An Empirical Assessment of a Tradeoff Between FDI and Exports

Hongshik Lee and Joon Hyung Lee

KIEP Korea Institute for International Economic Policy

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Executive Summary

The relation between exports and FDI could be complementary or substitutable depending on the types of FDI. Overseas investment to displace exports must have a substitution relation while FDI for vertical fragmentation between countries would boost the home export. Empirical studies have generally found a positive relation and finding a substitution relation is relatively recent. We investigate the relation between those two variables using detailed information of Korean multinational firms and their foreign affiliates from 1999 to 2004. In so doing, unlike previous studies, we consider the host country's income level and various activities of each affiliate, whether it serves the host country or exports outside in particular. The complementary relation is found by simply following previous studies. Once we consider the host country's income level and various activities of each affiliate, however, different results are produced. Our empirical results show substitution if the affiliates are located in a developed country and mainly serve the host country, while complementarity if the affiliates export their products outside of the host country. Moreover, the complementary effect is strengthened if they are located in a less developed country.

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최근 해외직접투자의 중요성이 크게 부각되고 있다. 그동안 우리나라는 해외직접투자의 경우 경제성장을 위한 외환의 확보나 물가안정과 같은 거시 경제적인 목적에 중점을 두고 규제 혹은 자유화하여 왔다고 평가할 수 있다. 최근 우리경제에서 차지하는 해외직접투자의 역할이 커지는 시점에서 국내 다국적기업의 수출과 해외 법인의 경제 활동이 어떻게 관련되어 있는지를 실증적으로 분석하는 것은 매우 중요하다. 이와 관련된 그동안의 연구는 단순히 연도별 해외직접투자 자료와 수출입 자료를 연결하여 해외직접투자와 수출이 보완관계에 있는지, 혹은 대체관계에 있는지를 분석하고 있다. 그러나 해외직접투자와 무역과의 관계는 해외투자전략과 밀접히 관련되어 있기 때문에 각 기업들의 해외투자전략과 투자국에 대한 분석이 선행되어야 한다. 즉, 해외투자가 현지판매를 목적으로 한 투자인지, 아니면 단순히 낮은 생산비를 이용한 후 모기업으로 역수입하여 제3국으로 수출하고자 하는 목적으로 투자한 것인지에 따라 모기업의 수출입에 미치는 효과는 완전히 다르게 나타나게 된다. 따라서 본 논문에서는 우리나라 기업자료와 해외직접투자 자료를 이용하여 국내 다국적기업의 수출과 해외 법인의 경제 활동이 어떻게 관련되어 있는지를 실증적으로 분석하고 있다.

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I. Introduction

How should we respond to outward foreign direct investment (FDI)? Some are worried since it would move production facilities and corresponding employed workers out of the country. The home country would become hollow in the end according to this scenario. Others are in favor of it since the firm would get efficiency gains and new investments would provide the home economy with blue ocean business opportunities. Although predictions of a bleak future or rosy future are a bit extreme, somewhere between the extremes would be true.

The investigation over the relationship between exports from the home country and the foreign affiliates' activities provide a glance of the consequences of outward FDI. This question is what this paper attempts to analyze: what is the relationship between FDI and international trade? In particular, would foreign affiliates' production substitute parent firm's exports or complement it?

Theories and empirical findings have produced mixed results so

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far. Among other theories, Brainard (1997) claims that a firm could have two choices to serve a foreign market, through either exporting or foreign affiliate, presumably assuming FDI and exports are substitutable. She also shows empirically establishing foreign affiliates is more likely rather than exporting, if there are high transportation costs, high tariffs, and low plant level economies of scale using industry level data. On the other hand, some other studies theorize possible complementarity through the exchange of intermediate goods between the home and the host country or through the demand effect where the presence of multinationals stimulates the demand for its products.

From an empirical perspective, most of the early works find a positive relationship. The problem is that most studies are based on country level or industry level data, which might have led to the spurious positive results. Finding a substitution effect has been relatively recent after more disaggregate level data became available. Head and Ries (2001) use Japanese firm data and consider firm characteristics such as upstream or downstream production. While they find complementarity in their whole sample, when they use only the sample of those firms that are unlikely to ship intermediates to overseas production affiliates, however, the results exhibit substitution. Blonigen (2001) also finds evidence for substitution using even more disaggregate level data from Japan and US product data. He finds that production of Japanese automobile parts in the US substitutes the export of automobile parts from Japan. Later, Swenson (2004) suggests the necessity of data disaggregation. Using US SIC code, she finds predicted substitution patterns at the data level that roughly corresponds to broad products while complementarity is found at the

more aggregate level.

However, no empirical papers have studied the possibly different consequences of various types of FDI yet. Also, when some effects are found, they conclude a foreign affiliate either substitutes or complements exports, not considering the possibility of both features by its various activities. With this question in mind, we investigate the relation with relatively new data, Korean multinational firm level data, and extends current findings. In so doing, we consider the host country's income level and the various activities of each foreign affiliate.

