How Local City and Its Hinterland Impact Global Firms:

An Empirical Test of Beijing

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Abstract

The location of global firms in a city has been regarded as a critical factor for a world city classification. Context factors of world city at different levels have also been recently considered to influence the location of global firms. In this paper, we use dynamic factors at three levels of the host city and its hinterlands namely state (country), city, and service sector to analyse the relations between these factors and the global firms during the globalization progression of Beijing. We use comprehensive data sets from Beijing Statistical Yearbooks from 1988 to 2014 for the city, firm level, and service sector factors; and the China Statistical Yearbook for the same period for the country level (Gross Domestic Product-GDP) factor. Using a Granger causal test, we find that the relationships among the four factors are not symmetric; especially, factors of larger scopes have more significant effects on the ones of smaller scopes than vice versa. This therefore shows that global firms tend to locate at the leader city with access to the big market of the national economy.

Keywords: Global firms, World city, Dynamic factors, Beijing

1. Introduction

World city is the final node on the urbanization and globalization path. It shows how a city moves from the local and regional scopes to a global one, a phenomenom defined by the distribution of global firms in the city. A world city thus becomes a command center for global firms of Advanced Production Service (APS) and innovation, in addition to hosting the market for leading production sectors. The connection between global firms and the host city thus underpins the globalization of the host country reflecting the importance of the city in the global economy. Many studies show that factors such as cost, innovation and markets of the host country determine the location of global firms (Antras, Fort, & Tintlenot, 2014; Aslesena & Harirchi, 2015; Friedman & Wolff, 1982; Giovannettia, Ricchiutia, & Vekucchi, 2013; Sassen, 2002; Peter, 1995; Taylor, 2004). It is however not certain whether a local city and its hinterland have a direct impact on the location of global firms. It is difficult to know the potential growth of global firms in the city without these factors impacting together.

As the capital of China, Beijing is rapidly becoming an important player in global affairs. Its growth and positioning as a world city makes her an import part of the emerging economies. The city has over the past decade been strategically positioned as a world city with the view of accelerating the pace of transition from a local city to an international one. In fact, since 2008, Beijing has greatly increased the internationalization extend. According to the state's overall strategic goal of modernization, by 2050 or so, Beijing will be built into a comprehensive and sustaibanle city with economic, social and ecological coordination, so as to enter the rank of world city (Yao and Shi, 2012, p.2). As global firms are becoming "stateless", Beijing is thus a good case to explore the relations between global firms and factors of the host city and its hinterlands.

Several indicators show that as a country rises in global affairs, its main cities are thus offered a chance to interenationalise (Yao and Shi, 2012). The rise of the Chinese economy makes it imperative for its main city, Beijing, to become a world city. However, the impact of global firms in this transition of Beijing is not very well understood. In this paper, we investigate the relationships between global firms and Beijing and its hinteland as it enters the rank of world city. This will help explain how a local city and its hinterland grow to become a world city in a transition economy.

We use data from the Beijing Statistical Yearbook for the periods 1988 to 2014 to evaluate global firms, service sector and world city progress of the host city; whiles data from the China Statistical Yearbook for the same period is used to evaluate the national economy of the host country. In the next section, we introduce world city conceptually which is embedded on some dynamic networks. We then present the data, empirical analysis and discuss the findings.

2. Literature Review

The study of location factors of the host countries impacting on global firms have widely been investigated by many scholars (Bevan, Estrin, & Meyer, 2004; Bevan & Estrin, 2004; Cantwell & Iammarino, 2000; Denisia, 2010; Kang, & Jiang, 2012; Majocchi & Strange, 2007; Meyer & Nguyen, 2005; Porter, 1994; Resmini, 2000), however, the factors of global connection within their cities and the hinterlands have been widely unrecognized. Even fundamental aspect of firm's location choices are largely overlooked in the literature. Global firms' performance and local bsiness have been found to reinforce each other (Mataloni, 2011), when local business and host countris are taken as the hinterlands of these firms, the conclusion is that size of the hinterlands is one of the impacting factors on global firms (Antras et al., 2014). Firms and provincial heterogeneity have been found to shape the internationalization of firms (Giovannettia et al., 2013), however, local and international networks influence firm internationalization processes in different ways (Anderssona, Eversb & Griot, 2013). These evidences show that global firms are impacted by the hinterlands as well as the connection of their hinterlands globally since world cities are the basic locations of global firms. Unfortunately, these evidences are conducted in isolation. No studies show the combined effectiveness of these factors on the location of global firms together.

