Very preliminary. Please do not quote.

Who Goes Where and How? Firm Heterogeneity and Location Decision of Korean Multinationals

Hea-Jung Hyun[*] Jung Hur[**]

November 2, 2010

Abstract

This paper examines the role of firm heterogeneity in multinationals' choice of FDI type and location. Using Korean firm-level data, we find that more productive firms are more likely than their less efficient counterparts to invest in tough markets and choose horizontal FDI against vertical or export-platform FDI across different host countries. These findings, consistent with the recent theories in international economics, suggest that firm heterogeneity may play a significant role in FDI strategy as well as location decision.

Keywords: Foreign Direct Investment, Firm Heterogeneity, FDI type, Location Decision

JEL Classification: F23, D22

[*] Korea Institute for International Economic Policy, 108 Yangjaedaero, Seocho-Gu, Seoul 137-747, Korea; Email: hjhyun@kiep.go.kr

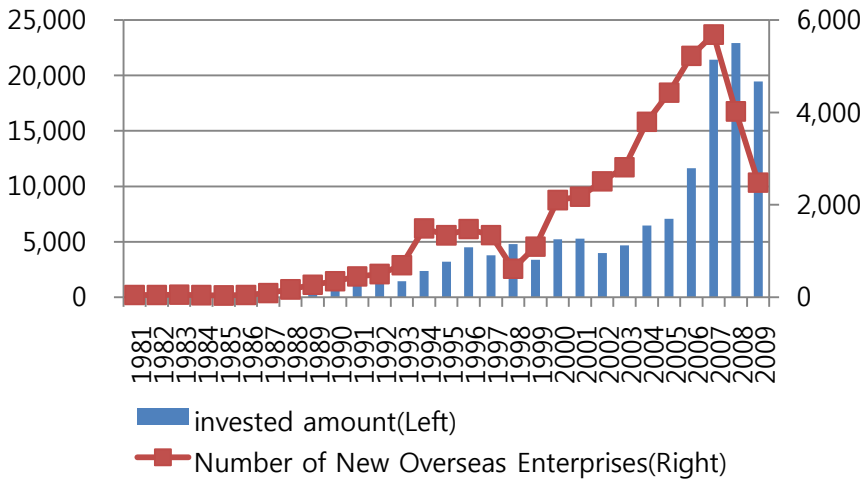
[**] Department of Economics, Sogang University, #1 Shinsu-Dong, Mapo-Gu, Seoul 121-742, Korea; Email: ecsjhur@sogang.ac.kr

1. Introduction

During the past years, the world has witnessed rapid expansion of multinationals (MNEs)' activities, albeit there were some declines in 2008 and 2009 due to the global economic downturn. The number of multinational enterprises in the world has grown from around 40,000 in 1993 with 270,000 foreign affiliates to about 82,000 MNEs with 810,000 affiliates abroad in 2008, whose exports accounting for about a third of total world exports of goods and services(UNCTAD, 2006 and 2009). This rapid growth of MNEs' activities has triggered much research into underlying determinants of location decisions. The vast literature on this topic, however, has been at the aggregate level rather than firm-level and was mainly about the role of host country attributes rather than investors' characteristics in firms' location choices. That is, in previous literature, 'who' was missing in determining where to go.

<Figure 1> Outward FDI Flows from the Republic of Korea: 1981–2009

($ millions, number of cases)



Source: The Export-Import Bank of Korea, *Overseas Economic Information System* database, available www.koreaexim.go.kr.

Recent developments in the heterogeneous firm trade theory about 'who goes where' have brought the role of firm productivity to the centre of analysis of firms' mode of entry to foreign market. Melitz (2003) and Bernard et al. (2003) have shown that firms (or plants) exporting to foreign markets are more productive than domestically oriented producers. Since

then, the role of firm heterogeneity has been highlighted in the literature as a determinant of firms' foreign market access. In particular, there is a growing literature that examines the role of firms' heterogeneity in choosing production location. Helpman et al. (2004) introduced firm heterogeneity as such a determinant into a decision of a firm between export and foreign direct investment (FDI). They showed that the most productive firms can invest abroad (i.e. horizontal FDI) and become multinationals. The hypothesis was tested by several works; Girma et al. (2004) for Irish plants, Girma et al. (2005) for UK multinational firms, Head and Ries (2003) and Tomiura (2007) for Japanese multinationals. They showed significant differences in productivity between multinationals and non-multinationals. Yeaple (2009) also provided a supportive evidence for the hypothesis using US multinationals. In addition, he showed that the most productive US firms invest in a larger number of foreign countries and sell more in each country. He also showed that the role of firm productivity becomes weakened when the host country is large. It seems that the host country characteristics matter for the decision of the multinationals. Focusing on various characteristics of host countries, Chen and Moore (2010) further found that more productive French firms are more likely to invest in less attractive host countries with a smaller market size, higher unit labor cost, a farther distance, higher fixed costs of FDI or lower import tariffs. Aw and Lee (2008) also examined Taiwanese multinationals' choice of location between US (less attractive one) and China (more attractive one) and found that the firms investing only in the US are more productive than those investing exclusively in China. That is, the most productive firms that are capable of overcoming high fixed costs of investment and doing business may be more likely than less efficient firms to enter tougher host markets with small market size, high production cost, long distance from home country, and bad institutions. Yeaple (2009) called it as a 'pecking order'.