The host country's income level has significant implications in FDI studies. Economists generally regard investment into developed countries (DCs) as horizontal FDI and that into less developed countries (LDCs) as vertical FDI. For this reason, we distinguish Korean affiliates into those located in DCs and those in LDCs and investigate whether or not income levels matter. We expect the investment into DCs have a negative relation with exports while that into LDCs have a positive relation, if the above reasoning is correct.

The affiliate's main role, whether it sells its products locally in the host country or exports outside the host country, is also important in studying the relation between FDI and parent firm's exports. The affiliate's local sales is generally regarded as horizontal and, accordingly, substitutable with parent firm's exports. In the case of the affiliate's exports, however, it is a bit complicated. It is reported there are three types of affiliate exports, exports back to parent firm, exports for export platform, and exports for complex vertical FDI. The latter two types have recently received attention as economists consider the third party country effect. Export platform or complex vertical FDI

are generally defined as hybrid type.[1] Export platform FDI is defined as overseas investment to serve the neighboring market around the host country and complex vertical FDI is defined as production fragmentation across many countries. Exports back to parent firm is regarded as vertical[2] and, accordingly, has a positive relation. Complex vertical FDI would also have the same characteristics as the vertical type except that more countries are involved and produce a positive relation. Export platform FDI is a bit more complicated. It would show substitution if a firm had already served those third party countries by exporting, since an export platform affiliate would displace parent firm's exports. However, the condition whether or not a firm has exported to those countries beforehand is important, since there will be nothing to be substituted otherwise. We argue that no definite relation is expected from this type of exports, since export platform FDI is generally made to target new markets.[3] Even though export platform FDI is not necessarily made for the new markets, the empirical result will tell whether exports with the vertical feature is generally strong or that with the horizontal feature is strong at the firm level given that our data does not clearly specify whether affiliate exports go to Korea or third party countries or it is whether export platform or complex vertical.

This paper includes Korean multinational manufacturing firms and all their foreign affiliates from 1999 to 2004. In particular, they specify

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1) See Blonigen, Davies, Waddell and Naughton (2006) and Baltagi, Egger and Pfaffermayr (2006).
2) See Hanson, Raymond J. Mataloni and Slaughter (2001).
3) The Hyundai automobile company announced to make a new model in its affiliate located in the Czech Republic to target Europe in 2006.

where each affiliate is located and sale variables are specified into local sales and exports outside the host country. The empirical results clearly show that the host country income level and each affiliate's activities matter in the relation between exports and FDI. Investment into LDCs boosts exports while that into DCs does not. Also, two different sale variables of each affiliate, local sales and exports, can produce the opposite result even if they are carried out by the same affiliate. The affiliate's exports outside the host country improve parent firm exports while local sales does not. Considering both location and sale activities, we find that the local sales of the affiliate located in DCs have stronger substitution effects and the exports of the affiliates located in LDCs have stronger complementarity effects.

II. FDI from South Korea

The overall investment patterns of South Korea in terms of the amount invested and the number of newly established affiliates is provided in Figure 1. Investment abroad has gradually increased since the early 1990s, except around 1998 when Korea faced the Asian financial crisis, but is recovering nowadays. The figure shows that more than 4 billion dollars is invested abroad and nearly 4000 foreign affiliates were newly established in 2004 alone.

The next two figures show the investment trends according to the income level of the host country. We group host countries into DCs and LDCs according to their per capita income level. The countries are categorized as DCs if their income level is higher than Korea's and LDCs otherwise. Figure 2 is represented in terms of the number of new affiliates and figure 3 in the amount invested. Early investment flows into DCs where US is a major recipient. However, a dramatic increase of investment into LDCs /except around 1998/ is prominent while DCs experience a relatively stable increase. In particular, the

Figure 1. Trends of South Korean FDI
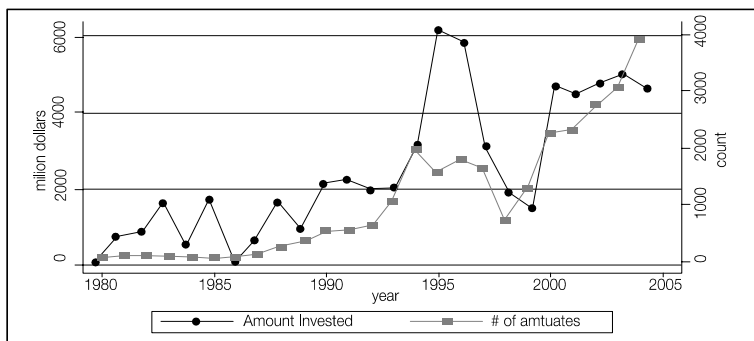
increasing trend into LDCs starting from 1992 when Korea and China entered into diplomatic relations implies that China's absorption power as the world's factory is also not an exception in Korea's case.[4]