In developing a ''world city hypothesis'' from the view of regional division of international labour force, Friedman & Wolff (1982) argued that the form and extend that a city being integrated with the world economy would determine all the new spatial structure of the city; corporate headquarters and famous banks would locate at high-end city, with a number of these organisations, world city would be re-identified. Firms in the service sector have been found to be the fundaments of a world city with the presence of financial centers and business centers forming the basic definitional elements (Sassen, 2002). These arguments insist that the main determinants for a world city depend on global firms' distribution in the service sector which indicates the service capabilities of a city in the world economy. Intuitively therefore, the function and roles of both service and global firms in a city have been directly included in the definition of a world city. However, these insistences excluded the relations between the host city and the hinterlands.

The connectivities among cities by global firms have been found to be explained by the dynamics in trading with and among cities and their hinterlands (Jacobs, 1984). While the typical trade-policy agenda is shaped along the lines of export interests, one of the key roles of a global city is to be an intermediate for imports and foster greater capacity for adaptation in domestic economic production by bringing the world to a local economy. This is not to suggest that the city itself does not have export interests, or that it does not help to foster export interests. But what distinguishes the role of the global city from other economic entities is its disposition to intermediate adaptation – to act as an "import replacer" (Erixon, Ferracane & ECIPE, 2014, p. 5). However, these results failled to explain the causal relations among global firms, their host cities and the speres of hinterlands empirically. Castells (1999) using flowing space, explained the network of cities during formation age suggesting that the city was nodes of the network, which is a flowing space. Obviously, the contents of the flowing space are thus the global businesses. However, Castells failed to stress it. Krugman (1993) argued that the second nature of city, which was defined by the city's relations in the city network, might depend on previous development at the location (e.g. the availability of specialist suppliers) or on the spatial structure of the economic system more generally (e.g the benefits of goods access to a large market). Here, a large market indicates the hinterland beyond the city implying that the city relations depend on market size. These arguments imply that the factors of hinterlands do determine the dynamics of global firms which organise the second nature of city. Heidi and Gouya (2015) found that global linkages do indeed impact the degree of novelty of innovation for ICT firms but with a modest effect. These studies could not provide the effects of these factors on the location of global firms; specifically, no evidences in these studies indicate the combined impaction of these factors at different levels. Thus, the factors at different levels of hinterland context are necessary to be included in the framework of global firms' dynamic factors.

Taylor (2004) suggests four agencies at diferent levels in explaining the world city network by the distribution of global firms. Service firms, city governments, service sector institutions and nation-states were primarily responsible for shaping the world city network measured by global firms' distribution at these cities. Taylor just defined the causal connection between firms and city; identiy relations between firms and state, state and city, firms and sector,

sector and city respectively. The work however did not establish causal relations among global business and context factors of their hinterlands; neither provided any proofs for his suggestions. The study of Yao and Shi (2012) shows that global firms have a consistency with the national economic sizes and this consistency changes with context factors of the host cities. This suggests that compared with the city and context factors, national context factors correlate well with global firms. In order to make an exact description of the context factors at the host city and country levels, it is necessary to do a causal test for these factors. The test will provide detailed description about the factors of four scopes impacting on global firms based on the work of Taylor (2004).

3. Definition of Factors and & Hypotheses

Global firms, service sector at the host city, world city progress of the host city and the national economy of the host country are defined as the four dynamic factors at four levels involved in the causal test. Global firms measured at the micro-level denote the strategic location of these firms' decision. Service sector of the host city is defined as the function of the host city's service sector contributions in global business. The host city's factor is measured by its progress as a world city command centre. Lastly, national economy is defined by the size of the economy as the hinterland for flowing space during globalization. Theoretically, Jacobs (1984) provided five great economic forces of the hinterland to the city and argued that they depended on the economic landscape of the hinterland in which the city existed. However in practice, all businesses and cities have the marks of their national origin in their workings (Dichen, 1998).

