Correlation between Sales of Foreign Affiliates and Productivity of Multinational Firms: Evidence from Korean Firm-Level Data[*]

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Using firm-level panel data for Korean multinational enterprises (MNEs), we make a distinction between being the only affiliate of a parent firm and being one of the multiple affiliates of a parent firm. In particular, we attempt to find a correlation between the sales of foreign affiliates and the productivity of multinational firms. Our main empirical results in this paper suggest that productive Korean MNEs would enlarge the number of affiliates in the host country.

Keywords: Foreign Direct Investment, Multinationals, Firm Productivity, Location Decision
JEL Classification: F23, D22, O53

I. Introduction

Korea's multinational enterprises (MNEs) have consistently increased their foreign direct investment (FDI) since 1994.[1] In 2010, the FDI outflow of Korean

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[1] The FDI outflow of the World as well as that of Korea has shown an upward trend, except for

MNEs was 23.2 billion dollars, and 2,855 foreign affiliates were newly established by Korean MNEs.[2]

In order to explain FDI and the multinational activities of MNEs, recent literature in international economics has emphasized differences in firm productivity, suggesting that it is productivity differences between MNEs that impact the parent firms' decisions on whether to export or to directly invest in foreign countries. According to the seminar paper of Helpman et al. (2004), only firms that are productive enough to control fixed costs of investment, such as construction and management costs in foreign markets, are able to establish foreign affiliates. Yeaple (2009) finds that the more productive U.S. firms show greater scope (number of affiliates) and scale (size of affiliates) in their multinational activities.

In this paper, when analyzing Korean data, we note that Korean MNEs' investments tend to be concentrated in a limited number of countries, such as China or the U.S. Therefore, while following the literature on productivity heterogeneity as a determinant of FDI choices, we further investigate whether the FDIs of Korean MNEs have been concentrated in one country. In particular, we choose China as a destination for FDI, since it is known that the main host country for Korean FDI has been China. In this context, we begin with an idea that the establishment of *multiple* affiliates in a specific host country may also be related to the parent firm's productivity. In so investigating this idea, we will compare the productivity levels of two groups of MNEs, that is, companies with single affiliates and those with multiple affiliates. In particular, we will examine the correlations between the sales of foreign affiliates and productivity levels of Korean MNEs for each of the two groups.

Our main empirical result in this paper suggests that Korean MNEs that are more productive are more likely to enlarge the number of affiliates in the host country. We conjecture that regionally concentrated FDIs of an MNE may yield benefits related to information and network advantages.[3] According to existing theories such as Helpman et al. (2004), firms that are more productive invest in foreign markets, rather than selling in the domestic market, and they are able to cover the higher fixed cost required for foreign investments. That is,

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a sharp drop during the financial crisis.

[2] FDI report 2010, Export-Import Bank of Korea.

[3] Note that we do not intend to show information and network advantages as determinants of multiple affiliates in the current paper. We simply give reasons for a firm to save their otherwise high fixed costs when FDIs are regionally concentrated by having multiple affiliates.

the firm may need to incur higher fixed costs when it invests in multiple affiliates rather than in a single affiliate. Regionally concentrated FDIs, however, can help in reducing the cost incurred for two reasons. First, the firm can save the fixed cost of information, because it is relatively easy for an affiliate to obtain information from existing affiliates about the same host country. Second, the firm may enjoy complementarity in production processes among its affiliates located in the same host country, as compared to the case where FDIs are spread to many countries.

We organize this paper as follows. First, in section 2, we will review the existing literature regarding firm heterogeneity and FDI. We will then move on to show a data description for Korean MNE activities in section 3. We will also begin our empirical studies with Korean MNEs' data and investigate how firms invest in international markets in general. Section 4 will focus on explaining the distribution of Korean affiliates located in China and compare the sales of an affiliate and the productivity of its Korean counterpart. We conclude in Section 5 by summarizing the results and commenting on some limitations of the current analysis.