By industry, a major part of FDI is in the manufacturing and service sectors, though a significant number of early FDI is in the extractive sector designed to supplement natural resources. Figure 4
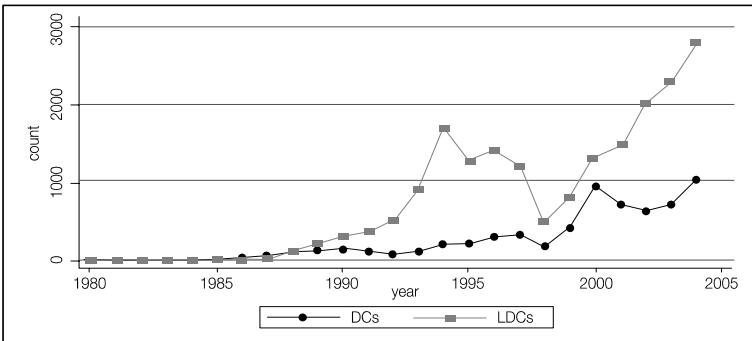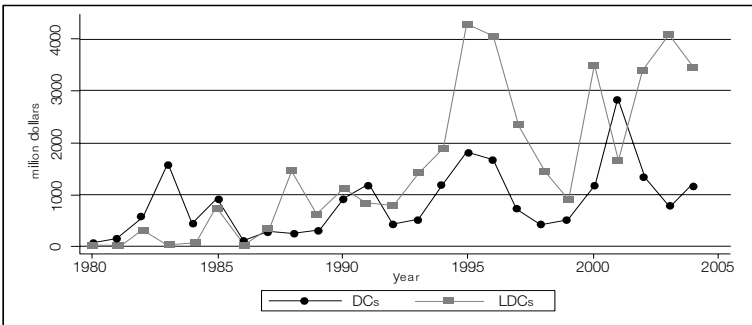
Figure 2. New affiliates, by host country income level

Figure 3. Amount invested, by host country income level

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4) Though official relation was announced in 1992, investment started from 1988.

shows the share of each industry in terms of the number of new affiliates subsequent to 1985.[5] The primary industries (such as mining, agriculture & fishing, and forestry) show a steady decrease. It is also notable that manufacturing has become the largest sector after 1988; service was the largest prior to that. This implies that multinationals has mainly used foreign affiliates to promote Korean products or provide foreign customers with service in the past, while nowadays they directly establish plants in the foreign countries and serve the

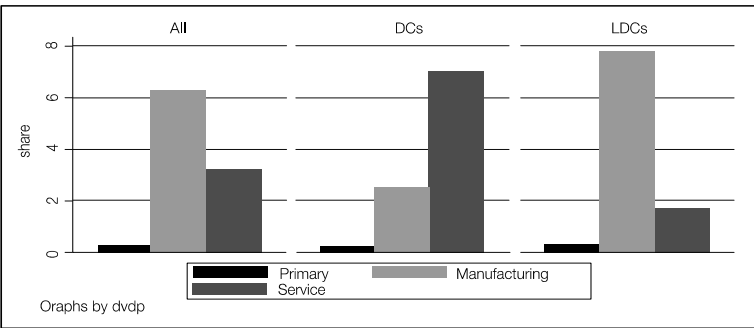**Figure 4. Industry share of new affiliates**
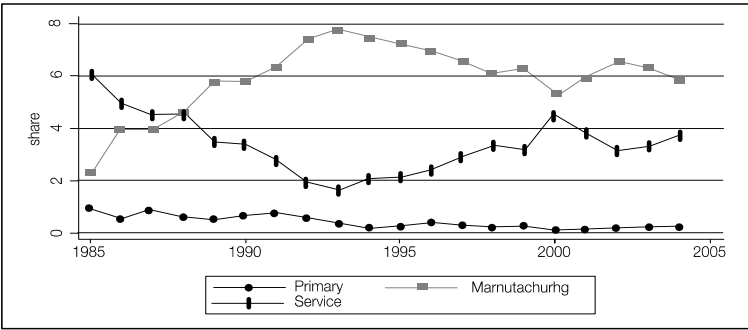
Figure 5. Industry of affiliates, by host country income level

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5) Retail and wholesale businesses are included in the service sector.

market. Also, the advent of China has stimulated firms to outsource some stages of production to take advantage of cheap labor costs.

To investigate whether or not the general trend above is the same across all host countries, we consider the distribution of foreign affiliates by the host country's income level and industries. Figure 5 illustrates the dramatic difference in the share of industry according to the host country's income level. The first figure, which does not distinguish the host country's income level, shows the share of manufacturing is more than 60% and service is more than 30%, which is consistent with Figure 4. Both sectors seem to be significant in general. Considering the income level, however, the service sector is more important than manufacturing in DCs for Korean firms, which is in contrast to overall patterns. On the other hand, manufacturing is dominant in LDCs. This implies that LDCs are used as production sites due to cheap labor costs, while DCs as marketing sites. Accordingly, the analysis of FDI without considering industries will be particularly misleading if it is associated with the country's income level. For this reason, this study focuses only on the manufacturing. Moreover, industry classifications of each affiliate is important in this sense, since it is possible that parent firm belongs to the manufacturing sector, but has service-oriented affiliates.