However, these studies do not differentiate the types of FDI. Yeaple (2003) and Ekholm et al. (2007) theoretically investigated multinationals' choice of FDI strategies such as vertical, horizontal and combined FDIs. They found that multinationals FDI strategies depend on transport costs, relative fixed costs of different FDI and unit costs of production. However, their models abstracted away firm heterogeneity in the location choice. Grossman et al. (2006) generalized the two previous studies and theoretically examined the role of firm heterogeneity in the different FDI strategies. They argued that heterogeneous firms facing even same characteristics of host countries have different FDI strategies. That is, the least

productive firm produce in home market, more productive firms engage in FDI and the most productive firms choose horizontal FDI (i.e., move both intermediate and assembly production stages to a southern country). They also showed that the shares of firms that choose different FDI strategies depend on the transportation costs and relative fixed costs of the intermediate and assembly stages. Hence, their theory provides us an empirically testable hypothesis of '*who goes where and how*?'

Our paper attempts to empirically investigate how firm heterogeneity plays a role in deciding its organization choice among horizontal, vertical and export-platform FDIs when facing different characteristics of host countries. In fact, it is rare to see any empirical studies that examine firm heterogeneity as a determinant of FDI strategies across different host countries which have distinct characteristics. Yeaple (2009) focused on the choice of export and FDI assuming homogenous host countries; Aw and Lee (2008) and Chen and Moore (2010) focused on the host country characteristics as determinant of export versus FDI assuming horizontal FDI only. Grossman et al (2006) suggested theoretical hypothesis about the role of firm heterogeneity in the choice of FDI type across north and south countries without empirical evidence. We try to fill the gap in the literature by providing empirical findings for the role of firm heterogeneity in the choice of different FDI strategies when multinationals enter different host countries with distinct features.

In doing so, based on the model of Yeaple (2009) and Chen and Moore (2010), we first examine the relationship between parent Korean firms' heterogeneity and their affiliates' activities. We find that more productive firms tend to own foreign affiliates in multiple countries and their affiliates sell more. Second, we confirm the pecking order of firm productivity across host regions; the more productive and large firms are more likely to invest in tough markets while less productive and small firms should invest in only attractive locations. Lastly, we find that the pecking order holds for horizontal FDI against both vertical FDI and export-platform FDI.

The key differences and main contributions of this paper to the literature are three folds. First, unlike previous research, we use firm-level data for Korea, a middle-income country. Most FDI literature focuses on either North-North market-seeking horizontal FDI or North-South efficiency-seeking vertical FDI, leaving middle-income countries behind. The case for location decision by firms headquartered in middle-income country, however, may be interesting in that both market-seeking and efficiency-seeking motives can be captured in the

data. Second, we further investigate the role of firm heterogeneity in location choices by type of FDI. Firm productivity may vary according to the purpose of FDI. To our knowledge, this is the first study that takes into account FDI type in examining how heterogeneous multinational firms self-select different host countries. Third, we consider various types of institutions such as law and order, internal conflict, time for contract, and RTA as host country characteristics as well as standard gravity variables in location choice model. The paper finds that quality of institutions matter in Korean multinationals' location decision. But when it comes to firm heterogeneity, more efficient firms are more likely to invest even in a market with low quality of institutions.

The remainder of this paper is organized as follows: Section2 outlines the empirical methodology. Section3 defines the data. Empirical results are reported in Section4. Section5 concludes.

2.Empirical Methodology

To capture the role of multinationals' firm heterogeneity in deciding where and how to locate, we adopt three strategies. We first begin by simple tests for the impact of parent firms' productivity on the scale and scope of affiliates' activities. The impact of firm productivity on affiliates' sales (scale) is estimated using pooled OLS. To test for the relationship between productivity and number of affiliates that are owned by a parent firm, Poisson estimation method is employed. Following Yeaple (2009), we use two measures of parent firm's productivity: the natural log of parent firm's sales and natural log of parent firm's TFP.

