for R&D or even to establish a regional headquarters (Enright 2009). While sequential investments tend to support functional agglomeration, these differences in the underlying rationale behind foreign investment acts to discourage spatial agglomeration of prior and present investments (Dunning, 1998; Enright 2010). Sale activities are typically market seeking, production efficiency seeking, R&D knowledge seeking and headquarters strategic asset seeking (Enright 2009). Activities differ in scale sensitivity and knowledge intensity (Alcacer 2006). Sales service activities appear non-scale sensitive while production and corporate support activities are scale sensitive. R&D and corporate support are the most scale sensitive and the most knowledge intensive. Activities also have different integration mechanisms, with R&D requiring people and information-based mechanisms; production requiring people,

information and formalization-based mechanisms; and marketing requiring information and centralization-based mechanisms (Kim et al. 2003).

The increasingly sophisticated decision making of managers in MNCs is slicing the activities of firms even more finely. Similar activities agglomerate in the same cities, particularly upstream activities. Because knowledge is often unstated, communication requires frequent interactions, leading firms to locate geographically close to external knowledge sources (Mariotti et al. 2010). Headquarters are knowledge intensive and demand professional services and specialized labor, encouraging agglomeration to exploit knowledge and information spillovers (Henderson and Ono 2008). R&D activities benefit the most from knowledge spillovers and specialized labor and are less exposed to local competition effects. In addition, production facilities benefit from specialized suppliers, as well as specialized labor and technological spillovers. Therefore, MNCs are likely to favor locations that match the kinds of business activities they hope to undertake (Yamawaki 2004; Enright 2009). For instance, Enright (2009) explored the investment behaviors of North American, European and Japanese companies across 12 economies in the Asia-Pacific region and found clear differences in their patterns of investments across sales, customer services, production, internal corporate support, and R&D.

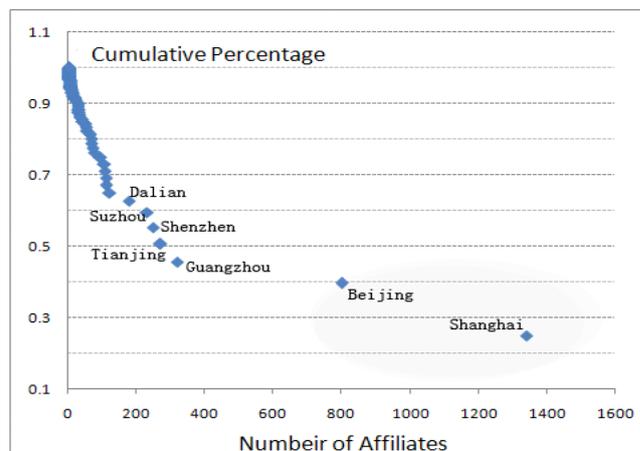
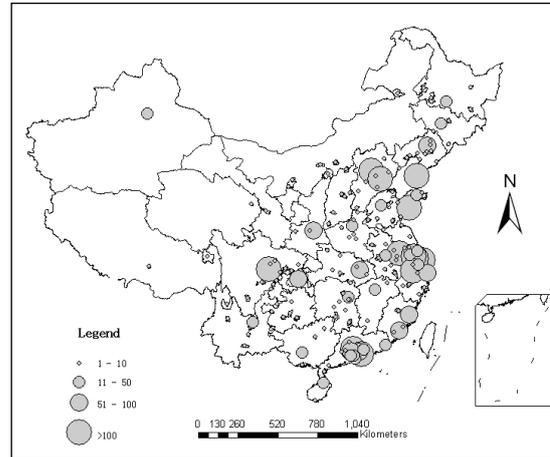
However, there may be crucial connections between different activities along the value chain. Firms would probably face additional coordination costs and the loss of coordination between stages if each stage was separated in space. Spatial proximity is critical to some firms since not all types of knowledge can be transmitted without costs. Thus, some functional externalities are still important business considerations that cannot be replaced by the new tools of information technology. Regional headquarters may co-locate with R&D centers since the two functions demand face-to-face contact. Headquarters and R&D centers also gain from geographical proximity to production facilities (Henderson and Ono 2008; Sun 2009). Empirically, Defever (2006) found that firms tend to locate services and R&D centers close to production plants in the European Union. In China, different activities of MNCs are likely to co-locate in large cities or mega- regions in order to limit coordination and logistics costs. The following section will describe the location patterns of different functions of fortune global 500 corporations and then identify their determinants using the conditional logit model technique.