Focusing on manufacturing, we also consider various activities of each manufacturing affiliate and study whether the main activity is different depending on the place where it is located. The following two graphs provide the information of each affiliate's focus of business using a sales variable which is specified into local sales and exports outside of the host country. The first graph of Figure 6 illustrates the share of local sales and exports of all manufacturing affiliates. The

graph implies that the host country as a market (presented by the share of the local sales) and as a production sites (represented by the share of exports) is nearly equally important. It shows dramatic difference once we distinguish the host country's income level, however: DCs are more important as markets while LDCs are more attractive as production sites. LDCs also show a significant share of the local sales, which implies they are also important as markets. It it true that China, the major recipient country of Korean investment, has attracted many Korean firms providing big business opportunities

**Figure 6. Activity of manufacturing affiliates,
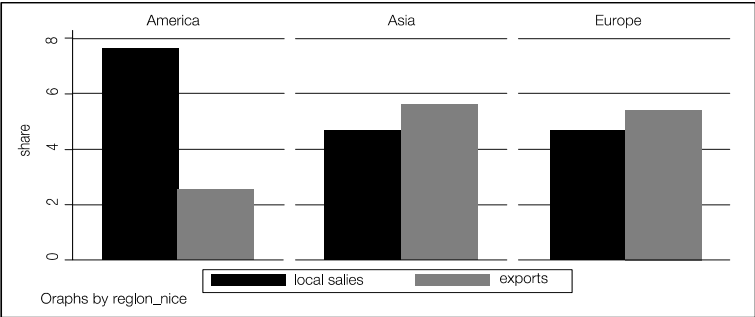by host country income level**
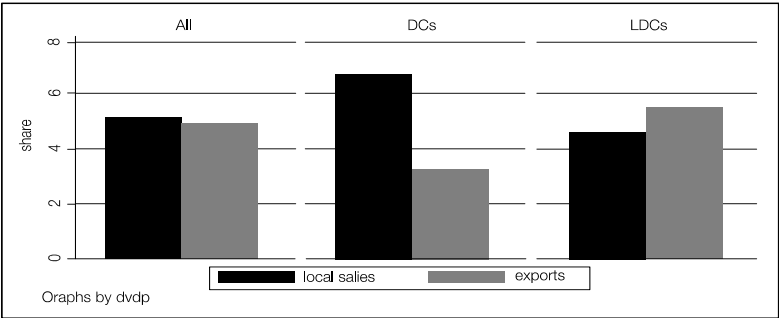
Figure 7. Activity of manufacturing affiliates, by region

as well as cheap labor inputs. Figure 7 shows the geographical difference of sale patterns. We roughly group regions into the Americas, Asia, and Europe.6) L200ocal sales is dominant in America where the US is the major recipient of Korean FDI. This suggests that horizontal type FDI plays a key role in this region. On the other hand, vertical type or hybrid FDI represented by exports is relatively large in Asia and Europe. Asia - where China and other less developed countries such as Vietnam, Indonesia, and Philippine are located - is used as a production site. Also, the significant share of exports in Europe is not surprising when we consider the advent of Eastern European countries into the world economy and the relative easiness of exports between European countries.

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6) The Americas includes North, Central, and South America.

III. Data

The firm-level data used in this paper are taken from two sources. The data on parent firms are provided by Korea Information System (KIS) database /2004/. This data set contains the balance sheets and the profit and loss statements of all South Korean firms that are listed on the Korea Stock Exchange. The data are available in annual series from 1980 to 2004. We selected the firms in manufacturing between 1999 and 2004, which is after the 1997-1998 Asian financial crisis. The data set provides the information on a firm's outputs (sale and export) and inputs (i.e. employed workers, capital stock, material purchase, etc.). The firms are classified by the five digit Korean Standard Industrial Classification (KSIC) codes that are similar to Standard Industrial Classification (SIC) codes used in the US. To deflate the value of total exports, industry-specific domestic producer price indices were obtained from the National Statistics Organization at the three digit industry level. The measure of capital input is the book value of tangible assets: including land, buildings, structures, machinery, vehicles, fixtures, tools, etc. Raw material costs provide the measure of material inputs. Finally, the number of employed workers is also included in this data set.

The other sources of unpublished firm-level data related to affiliates are obtained from the Export-Import Bank of Korea. This data set contains all outward FDI from 1968 to 2004.[7] It provides the amount invested, date, destination, and industry classification of each foreign affiliate. Figure 1 to 5 that show the general pattern of Korean FDI /in the last section/ are provided from this data set.