We then take into account host country characteristics as determinants of location decision and investigate the interplay between firm productivity and host country attributes in the choice of location. First, we examine the role of host country attributes on cutoff productivity in each industry. In doing so, we regress cutoff TFP of industry-country pair on host country characteristics. We build on Manova (2006) and Yeaple (2009). The minimum TFP of parent firm which invested in a specific industry of a given host country is used as cutoff productivity. In the gravity model setting, however, we consider quality of institutions as well as other gravity variables. Institutions were not incorporated in Yeaple (2009). We check for the validity of three components of institutions separately; Law and Order, Internal conflict, and Time for Contract. Since there are no observations for common language and

former colonies owned by Korea, we exclude these geographical variables except distance and RTA. Second, to confirm the role of firm heterogeneity in the choice of different locations with distinct features, we interact firm productivity with host country attributes and investigate how the firm productivity responds to the attractiveness of host market.

Lastly, we examine how the firm heterogeneity relates the choice of FDI type in location decision. The role of firm heterogeneity and pecking order is analyzed using sub-samples of data. The whole dataset is classified into three groups; the location choice between horizontal FDI vs. vertical FDI, horizontal FDI vs. export-platform FDI, vertical FDI vs. export-platform FDI. For robustness check, we use the fraction of the sales by each type of FDI as dependant variable. For empirical test using data of affiliates' sales, we employ fractional logit model.

3.Data

This paper relies on firm-level data of Korean manufacturing multinational enterprises. The data on MNEs' activities was drawn from Korea EXIM bank (Export-Import Bank of Korea). Two different datasets are used according to empirical purposes. The first dataset includes information on the size, destination, and year of establishment of foreign affiliates of 1860 parent firms in 2007. The second dataset, a balanced panel, includes more detailed information on foreign affiliates' sales of 401 parent firms in the three year period from 2005 to 2007. The foreign affiliates' sales are broken down into three types; local sales in the host country, export sales back to Korea, and export sales to the third countries.

The data source of parent firms' financial information is KISVALUE, a comprehensive dataset that contains financial data based on financial statements of all firms listed in KOSPI(Korea Composite Stock Price Index), KOSDAQ(Korean Securities Dealers Automated Quotations), and statutory audited firms. We use data on sales, fixed assets, machine and employment to estimate firms' total factor productivity and firm size.

A number of host country characteristics are used as standard gravity variables. The real GDP and GDP per capita are taken from World Development Indicators. Distance between Korea and the host country and RTA dummy variables are from CEPII and WTO respectively.

To capture the institutional quality of host countries we use annual data from the International Country Risk Guide which reports on the quality of various institutional types.

We select Law and Order, Internal Conflict and Time for Contract. Law and Order is an assessment of the strength of the legal system and popular observance of the law. The score is measured on a scale ranging from 0 to a bounded random number 6. A score of 0 indicates the presence of institutions of very low quality and a maximum score means a very high quality of law and order in the country. Internal Conflict is an assessment of political violence and its actual or potential impact on government. Since the maximum score of Internal Conflict is 12 and there are discrepancies in measurement of institutions, we use the normalized components as a proxy for quality of institutions. Time for contract, collected from WDI, is the number of days taken for making contract in business.

<Table 1> Summary Statistics

Variables	Mean	Std. Dev.	Min	Max
Location	0.019	0.137	0.000	1.000
TFP	-0.089	0.721	-2.246	4.091
Sales	24.565	1.381	21.270	31.777
GDP	19.051	1.739	13.531	23.280
GDPPC	9.322	1.072	6.827	11.389
Distance	8.450	0.555	6.374	9.371
Law and Order	0.722	0.254	0.000	1.000
Internal conflict	0.635	0.242	0.000	1.000
Contract	-6.249	0.491	-7.286	-4.796
RTA	0.116	0.321	0.000	1.000

Notes: Natural logs are taken for all variables except location, law and order, internal conflict, and RTA.

<Table 2> compares average firm characteristics across different modes of entry. It seems that more internationalized firms are larger and more productive than domestically oriented firms. Among firms that serve foreign markets, those that are engaged in FDI than exporting firms on average sell more and are usually more productive. These simple statistics are in line with predictions by Melitz (2003), Bernard et al. (2003) and Helpman et al. (2004).