3. Locational Patterns of Investments from Fortune Global 500 MNCs in China

To demonstrate the spatial patterns of MNCs, we collect data from the Annual Report of Transnational Corporations in China published by the China Economic Publishing House and then visit the Webpages of the corresponding MNCs to verify the data. For each subsidiary, we identify the parent company, home country, host city, type of business activities and year established. The study covers 5391 subsidiaries. We divide the subsidiaries into several categories: regional headquarters, representative office or branch, R&D center, business service center, production plant, and marketing agencies, social services and others.

The spatial distribution of MNCs' subsidiaries at the prefecture-city level is mapped to explore the geographical agglomeration of MNCs' investments (Figure 1).

Figure 1: Spatial Distribution of Fortune Global 500 MNCs' Subsidiaries in China (2008)



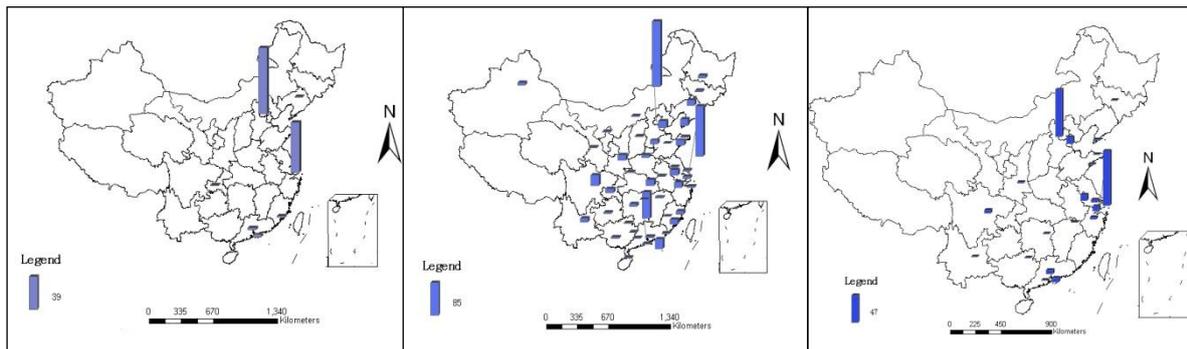
MNCs disproportionately favor mega-city regions along the coast, including the Capital Region, the Yangtze River Delta, the Minnan Delta, the Pearl River delta, the Shandong Peninsula, and the Liaodong Peninsula. Inland cities such as Chongqing, Chengdu, Wuhan and Xi'an are attractive to MNCs. MNCs' subsidiaries are highly concentrated in the top cities in the Chinese urban hierarchy. As the two most favorable locations, Shanghai and Beijing host 1340 and 800 subsidiaries, accounting for 39.70% of MNCs' subsidiaries. The second most popular group of hosting cities includes Guangzhou, Tianjin, Shenzhen, Suzhou and Dalian, with about 23.06% of subsidiaries. The entry of MNCs into top cities enhances their international competitiveness as national and regional centers.

We further explore the locational distribution of different functions from the fortune global 500 MNCs. Regional headquarters are information processing and decision-making centers and serve as bridges between subsidiaries and parent companies. MNCs only establish one regional headquarters in China and typically

locate it in first-tier cities since they benefit from face to face contacts and good business services and appreciate the benefits of agglomeration (Zhao et al. 2005).