II. Literature Review

There are many existing studies on theoretical models and empirical evidence about the relationship between productivity differences and MNEs' multinational activities. Here, we review the literature directly related to our research question on FDI. In the area of international economics, Melitz (2003) and Helpman et al. (2004) were among the first to emphasize productivity differences among firms. They showed that the most productive firms undertake FDI, less productive firms engage in exports (or foreign outsourcing), and the least productive firms operate in the domestic market. This hypothesis has been empirically tested and confirmed by Girma et al. (2004) for Irish plants, Girma et al. (2005) for UK, Wagner (2006) for Germany, Tomiura (2007) for Japan, and Chun and Oh (2012) for Korea[4].

While the aforementioned studies explain the ranking of heterogeneous firms investing in foreign markets, Yeaple (2009) empirically investigates the relations between heterogeneous U.S. MNEs' multinational activities and the host

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[4] One of the earlier works in this branch of literature is Aw et al. (2000), in which Korean and Taiwanese plant productivities in export markets are examined. About the vertical structure and foreign ownership in Korea, see Chun and Oh (2012).

country's characteristics, based on the firm heterogeneity model from Helpman et al. (2004). He finds that the more productive U.S. firms show greater scope (number of affiliates) and scale (size of its affiliates) in their multinational activities. In addition, he verifies the "pecking order" among U.S. MNEs. In other words, the data show that the more productive firms tend to invest in countries that are considered to be tougher markets. For example, host countries that are at a greater distance from the home country and have a smaller GDP and GDP per capita are considered as tougher markets owing to higher transportation costs, smaller market size, and smaller effective demand, respectively. Yeaple (2009) also uses aggregated U.S. firm data to confirm the specific country characteristics that affect multinational activities. Chen and Moore (2010), also based on Helpman et al. (2004), have empirically investigated the productivity distribution of French MNEs and their multinational activities, and focused on how productivity differences among MNEs may lead to differential effects on host-country attributes, and consequently, distinct choices of foreign locations for production. However, contrary to Yeaple (2009), by adopting various methods such as using past production performance data at home and in controlling unobserved country, and firm heterogeneity, Chen and Moore (2010) contribute to clarifying the ambiguous causality between firm productivity and FDI activity.

Other studies also deal with heterogeneous firms' FDI activities, as well as types or strategies of FDIs, and the location decisions of MNEs. Yeaple (2003) explains an FDI strategy of complex integration, which combines vertical and horizontal integration strategies. Vertical and horizontal integrations are different in their motivation of investment. The motivation of a firm involved in vertical integration is exploiting a factor price difference in a host country; whereas that of a firm involved in horizontal integration is saving cost from international trade. Assuming that the home country is one of the developed countries in the North, an MNE can choose four strategies. By using a three-country model with two developed countries of the North and one developing country of the South, Yeaple (2003) answers a question about the circumstances in which an MNE would choose complex integration strategies. He points out that transportation cost is an important factor in explaining the behavior of MNEs that choose the complex integration strategy. Ekholm et al. (2007) use a similar model to argue that multinationals' choice of FDI types depends on transport costs, relative fixed costs of different FDIs, and unit costs of production. Grossman et al. (2006) modify and extend Yeaple's (2003) study. They design

a more complicated model with an intermediate good and a final good and introduce the concept of export-platform FDI. They show that firms with different productivity levels may choose different integration strategies. Aw and Lee (2008) further modify the model of Grossman et al. (2006) by focusing on reflecting circumstances of a middle-income country, using Taiwanese data in 2000. They explicitly model the effects of firm heterogeneity and different productivity levels across countries on MNEs' choice of different production locations and FDI strategies. According to the study, among the Taiwanese firms that invest in either China, the U.S., or both countries, the most productive firms invest in both countries, the less productive firms invest in the U.S. or China only, and the least productive firms choose to be domestic firms.

One main difference between the existing literature and our work is that we found that parent firms with higher productivity increase the number of affiliates in a specific country, whereas existing studies focus on parent firms with higher productivity investing in a wider range of host countries. Why do they tend to agglomerate in a host country? A potential explanation may be benefits arising from information and network advantages. Based on the existing theories of FDI choices, one may think that having multiple affiliates requires incurring higher fixed costs, and thus, only high-productivity firms can make such choices. Thus, reducing costs may matter in this case. In this context, information and network advantages from agglomeration may be important for firms to incur lower fixed costs of information gathering in foreign markets and to enjoy the complementarity effect among foreign affiliates located in the same host country. In this paper, we do not intend to show the two cost advantages as the main determinants of choosing multiple affiliates: we will simply examine whether or not a firm choosing multiple affiliates is more productive than a firm with a single affiliate.

