

The Impact of Free Trade Agreements on Foreign Direct Investment: The Case of Korea *

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This paper aims to empirically identify the effects of FTAs on outward and inward FDIs in Korea. Considering the income differences between Korea and its FTA partners, we hypothesize that FTAs have a positive effect on outward FDI to developing countries and inward FDI from developed countries. An underlying source of the hypothesis is the Knowledge-Capital model, addressing the positive (negative) relationship between trade costs and horizontal (vertical) FDI. We test for the hypothesis using data on Korea's FTAs and FDI over the period 2000-2010. We find that our empirical results support the hypothesis, and additionally, FTAs in general encourage FDI by creating an FDI-friendly environment.

Keywords: FTA, Horizontal FDI, Vertical FDI, Knowledge-Capital Model

JEL Classification: F15, F21, F23

1. Introduction

Since World War II, the world economy has steadily pursued trade liberalization through regional trade agreements (RTAs) to improve economic welfare. RTAs have continued to increase at an annual rate of 16% since 1992, and up to the present, the number of RTAs in force that were notified to the WTO is around 260. In particular, free trade agreements (FTAs), the lowest level of RTAs, account for 90% of the total number of RTAs.¹

Korea has actively expanded its FTA network since the Korea-Chile FTA in

* This paper expands on Bae, Kim, Keum and Jang (2012, pp. 121-160), which is a KIEP policy report, providing the detailed rationale behind the Knowledge-Capital model and the robustness of the estimates.

¹ Refer to the Regional Trade Agreements Information System (RTA-IS) on the WTO website.

2004. As of 2012, Korea has FTAs with 45 trading partners, including the world's top three economic blocs: the U.S., EU, and ASEAN plus India (see Table 1).

Table 1. Korea's FTAs as of 2012

Country	Year of Inception	Country	Year of Inception
Chile	Apr. 2004	India	Jan. 2010
Singapore	Mar. 2006	EU	Jul. 2011
EFTA	Jun. 2006	Peru	Aug. 2011
ASEAN	Jun. 2007	U.S.	Mar. 2012

Source: FTA Portal Information Service of Korea Customs Service

Meanwhile, foreign direct investment (FDI) has also increased over the past two decades in the world. The World Investment Report 2010 published in the United Nations (UN)² shows that the number of multinational enterprises (MNEs) has more than doubled to 103,786 in 2010 from about 40,000 in 1993. Accordingly, the number of foreign affiliates has increased to 892,114 in 2010 from about 270,000 in 1993.

A steady rise in Korea's FDI reflects this global trend. In particular, since 2000, outward and inward FDI in Korea has grown dramatically (see Table 2). The amount of outward FDI from Korea has increased by 10 fold over the past 10 years, increasing from \$26 million in 2000 to \$255 million in 2010. Also, since 2000, the amount of inward FDI to Korea has increased by 3.6 times.

In academic circles there has been a long dispute about whether economic integration such as FTAs helps or hinders domestic economic performances. Regarding the relationship between FTA and FDI, the world data show that both FTA and FDI have increased during the last two decades, and therefore, economists pay attention to how FTAs affect FDI. Currently, one of the economic issues attracting much attention in Korea is to find a correlation between FTA and FDI because Korea's FTA and FDI move in the same direction in the 2000s.

Table 2 shows that Korea's outward FDI to the FTA partners, Chile, Singapore, EFTA, and ASEAN, tended to grow at a faster rate than the total amount of its overseas investment, particularly after the inception of the FTAs. After the Korea-Chile FTA, Korea increased investment in Chile mainly in the mining industry for resource development but remained at relatively low levels - \$45 million in 2004 and \$81 million in 2009. Korea's investment in Singapore increased at an average of 60%

² The UN publication symbol of the report is UNCTAD/WIR/2010.

per year from \$594 million in 2004 to \$5.295 billion in 2010, especially in the financial and professional services sectors. Outward FDI to EFTA was only \$48 million in 2004 but increased dramatically to \$2.828 billion in 2010. Korea's investment in ASEAN, a major destination of Korea's overseas investment, reached \$31.228 billion in 2010 from \$4.478 billion in 2004, with increases in a variety of industries, ranging from mining, metal, and chemicals to real estate and financial services.

Inward FDI from the FTA partners has generally showed an upward trend since the FTAs entered into force. Chile became an investor in Korea for the first time in the year that followed the Korea-Chile FTA in 2004. It invested \$7 million in 2005 and \$20 million in 2009, mostly in the wholesale/retail and warehousing industries to distribute its agricultural products in Korea. During the post-FTA period Singapore has invested in electrical/electronic manufacturing, real estate, and financial services sectors, and in the cultural and entertainment industries as well. Singapore's total investment in Korea increased to \$3.469 billion in 2010 from \$1.823 billion in 2005. At the start of the year of the Korea-EFTA FTA, inward FDI from EFTA has increased, particularly in the machinery/equipment manufacturing and wholesale/retail and business services sectors. It was \$855 million in 2005 and \$3.352 billion in 2010. On the other hand, ASEAN has rather decreased its overseas investment in Korea from \$6.332 billion in 2007 to \$5.840 billion in 2010 due to the steep decline in investment inwards from the electrical and electronic industries, reducing the share of ASEAN in Korea's total inward FDI to 4% in 2010 from 10% before the Korea-ASEAN FTA.