In summary, the relations among the four dynamic factors at four levels are organised in the flowing framework:
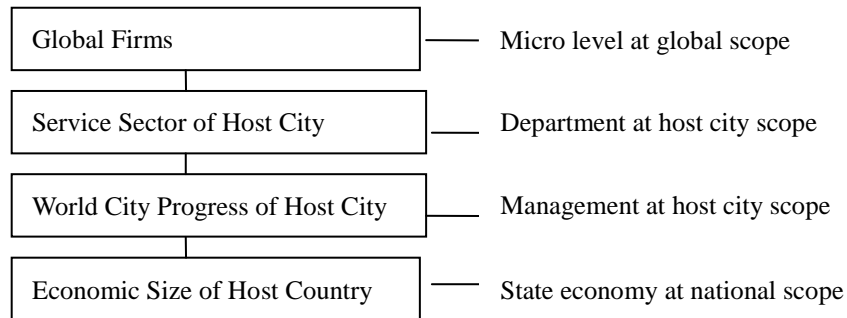

Figure 1. Framework of Factors at Four levels

Figure 1 shows that from firms, service and city to country levels, the scopes of factors become wider whiles the scopes from country, city and service to firm levels become narrower on the same path. It thus follows that the relations among the factors depend on the distances among the scopes which leads us to our hypotheses for establishing a causal relations or otherwise.

We pose three hypotheses:

H1: All the relations between each pair of the factors are two ways causal relations with all the four factors equally involved in forming a complicated network of relations.

H2: All the relations are one way causal relation.

H3: Some of the factors are two ways and others are one way causal relations.

4. Data and Measures

As already stated above, we use data from the Beijing Statistical Yearbooks for period 1988 to 2014 and China Statistical Yearbooks for the same period. The databases contain detailed information on all socio-economic activities at all sectors (primary, secondary and tertiary sectors of the economy, e.g.) and are published by the respective government agencies annually.

At the global firm level we use the number of resgistered foreign firms in Beijing at every particular time to indicate the city's movement towards internationalization. Service sector growth in any economy is regarded as progress towards high-end productivity and so we use the value of the service sector's contribution to the economy of Beijing to represent the progress of the city. The country as the hinterland of the host city is measured by the GDP at the national level. In measuring the city's world city progress, we use the city competitiveness index largely adopted by literature (Peter, 1995; oral & Habib, 1996; Hao & Ni, 1998; Ning, 2001; Tu, 2004 & 2009; IMD, 2010; Ni, 2010)

and world city index (Yao & Shi, 2012). Table 1 explains the variables in the index of world city progress. All the values are annual growth rates.

Table 1. Index of world city progress (%)

First class Indicators	Weight	Second class indicators	Weight
Openness	0.2	Trade dependence	0.50
		FDI dependence	0.50
Creativity	0.2	Total population	0.20
		Population of University Students to total population	0.40
		Patents number	0.40
Economic vitality	0.2	GDP	0.20
		GDP/person	0.20
		Total Investment	0.20
		Employee of tertiary industry to total population	0.20
		Financial trade and assess	0.20
Basic Infrastructure	0.2	Transit length (road and rail)	0.50
		Telecommunication value	0.50
Social Equity	0.2	Doctors every 1000 residents	0.25
		Consumption price index(CPI)	0.25
		Engel Coefficient	0.25
		Gini Coefficient	0.25

Note: the Engel coefficient and Gini coefficient have opposite direction with other indicators, so we use negative values in the calculation.

As shown in Table 1, the first class indicators consist of five parameters: openness which defines the economic controlling power of Beijing, creativity which defines the innovation capacity of the city, economic vitality which defines the essentiality of economic activities in the city, basic infrastructure which defines the capacity of the city to grow or expand, and social equity which defines the city's goal of urban development. All the variables are equally weighted at 0.20. The second class indicators consist of all sixteen (16) elements with weighted values for each sub-indicator.

Table 2. Summary description of the four indicators

	Max.	Min.	Mean	S.D.	Obs.
Firms (number)	5755	85.3	3128.01	1904.58	27
Value of tertiary sector (100 million Yuan RMB)	16627	138.5	4569.05	5124.64	27
Index value of world city (%)	1841592	14480.52	464669.7	525200.3	27
National GDP value (100 million Yuan RMB)	643974	12174.6	187327.6	191247.3	27

Considering the complex nature in data gathering in China, we acknowledge the importance to the stationarity of the dataset in order to perform a reliable Granger causal test. In this regard, the appropriate methodology is to use the Augmented Dickey-Fuller (ADF) test.