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7) Korean law requires investment outflow over a certain amount to be reported.

Independent from this set, the bank has also started surveying all foreign affiliate activity of some benchmark parent firms since 1999. The survey has been carried out with about 120 parent firms until 2003 and its number has increased to over 500 since 2004.[8) Each parent firm has a minimum of 1 to a maximum 40 foreign affiliates for the sample period. These unique survey data provide information on all foreign affiliate activity of selected multinationals. It contains data for sales, the number of workers, two-digit level industry codes, the host country, etc. In particular, it specifies sales into local sales and exports outside the host country. Figure 6 and 7 are provided from this data set. However, the data does not provide where each affiliate exports goes; it could go either back to Korea or to third party countries. In spite of this, the relationship between parent firm exports and affiliate exports will be positive as long as parent firm has not exported to third party countries before. On the other hand, if parent firm has exported to third party countries before, the estimation result will at least tell us which feature among vertical or horizontal is stronger as far as foreign affiliate exports are concerned.

We merge the first data set that includes parent firm information with the last data set that includes all foreign affiliate information of the benchmark multinationals according to parent firm. In so doing, we have to drop a fair number of multinationals and affiliates for several reasons. Since this study focuses on the manufacturing industry only, other industries such as service is dropped. The information of each affiliate's industry classification is important in that some of

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8) We had to drop around 300 firms that were newly added to this survey in 2004, since data with at least a 2 year span is needed to use panel estimation.

parent firms classified as belonging to the manufacturing industry may have affiliates engaging in other than manufacturing. Also, we can only include the multinationals and affiliates that have a complete list of variables. As for multinationals, we need the information of the number of workers, capital, material costs, and exports. As for affiliates, we need the information of sales activity, such as local sales or exports. The firms that only have data for one year are excluded for the panel as well. We also had to drop firms with abnormal values (excessively low/high variables compared to the other variables in some years). In the end, the sample included 69 multinational parent firms and 136 manufacturing affiliates.[9] 12 multinationals out

Table 1. Geographical distribution of manufacturing affiliates

Region	All data		Benchmark data	
	Affiliates count	Share(%)	Affiliates count	Share(%)
America	1,693	10	21	15.4
US	1,334		15	
Asia	14,798	86	89	65.4
China	11,189		51	
Vietnam	588		9	
Indonesia	607		9	
Philippines	708		6	
Europe	431	2.5	24	17.6
W. Europe	231		15	
E. Europe	200		9	
Other	238	1.4	2	1.5
Total	**17,199**	**100**	**136**	**100**

9) It is an unbalanced panel since some firms included in 1999 disappear before 2004 and some firms that were not included in 1999 show up after 1999.

of 69 have affiliates in both DCs and LDCs; 45 firms in LDCs only; and, 12 firms in DCs only. It is not surprising that there are a relatively small number of multinationals that are active in DCs than LDCs since we dropped service oriented affiliates, which are more prevalent in DCs. The geographical distribution of all foreign manufacturing affiliates and those used in this paper are shown in Table 1. As we can see, the US and China are the biggest recipient countries for Korean FDI in the Americas and Asia, respectively. There is a huge gap between the two data in terms of the affiliate count. The first set of columns is from the FDI data the Export-Import bank has collected, while the second set is from survey data that the bank has started from 1999 with benchmarking multinationals. The former does not have detailed information of affiliate activity - sale activity in particular - while the latter does. For the formal analysis, the latter data are used. Again, once a multinational is selected for the survey, it is required to report its all foreign affiliate activities.[10]

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10) We understand concern for a selection problem. The firms which the Export-Import bank has selected and surveyed are major multinationals representing Korea. Hence, they are large in all aspects, such as size, capital intensity, etc. For this reason, we try to control firm heterogeneity and attempt various empirical specifications when we estimate.

IV. Empirical Specification

We follow the estimation strategy used in previous firm level studies. In particular, Head and Ries (2001) study correlation of a firm's exports and its overseas investment and use the affiliate count as an FDI variable with controls on a number of sources that might affect exports. They control heterogeneity among firms with fixed effects as well as other firm specific variables, such as size, capital intensity, and labor input characteristics. They also employ annual dummy variable to capture shocks common to firms. Following their estimation strategy, we use a panel estimation method and control associated variables.

Panel estimation controls heterogeneity across firms by allowing fixed effect.[11] Also, following suggestions by Roberts and Tybout (1997) and Bernard, Jensen and Schott (2005), we also control size through the parent firm's employment level, capital intensity (ratio of capital stock over total workers), and material inputs usage (raw material costs over total workers). We also put annual dummy variables that control time specific shocks common to all firms. The FDI variable which is critical in FDI studies is measured by the sales of foreign affiliates.