Table 2. Korea's outward and inward FDI (in millions of USD)

Year	World		Chile		Singapore		EFTA		ASEAN	
	Out	In	Out	In	Out	In	Out	In	Out	In
2000	25,816	37,423	25	-	486	901	-	457	3,659	4,268
2001	28,706	41,282	25	-	507	962	20	458	3,206	4,702
2002		44,341		-		1,082		660		5,098
2003	33,843	48,229	31	-	423	1,148	46	682	2,573	5,362
2004	39,936	55,955	42	-	594	1,264	48	784	4,478	5,392
2005		62,020		7		1,588		855		5,648
2006	54,075	70,951	45	7	984	1,823	60	966	8,327	5,860
2007	74,776	67,842	72	7	1,668	2,332	816	1,186	9,228	6,332
2008	98,483	75,446	37	7	2,720	2,147	1,295	1,186	14,182	5,945
2009	115,450	117,732	81	20	2,785	4,048	1,426	2,612	16,157	6,053
2010	254,716	134,234	-	-	5,295	3,469	2,828	3,352	31,228	5,840

Note: 1) No data of outward FDI exists in 2002 and 2005.

2) "Out" and "In" represent Outward FDI and Inward FDI, respectively.

Source: OECD International Direct Investment Statistics

As shown in Table 2, it seems that FTAs stimulate FDI in general, consistent with some previous empirical studies.³ However, it is unclear, theoretically and empirically, how FTAs should affect FDI. A major feature of FTAs is the elimination of bilateral tariffs over time. If FDI is a substitute for exports, FTAs should lead to reductions in FDI as a firm, specifically an MNE, pursues exporting rather than FDI, given horizontal FDI as a strategy for its overseas expansion. On the other hand, if FDI is complementary with exports, FTAs should encourage additional FDI, given that the MNE seeks to specialize vertically in production, because FTAs lower the costs of intra-firm trade. After all, the impact of FTAs on FDI could appear in different guises depending mainly on motives behind investment. As a matter of fact, several studies point out that the impact of economic integration on FDI should depend on country-, industry-, and market-characteristics, types of FDI, and so on (Markusen and Venables, 1998; Blomström and Kokko, 1997; Jang, 2011; Oberhofer and Pfaffermayr, 2012).

While a large number of studies have analyzed a trend of FDI after an individual FTA or predicted it using a simulation approach in Korea, there have been little works to empirically test for the impact on FDI of the overall FTAs that Korea has made. In this context, we aim to empirically identify how FTAs affect outward and inward FDI at the bilateral level in Korea, focusing on the agreements with Chile, Singapore, ASEAN, and EFTA. Based on the Knowledge-Capital model and previous empirical studies, we make the following hypotheses: if Korea is more (less) developed than its partner countries by per capita income, then outward FDI from Korea is more likely to be a vertical (horizontal) type. On the other hand, inward FDI to Korea is more likely to be a horizontal (vertical) type.

The data on FDI after ratifying the FTAs in Table 2 show that the vertical types of FDI may dominate the horizontal types for outward FDI, and vice versa for inward FDI, to a lesser degree. Compared to the FDI data between a group of developing countries, “Chile and ASEAN”, and the other group of developed countries, “Singapore and EFTA”, it seems that outward FDI with vertical motives is more prevalent; on the other hand, for inward FDI the two types of FDI are relatively evenly mixed or the horizontal type of inward FDI is slightly higher. In this context, in Korea the impact of FTAs should be positive on outward FDI, while negative on inward FDI. However, as liberalization beyond the elimination of tariffs, FTAs at large encourage bilateral economic exchanges. It suggests that

³ See Velde and Bezemer (2006) for U.S. and U.K, Pain and Lansbury (1997) for German, Feils and Rahman (2008) for NAFTA members, Yeyati *et al.* (2003) and Leshner and Miroudot (2006) for OECD countries and Baltagi *et al.* (2007) for Europe.

the impact on inward FDI of FTAs may be generally ambiguous, and in some cases may appear to be positive.

More concretely, we expect that the effects of FTAs on outward FDIs to relatively low income countries are always positive as long as the vertical types overwhelm the horizontal types. As for inward FDI from higher income countries than Korea, the impact of FTAs can vary with the relative magnitude between the substitution effect of exporting for horizontal FDI, the effect on vertical FDI depending on the amount of intra-firm trade, and the promotion effect of FTAs led by FDI-friendly economic environment.

To empirically test for the hypotheses, we estimate several econometric specifications, basically derived from the Knowledge-Capital model, similarly to Egger and Pfaffermayr (2004), using bilateral outward and inward FDI data from OECD over the period of 2000 through 2010. From the estimations we find some evidence supporting the hypotheses. In Korea, FTAs have a positive effect on outward FDI, regardless of the income level of its partner countries, while they stimulate inward FDI only from high income countries.

Additionally, we check whether or not our main results are robust in the following three aspects: discarding the outliers, handling zero FDI observations with Tobit, Poisson Quasi Maximum Likelihood (PQML) technique, and Heckman's two step procedures, and dealing with endogeneity of trade policies with the Arellano-Bond estimation. The estimation results, obtained from the alternative specifications, are consistent with the main regressions. Hence, we conclude that the empirical findings support our hypotheses on the relationship between FTA and FDI.