<Table 2> Mode of Entry and Average Firm Characteristics (2007)

	Domestic only	Export only	FDI only	FDI and Export

Number of parent firms	1,916	1,672	430	1,802
Sales (Million KRW)	32573.09	62125.52	71868.66	340649.1
Labor	113.4	165.1	204.6	529
TFP	-0.127	-0.022	0.063	0.133

Notes: Only manufacturing companies are included in the data.

4.Empirical Results

4.1. Firm Heterogeneity and Multinationals' Activities

<Table 3> reports the estimation results for the role of parent productivity and firm size on Korean multinationals' foreign activities: affiliates' sales and the number of host countries. The effects of TFP and firm size on affiliates' sales are estimated using pooled OLS while the effects on the number of host countries are estimated using Poisson estimation method. The results shown in the <Table 3> show that more efficient firms are more likely to invest in more host countries, and their affiliates sell more in the country. The results are similar even if the full sets of fixed effects are removed.

<Table 3 > Korean Multinationals' foreign activities during 2005-2007

Dep. Var.	**Affiliates' Sales (Pooled OLS)**			**Number of Host Countries (Poisson)**		
Parent TFP	0.870***			0.505***		
	(0.092)			(0.035)		
Parent Size		0.490***			0.288***	
		(0.036)			(0.009)	
Parent Size (IV)			1.055***			0.321***
			(0.182)			(0.026)
Year FE	YES	YES	YES	YES	YES	YES
Parent's Industry FE	YES	YES	YES	YES	YES	YES
Affiliate's Industry FE	YES	YES	YES	YES	YES	YES
Host Country FE	YES	YES	YES	YES	YES	YES
N	1,153	1,156	1,156	1,089	1,162	1,162
R-squared	0.603	0.659	0.511	0.534	0.561	0.562
Pseudo Likelihood				-1890.93	-1859.08	-1858.68

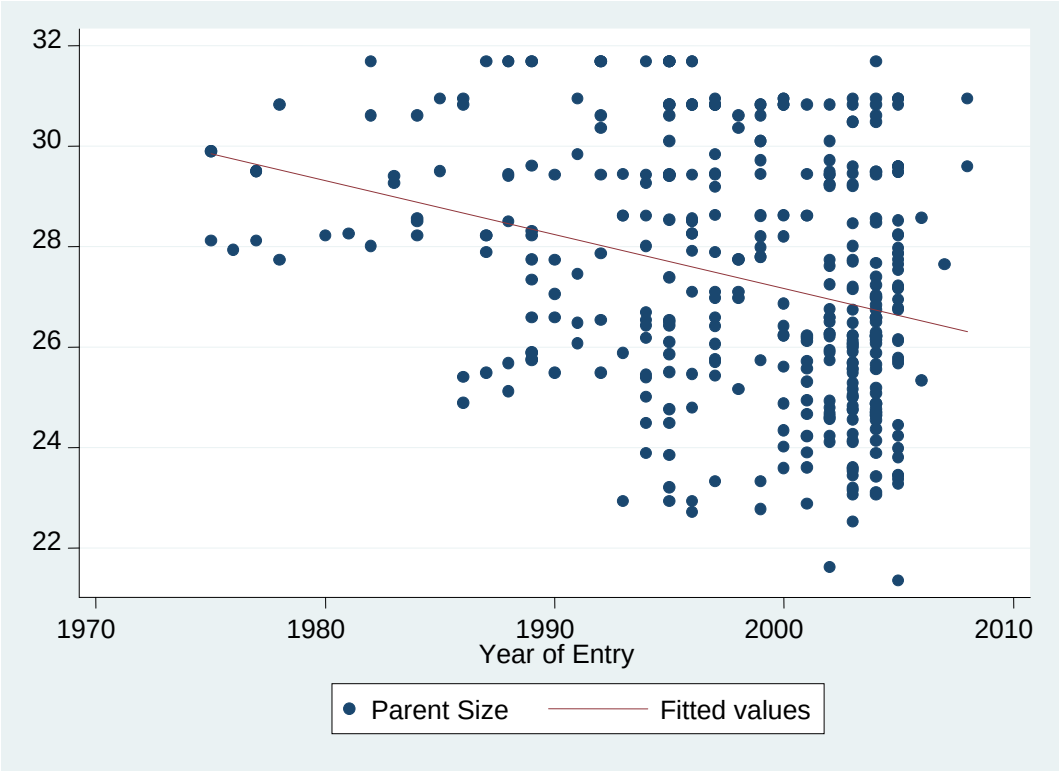
Notes: The heteroskedasticity-robust standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% respectively. We also obtained standard errors which are robust to clustering by year, parent's industry, affiliate's industry and host country, respectively. The results are very similar to those reported above. Both dependent variables are in natural logarithms. TFP is measured as the residual of the random-effect panel

regression of the natural logarithm of output (i.e. sales) per worker on the logarithm of capital (i.e. fixed assets) per worker, the logarithm of the number of workers and the year dummies. The coefficients in the TFP regression are 0.32 and -0.23 respectively. Size is the sales of a parent firm. Instrument for the Size is the dummy of foreign direct investment liberalization policy in Korea. The dummy is 1 when the entry year of an affiliate of a parent firm is before 1994 and 0 otherwise. The F-values from the first stage in the IV regressions are 30.93 and 31.26, respectively.