The Dickey-Fuller 't-statistics' for the significance of ρ is based on the estimated model.

$$\Delta x_t = \alpha + \pi x_{t-1} + \varepsilon_t \tag{1}$$

Alternatively, in the case of autocorrelation in the observed series, Δx is estimated by the augmented Dickey-Fuller model:

$$\Delta x_t = \alpha + \pi x_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta x_{t-i} + \varepsilon_t \tag{2}$$

The null hypothesis is that $x_t = x_{t-1} + \varepsilon_t$ where $\varepsilon_t \sim NID\ (0, \sigma^2)$. Under the null $\hat{\pi}$ will be negatively biased in a limited sample, thus only a one sided test is necessary for determining $H0: \pi = 0(x_t \sim I(1))$ against $Ha : \pi < 0.\ (x_t \sim I(0))$. This model is less restricted, because it allows a deterministic trend as $x_t = \alpha t + \pi x_{t-1} + \varepsilon_t$. The critical values are tabulated in Fuller (1976), p.373 and also in Benerjee et al (1993) p. 103. The critical value at 5% and 27 observations is -3.00. Table 3 presents the result of the ADF test.

Table 3. ADF result for unit root test

Variable	Test Type	t-Statistics	Prob.	Conclusion
Firms	level	-2.210	0.2028	N
	1st difference	-4.365	0.0003	Y
	2nd difference	-6.372	0.0000	Y
Service	level	11.093	1.0000	N
	1st difference	-0.943	0.7736	N
	2nd difference	-5.884	0.0000	Y
City	level	4.448	1.0000	N
	1st difference	-3.428	0.0100	N
	2nd difference	-8.785	0.0000	Y
Country	level	9.003	1.0000	N
	1st difference	-1.143	0.6975	N
	2nd difference	-5.790	0.0000	Y

Note:1% critical value is -3.750, 5% critical value is -3.000, 10% critical value is -2.630; Y indicates static, N indicates non-static.

Table 3 shows that the ADF values of the 2nd difference about the four variables are more than the test critical values at the level of 1%. It denotes that those values of global firms, service or tertiary sector of Beijing, world city index of Beijing and the GDP value of China during the 27 years of 1988-2014 are $I(2)$ static. This result allows for the process of co-integration analysis of the dataset.

5. Co-integration Analysis

Once variables have been classified as integrated of order $I(0), I(1), I(2)$ etc., it is then possible to set up models that lead to stationary relations among the variables, and where standard inference is possible. In order to find a broader classification of co-integration for the variables, Johansen co-integration test is used. It follows that:

$$x_{1,t} = \beta_1 + \beta_2 x_{2,t} + ... + \beta_p x_{p,t} + u_t \tag{3}$$

Where, p is the number of variables in the equation. We assume I(1) and might cointegrate to form a stationary relationship, and a stationary residual term $\hat{u}_t = x_{1,t} - \beta_1 - \beta_2 x_{2,t} - ... - \beta_p x_{p,t}$. This equation represents the assumed economically meaningful (or understandable) steady state or equilibrium relationship among the variables. If the variables are cointegrating, they will share a common trend and form a stationary relationship in the long run. Furthermore, under cointegration, due to the properties of super converge, the estimated parameters can be viewed as correct estimates of the long-run steady state parameters, and the residual (lagged once) can be used as an error correction term in an error correction model (Sjö, 2008, p. 10).

The second step, in Engle and Granger's two-step procedure, is to test for a unit root in the residual process of the cointegrating regression above. For this purpose set up a ADF test like (4).

$$\Delta \hat{u}_t = \alpha + \pi \hat{u}_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta \hat{u}_{t-i} + v_{t1} \tag{4}$$

Where, the constant term α (in most cases) can be left out to improve the efficiency of the estimate. Under the null of no cointegration, the estimated residual is $I(1)$ because $x_{1,t}$ is $I(1)$, and all parameters are zero in the long run. Finding the lag length so the residual process becomes white noise, it is extremely important. The empirical t-distribution is not identical to the Dickey-Fuller, though the tests are similar. The reason is that the unit root test is now applied to a derived variable, the estimated residual from a regression. Thus, finding a significant π implies co-integration. The alternative hypothesis is that the equation is a cointegrating equation, meaning that the integrated variable $x_{1,t}$ cointegrates at least with one of the variables on the right hand side. If the dependent variable is integrated with d > 0, and at least one regressor is also integrated of the same order, cointegration leads to a stationary $I(0)$ residual. But, the test does not tell us if $x_{1,t}$ is cointegrating with all, some or only one of the variables on the right hand side. Lacking of cointegration means that the residual has the same stochastic trend as the dependent variable. The integrated properties of the dependent variable will if there is no cointegration pass through the equation to the residual. The test statistics for *H0: $\pi = 0$* (no co-integration) against *Ha: $\pi < 0$* (co-integration), changes with the number of variables in the co-integrating equation, and in a limited sample also with the number of lags in the augmentation *(k > 0)* (Sjö, 2008, p. 11). Table 4 presents the result of the Johansen cointegration test.