This paper proceeds as follows. Section 2 looks over Knowledge-Capital model on FDI and the previous related studies and draws some plausible hypotheses on the relationship between FTA and FDI in Korea. Section 3 introduces the econometric specifications and data employed in this study. Section 4 presents the empirical results. Section 5 tests to see whether our findings are robust to the alternative specifications. Finally, Section 6 summarizes the findings and makes concluding remarks with a future research agenda.

2. Literature Review and Hypotheses

Conceptually, FDI can be divided into two types, depending on its motives: horizontal and vertical FDI. Horizontal FDI is driven by desire to place production bases close to foreign markets, while vertical FDI is motivated with incentives to carry out labor or resource intensive production activities in labor or resource

abundant countries.⁴ The two motives for FDI determine the forms of the outcomes of FDI, and ultimately the relationship between trade costs and FDI. Since a major feature of FTAs is to reduce trade costs mainly through the elimination of bilateral tariffs, the relationship between FTA and FDI depends on the types of FDI.

1) FTA and horizontal FDI

In general, a firm that is planning to extend its business abroad can make two choices: exporting or horizontal FDI. If an MNE duplicates its production facility in foreign markets through horizontal FDI, then it can save not only tariffs but also the other trade-related variable costs such as transportation, insurance, and storage. Hence, horizontal FDI is often called a tariff-jumping strategy. However, the MNE cannot reap benefits from economies of scale because its production plants are dispersed over the world. In addition, it should pay a higher fixed cost for building production facilities in its foreign markets than in its domestic market. On the contrary, if the firm builds its all production plants in the home country and exports its products to the foreign markets, then it can benefit from economies of scale and save potentially a higher fixed cost. In this case, however, the firm as an exporter should pay trade variable costs regularly.

Overall, the relationship between exporting and horizontal FDI can be expressed as the trade-off between economies of scale and tariff-jumping strategy. It is also explained by the proximity-concentration hypothesis, implying that horizontal FDI substitutes for exports (Brainard, 1997; Helpman, Melitz and Yeaple, 2004; Head and Ries, 2004; Greenaway and Kneller, 2007).

As a consequence, when trade costs decrease through FTAs, a firm is more likely to export rather than to make horizontal FDI because there is a greater benefit from economies of scale than the tariff-jumping strategy. Some empirical studies support substitution between exports and horizontal FDI, showing the positive (negative) relationship between trade costs (FTA) and horizontal FDI. Using data on European firms and a bivariate Probit model, Oberhofer and Pfaffermayr (2012) find that large and remote markets are served via horizontal FDI while small and nearby markets tend to be served by exports. Assuming that bilateral FDI in developed country-pairs is more likely to be driven by horizontal motives, Jang (2011) shows that bilateral FTAs have a negative effect on bilateral FDI in OECD-OECD country-pairs.⁵

⁴ Greenaway and Kneller (2007) define that vertical FDI is factor-seeking, while horizontal FDI is market-seeking.

On the other hand, Blomström and Kokko (1997) address that an FTA can result in increasing horizontal FDI because it expands the common market between member countries and fosters an FDI-friendly economic environment by including investment provisions.⁶ In addition, Irarrazabal, Moxnes and Opromolla (2009) point out that intra-firm trade exists between headquarter and its overseas branches constructed even with horizontal motives. Thus, if trade costs decrease through FTAs, horizontal FDI can increase with FTAs because an MNE can more easily send its key components to its overseas affiliates in the partner countries.

Based on the conceptual background above, some studies provide empirical evidence that horizontal FDI is complementary with exporting. Lipsey, Ramstetter and Blomström (2000) and Kneller and Pisu (2004) show that MNEs export even more intensively than indigenous firms in Japan, the U.S. the U.K and Sweden. Lipsey and Weiss (1984) find that the higher an affiliate's output in a foreign country, the larger its exports from the home to the foreign country. Furthermore, they show that the positive relationship is more prominent between foreign output and exports of intermediate goods for further processing. Interestingly, Head and Ries (2001) find that there exists the complementary relationship between exports and horizontal FDI, especially in the most vertically integrated firms.

As a consequence, the impact of FTAs on horizontal FDI is ambiguous and actually changes with whether the FDI is a complement to or a substitute for exporting. In particular, the relationship between horizontal FDI and exports depends on the types of exporting goods and the characteristics of home and host countries. Using data on Swedish MNEs, Svensson (1996) shows that horizontal FDI replaces exports of finished goods, but attracts intermediate goods from the parent. As regards the U.K. and the U.S. FDI in developing countries, Velde and Bezemer (2004) find that the impact of economic integration on FDI depends on the economic sizes and the distance between home and host countries. Finally, they conclude that countries that have larger economies or are geographically closer to larger economies can expect a larger increase in FDI in response to joining FTAs. In any case, the positive (negative) effects of FTAs on horizontal FDI will be more (less) remarkable when the members have greater market sizes and economic similarity between each other.

⁵ See table 4 in Greenaway and Kneller (2007) for other empirical evidences on the substitutional relationship between exports and horizontal FDI.

⁶ All FTAs in Korea include investment treaties as well as commodity agreements. In addition, it is evaluated that investment treaties in FTAs pursue a higher level of openness than bilateral investment treaties (BITs).

2) *FTA and vertical FDI*

As an MNE accomplishes production activity in a host country with relatively low production costs through vertical FDI and imports its products to the home country, it is predicted that the relationship between trade and vertical FDI is complementary (Helpman, 1984; Helpman and Krugman, 1987). In general, the headquarters in the home country export their core components to production facilities constructed by vertical FDI in the host country. Accordingly, when trade costs such as tariffs decrease through FTAs, the MNE is likely to perform more vertical FDI due to lower costs to import final goods and to export intermediate goods.