Hence, for comparison, we start with the following specification, as in previous studies, without considering the host country's income level or affiliate activity:

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11) Among others, Helpman, Melitz and Yeaple (2004) suggests the importance of heterogeneity in micro-level analysis.

$$\ln EX = D_i + D_t + \beta_0 \ln l + \beta_1 \ln(k/l) + \beta_2 \ln(m/l) + \gamma \ln\left(\sum_j Sale_{ijt}\right) + \epsilon \quad (1)$$

where i represents parent firm, and j foreign affiliates that belong to parent firm i. If exports and FDI are completely substitutable, γ will be negative. On the other hand, γ will be positive if the two variables are complementary, which is generally found in previous studies.

Then, the sales variable of foreign affiliates is distinguished into local sales and exports outside the host country as in the following specification:

$$\ln EX = D_i + D_t + \beta_0 \ln C + \gamma_1^* \sum_j LS_{ijt} + \gamma_2^* \sum_j EX_{ijt} + \epsilon \quad (2)$$

EX in the left hand side is exports of parent firm and EX in the right hand side is exports of the foreign affiliate. Due to space limitations, we denote all control variables, such as size, capital intensity, and material inputs, as C. Local sales are generally regarded as horizontal type FDI. Accordingly, we expect the relation with parent firm's exports to be substitutable (negative $\gamma 1$). On the other hand, affiliate exports outside the host country are considered as general vertical-type FDI as argued earlier. Accordingly, we expect this relation will be complementary (positive $\gamma 2$).

Next, we consider the host country's income level to see whether or not it matters in the relation between exports and FDI:

$$\ln EX = D_i + D_t + \beta \ln C + \gamma_1^* \sum_{j \in DCs} Sales_{ijt} + \gamma_2^* \sum_{j \in LDCs} Sales_{ijt} + \epsilon \quad (3)$$

Economists generally regard FDI flow into DCs as horizontal and

FDI flow into LDCs as vertical. Also, as we show through several figures, the host country's income level significantly affects the multinational investment patterns. In particular, the share of local sales is dominant in DCs, while that of exports is more important in LDCs. Combining these two arguments, we expect affiliates in DCs to have a substitution relation (negative $\gamma 1$) while those in LDCs a complementarity relation (positive $\gamma 2$). Finally, we consider both the host country's income level and sales activity, in which case FDI consist of four variables:

$$\gamma_1 * \sum_{j \in DCs} LS_{ijt} + \gamma_2 * \sum_{j \in DCs} EX_{ijt} + \gamma_3 * \sum_{j \in LDCs} LS_{ijt} + \gamma_4 * \sum_{j \in LDCs} EX_{ijt} + \epsilon \qquad (4)$$

It is clear that local sales in DCs are substitutable (negative $\gamma 1$) and exports from LDCs to outside markets are complementary (positive $\gamma 4$).

V. Results

Table 2 shows the estimation results. In all specifications, size, capital intensity, and material input usage are positively correlated with a firm's exports as expected. A firm that is large and capital-intensive and use more material inputs is more likely to export. Column (1) shows that the variable of interest - foreign affiliates sales (without considering the host country's income level or sales type) - are positively correlated with parent firm exports even though it is at the 10% level. This result is consistent with previous empirical works that have found a positive correlation between FDI and trade.

Analysis with detailed information on sales produces a different story, however. In column (2), we specify affiliate sales into local sales and exports outside the host country. The affiliate exports affect parent firm's exports in a significantly positive way. As we argue, this implies that vertical type or hybrid FDI has a complementary characteristic, which in turn suggests that foreign affiliate exports indeed improve parent firm exports because affiliates must import intermediate goods from parent firm. On the other hand, local sales do not have any significant impact, though we have to expect a negative sign, if local sales represent a complete horizontal type FDI. The insignificance of local sales makes sense, however, in that this study is based on firm level data. As previous empirical studies have suggested, data disaggregation is critical and it is hard to keep track of each product even at the firm level. If a firm produces various products and uses its own products to produce other products, which is more true in the case of multinationals, the substitution of one product does not necessarily mean less use of its own intermediate

products. In other words according to our study, if a foreign affiliate produces the product locally, but has to import intermediate goods from parent firm, the local sales variable will not necessarily produce

Table 2. FDI and Export

Regressor	(1)	(2)	(3)	(4)
Size	0.794 (0.084)***	0.816 (0.080)***	0.809 (0.080)***	0.843 (0.079)***
Capital Intensity	0.237 (0.074)***	0.222 (0.071)***	0.220 (0.073)***	0.220 (0.071)***
Material Input Usage	0.314 (0.072)***	0.347 (0.070)***	0.337 (0.072)***	0.382 (0.071)***
Affiliate Sales	0.073 (0.040)***			
Local Sales		0.018 (0.025)		
Exports		0.086 (0.019)***		
Sales of Affiliates located in DCs			0.029 (0.049)	
Sales of Affiliates located in LDCs			0.082 (0.028)***	
Local Sales of Affiliates located in DCs				-0.040 (-0.028)
Exports of Affiliates located in DCs				0.062 (0.026)**
Local Sales of Affiliates located in LDCs				0.021 (0.023)
Exports of Affiliates located in LDCs				0.051 (0.025)**
Year Dummy	Yes	Yes	Yes	Yes
Fixed Effect	Yes	Yes	Yes	Yes
R2	0.43	0.48	0.45	0.49
Observations	273	273	273	273

Note: 1) All regressors are in a log term.