III. Empirical Specifications and Data for Korean MNEs' Activities

In this section, we first describe two empirical specifications of the MNE model used in Yeaple (2009). These are a cross-country regression model for the aggregated sales of affiliates and a panel fixed-effect model for the individual sales of an affiliate. After that, we provide an analysis of multinational activities of Korean MNEs in China. We test a probit panel model for a choice of multiple affiliates and a linear regression model for the number of affiliates in China. We begin this section by explaining the empirical specifications, variables used

in the regression models, and data for Korean MNEs' activities.

1. Cross-country regression model for affiliates' aggregated sales

First, a unique feature of Yeaple's (2009) theory of MNEs is that it takes into account the country characteristics that may affect the structure of multinational activity across countries. The first mechanism for this is related to country-specific scale, which is measured using data on the aggregated sales of affiliates in country j and the aggregated sales of their parent firms in country h. The second mechanism is the effect of the magnitude of country-specific fixed costs relative to the measure of unit cost saving of multinational activity. Hence, our first econometric specifications regarding the two mechanisms derived in Yeaple's (2009) model are as follows:

$$\ln\left(\frac{S_j}{S_h}\right) = \beta_0 + \beta_1 \ln(\mathrm{GDP})_j + \beta_2 \ln(\mathrm{GDP\ per\ Capita})_j + \beta_3 \ln(\mathrm{Distance})_j + \varepsilon_j$$

$$\ln\left(\frac{S_j}{N_j}\right) = \beta_0 + \beta_1 \ln(\mathrm{GDP})_j + \beta_2 \ln(\mathrm{GDP\ per\ Capita})_j + \beta_3 \ln(\mathrm{Distance})_j + \varepsilon_j$$

We conduct a cross-country regression, where the error term, ε_j follows a standard normal distribution, using 26 countries in our sample dataset. S_j is aggregated affiliate sales in country j, S_h is aggregated parent firm sales in the home country h, and N_j is the aggregated number of Korean affiliates in country j. The logarithms of gravity variables of *GDP*, *GDP per capita*, and *Distance* are included as country characteristics. The coefficients of β summarize the effects of country characteristics on the scale of affiliates in the first model, and the relative size of the concentration cost versus proximity benefits of FDI in the second model. The results are summarized in Table 4.

2. Panel fixed-effect regression model for an affiliate's individual sales

Second, when explaining the investment behavior of individual Korean MNEs, the most important assumption that Yeaple (2009) makes is that every firm in a country has different productivity. The model predicts that the intensity of FDI for an individual MNE is positively correlated to its productivity level. The model produces an equation that the firm's sales revenue is proportional to its productivity index. Thus, our empirical model derived from the MNE

theory can be organized as follows:

$$ln(\text{Affiliate Sales})_{ijt} = \alpha + \beta ln(\text{Parent Firm Sales}_t^{C_i}) + \varepsilon_{ijt}$$
$$ln(\text{Affiliate Sales})_{ijt} = \alpha + \beta (\text{Parent Firm TFP})_t^{C_i} + \varepsilon_{ijt}$$

We will conduct a panel fixed-effect regression, where ε_{ijt} is assumed to be $\varepsilon_{ijt} = \mu_i + \tau_t + \epsilon_{ijt}$. That is, the affiliate-fixed effects (μ_i) and year-fixed effects (τ_t) are introduced. Note that we drop the host-country fixed effect due to a high collinearity with the affiliate-fixed effect. The superscript *Ci* indicates a company (C) that owns an affiliate (*i*). For example, notations of C1 and C2 imply that the company C owns affiliates 1 and 2.