The difference in factor endowments or skill between two countries is also a major factor to affect incentives for vertical FDI. For example, consider that home is relatively skilled labor-abundant while host is relatively skilled labor-scarce (unskilled labor-abundant). Then, an MNE in the home country has an incentive to carry out unskilled labor-intensive production activity in the host country through vertical FDI to save production costs. Several empirical studies prove that vertical FDI increases with the difference in factor endowments between two countries. Addressing that vertical FDI takes place between countries with sufficiently different factor endowments, Yeyati, Stein and Daude (2003) and Velde and Bezemer (2006) show that RTAs have positive effects on inward FDI of developing countries, for example, an increase in U.S investment in Mexico under NAFTA.

For the relationship between trade and vertical FDI, Head and Ries (2003) and Kiyota and Urata (2005) use data on Japanese firms and find positive relationships between exports and vertical FDI. Jang (2011) shows that bilateral FTA has positive effects on bilateral FDI in OECD-non OECD country-pairs under the hypothesis that outward FDI from developed countries to developing countries is driven by vertical motives. For the case of Korea, Kim and Hyun (2011) investigate Korean MNEs' activities during the period 1992-2008 and find that a complementarity between trade and vertical FDI has been intensified with the spread of global production networks and intra-firm trade.

3) *Knowledge-Capital model and hypotheses*

Our dataset contains FDI values collected at country level, and unfortunately, does not distinguish whether the motives of FDI are horizontal or vertical. Thus, we draw an underlying conceptual and empirical methodology from the Knowledge-Capital model. Markusen and Venable (1998) consider that horizontal and vertical FDI is mixed up together in the country-level FDI data. They propose

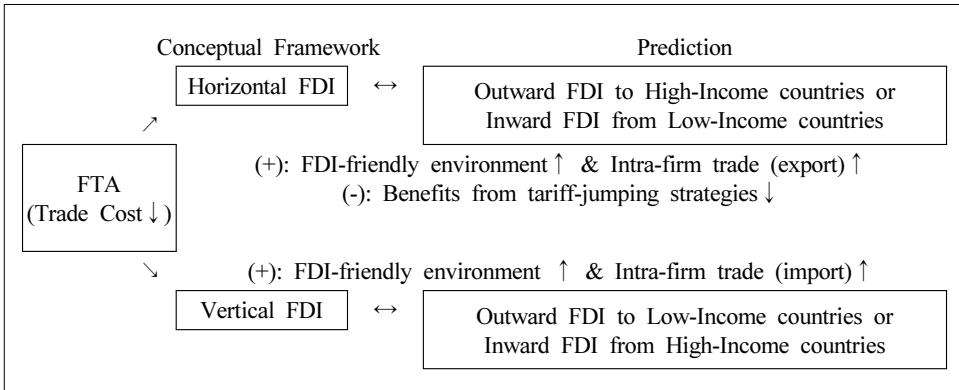
the Knowledge-Capital model, which simultaneously considers various factors that affect FDI such as the economy sizes of home and host, the difference in factor endowments, barriers to investment, and trade costs. As mentioned in the preceding section, the Knowledge-Capital model expects that horizontal FDI increases with the sizes of home and host economy and economic similarity between the two countries. On the other hand, vertical FDI rises with the difference in factor endowments or the levels of skill between the two.

Carr, Markusen and Maskus (2001) empirically test the Knowledge-Capital model and show that FDI is significantly affected by economic size and similarity, the difference in factor endowments, and barriers to investment. In particular, they draw a conclusion that the effects of trade costs on FDI depend on the difference in factor endowments between countries. They find that trade costs are more likely to increase aggregate FDI by stimulating horizontal motives, especially when the difference in the factor endowments is small. On the other hand, trade costs negatively affect aggregate FDI by constricting vertical motivation when the difference in factor endowments is large. Egger and Pfaffermayr (2004) and Jang (2011) also present similar results from data on FDI between OECD countries.

Following on the previous studies, we assume that outward FDI from Korea is more likely to be horizontal, if a host country's income level is higher than Korea's. On the contrary, outward FDI from Korea is more likely to be vertical, if a host country's income level is lower than Korea's. Similarly, inward FDI to Korea is more likely to be a vertical (horizontal) type if a host country's income is higher (lower) than Korea's. In this respect, the effects of FTAs on horizontal FDI are ambiguous, and thus, without considering any promotion effects of FTAs, we hypothesize as follows: *when Korea's income is higher than its partners, the impact of FTAs on aggregate outward FDI to the partners from Korea is positive, but when the case is reversed, the impact is ambiguous.*

In addition, as the impact of FTAs on vertical FDI is positive, we propose another hypothesis: *when Korea's income is lower than its partners, the impact of FTAs on aggregate inward FDI to Korea from the partners is positive, but vice versa the impact is ambiguous.* Figure 1 describes the hypotheses of this empirical study and their rationales.