As Figure 2 shows, Beijing and Shanghai host the majority of MNC regional headquarters. Others scatter in Guangzhou, Shenzhen, Shenyang and Xiamen. Offices are established to collect information and branches are created to provide services or coordinate subsidiaries located in certain regions. Most businesses attach great importance on infrastructure, market access and information costs when choosing locations. As expected, offices and branches are agglomerated in the national and regional centers such as Beijing, Shanghai, Guangzhou, Chengdu, Shenyang and Wuhan. The mega-city regions of the Pearl River Delta, the Yangtze River Delta and the Capital Region are particularly attractive to MNC offices and branches. R&D centers provide technical support for local production or conduct basic research. Typically, R&D centers benefit from proximity to local managers and R&D centers of other MNCs. They also stress availability to research personnel and market access. They are typically concentrated in top-tier cities (Sun 2009).

Figure 2: Spatial Distribution of Regional Headquarters (Left) and Offices and Branches (Center) and Research and Development Centers (Right)

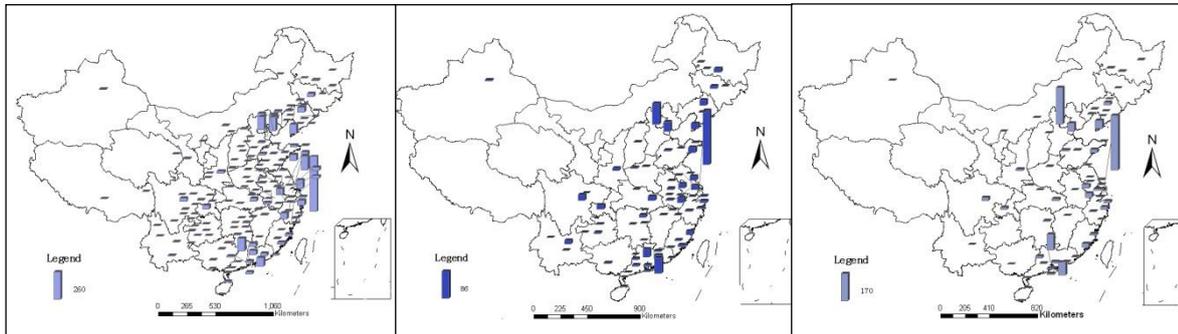


As shown in Figure 2, R&D centers are disproportionately agglomerated in the Yangtze River Delta and the Capital Region, accounting for 50.21% (Shanghai, Nanjing, Suzhou, Hangzhou and Wuxi) and 37.86% (Beijing and Tianjin), respectively. In addition, Guangzhou and Shenzhen hosted 5.35% of R&D centers.

Production plants benefit from localized business links and proximity to management and R&D centers (Yeung et al., 2006), resulting in their agglomeration in the Yangtze River Delta, the Pearl River Delta and the Capital Region (Figure 3). Sales offices and marketing agencies, by contrast, follow the customers (Figure 3). They are concentrated in mega-city regions, especially the Capital Region, the Yangtze River Delta and the Pearl River Delta, as well as being scattered in provincial capitals throughout the country.

In addition, the study looked at business services subsidiaries of fortune global 500 MNCs. Those functions include banking, logistics, trading and purchasing centers. Existing studies found that business services follow their competitors or customers and are highly agglomerated in a few Chinese cities (He and Yeung 2011).

Figure 3: Spatial Distribution of Production Facilities (Left) and Sales and Marketing Offices (Center) and Business Services (Right)



They are sensitive to customer and geographical deregulations and information externalities (He and Fu 2008). As Figure 3 shows, business services units are clustered in Shanghai, Beijing, Guangzhou, Shenzhen, Dalian and Tianjin. Meanwhile, business services are co-agglomerated with upward functions in the value chain, particularly regional headquarters and R&D centers.

As China is increasingly integrated with the global economy, the fortune global 500 MNCs have invested sequentially in different functions in China. Functions differ in location requirements and follow the urban hierarchy to locate. High value-added functions cluster in the top of the urban hierarchy while downstream functions have diffused to the middle cities, further triggering functional specialization in Chinese cities.