Note that here, for the Korean firm's TFP (total factor productivity), we followed Yeaple's (2009) TFP calculation method. It is derived from the difference between the observed value and fitted value from the regression of the natural logarithm of sales (output) on the logarithm of fixed assets (capital), and the logarithm of the number of workers with year dummies. We used 168 parent firms in our sample: the coefficients on the TFP regression are 0.3748 and 0.6229 respectively. The results are summarized in Table 5.

3. Probit panel regression model for a choice of multiple affiliates in China

Third, we consider Korean MNEs' activities in China as a case study. We choose China as the main host country of interest in this study, since 40% of the foreign affiliates in the whole industry are located in China. Considering only the manufacturing industry, 58% of all foreign affiliates are in China. In analyzing the activities of Korean MNEs in China, we will investigate the correlations between purchases and sales to capture the multinational activities of Korean foreign affiliates in the host country.

Specifically, we try to test a hypothesis that productive Korean MNEs would decide to have multiple affiliates in the country, rather than a single affiliate. We employ a probit panel regression model as follows:

$$P^* = \alpha + \beta \, ln(\text{Parent Firm Sales})_t^{C_i} + \varepsilon$$
$$P_{it}^* = \alpha + \beta (\text{Parent Firm TFP})_t^{C_i} + \varepsilon_{it}$$

where $P^* = AP^*(\text{Multiple Affiliates}) - AP^*(\text{Single Affiliate})$

$$P_{it} = \begin{cases} 1 \text{ if a parent firm has multiple affiliates} \\ 0 \text{ if a parent firm has single affiliate} \end{cases},$$

$$Prob\,(P=1\,|\,ln(\text{Parent Firm Sales})_t^{C_i}) = F(\alpha + \beta ln(\text{Parent Firm Sales})_t^{C_i}) \text{ and}$$

$$Prob\,(P_{it}=1\,|\,ln(\text{Parent Firm TFP})_t^{C_i}) = F(\alpha + \beta(\text{Parent Firm TFP})_t^{C_i})$$

Here, AP_{it}^* (Multiple Affiliates) is the profit level of affiliate i at time t when it is one of the multiple affiliates owned by its parent firm in Korea, and AP_{it}^* (Single Affiliate) is the profit level for single affiliates. When the individual profit of multiple affiliates is larger than that of single affiliates, the parent firm will choose to invest in multiple affiliates in China. Since we cannot observe its decision before the investment, we use a dummy variable that is equal to one if a parent firm has multiple affiliates and zero if not (i.e., single affiliate). F is a standard normal cumulative distribution function. Since the probit is not a linear model, we cannot interpret the affiliate-fixed effect dummy as usual. Nonetheless, we try to control the year-specific effect by assuming that $\varepsilon_{it} = \tau_t + \epsilon_{it}$.

The model shows the probability of the parent firm of foreign affiliate i at time t to have multiple affiliates, instead of a single affiliate. We analyze the model for a pair of parent and affiliate firms in the same manufacturing sector, and for those in the entire industrial sector, respectively. In order to confirm whether this probability of having multiple affiliates in a specific country increases with an increase in the parent firm's productivity, we restrict the data in the range of foreign affiliates located in China. The results are reported in Table 7.

4. Linear regression model for the number of affiliates in China

Finally, by regressing the logarithm of numbers of affiliates a parent firm possesses in China on the parent firm's productivity variables as follows, we examine the relation between the productivity of a parent firm of Chinese affiliate i and the number of its other Chinese affiliates.

$$ln\,(\text{Number of Affiliates in China})_{it} = \alpha + \beta\, ln(\text{Parent Firm Sales})_t^{C_i} + \varepsilon_{ijt}$$

$$ln\,(\text{Number of Affiliates in China})_{it} = \alpha + \beta(\text{Parent Firm TFP})_t^{C_i} + \varepsilon_{ijt}$$

We use a logarithmic value of the number of affiliates in China, instead of the probability function. Except for this, the other specifications are the same

as before. The results are reported in Table 8.