Figure 1. Conceptual framework on the relationship between FTA and FDI in Korea



3. Econometric Specifications and Data

In this section we seek to find empirical evidences on the effects of FTAs on the changes in bilateral outward and inward FDI in Korea and examine whether or not they are in line with our hypotheses. We expand the Knowledge-Capital model estimated by Carr *et al.* (2001), Markusen and Maskus (2002), and Egger and Pfaffermayr (2004) using the FTA dummy.⁷ The main regression is given by:

$$\begin{aligned} \ln(FDI_{kjt}) = & \beta_0 + \beta_1 \ln(GDPSUM_{kjt}) + \beta_2 \ln(SM_{kjt}) + \beta_3 \ln(DIFF_{kjt}) \\ & + \beta_4 \ln(OPEN_{jt}) + \beta_5 BIT_{kjt} + \beta_6 FTA_{kjt} + \gamma_j + \tau_t + \varepsilon_{kjt} \end{aligned} \tag{1}$$

The dependent variables are the log of outward or inward FDI stocks between Korea (k) and its 184 trading partners (j) at the bilateral level for year t .

Based on the Knowledge-Capital model, FDI stocks are explained by the four types of variables: country sizes, factor endowments, trade and FDI frictions. $GDPSUM_{kjt}$ represents the sum of the economic sizes of countries k and j ,

⁷ Carr *et al.* (2001) empirically test how various factors such as economic sizes, factor endowments and trade costs affect FDI, based on the Knowledge-Capital model. Egger and Pfaffermayr (2004) expand Carr *et al.* (2001) with bilateral investment treaties (BITs). Markusen and Maskus (2002) estimate the role of horizontal FDI and vertical FDI within the Knowledge-Capital model framework.

i.e., $GDP_{SUM}_{kjt} = GDP_{kt} + GDP_{jt}$. SM_{kjt} captures the degree of similarity in the economic sizes between Korea and its partner countries. It is measured as $SM_{kjt} = 1 - \left(\frac{GDP_{kt}}{GDP_{kt} + GDP_{jt}} \right)^2 - \left(\frac{GDP_{jt}}{GDP_{kt} + GDP_{jt}} \right)^2$. It is expected that an increase both in size (GDP_{SUM}) and similarity (SM) of Korea and its partner country positively affects horizontal FDI.

$DIFF_{kjt}$ denotes a proxy for the differences in factor endowments between Korea and its partners. It is practically recognized that wage differentials between two countries is a major driver for vertical FDI.⁸ As in Brainard (1997), therefore, we define $DIFF_{kjt}$ as the ratio of GDP per capita between two countries. It is expected that an increase in $DIFF_{kjt}$ stimulates vertical FDI, according to the Knowledge-Capital model.⁹ $OPEN_{jt}$ stands for the degree of trade openness in the partner country, calculated as the ratio of total trade to GDP, i.e., $OPEN_{jt} = \frac{EXPORT_{jt} + IMPORT_{jt}}{GDP_{jt}}$. BIT_{kjt} is a dummy, which is 1 after a BIT is contracted between Korea and country j , and 0 otherwise. We expect that both $OPEN_{jt}$ and BIT_{kjt} obviously promote both horizontal and vertical FDI because they contribute to creating an FDI-friendly environment.

The key variable, FTA_{kjt} , is a dummy, which is 1 after the FTA's entry into force, and 0 otherwise. The impact of FTAs on FDI may differ depending on reasons for investment, horizontal and vertical, as previously mentioned: positive effects on vertical FDI, but ambiguous effects on horizontal FDI. Less tangibly, the FTA's entry into force is likely to drive FDI intensifying economic and political cooperation between the two countries. γ_j and τ_t indicate partner country-fixed effects and year-fixed effects, respectively. Since the source country is fixed as Korea, γ_j stands for country-pair fixed effects. Finally, the usual error term is denoted by ε_{kjt} .

In equation (1), because $DIFF_{kjt}$ is measured by GDP per capita, it is important to consider the relative magnitude of per capita income between Korea and

⁸ Among previous studies on the Knowledge-Capital model, Egger and Pfaffermayer (2004) consider the difference in the skill-unskilled ratio between countries, while Brainard (1997) includes the difference in GDP per capita. Although the former have a merit of directly measuring factor endowments, it does not reflect any differences in production costs, caused by, for example, wage differentials between countries. On the contrary, the latter can reflect well the difference in production costs, but not directly related to factor endowment.

⁹ However, $DIFF_{kjt}$, might be also related with horizontal FDI because it is measured by GDP per capita. We tackle this issue using augmented specifications (2) and (3).

its partner countries (Blonigen, Davies and Head 2003). For example, if an increase in $DIFF_{kjt}$ comes from an improvement in productivity or purchasing power in Korea, we can expect that there will be an increase both in outward and inward horizontal FDI. However, if an increase in $DIFF_{kjt}$ is related to a decline in productivity or purchasing power in partner countries, then both outward and inward horizontal FDI will decrease with $DIFF_{kjt}$. As a consequence, we need to distinguish the sizes of partner countries on the basis of per capita GDP of Korea. We modify equation (1) as follows:

$$\begin{aligned} \ln(FDI_{kjt}) = & \beta_0 + \beta_1 \ln(GDPSUM_{kjt}) + \beta_2 \ln(SM_{kjt}) + \beta_3 \ln(DIFF_{kjt,>1}) \\ & + \beta_4 |\ln(DIFF_{kjt,<1})| + \beta_5 \ln(OPEN_{jt}) + \beta_6 BIT_{kjt} + \beta_7 FTA_{kjt} \\ & + \gamma_j + \tau_t + \varepsilon_{kjt} \end{aligned} \quad (2)$$

In equation (2), $DIFF_{kjt}$ is split into two parts, $DIFF>1$ and $DIFF<1$, because the characteristic of partners changes by one. For instance, when $DIFF<1$, we can classify partners as developed countries with higher income than Korea. $DIFF_{kjt,<1}$ is the case in equation (2). Similarly, when $DIFF_{kjt,>1}$, partners are expected to be developing countries.