One thing that is noticeable in the above table is the results from IV regressions. Yeaple (2009) showed that the coefficient on the logarithms of parent size in the United States is less than one (i.e. 0.538) and stated that it is inconsistent with the predictions of the model of Helpman et al. (2004). We also had the coefficients less than one; 0.490 in Korea. However, when we used the foreign direct investment liberalization policy dummy as an instrument of parent size, the estimated coefficient becomes close to one; 1.055. So, our IV regression makes the estimation consistent with the theoretical predictions for multinational firms. Here, we explain for the use of the instrument variable. The dummy for the FDI liberalization policy is 1 when an affiliate of a parent firm was established before 1994, and 0 when it was established after 1994. The year of 1994 is when the foreign direct investment of Korean firms was liberalized and more Korean firms began investing in other countries since then. However, we observe FDI activities of Korean firms even before 1994. These firms involved in FDI before the FDI liberalization policy should be efficient and productive enough to invest in other countries as well as in Korea.

In fact, according to theories of Yeaple (2009) and Helpman et al (2004), "an increase in multinational activity is driven by a decrease in the cutoff productivity. A decrease in the cutoff implies that the additional firms being attracted are less productive than the incumbent firms." In our Korean multinationals' data, this prediction appears true clearly. That is, if a firm invested and established in other countries before 1994, the productivity of the firm should be greater than that of another firm invested in other countries after 1994. After 1994, less productive firms should invest in other countries due to the FDI liberalization policy. This can be shown as follows.

<Figure 2> Parent Size in 2005



<Table 4> reports the impact of parent firms' TFP or firm size on affiliates' TFP. It shows that the coefficient of the impact of parent TFP on affiliates' TFP is less than one. This implies that the source of productivity of parent firm such as headquarter services (knowledge, R&D, managerial skills, etc.) may not be completely transferred to foreign subsidiaries.

<Table 4> Korean Multinationals' foreign activities during 2005-2007

Dep. Var.	**Affiliates' Productivity (Pooled OLS)**		
Parent TFP	0.539***		
	(0.069)		
Parent Size		0.335***	
		(0.038)	
Parent Size (IV)			0.622***
			(0.143)
Year FE	YES	YES	YES
Parent's Industry FE	YES	YES	YES
Affiliate's Industry FE	YES	YES	YES
Host Country FE	YES	YES	YES

N	1031	1094	1094
R-squared	0.4721	0.5518	0.4688

Notes: The robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Dependent variables are in natural logarithms.

We further investigate the role of parents' productivity on affiliates' sales by FDI types. We classify FDI into three types; horizontal FDI, vertical FDI, and export-platform FDI. Horizontal FDI sales are measured as affiliates' sales in local host market. Sales from vertical FDI is measured as affiliates' sales back to home country, Korea. Export sales to a third country is defined as sales for export-platform FDI. The results are shown in <Table 5>. Horizontal FDI and export-platform FDI seem to be positively related with parents' productivity, while it is not statistically significant for vertical FDI.

<Table 5> Parents' productivity and foreign activities by type of FDI

Dep. Var	Horizontal FDI			Vertical FDI			Export-platform FDI		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Parent TFP	0.946***			0.409			0.679***		
	(0.151)			(0.325)			(0.174)		
Parent Size		0.579***			0.243			0.744***	
		(0.048)			(0.156)			(0.118)	
Parent Size (IV)			1.153**			1.26			1.067
			(0.481)			(0.771)			(1.127)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent's Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Affiliate's Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Host Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,083	1,156	1,156	1,083	1,156	1,156	1,083	1,156	1,156
R-squared	0.552	0.569	0.522	0.452	0.440	0.332	0.367	0.407	0.394

Notes: The robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Dependent variables are in natural logarithms.