5. Data for Korean MNEs and affiliates

We use firm-level panel data of Korean MNEs and their foreign affiliates obtained from Korea Export-Import Bank. The data includes information on 401 foreign affiliates and their parent firms, that is, Korean MNEs, from 2005 through 2007[5]. In all, the 401 foreign affiliates belong to 219 parent firms in various manufacturing and service industries. Of these, 229 foreign affiliates and their parent companies are in manufacturing. We separately report our empirical results for the manufacturing companies and for all companies.

For our first analysis regarding the effect of country characteristics on multinational activities, we aggregate the sales of all Korean affiliates in host country j. There are 28 host countries in the aggregated sample. The measure of the number of entrants corresponds to the total number of Korean firms that own affiliates in country j. In addition, average parent-firm sales or TFP is the sales or TFP of the parent firms that have affiliates in country j. The summary statistics for host country variables are shown in Table 1.

Table 1. Host Country's Summary Statistics

	Observation	Mean	Standard Deviation
ln(GDP)	26	20.3946	1.3879
ln(GDP per Capita)	26	9.5300	.8337
ln(DIST)	26	8.3070	.5980
ln(aggregate sales)	28	14.0730	3.0123
ln(number)	28	.9110	1.1774
ln(average parent sales)	28	30.5401	2.7468
ln(average parent TFP)	28	13.1621	2.3315

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[5] Sources for each of the data are as follows: Information on Korean MNEs' foreign affiliates is from Export-Import Bank of Korea. Information on Korean MNEs is from KISVALUE. KISVALUE is Korean firms' information system supported by the National Information and Credit Evaluation Inc. Information on foreign affiliates is from Export-Import Bank of Korea. Information on country characteristics such as real GDP and GDP per capita is from World Development Indicators, and the distance between Korea and the host country is from CEPII.

Comparing the Korean MNEs' foreign activities with those of U.S. MNEs[6], it can be noted that the average GDP and GDP per capita of the countries where Korean MNEs invest is larger than that of the countries where U.S. MNEs invest, and the average distance of the host countries is shorter than that for U.S. MNEs.

For our second analysis on the investment behavior of individual Korean MNEs, we use the panel data that includes information on Korean parent firms and their foreign affiliates. In addition to results for firms in the manufacturing industry, we also provide information on MNEs in all industries, which includes manufacturing and service.[7]

Table 2. Parent Firms' Summary Statistics

	Manufacturing Industry (168)		Whole Industry (219)	
	Mean	Standard Deviation	Mean	Standard Deviation
ln(Parent firm sales)	26.2274	2.0225	26.0160	2.0135
TFP	-.1132	.7696	-.2178	.6810

Table 2 shows summary statistics of the parent firms, with information on the parent firms' sales and TFP. It shows that the averages of parent firm sales and TFP are slightly lower in the whole industry than in the manufacturing sector. There are 168 samples of parent firms, which are Korean manufacturing MNEs. Of these, 121 have only one and 47 have more than one affiliate in the foreign country. The maximum number of affiliates that a parent firm possesses is 22. Appendix - Table 2 shows that parent firms invest in a limited

Table 3. Foreign Affiliates' Summary Statistics

	Manufacturing Industry (229)		Whole Industry (401)	
	Mean	Standard Deviation	Mean	Standard Deviation
ln(affiliate_sales)	10.4060	2.1017	10.1246	1.9062
affiliate_TFP	0.0003	1.9846	-.5141	1.6082

[6] Information on the summary statistics of U.S. affiliates' host countries is listed in Yeaple (2009), Appendix Table 2.

[7] Industry list for the parent firms is in Appendix Table 1.

number of countries, rather than in a wide variety of host countries.

Summary statistics for foreign affiliates in Table 3 show information on both sales and TFP. The TFP of foreign affiliates is measured by exactly the same method as TFP for parent firms. We can see that the average sales and TFP of foreign affiliates in the manufacturing industry are slightly lower than those of foreign affiliates in the whole industry.

IV. Results and Discussion

In this section, we investigate the effect of the host country's characteristics on aggregate affiliate sales of Korean MNEs. The results reported are shown in Table 4.