4. Modeling the Functional Location of the Fortune Global 500 MNCs in Chinese Cities

This study applies the conditional logit model (CLM) to investigate the functional locational choices of MNCs in China, assuming that MNCs face a set of choices when locating business activities. The CLM assumes that a MNC selects a city with the greatest probability of generating the highest expected profit, determined by both the MNC's demand and production functions. We model the locational choices of business functions established between 2002 and 2008 by fortune global 500 MNCs. China entered the WTO in the end of 2001 and MNCs enjoyed more freedom to choose cities in the post-WTO period. There are 2225 new entries from the fortune global 500 MNCs from 2002-2008, among which are 45 regional headquarters, 190 offices and branches, 154 R&D and training centers, 786 production units, 577 business services units, and 438 sales units, as well as 35 units in social services and others. We intend to test the agglomeration effects of sequential investments from the fortune global 500 MNCs and therefore exclude those cities which only attracted one business unit from 2002-2008. With that adjustment, the total number of business units is 2178, located in 89 prefecture-level cities. The estimate of CLM is complicated by the magnitude of the choice set. Fortunately, McFadden (1978) has established that consistent estimators for the parameters can still be obtained from a random sample of choices taken from the full choice set. Likewise, we consider that the choice set for individual i consists of

its actual choice and 34 other randomly selected cities. The CLM assumes the independence of irrelevant alternative location choices. To control the influence of the interdependency of the previous and new location choices of MNCs, we introduce the number of subsidiaries from the same fortune global 500 MNCs (Count_own) in Chinese cities in the previous year. This variable is also used to test whether sequential investments follow prior investments from the same MNC.

The theoretical point of interest is whether similar functions agglomerate in certain cities. We introduce the number of subsidiaries from fortune global 500 MNCs with the same function in a city in the previous year (Count_Samefunction) and the number of subsidiaries from fortune global 500 MNCs with other functions in a city in the previous year (Count_otherfunctions) to test this theoretical interest. In the disaggregated analysis, we include function-based counts of MNCs, including regional headquarters, representative offices and branches (Count_RH), R&D centers (Count_RD), production facilities (Count_Production), business services (Count_Business), and sales offices and marketing agencies (Count_Sales) from all fortune global 500 MNCs in a city in the previous year.

We also include several other agglomeration proxies and controlling variables. We use the market potential to measure the demand-side agglomeration. Because the sales of MNCs are not confined to a city's boundaries, an access index is a better measure for a city's market potential (He, 2003). The market potential (MART) is the sum of the GDP of other cities weighted by their distance to the chosen city, defined as
$$Mart_j = \sum_{j \neq k} \left(\frac{GDP_k}{D_{jk}} \right)$$
, where D_{jk} is the shortest railway distance

between city j and k.

To capture the additional supply-side agglomeration effect, we introduce the development of service industries and internet access in the models. The level of services (SERVICE) is measured as the ratio of tertiary industries in GDP in the urbanized area. The number of internet users per 10,000 people (INTERNET) quantifies the ease of communication. More developed services and internet access should save costs for MNCs. In addition, we control for labor cost using the average wage rate (WAGE) in the model. As leaders of the global economy, the fortune 500 MNCs invest strategically in China and favor larger cities with favorable political conditions to reap strategic benefits and institutional advantages. To test the impact of political factors, we introduce a dummy for the four centrally administered municipalities (CDMS) and a dummy for subprovincial cities and provincial capitals (PROV) in the model. We include a dummy for cities with more than 5 million people (SUPER) and a dummy for cities with 2-5 million people (BIG) to test the impact of the economic power of cities on the location choices of MNCs in China. Finally, to test the impact of institutional advantages, we include a dummy (OPEN) for special economic zones, open coastal cities and open cities along the Yangtze River. In this study, we are particularly interested in the importance of agglomeration externalities in the locational strategy of MNCs. Locational choice is however a complicated process, in which amenity and subjective factors may be decisive. For example, proximity to the central government or to foreign embassies may attract MNCs to Beijing while some MNCs may choose Shanghai for its western lifestyle. Those are beyond our concern.