4.2. Firm Heterogeneity and Country Characteristics

In this section, we investigate the role of firm productivity and host country attributes in investment decision. The main results are shown in <Table 6>. Column (1) reports the

coefficient estimates obtained by regressing cutoff TFP of industry-country pair on host country characteristics. The cutoff productivity level of parent firms becomes lower in large markets (GDP), higher in high income countries (GDPPC) and countries that are remote (Distance) from Korea. These results are in line with Yeaple (2009) and Chen and Moore (2010). Whether the country concluded RTA with Korea does not seem to be related with cutoff productivity level. The estimation results reported in column (2) through (4) seem to be similar with the result shown in column (1). All three coefficients on the effects of quality of institutions enter significantly negative. The effect of RTA can differ depending on the model specifications. Our model implies that the least productive firms invest in the most attractive markets with large market size, low labor costs, high proximity and high quality of institutions, while the most productive firms invest in all foreign locations, that is, the pecking order of firm productivity across destination holds for Korean multinationals. Overall, this result is consistent with Yeaple (2009) and Chen and Moore (2010), but differ from their results in that institutional quality is not as important as other gravity variables in their empirical analyses.

<Table 6> Host country characteristics and parents' cutoff productivity

Dep. Var	Cutoff TFP			
	(1)	(2)	(3)	(4)
GDP	-0.149***	-0.177***	-0.197***	-0.164***
	(0.025)	(0.021)	(0.021)	(0.025)
GDPPC	0.074**	0.117***	0.162***	0.16***
	(0.035)	(0.038)	(0.041)	(0.041)
Distance	0.225***	0.224***	0.204***	0.166***
	(0.043)	(0.044)	(0.044)	(0.047)
Law and Order		-0.433***		
		(0.138)		
Internal conflict			-0.662***	
			(0.168)	
Time for Contract				-0.249***
				(0.072)
RTA	-0.065	-0.257***	-0.149**	-0.018
	(0.077)	(0.081)	(0.074)	(0.077)
Industry FE	YES	YES	YES	YES
Number of Obs.	464	450	450	452
R-squared	0.411	0.438	0.445	0.428

Notes: The standard errors robust to heteroskedasticity and clustering at the country level are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Dependent variables are in natural logarithms. The cutoff TFP is calculated as the logarithm

of the smallest TFP of parent firm that owns affiliates in a 65 host country-24 industry pair in 2007. 21 countries in which there is only one foreign subsidiary are excluded.

To confirm the existence of "pecking order", we further examine how the firm heterogeneity interacts with host country characteristics in location decision. <Table 7> reports the estimation results for the disaggregated firm-level choices for location. Column (1) shows that more productive firms are more likely to enter any given foreign market. We also find that the probability of investment is increasing in host country market size, good institutions and integration through RTAs while it is decreasing in high labor cost and remoteness from Korea. Column (2) corresponds to the specification in which firm productivity is measured as parent firm sales. The result is largely similar when firm productivity is measured using TFP. The coefficient estimates reported in column (2) have the same signs as those in column (1) and are larger in absolute value. The size of the coefficient of firm size is more than twice as large as that of TFP.

As shown in column (3), by including interaction term between parent firm TFP and host country attributes, we examine how the firm productivity responds to specific host-country characteristics across firms in determining location. Except TFP, the signs and magnitudes of coefficient estimates are quite similar with specification in column (1) which does not include interaction terms. On average, a large market size, low labor cost, high proximity, good governance of host country and RTA raise Korean multinationals' propensity to go abroad. These effects, however, are smaller for firms with high productivity. Most of the signs of the coefficients on the impacts of interaction between parent firm TFP and host country attributes are opposite to the signs of coefficients on country characteristics except distance. This is more obvious when parent firm size is measured as firm productivity as reported in column (4). Together, these results imply that more productive and larger firms are more likely than their less efficient firms to invest in tough markets with small market size, high labor costs, long distance, low quality of institutions and no trade agreement. This result is consistent with the previous finding reported in <Table 3> that more productive firms are more likely to invest in more host countries. It is also in line with Yeaple (2009) and Chen and Moore (2010), but again is different from previous literature in that in our data institutions is one of important sources of fixed costs that can influence Korean

multinationals' location decision. It is also shown that more productive firms are more likely to overcome obstacles related with high fixed cost of entry in tough markets.