Table 4. Aggregate Multinational Activity by Component

	(1) Aggregate Sales $ln(S_j)$	(2) Number $ln(N_{hj})$	(3) Average Productivity $ln(S_h/N_{hj})$	(4) Scale $ln(S_j/S_h)$	(5) Average Sales $ln(S_j/N_{hj})$
GDP	.5031* (.3262)	.3911*** (.1842)	.1590 (.4425)	-.0470 (.2137)	.1120 (.3093)
GDP per Capita	-.5906* (.4334)	.1421 (.2506)	-.3109 (.6056)	-.0307 (.2861)	-.3416 (.4375)
DIST	-1.3712** (.8311)	-.8127*** (.3230)	-1.2300 (.9854)	.6716*** (.3419)	-.5585 (.7802)
N	26	26	26	26	26
R2	0.2117	0.4480	0.1028	0.1321	0.0590

Notes: Heteroskedasticity robust standard errors are shown in parentheses. Aggregate sales correspond to local affiliate sales of all manufacturing affiliates owned by Korean parent firms. All independent variables are in logarithms. By construction, the coefficient estimates in column (1) are equal to the sum of the coefficients in columns (2)-(4). The coefficients in columns (4) and (5) have structural interpretations as Scales and Relative Costs. * indicates 90%, ** indicates 95%, and *** indicates 99% significance.

Column 1 reports the coefficient estimates obtained by regressing aggregated multinational sales on the set of the gravity variables of host countries. We found that: (i) local affiliate sales of Korean multinationals increase with the GDP level of the host country and decrease with distance, and (ii) local affiliate sales of Korean multinationals decrease with the GDP per capita. We also observed that a 10% increase in GDP is associated with a 3.9% increase in

the number of Korean affiliates present in that country (column 2) and a 5.0%
increase in the sales of those affiliates (column 1), implying that the average
affiliate size increases by approximately 1%. Considering that the aggregated
sales of column 1 can be decomposed into columns 2, 3, and 4, and that
coefficients in column 2 are in general more than half the size of the coefficients
in column 1, the variation in the extensive margin (the number of entrants)
explains more than half of the variation in affiliate sales, except for the variable
of GDP per capita.

   Column 3 reports the results from a regression of the average productivity
of parent firms (as measured by those firms' sales in Korea that own an affiliate
in a given country) on the gravity variables. However, the results are not
statistically significant. Column 4 reports the coefficient estimates from the
specifications relating the logarithm of scale to the set of country characteristics.
The results of the coefficients of GDP and GDP per capita show that they are
statistically insignificant, whereas the estimated coefficient of distance shows
a significant, positive sign. Note that the dependent variable of scale has the
aggregate foreign affiliates' sales as the numerator, which is divided by the
parent firms' aggregate sales in Korea, the denominator. Since the result of
the regression of aggregate foreign affiliates' sales on distance produces a
negative value, it is expected that when regressing the logarithm of the aggregate
parent firms' sales on distance, the coefficient on distance will show a negative
sign and a bigger absolute value than -1.37, as shown in column 1. It indicates
that as the host country becomes further in distance, only a few firms with
a high level of productivity can invest in the country. Since only a few parent
firms can invest in a long-distance host country, denoted by the coefficient of
distance in column 2, the denominator becomes smaller at a larger rate than
the numerator does.

   The last column shows the results obtained by the regression analysis of the
logarithm of average affiliate sales to the local market on the same gravity
variables. These results can be interpreted as describing the effect of country
characteristics on the relative magnitude to country fixed costs and the cost
saving of country variable cost. The positive coefficient on GDP is interpreted
as evidence that fixed costs rise with market size, and the negative coefficient
on distance is interpreted as either country fixed costs decrease with distance,
or the benefit from saving country variable cost increases with distance.
However, the result is not statistically significant.

   Second, we provide an empirical analysis of the foreign activity of individual

Korean multinational firms. Two measures of a parent firm's productivity are used in the paper: the values of the parent firm's sales in Korea, and the parent firm's TFP. In order to explain the scale of Korean MNEs' activities, we made a panel regression of the logarithm of the individual affiliates' local sales in foreign countries on the logarithm of their parent firms' Korean sales and TFP. The results are shown in Table 5.