5. Empirical Results

The CLM estimates from the full sample and individual functions are reported in Table 1. The Lagrange multiplier (LM) tests show the significance of the model. There is strong evidence to show that sequential investments of MNCs follow prior investments in location choice, suggested by the highly positive and significant coefficient on Count_own. With the inclusion of Count_own, statistical results suggest that subsidiaries conducting similar functions tend to co-locate, contributing to the functional specialization of Chinese cities in the long run. In addition, business units performing different functions are likely to co-agglomerate in the same cities. These inter-functional business links facilitate co-location, which in turn reduces distance-based transaction and coordination costs.

Table 1: Results from the Conditional Logit Model Estimations

Variables	All	Business services	Headquarter , office and branch	Production facilities	R&D and training	Sales offices
Count_own	0.069***	0.060***	-0.020	0.080***	0.088***	0.085**
Count_samefunction	0.001**					
Count_otherfunctions	0.002***					
Count_Business		-0.025***	-0.022	-0.035***	0.010	-0.014
Count_Office		0.036***	0.038***	0.019***	-0.005	0.015*
Count_Production		0.017***	0.012***	0.024***	0.016***	0.012**
Count_RD		-0.009	-0.033*	0.025***	0.021	0.001
Count_Sale		-0.023*	0.001	-0.031***	-0.064	-0.019
MART	1.519***	1.408***	-0.055	1.136***	2.046**	0.261
SERVICE	0.216	-0.283	0.386	-0.124	0.948	0.097
INTERNET	0.204***	0.195**	0.149	0.083	0.204	0.241**
WAGE	-0.017	-0.174***	0.214	-0.204***	1.927***	-0.049
CMDS	1.340***	1.137***	2.029***	-0.490*	1.876**	1.115**
PROV	1.105***	1.862***	2.142***	0.637***	1.309**	1.187**
SUPER	0.748***	0.100	0.045	0.493***	-0.171	0.258
BIG	0.350***	0.197	0.447*	0.177	0.910*	0.453*
OPEN	-0.051	0.680***	0.221	0.463***	-0.326	0.191
# of Obs.	2178	575	234	753	154	427
Log likelihood	-5530	-1171	-504	-2042	-210	-1139
LM χ^2	4428	1747	657	1270	675	759
Pseudo R^2	0.2859	0.4272	0.3947	0.2373	0.6167	0.2499

Note: ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

Among other explanatory variables, MNCs highly value the market potential in Chinese cities but do not respond to labor costs. Fortune global 500 MNCs are strategic investors and mainly target the Chinese market. MNCs concentrate their subsidiaries in cities with good market access to realize scale economies and are able to bear higher labor costs. Moreover, strong agglomeration benefits compensate for labor costs. SERVICE has the expected positive but remains insignificant, while INTERNET is significant at the 0.01 level. MNCs significantly favor cities with better internet access and developed services. Easy access to internet can help MNCs lower information costs. The statistical results evidently show that MNCs have a high regard for political and economic status. Both CMDS and PROV are highly significant and positive, implying that MNC subsidiaries are more likely to favor centrally administered municipalities, provincial capitals and sub-provincial cities. This perhaps reflects that MNC location choice is a bargaining process, involving intensive interactions with decision-makers. Proximity can facilitate interactions between MNCs and government agencies and provide favorable institutional support. For example, regional headquarters of MNCs are largely concentrated in Beijing and Shanghai to reap the institutional advantages and information externalities (Zhao et al. 2005). As expected, fortune global 500 MNCs significantly favor top cities in the Chinese urban hierarchy, particularly those with more than 5 million people. Lastly, MNCs are not attracted to open door policies any more. This study focuses on the post-WTO period, during which the central government has significantly opened the domestic market to foreign investors and has implemented deregulation policies in many areas, especially in the service sector.