Table 4. Johansen test for cointegration of the four variables

Maximum rank	Parms.	LL	Eigenvalue	Trace statistic	5% critical value
0	20	-972.0983		76.7234	47.21
1	27	-949.58746	0.82300	31.7017	29.68
2	32	-937.50082	0.60534	7.5284***	15.41
3	35	-934.09222	0.23064	0.7113 ***	3.76
4	36	-933.73659	0.02699		

***indicates significance at the level of 5%.

Table 4 shows that at least there are two variables in the model which exhibit cointegration or move together in the long run therby rejecting the null hypotheses of no or only one cointegation. To further test the level of cointegration between the pairs of variables in the model, we organise the variables as follows:

$$firms_t = \alpha + \beta(service)_t + \varepsilon_t \tag{5}$$

$$firms_t = \alpha + \beta(city)_t + \varepsilon_t \tag{6}$$

$$firms_t = \alpha + \beta(country)_t + \varepsilon_t \tag{7}$$

$$service_t = \alpha + \beta(city)_t + \varepsilon_t \tag{8}$$

$$service_t = \alpha + \beta(country)_t + \varepsilon_t \tag{9}$$

$$country_t = \alpha + \beta(city)_t + \varepsilon_t \tag{10}$$

The residuals for the six equations $\varepsilon_{5,\,10}$ are then tested for the existence of any cointegration of each pair. Table 5 presents the result of the test.

Table 5. ADF test for the six pairs of variables

Variable E	t-Statistic	P>|t|	Type of test (c,t,k)	conclusion
E1	-5.231***	0.000	(0,0,2)	Y
E2	-5.147**	0.000	(0,0,2)	Y
E3	-5.137***	0.000	(0,0,2)	Y
E4	-4.682**	0.0001	(0,0,2)	Y
E5	-2.847*	0.0518	(0,0,2)	Y
E6	-3.302**	0.0148	(0,0,2)	Y

Note: 1% critical value is -3.750, 5% critical value is -3.000, 10% critical value is -2.630. ***, **, * indicate 1%, 5% and 10% significance levels respectively. Y indicates static, N indicates non-static, *c* indicates constant, *t* indicates *t* variable, *k* indicates lag.

Table 5 shows that equations (5) and (7) are static at 1% significance level, equations (6), (8) and (10) are static at 5% significance level, and equation (9) is static at 10% significance level. These results thus mean that there are ointegration between each pair of variables.

The analyses above of the factors in the model lead us to conduct a causal relation test to establish the level of relationship among the factors, the main aim of this paper. The next section presents the findings and analysis.

6. Causal Test and Findings

Taylor (2004) defined six pairings with four factors and divided them into two types of cconnections with two causal nexuses and four identity assignments. However, the work failed to test the model with empirical data. In order to test the causal relations among the four factors, Granger causal test is used in this paper. In China, the policy period mostly is five (5) years and as such the most important plan is the Five-Year Plan all over the country. In order to keep enough freedom for the model, the lags of 1-5 years is selected to match the policy period. The results of the Granger causal test are presented in Table 6 below:

Table 6. Granger test for causal relations among the four factors

variables	hypothesis	lags	Chi2	P>Chi2	conclusion
firms vs. service	service is not granger cause of firms	4	5.921**	0.205	accept
		5	193.33***	0.000	reject
	firms is not granger cause of service	4	82.975**	0.000	reject
		5	2780.2***	0.000	reject
firms vs. city	city is not granger cause of business	4	5.5918*	0.232	accept
		5	225.91***	0.000	reject
	firms is not granger cause of city	4	28.308	0.000	reject
		5	142.33**	0.000	reject
firms vs. country	country is not granger cause of firms	4	9.2924**	0.054	accept
		5	143.57*	0.000	reject
	firms is not granger cause of country	4	51.259	0.000	reject
		5	431.82	0.000	reject
service vs. city	city is not granger cause of service	4	27.614	0.000	reject
		5	1226.2*	0.000	reject
	service is not granger cause of city	4	49.047**	0.000	reject
		5	182.4***	0.000	reject
service vs. country	country is not granger cause of service	4	49.047	0.000	reject
		5	236.45*	0.000	reject
	service is not granger cause of country	4	113.68	0.000	reject
		5	776.81	0.000	reject
country vs. city	city is not granger cause of country	4	17.307	0.002	reject
		5	165.33**	0.000	reject
	country is not granger cause of city	4	51.046**	0.000	reject
		5	236.45	0.000	reject

Note: The results with 1-3 lags are omitted due to their insignificance. ***, **,* represent significance levels of 1%, 5% and 10% respectively.

The causal test shows that there are no significant effects among the four factors wth 1-3 lags. It suggests that the four factors do not affect each other in the short term of three year periods. There are siginificant effects for 4-5 years lagged; with the effects being very significant at 5 years lagged than 4 years lagged. This shows that the four factors

affect each other within a longer term period. Meanwhile, among the effects for four years lagged only service sector impact city and firms. On the contrary, all effects are shown to be five years lagged. Two ways effects are seen to be present between the pairs of firms and service, service and city, city and country, as well as firms and country; one way effects are present between the pairs of city and firm, country and firms, and lastly between country and service.

The result thus means that we can reject Hypotheses 1 and 2 which stipulate that all factors exhibit two ways and one way causal relations respectively and accept Hypothesis 3 that the factors exhibit either a two ways or one way causal relation. This result is presented in the schema figure below:
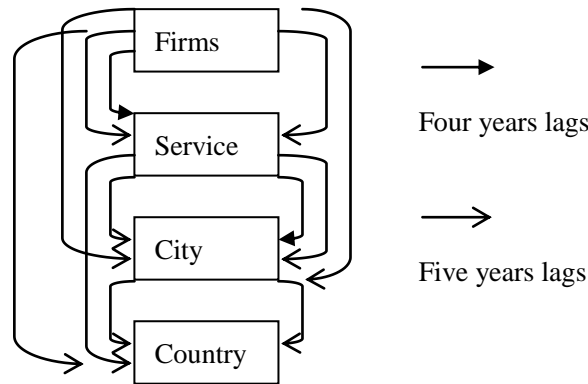

Figure 2. Schema of causal relationships among the four factors

The figure shows that the country factor affects the firm, service and city factors. However and interestingly, the firm factor does not affect the country factor; neither does the service factor affect the country factor. This analysis shows that the factors at the wide scopes have more effects on the ones at the narrower scopes than vice versa.

7. Conclusion and discussion

The results of this paper show that the case of Beijing supports hypothesis 3 that the relationships are either two ways or one way causal relation. Factors of larger scopes have more significant effects on the ones of smaller scopes. The factors between closer scopes have more effectiveness than the ones between further scopes. Meanwhile, the effectiveness at closer scopes is shorter term and vice versa. Again, the effectiveness of factors at larger scopes is more significant than the ones at smaller scopes and vice versa. Hence, we conclude that the relationships among the four factors are not symmetric among levels, neither among causal effects; global firms are mainly determined by their host city and the hinterlands and not vice vesa. It is the host hinterland features that are denoted as the dynamic factors of global firms.

Among the four level factors, national economy impacts on the world city progress of the host city and the openness of the host city impacts its service sector; together, they have long term effects on global firms' location decisions. This supports Krugman (1993) argument that large market is denoted as the feature at state scope other than the city itself. That is to say, the size of the city depends on the size of the hinterland, the larger the hinterland the larger the city, which affetcs its market size. Therefore, global firms tend to locate at the leader city which has access to the big market of the national economy. Meanwhile, the country does not follow global firms especially in the long term.

The result of this study based on the data of Beijing, it will thus be very important to test the hypotheses with data from some other big cities in China like Shanghai, Guangzhou and Chengdu. Further study can also be conducted on some of the lower tier cities which have very different characteristics from the tier-1 cities. Moreover, since the type of business depends on the different markets which connect their hinterlands, it is expected that when different types of firms at various sectors are included into any future study, the results will be more availiable for various global firms.

Acknowledgements

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