Table 5. The Scale of Korean MNEs' Activities in Host countries

Panel Data 2005-2007	Manufacturing Industry		Whole Industry	
	(1)	(2)	(3)	(4)
ln (Parent firm Sales)	.2796** (.1277)		.2434*** (.0987)	
Parent firm TFP		.0701 (.1011)		.0450 (.0772)
Affiliate Fixed Effect	O	O	O	O
Year Fixed Effect	O	O	O	O
Number	678	677	1156	1153
R squared	0.2400	0.2328	0.1823	0.1752

Notes: Standard errors shown in parentheses. TFP is derived from the difference between the observed value and fitted value from the regression of the natural logarithm of sales (output) on the logarithm of fixed assets (capital), the logarithm of the number of workers with year dummies. The number of parent firms in the sample is 219 for total industry and 168 for manufacturing industry, respectively. Industry fixed effect includes affiliates' industry fixed effect. * indicates 90%, ** indicates 95%, and *** indicates 99% significance.

Column 1 corresponds to the specification in which firm productivity is measured using the parent firm's sales in Korea, whereas column 2 corresponds to the specification in which firm productivity is measured using the parent firm's TFP. Although we could not get significant results from the latter, we found that the larger the sales of the parent firm, the more likely it is for the firm's foreign affiliates to engage in larger sales. In column 3 of Table 5, we use the data of Korean MNEs for the whole industry. There is no critical difference from the analysis of Korean manufacturing MNEs' foreign activities. The results confirm the fact that the size of foreign affiliates increases with the parent firm's productivity.

Third, we turn to the case of China as the destination for Korean MNEs. We suggest, to begin with, a summary statistics for manufacturing Korean MNEs

that have either single or multiple affiliates. The summary statistics in Table 6 show that parent firms with multiple affiliates have higher sales and better TFP on average.

Table 6. Summary Statistics for Korean Manufacturing MNEs in China

Year 2007	The Only Affiliate (309)		One of Multiple Affiliates (93)	
	Mean	Standard Deviation	Mean	Standard Deviation
ln(Parent firm Sales)	25.7439	1.9434	27.5687	2.1387
TFP	-.2689	.6728	-.1125	.5646
Number of Affiliates	1	0	2.5483	.7150

Here, we examine if a parent firm with higher productivity has a higher probability to have multiple affiliates in China. The dependent variable becomes one if the parent firm of a foreign affiliate i possesses more than one Chinese affiliate, and zero if a parent firm possesses only one Chinese affiliate.

Table 7. Probability of Having Multiple Foreign Affiliates in China

Panel Data 2005-2007	Manufacturing Industry		Whole Industry	
	(1)	(2)	(3)	(4)
ln(Parent Firm Sales)	.2409*** (.0368)		.2879*** (.0340)	
Parent firm TFP		.2197 ** (.1004)		.2039** (.0808)
Year Fixed Effect	O	O	O	O
Number	401	400	492	490
R squared	0.1201	0.0097	0.1637	0.0103

Notes: Robust standard errors shown in parentheses. * indicates 90%, ** indicates 95%, and *** indicates 99% significance.

Results in Table 7 show parent firms with higher productivity have a higher probability to have multiple Chinese affiliates. With both of the samples, which cover the manufacturing industry and the whole industry, the coefficients on the measure of firm efficiency are positive and statistically significant, both in parent firms' sales and TFP. The positive signs on the coefficient of logarithm

of parent firms' sales and TFP can be interpreted to state that the number of countries that an MNE invests in does not increase linearly with the number of affiliates it possesses. According to Appendix – Table 2, Korean MNEs' foreign investment shows a high tendency of being concentrated in a limited number of countries.

Finally, we examine the relationship between the number of affiliates and the parent firm's productivity. The results in Table 8 show that the parent firm's productivity also has a positive and statistically significant effect on the number of affiliates, in the case of both manufacturing and the whole industry.