To further explore the agglomeration and co-agglomeration of different functions from the fortune global 500 MNCs, we perform the model estimations for different functions (Table 1). Beside regional headquarters and offices, other types of business units tend to follow their parent corporations' prior investments, confirming the agglomeration effect of sequential investments. Statistical results indicate that business services units do not co-locate. They however follow regional headquarters and production facilities but do not attract other types of investment from MNCs. However, regional headquarters and offices, and production facilities, not only attract rival subsidiaries conducting the same function but also other types of subsidiaries. Regional headquarters tend to follow other headquarters and production facilities. Production facilities tend to follow regional headquarters, production facilities and R&D centers but avoid business services units and sales and marketing agencies. Information exchange and business connections may foster this trend. Regional headquarters provide information and knowledge for other functions while production plants demand services from business services, regional headquarters and R&D centers and provide finished goods to sales offices. Surprisingly R&D centers do not co-locate with regional headquarters and offices. They even mutually avoid each other. R&D centers and production facilities however mutually attract each other. Perhaps because many R&D centers provide technical supports for manufacturing and processing plants. Sales offices follow regional headquarters, offices and production facilities but they do not attract other types of investments.

In addition, functions respond to different location factors. Business services highly correlate with market potential and internet access and particularly favor cities with higher political status and institutional advantages. Business services

activities are particularly affected by strict regulations. Because the central government has gradually relaxed business and geographical restrictions in the post-WTO period, it makes sense for business services centers to cluster in cities with high political status and earlier open door policies. Note however, that business services investments avoid high labor cost cities.

Comparatively, regional headquarters and offices are particularly drawn to centrally administered municipalities, provincial capitals and subprovincial cities. Regional headquarters and offices, as the information processors and decision-makers, clearly benefit from agglomeration benefits and political advantages. Production facilities, however, are attracted to market access, provincial capitals and subprovincial cities and open cities, but avoid the centrally administered municipalities and high labor cost cities. In addition, fortune global 500 MNCs mainly aim at the Chinese market. R&D centers concentrate in cities with higher wage rates, good market access and better political status since they demand high quality labor and institutional supports from government. They are not attracted to the status of open cities since they are less likely to exploit favorable policies, which mainly target manufacturing and processing facilities. Finally, sales offices particularly respond to internet access and favor cities with high political status as well as those with 2-5 million people. Good internet access suggests easy communication. National and provincial centers are also major markets. The different significance of location factors is consistent with location requirements of different types of functions.

6. Conclusions and Emerging Issues

China has attracted a large number of MNCs, which disperse their business activities throughout the country. Spatial organization of multinational corporations provides a useful perspective to understand the tendency toward functional specialization in Chinese cities, especially since activities conducting same functions may share the same locational logic.

Based on investment data from fortune global 500 MNCs in China between 1979 and 2008, this study found that as China increasingly integrated with the global economy, MNCs has diversified their business scopes. MNCs disproportionately concentrate in costal mega-city regions including the Capital Region, the Yangtze River Delta, the Minnan Delta, the Pearl River Delta, the Shandong Peninsula, and the Liaodong Peninsula. Furthermore, similar functions tend to agglomerate in certain cities. High level functions such as regional headquarters and R&D centers are agglomerated in first-tier cities. Taken together, the agglomeration and co-agglomeration of different functions has resulted in a disproportionate concentration of foreign investment in the top-tiers cities. Large cities with favorable political environments are particularly attractive for upstream functions like regional headquarters and offices, R&D centers, and business services.

Empirical results found strong evidence of functional and cross-functional clustering among fortune global 500 MNC location choices. In addition, the study found some evidence of functional specialization in Chinese cities, with upstream functions clustering in top-tier cities in the political and economic urban hierarchy. As this process continues, functional specialization will be likely to change the nature of inter-urban links in China, with substantial information, service and

capital flows along the urban hierarchy. As a consequence, globalization is a critical factor restructuring the Chinese urban system, upgrading economic and business functions and enhancing the importance of top-tier cities.

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