If we take the outward FDI as a dependent variable, then it is expected that the coefficient of $DIFF_{kjt,>1}$ is estimated to be significantly positive so that Korea is more likely to make vertical FDI to the partner country. On the other hand, if it is estimated that the coefficient of $DIFF_{kjt,<1}$ is positive, we expect that Korea is likely to make overseas investment with horizontal motives to a partner country. In the case of inward FDI, a partner country tends to perform horizontal inward FDI to Korea when $DIFF_{kjt,>1}$, while it is more likely to make vertical inward FDI to Korea when $DIFF_{kjt,<1}$.

In equation (3), we augment equation (2) with the interaction terms of $DIFF$ and FTA in order to capture the different effects of FTAs with partner countries with higher or lower per capita GDP than Korea.

$$\begin{aligned} \ln(FDI_{kjt}) = & \beta_0 + \beta_1 \ln(GDPSUM_{kjt}) + \beta_2 \ln(SM_{kjt}) + \beta_3 \ln(DIFF_{kjt,>1}) \\ & + \beta_4 |\ln(DIFF_{kjt,<1})| + \beta_5 \ln(OPEN_{jt})_{kjt} + \beta_6 BIT_{kjt} + \beta_7 FTA_{kjt} \\ & + \beta_8 \ln(DIFF_{kjt,>1})FTA_{kjt} + \beta_9 |\ln(DIFF_{kjt,<1})| FTA_{kjt} + \gamma_j + \tau_t + \varepsilon_{kjt} \end{aligned} \quad (3)$$

Korea's outward FDI is more likely to be of a vertical type when Korea's GDP per capita is greater than its partners. In other words, as $DIFF_{kjt, > 1}$ is greater, the positive effect of FTAs on outward FDI becomes larger. Hence, we expect β_8 in equation (3) to be positive, taking outward FDI as a dependent

variable, i.e. $\frac{\partial^2 \ln(OutwardFDI_{kjt})}{\partial FTA_{kjt} \partial \ln DIFF_{kjt, > 1}} > 0$. However, it is expected that the sign of β_9 will be ambiguous, because when $DIFF_{kjt, < 1}$ outward FDI will be driven mainly by horizontal motives. As a result, the relationship between FTAs and horizontal FDI is ambiguous, i.e. $\frac{\partial^2 \ln(OutwardFDI_{kjt})}{\partial FTA_{kjt} \partial |\ln DIFF_{kjt, < 1}|} \cong 0$.

As for inward FDI, it is expected β_8 to be ambiguous in equation (3) because when $DIFF_{kjt, > 1}$ inward FDI is more likely to be horizontal, i.e. $\frac{\partial^2 \ln(inwardFDI_{kjt})}{\partial FTA_{kjt} \partial \ln DIFF_{kjt, > 1}} \cong 0$. Similarly, since inward FDI tends to be of a vertical

type when $DIFF_{kjt, < 1}$, we expect β_9 to be positive, i.e. $\frac{\partial^2 \ln(inwardFDI_{kjt})}{\partial FTA_{kjt} \partial |\ln DIFF_{kjt, < 1}|} > 0$.

Table 3 presents the definition of the explanatory variables and their expected signs from previous literature and our hypotheses on outward FDI and inward FDI respectively.¹⁰ Regardless of outward or inward FDI, $GDPSUM_{kjt}$ and SM_{kjt} positively affect horizontal FDI, but have nothing to do with vertical FDI. It implies that the expected signs of the coefficients of $GDPSUM_{kjt}$ and SM_{kjt} are positive on total FDI. $OPEN_{jt}$ and BIT_{kjt} are expected to promote FDI without regard to FDI types, which are outward or inward and horizontal or vertical. Thus, the impact of $OPEN_{jt}$ and BIT_{kjt} on total FDI is expected to be positive.

If $DIFF_{kjt}$ is ideally considered a proxy for wage differentials, we can expect that it will affect vertical FDI positively. However, $DIFF_{kjt}$ is also related to FDI of the horizontal type due to its measurement method. It suggests that the estimated impact of $DIFF_{kjt}$ may practically be ambiguous both on outward and inward FDI. According to our hypotheses, when $DIFF_{kjt} > 1$ vertical (horizontal) FDI dominates horizontal (vertical) FDI on outward (inward) FDI. Note that an increase in $DIFF$ comes from an increase in Korea's GDP per capita and/or a decrease in the partner's per capital GDP. We expect that outward FDI is rising with $DIFF$ greater than one. However, the impact on inward FDI

¹⁰ See Carr *et al.* (2001), Markusen and Maskus (2002), and Egger and Pfaffermayr (2004) for the model prediction.

is ambiguous because it increases with Korea's income, but decreases with a reduction in partners' income.