Table 8. The Number of Foreign Affiliates and an MNE's Efficiency in China

Panel Data 2005-2007				
	Manufacturing Industry		Whole Industry	
	(1)	(2)	(3)	(4)
ln(Parent firm Sales)	.0854*** (.0116)		.1020*** (.0104)	
Parent firm TFP		.1002*** (.0329)		.0853*** (.0261)
Year Fixed Effect	O	O	O	O
Number	401	400	492	490
R squared	0.2066	0.0265	0.2490	0.0190

Notes: Robust standard errors shown in parentheses. * indicates 90%, ** indicates 95%, and *** indicates 99% significance.

What are the benefits of agglomeration in a host country? Although our empirical results do not prove that agglomeration in a country enhances an MNE's productivity, here we will briefly describe the potential gains for affiliates from agglomerating in a host country.

Suppose that an MNE has one foreign affiliate in a specific host country. Then, there are additional benefits of investing in the host country or a country geographically close to that host country. First, there can be benefits related to the information advantage—the firm can save on market research costs, since it already has the required information for investing in the market through its existing foreign affiliate. In addition, firms with multiple affiliates in the market will have more channels to gather market information. Second, there can be benefits related to the network advantage from the complementarities among multiple affiliates in a market. In fact, in our dataset, we observed that foreign affiliates in a host country belonged to a wider range of industries than the

industries their parent firms belonged to in the home country. The affiliates are much more diversified than the parent firms' industries. Dunning (2000) argues that transaction and coordination cost variables from interpersonal relations, information asymmetries, and language and cultural differences are more important than production-related variables in determining FDI locations. Following this idea, Safarin (1999) mentions that since there are already many well-established MNEs, FDIs are less directed toward initial FDI and more toward sequential FDI. Moreover, Chen & Chen (1998) use Taiwanese firm data to show that network linkage among foreign affiliates is an important determinant of location choice in FDI. The above ideas fortify the explanation of the possible benefits of agglomeration through network or information advantages.

V. Conclusion

In this paper, using Korean MNEs' data, we divide foreign affiliates into two groups of parent firms: those with only one foreign affiliate, and those with multiple foreign affiliates. Two regression models, regarding the probability of having multiple affiliates and the number of affiliates on parent-firm productivities, are implemented. Our main results suggest that there are additional motivations that induce productive Korean MNEs to establish foreign affiliates in China. From the data, the correlations between purchases and sales activities show distinct differences in multinational activities between parent firms with one affiliate and those with multiple affiliates; and empirical study confirms that the larger the parent firms' sales, the higher the probability for the parent firms to possess more than one affiliate in China.

From the existing studies, domestic firms that are productive enough to invest abroad are engaging in FDI to take advantage of efficiency-seeking or market-seeking motivation. Likewise, MNEs with one affiliate that are productive enough to invest more are engaging in additional FDI, not only to earn benefits from the traditional motivations, but also from extra motivations suggested in this paper, such as information advantages and network effects.

One of the main drawbacks of the current analysis is that we did not consider the endogeneity problem. However, the regression models are based on Yeaple's (2009) theoretical framework. Therefore, it is an extension of his test using Korean firm-level data. Although we are not able to avoid such criticism in the current analysis, we will address it in a future work, where a more general idea of productivity and MNEs' choice of globalization will be considered.

Appendix Tables

Appendix Table 1. Distribution of the Foreign Affiliates' Parent Firm Industry

The Only Affiliate		One of the Multiple Affiliates	
Parent Firm Industry	Number	Parent Firm Industry	Number
Manufacture of Fabricated Metal Products, Except Machinery and Furniture	20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	7
Other manufacturing	20	Manufacture of Fabricated Metal Products, Except Machinery and Furniture	6
Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	16	Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	6
Manufacture of Other Machinery and Equipment	12	Manufacture of Motor Vehicles, Trailers and Semitrailers	5
Manufacture of Motor Vehicles, Trailers and Semitrailers	11	Other manufacturing	4
Manufacture of Rubber and Plastic Products	8		

Appendix Table 2. Distribution of the Foreign Affiliates' Host Countries

The Only Affiliate		One of the Multiple Affiliates	
Host Country	Number	Host Country	Number
China	98	China	68
United States	19	United States	31
Vietnam	8	Germany	16
Indonesia	6	Japan	12
Hong Kong	3	Vietnam	11
Thailand	3	United Kingdom	9

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