<Table 7> Firm Heterogeneity, Host country characteristics and Location Decisions

Dep. Var	Location			
	(1)	(2)	(3)	(4)
TFP	0.203***		3.893***	
	(0.037)		(0.830)	
Size		0.427***		1.71***
		(0.040)		(0.340)
GDP	1.328***	1.373***	1.331***	5.139***
	(0.038)	(0.033)	(0.037)	(0.308)
GDPPC	-0.679***	-0.712***	-0.677***	-5.764***
	(0.046)	(0.046)	(0.045)	(0.495)
Distance	-0.616***	-0.642***	-0.617***	-1.646***
	(0.021)	(0.022)	(0.021)	(0.381)
Law and Order	2.091***	2.188***	2.089***	13.338***
	(0.139)	(0.139)	(0.137)	(1.507)
RTA	1.876***	1.92***	1.885***	9.687***
	(0.109)	(0.107)	(0.107)	(1.054)
TFP (or Size)∗				
GDP			-0.193***	-0.148***
			(0.036)	(0.012)
GDPPC			0.089*	0.2***
			(0.056)	(0.019)
Distance			-0.017	0.041***
			(0.026)	(0.015)
Law and Order			-0.284*	-0.439***
			(0.160)	(0.058)
RTA			-0.131	-0.3***
			(0.112)	(0.040)
Parent's Industry FE	YES	YES	YES	YES
Number of Obs.	148,800	148,800	148,800	148,800
R-squared	0.380	0.409	0.382	0.422

Notes: 1860firm-86 country pair sample constitutes dataset. Heteroskedasticity robust standard errors are in parentheses. The standard errors are robust to clustering at the firm level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Dependent variables are in binomial variable for location choice.

4.3. Firm Heterogeneity, Host Country Characteristics and Location Decision by type of FDI

Now we explore how the effect of firm productivity can vary across three types of FDI. <Table 8> shows the estimation result of the role of firm heterogeneity and pecking order when we classify FDI into three types: horizontal FDI, vertical FDI, and export-platform FDI. In terms of the effect of parent firms' TFP, we find that more productive firms are more likely to choose to serve local markets (horizontal FDI) rather than to perform assembly and finishing operations (vertical FDI or export-platform FDI). The statistical significance of the coefficient on TFP effect disappears when it comes to firms' choice between vertical FDI and export-platform FDI. This result is consistent with Head and Ries (2003) where high-productivity firms do horizontal FDI and low-productivity firms do vertical FDI. Host country characteristics such as market size, income level, remoteness from Korea, institutional quality, and RTA all show expected signs while the interaction term between TFP and institutions is statistically insignificant in column (1) and (2).

<Table 8> Firm Heterogeneity, Host Country Characteristics and Location Decisions by type of FDI

Dep. Var	Location		
	(1) Horizontal vs. Vertical	(2) Horizontal vs. Export-platform	(3) Vertical vs. Export-platform
TFP	6.214***	6.287***	6.233
	(2.264)	(2.257)	(7.043)
GDP	1.327***	1.378***	1.718***
	(0.169)	(0.178)	(0.523)
GDPPC	-0.873***	-0.929***	-1.642***
	(0.119)	(0.129)	(0.29)
Distance	-0.206**	-0.238**	-1.459**
	(0.101)	(0.101)	(0.599)
Law and Order	2.65***	2.917***	4.416*
	(0.861)	(0.938)	(2.594)
RTA	1.326***	1.387***	3.309**
	(0.463)	(0.49)	(1.622)
TFP *			
GDP	-0.341***	-0.356***	-0.548***
	(0.08)	(0.081)	(0.166)
GDPPC	0.328***	0.354***	0.754***
	(0.08)	(0.083)	(0.125)
Distance	0.181**	0.204**	0.601*
	(0.089)	(0.087)	(0.34)
Law and Order	-0.712	-0.824	-1.548*
	(0.479)	(0.508)	(0.879)
RTA	-0.675**	-0.692**	-1.036**

	(0.267)	(0.271)	(0.502)
Industry FE	YES	YES	YES
Number of Obs.	7,575	7,569	5,655
R-squared	0.328	0.341	0.455

Notes: 401firm-46 country pair sample constitutes dataset. Heteroskedasticity robust standard errors are in parentheses. The standard errors are robust to clustering at the firm level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively.

To check for the robustness of above results, we further estimate the effect of firm productivity and geographical variables on the share of each type of FDI in the location decision. The share of horizontal FDI, vertical FDI and export-platform FDI is measured as fraction of sales to local market, export sales back to Korea, and export sales to a third country respectively. The estimation result reported in <Table 9> shows that the effect of firm productivity on location decision seems to vary across FDI strategies. The parent firm's productivity is likely to exert a significant effect on multinational's location and sales decision for horizontal FDI vis-a-vis vertical FDI or horizontal FDI while it is not significant in the case of vertical FDI over export-platform FDI. This result confirms the previous findings.