On the other hand, when $DIFF_{kjt} < 1$, with regard to inward (outward) FDI, vertical (horizontal) types of FDI dominate horizontal (vertical) FDI. As Korea's (partner's) GDP per capita increases (decreases), vertical types of inward FDI decrease. It is likely that an increase in $DIFF$ reduces inward FDI. This impact is ambiguous on outward FDI because an increase in the income levels of the two countries has a different effect on horizontal types of outward FDI.

Finally, as the effect of FTAs on vertical FDI is expected to be positive, but equivocal for horizontal FDI, we cannot determine the sign of the coefficient of FTA both on total outward and inward FDI. If the coefficient of FTA is estimated to be positive, then we can predict that vertical FDI dominates horizontal FDI on total FDI. To support this, we additionally take into account the interaction terms between $DIFF$ and FTA . For outward (inward) FDI with $DIFF > 1$, vertical (horizontal) types of FDI dominate horizontal (vertical) types. Therefore, the positive effect of FTAs on outward (inward) FDI is likely to be large (small). Regarding inward (outward) FDI with $DIFF < 1$, on the reverse, vertical (horizontal) types dominates horizontal (vertical), so that the effect of FTAs would be large (small).

Table 3. Variables and their expected signs

Variable	Definition	Horizontal FDI	Vertical FDI	Total FDI	
				Outward	Inward
$GDPSUM_{kjt}$	Sum of GDP in k and j	+		+	+
SM_{kjt}	$1 - \left(\frac{GDP_{kt}}{GDPSUM_{kjt}} \right)^2 - \left(\frac{GDP_{jt}}{GDPSUM_{kjt}} \right)^2$	+		+	+
$DIFF_{kjt}$	Ratio of per capita GDP of k and j	+/-	+	+/-	+/-
$DIFF_{kjt, > 1}$	$DIFF > 1$	+/-	+	+	+/-
$DIFF_{kjt, < 1}$	$DIFF < 1$	+/-	+	+/-	-
$OPEN_{jt}$	Trade volume divided by GDP in j	+	+	+	+
BIT_{kjt}	1 if BIT in force, 0 otherwise	+	+	+	+
FTA_{kjt}	1 if FTA in force, 0 otherwise	+/-	+	+/-	+/-
$\ln(DIFF > 1)FTA$	$DIFF > 1$ and $\ln(DIFF > 1) \cdot FTA$	+/-	+	+	+/-
$\ln(DIFF < 1)FTA$	$DIFF < 1$ and $\ln(DIFF < 1) \cdot FTA$	+/-	+	+/-	+

Our dataset covers FDI stocks between Korea and its 184 partners over the period of 2000 through 2010. The data on bilateral outward and inward FDI stocks are collected from the OECD International Direct Investment Statistics.

DIFF and *OPEN* are calculated using GDP and trade data from the World Development Indicator (WDI) provided by the World Bank. Information on BITs is obtained from UNCTAD (United Nations Conference on Trade and Development).¹¹

Table 4 reports the summary statistics of the variables used in the regressions.¹² It is noted that outward FDI is on average greater than inward FDI in Korea. The mean value of $\ln(DIFF)$ is 1.16, which is greater than one. It implies that Korea's income level is greater than its partner countries, on average. Based on this information, we expect that Korea's outward FDI is more likely to be vertical types, while inward FDI is to be horizontal type.¹³ Hence, the impact of FTAs would be larger on outward FDI than on inward FDI.

Table 4. Description of variables

Variable	Mean	Std.Err	Min	Max
$\ln(\text{Outward FDI})$	3.53	2.97	-5.29	10.95
$\ln(\text{Inward FDI})$	2.27	3.38	-2.88	10.38
$\ln(GDPSUM)$	27.51	.44	26.94	30.38
$\ln(SM)$	-3.45	1.99	-9.92	-.69
$\ln(DIFF)$	1.62	1.63	-1.82	5.14
$\ln(DIFF > 1)$	1.77	1.41	0	5.14
$\ln(DIFF < 1)$	-.15	.34	-1.82	0
$\ln(OPEN)$	4.39	.49	3.01	6.13
<i>BIT</i>	.36	.48	0	1
<i>FTA</i>	.03	.17	0	1

4. Empirical Results

Equations (1) through (3) are estimated by sweeping country-pair fixed effects with the within transformation. Unobservable year characteristics are controlled for by a set of year dummies. The first three columns of table 6 present the estimates of equations 1 to 3 taking bilateral outward FDI as a dependent

¹¹ Korea ratified 82 BITs over the period 1980-2011. Among Korea's FTA partners, Korea contracts a BIT with Malaysia in 1989, Philippines in 1996, Thailand in 1989, Chile in 1999, Vietnam in 2004 and Switzerland in 2006. See table A1 in the appendix.

¹² See table A2 in the appendix for pair-wise correlations between the explanatory variables.

¹³ Similarly to our prediction, Kim and Kang (1997) find that Korea's outward FDI tends to be a vertical type by comparing Korea and Japan's overseas direct investments.

variable. In all regressions the coefficients of *GDPSUM* and *SM* are estimated to be significantly positive, as expected, implying that outward FDI increases with the size and similarity of Korea and its partner country measured by GDP. The estimated coefficient of *OPEN* is negative, but not significant, while *BIT* is significantly positive in columns (1) and (2). If Korea's outward FDI tends to be a vertical type as expected in the previous section, the amount of resources that investors want to use and their prices may be main determinants in investing abroad. Since its major destinations are indeed among developing countries, an institutional device to reduce investment risks may be an important consideration. In these circumstances the estimates on *OPEN* and *BIT* have a comprehensible plot.