    2) The number in parenthesis is standard error.

    3) ***, **, and * indicate significance at the 1, 5, and 10% level.

a substitution effect. Rather, the substitution effect of the final product and the complementary effect of intermediate products will produce a mixed effect. For example, if a Korean automobile company establishes a manufacturing plant in a foreign country in order to save transportation costs, it substitutes previous exports. At the same time, it creates a new export business since it still needs auto parts from parent firm. The empirical estimation result will, thus, give a mixed total effect even though the local sales of one specific product itself has substitution properties. However, this is not necessarily a disadvantage. Firm level data are more suggestive in studying the relation and general effects between FDI and trade in terms of firm behavior. At the start of this paper, we introduced two quite opposite opinions about outward FDI: worries over hollowing out and a rosy future with new business opportunities. According to our results, neither is completely correct. While it is true some facilities will move out, it also provides a new opportunity at the same time.

Next, we examine the effect of host country's income level. Since the affiliates in DCs focus on local sales, while those in LDCs on exports, we expect that affiliates in LDCs will help parent firm exports while those in DCs will not. Column (3) shows that FDI into LDCs complements exports while FDI into DCs does not.

Finally, we consider both of the different sales types and the host country's income level. First of all, column (4) shows that the coefficient of local sales in DCs is negative, while that in LDCs is positive though neither are significant. This implies that local sales in DCs are more substitutable than in LDCs. The offsetting power of intermediate product imports against the substitution effect of local sales is much weaker in the affiliates located in DCs than LDCs. This

makes sense in that an affiliate does not necessarily import goods from parent firm for its production since various products with high quality are available in DCs as well. Secondly, the affiliate's exports show significantly positive effects regardless of location. This confirms the fact that vertical or hybrid type FDI has complementary properties.

Next, we examine whether or not it has been correctly argued that a firm produces various products causing local sales to produce the mixed results. We estimate the same regression as above using multinationals that have only one manufacturing affiliate abroad. We presume that the firms with less foreign affiliates are small in all aspects compared to other multinationals with many affiliates and produce a less number of products leading to less mixed estimation results. First, we show a simple comparison at the two samples in Table 3. We confirm from the table that, in fact, multinationals with only one foreign affiliate is small in size and use less capital and material inputs. The estimation results are as follows in Table 4. The overall results are the same as the previous results except that the substitution effect of local sales is more prominent. Also, the complementarity effect of exports becomes insignificant, though it is still positive.

Next, we examine whether or not a firm that has more local

Table 3. All vs. reduced sample

	All Sample	Reduced Sample
Size	4,676	2,262
Capital	1,120,000	208,000
Material	890,000	429,000
Observations	273	181

Note: Units are persons or million Korean Won.

market oriented affiliates is indeed more likely to be substituted than one with export oriented affiliates. In so doing, we interact the variable for foreign affiliate sales with the variable for the share of

Table 4. FDI and Export(using reduced sample)

Regressor	(5)	(6)	(7)	(8)
Size	0.861 (0.103)***	0.869 (0.101)***	0.925 (0.099)***	0.928 (0.099)***
Capital Intensity	0.227 (0.084)***	0.231 (0.083)***	0.269 (0.080)***	0.266 (0.081)***
Material Input Usage	0.414 (0.101)***	0.417 (0.100)***	0.434 (0.095)***	0.424 (0.097)***
Affiliate Sales	0.007 (0.045)			
Local Sales		-0.027 (0.033)		
Exports		0.035 (0.035)		
Sales of Affiliates located in DCs			-0.361 (0.103)***	
Sales of Affiliates located in LDCs			0.064 (0.045)	
Local Sales of Affiliates located in DCs				-0.27 (0.082)***
Exports of Affiliates located in DCs				-0.106 (0.089)
Local Sales of Affiliates located in LDCs				0.008 (0.034)
Exports of Affiliates located in LDCs				0.045 (0.037)
Year Dummy	Yes	Yes	Yes	Yes
Fixed Effect	Yes	Yes	Yes	Yes
R2	0.42	0.43	0.49	0.48
Observations	181	181	181	181

Note: 1) Reduced sample because multinationals that have only one affiliate are used.

2) All regressors are in a log term.

3) The number in parenthesis is standard error.