<Table 9> Firm Heterogeneity, Host country characteristics and Location Decisions by type of FDI

Dep. Var	Share of FDI Type		
	(1) Horizontal vs. Vertical	(2) Horizontal vs. Export-platform	(3) Vertical vs. Export-platform
TFP	5.594**	5.793***	3.749
	(2.331)	(2.226)	(6.099)
GDP	1.353***	1.350***	1.414***
	(0.137)	(0.133)	(0.411)
GDPPC	-0.887***	-0.906***	-1.45***
	(0.092)	(0.091)	(0.233)
Distance	-0.195*	-0.222**	-1.452***
	(0.102)	(0.099)	(0.554)
Law and Order	2.694***	2.768***	3.112
	(0.741)	(0.721)	(2.035)
RTA	1.388***	1.33***	2.541**
	(0.425)	(0.407)	(1.266)
TFP *			
GDP	-0.321***	-0.332***	-0.448***
	(0.078)	(0.076)	(0.136)
GDPPC	0.318***	0.334***	0.666***
	(0.072)	(0.071)	(0.118)
Distance	0.199**	0.207**	0.605*

	(0.098)	(0.094)	(0.312)
Law and Order	-0.667	-0.735	-1.115
	(0.505)	(0.486)	(0.697)
RTA	-0.610**	-0.644**	-0.823**
	(0.272)	(0.263)	(0.410)
Industry FE	Yes	Yes	Yes
Number of Obs.	7897	7891	7754
Deviance	1080.05	1090.44	322.05
Pearson	32078.88	31537.33	2452086.71

Notes: 401firm-46 country pair sample constitutes dataset. Robust standard errors are in parentheses. ***, **, and *indicate statistical significance at 1%, 5%, and 10% respectively. Fractional logit estimation method is employed.

5.Conclusions

In this paper, we test whether firm heterogeneity plays a role in multinationals' decision on where and how to go. Using Korean firm-level data, we confirm that parent firm's productivity may be positively related with performance of its own foreign affiliates and that pecking order of firm productivity across destination holds for Korean multinationals. Above all, we show that more productive firms are more likely to choose market-seeking horizontal FDI rather than vertical or export-platform FDI across different host regions. This supports the theoretical prediction by Grossman et al. (2006) that more productive firms engage in FDI and the most productive firms choose horizontal FDI across regions. The findings of this paper suggest that firm's FDI strategy as well as location decision may be significantly affected by firm productivity; firm heterogeneity matters not only for *where* to go but *where and how* to go.

References

Aw, B.Y., Lee, Y. (2008), "Firm heterogeneity and location choice of Taiwanese multinationals", *Journal of International Economics*, 75(1), 167-179.

Bernard, A., Eaton, J., Jensen, J.B., Kortum, S. (2003), "Plants and productivity in international trade", *American Economic Review*, 93(4), 1268-1290.

Chen, M., Moore, M. (2010), "Location decision of heterogeneous multinational firms", *Journal of International Economics*, 80(2), 188-199.

Ekholm, K., Forslid, R., Markusen, J. (2007) "Export-platform foreign direct investment", *Journal of European Economic Association*, 5(4), 776-795.

Girma, S., gorg, H., Stroble, E. (2004), "Exports, international investment, and plant performance: evidence from a non-parametric test", *Economics Letters*, 83(3), 317-324.

Girma, S., Kneller, R., Pisu, M. (2005), "Exports versus FDI: an empirical test", *Weltwirtschaftliches Archiv*, 141(2), 855-866.

Grossman, G., Helpman, E., Szeidl, A. (2006), "Optimal integration strategies for the multinational firm", *Journal of International Economics*, 70(1), 216-238.

Head, K., Ries. J. (2008), "Heterogeneity and the FDI versus export decisions of Japanese manufacturers", *Journal of the Japanese and World Economies*, 17(4), 448-467.

Helpman, E., Melitz, M., Yeaple, S. (2004), "Export versus FDI with heterogeneous firms", *American Economic Review*, 94(1), 300-316.

Manova, K. (2006), "Credit Constraints, Heterogeneous Firms and International Trade", NBER Working Paper 14531.

Melitz, M. (2003), "The impact of trade on intra-industry reallocations and aggregate industry productivity", *Econometrica*, 71(6), 1695-1725.

Tomiura, E. (2007), "Foreign outsourcing, exporting and FDI: a productivity comparison at the firm level", *Journal of International Economics*, 72(1), 113-127.

Yeaple, S. (2003), "The complex integration strategies of multinationals and cross country dependencies in the structure of foreign direct investment", *Journal of International Economics*, 60(2), 293-314.

Yeaple, S. (2009), "Firm heterogeneity and the structure of U.S. multinational activity: an empirical analysis", *Journal of International Economics*, 78(2), 206-215.