4) ***, **, and * indicate significance at the 1, 5, and 10% level.

affiliate local sales. The share is calculated as local sales divided by the sum of affiliates' local sales and exports. So, it will be 1 if all foreign affiliates focus on the local market without exporting anything outside the host country. On the other hand, it will be 0 if foreign affiliates export all products, not serving the local market at all. Hence, if the coefficient of the interaction term is negative, it implies that the general complementary effect of affiliate sales will weaken as the share of local sales increase. Table 5 shows the results. We insert column (1) of table 2 for comparison. The difference between column (9) and (10) is that the former share is calculated from the local sales of all affiliates, while the latter share from the local sales of affiliates

Table 5. The effect of local sales; analysis by interaction

	(1)	(9)	(10)
Size	0.794	0.817	0.802
	(0.084)***	(0.083)***	(0.084)***
Capital Intensity	0.237	0.245	0.249
	(0.074)***	(0.073)***	(0.074)***
Material Input Usage	0.314	0.334	0.312
	(0.072)***	(0.071)***	(0.072)***
Affiliate Sales	0.073	0.107	0.098
	(0.040)***	(0.041)***	(0.043)**
interaction (Affiliate sales * share of local sales)		-0.07	-0.166
		(0.023)***	(0.098)*
Year Dummy	Yes	Yes	Yes
Fixed Effect	Yes	Yes	Yes
R2	0.43	0.46	0.44
Observations	273	273	273

Note: 1) All regressors are in a log term.

   2) The number in parenthesis is standard error.

   3) ***, **, and * indicate significance at the 1, 5, and 10% level.

located in DCs. Both (9) and (10) suggest the more affiliates focus on local sales, the more they substitute parent firm exports. In particular, we infer from (9) that foreign affiliate sales improve parent firm exports by 10% when they focus only on exporting (local sales share= 0) and that it decreases as local sales ratio increases. It drops to 3% when they focus only on the local market (local sales share=1). Since local sales have different effects depending on the location of affiliates, we next consider the share of local sales of affiliates located in DCs. As local sales in DCs have stronger substitution effects than that in

Table 6. FDI and Export by geography

	All Sample	Reduced Sample
Size	0.818 (0.081)***	0.916 (0.099)***
Capital Intensity	0.213 (0.074)***	0.264 (0.080)***
Material Input Usage	0.339 (0.071)***	0.432 (0.095)***
Sales of Affiliates located in America	-0.055 (0.081)	-0.37 (0.103)***
Sales of Affiliates located in Asia	0.078 (0.027)***	0.066 (0.045)
Sales of Affiliates located in Europe	0.116 (0.041)***	0.401 (0.529)
Year Dummy	Yes	Yes
Fixed Effect	Yes	Yes
R2	0.47	0.49
Observations	273	181

Note: 1) All regressors are in a log term.
2) The number in parenthesis is standard error.
3) ***, **, and * indicate significance at the 1, 5, and 10% level.

LDCs /according to Table 2 and 4/, the interaction term in column (10) shows stronger substitution effects. At this point, we would like to stress that the total effect could possibly be negative.[12] Though both column (9) and column (10) produce a substitution effect of local sales, the total effect of column (9) is still positive while that of column (10) is negative. Thus, the local market oriented foreign affiliate in DCs can indeed substitute parent firm exports.

Finally, we explore whether or not the relation is different according to geography. The relation should produce somewhat different results since the main activity of affiliates is different depending on the region as Figure 7 shows. We expect more substitution and less complementarity from affiliates located in the Americas, while more complementarity and less substitution from those in Asia or Europe. Table 6 confirms our expectations. The left column for all samples shows the significant positive relation in Asia and Europe and the right column using a reduced sample shows a significant negative relation in the Americas.

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12) 9.8%. 16.6% = .6.8%

VI. Conclusion

This paper investigates the activity of Korean multinational firms, focusing on the relationship between parent firm exports and foreign affiliate sales. At first glance, affiliate sales seem to be complementary to exports, which is found in previous studies. Once we differentiate affiliate sales into local sales and exports outside the host country and consider the location of affiliates, however, the estimation results produce a different story. Using unique Korean multinational firm level data, we were able to find whether substitution or complementarity depends on various foreign affiliate activities and their location. If foreign affiliates export their products, parent firm exports are enhanced. On the other hand, exports are substituted, if foreign affiliates focus on the local market. Also, parent firm exports are more likely to be substituted if foreign affiliates are more oriented to the local market in developed countries. This result is strengthened for the firms that are less likely to produce intermediate products and are located in developed countries.

Our parent firm exports variable encompasses all exports the parent firm makes. This is not necessarily a disadvantage in studying the general effects of FDI on firm behavior. We also control other factors that might affect firm exports. In spite of that, we are aware that it would be ideal to investigate affiliate activities in a host country and parent firm exports to that host country in studying the relation between those two variables. At this moment, however, we do not have sufficient information for each parent firm and the export destination of foreign affiliates. We would like to revisit this study as those data become available.

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