In column (1) the coefficient of *DIFF* has a positive sign, implying that an increase in the endowments or income difference affects outward FDI asymmetrically according to whether partners are developed or developing countries. In columns (2) and (3) when partners are countries with lower per capita income than Korea ($DIFF > 1$), *DIFF* is significantly positive, suggesting that increased factor prices in Korea and/or decreased factor prices in developing countries stimulate bilateral outward FDI to the partners from Korea. On the other hand, when $DIFF < 1$ it is estimated to be significantly negative. It suggests that an increase in the income difference between the two reduces outward FDI reflecting that the motives behind outward FDI to developed countries are likely to be horizontal rather than vertical. Consequently, the estimated coefficients of *DIFFs* in table 5 are consistent with our predictions presented in table 3.

In columns (1) and (2), the coefficient of *FTA*, which is of our main interest, is estimated to be significantly positive at the 5% significance level. Its magnitude shows that FTAs increase Korea's overseas investment by more than 50% on average. It supports our hypothesis that vertical types of outward FDI dominate horizontal types and the relationship between vertical FDI and FTA is positive. Furthermore, as expected, in column (3) the interaction terms of *DIFF* and *FTA* are significantly positive when $DIFF > 1$. It implies that FTAs encourage outward FDI to developing countries more prominently. The impact of FTAs is also positive on outward FDI when $DIFF < 1$, even though we expect its sign to be ambiguous. It can be interpreted as FTAs promoting outward FDI to developed countries by creating new investment opportunities, as already mentioned.

In the last three columns of table 5, the dependent variable is inward FDI from partner countries. Not surprisingly, *GDPSUM* and *SM* have a positive

coefficient. In all columns the estimate of *OPEN* shows that inward FDI is significantly positively affected by the trade openness of partner countries. It is quite natural because trade openness is highly related to the extent of economic liberalization of source countries, especially in overseas investment. On the other hand, it seems that *BIT* is not related to inward FDI. It is expected that inward FDI would most likely be a horizontal type for the purpose of local sales in a foreign market. This type of FDI is usually induced by buying power and competition, especially with domestic presences, in host countries. BITs do not actually change these key determinants, and moreover, it seems that in Korea BITs have little contributed to improving the environment for foreign investment. The OECD FDI regulatory restrictiveness index shows that the barrier to FDI in Korea is higher than the average of the OECD countries in 2012.¹⁴ Besides, we should notice that there is no BIT between Korea and U.S. as a major source of FDI, and Korea already arranged BITs with the leading EU investors such as France, Germany, and UK in 1990s, which is out of the coverage of our data.¹⁵

As seen in column (5), the coefficients of *DIFF* is estimated as marginally significantly positive, but only when $DIFF > 1$. Since foreign investments are mostly brought into Korea with horizontal motives (see table 3), an increase in *DIFF*, possibly combined with a rise of Korea's per capita income, is likely to lead to an influx of horizontal FDI, especially from countries with lower incomes than Korea. When partners are countries more developed than Korea ($DIFF < 1$), the coefficient of *DIFF* is estimated to be negative, but marginally significant only in column (6). It suggests that inward FDI declines with an increase in Korea's per capita income and/or with a decrease in the income level of developed countries, as expected.

Unlike the result for outward FDI, there is no evidence that FTAs have a significant effect on inward FDI from partners in columns (4) and (5), as expected. It is noticeable that in column (6) the effects of FTAs are negative, though significantly only at the 10% level. In addition, the interaction term of $DIFF < 1$ and *FTA* is estimated to be positive at the 1% significance level, as shown in column (6). This negative sign of *FTA* impact may be sourced from the negative relationship between FTAs and the horizontal types of FDI. Consequently, it is revealed that FTAs stimulate inward FDI mainly from high-income countries, implying that a substantial portion of FDI from those

¹⁴ See the FDI regulatory restrictive index by country at www.oecd.org/investment/index.

¹⁵ See table A2 in the appendix for Korea's BITs.

countries may be flowing into Korea in vertical types.

Putting the results of table 5 together, vertical types of outward FDI dominate horizontal types in Korea, and vice versa on inward FDI. Hence the effects of FTAs are positive on total outward FDI, but negative or ambiguous on total inward FDI. However, dividing partner countries into two categories, developed and developing countries, we reach a specific conclusion that in Korea FTAs encourage outward FDI to developing countries and inward FDI from developed countries.

Table 5. Effects on Outward and Inward FDI

	Outward FDI			Inward FDI		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>ln(GDP_{SUM})</i>	7.163 ^{***} (2.047)	6.935 ^{***} (2.071)	7.332 ^{***} (2.066)	3.719 ^{***} (1.455)	3.720 ^{***} (1.457)	3.886 ^{***} (1.456)
<i>ln(SM)</i>	3.130 ^{***} (.979)	3.100 ^{***} (.980)	3.222 ^{***} (.976)	2.249 ^{***} (.677)	2.248 ^{***} (.679)	2.307 ^{***} (.678)
<i>ln(DIFF)</i>	3.302 ^{***} (.966)			1.204 [*] (.686)		
<i>ln(DIFF_{>1})</i>		3.285 ^{***} (.967)	3.404 ^{***} (.964)		1.202 [*] (.691)	1.222 [*] (.691)
<i> ln(DIFF_{<1}) </i>		-2.854 ^{**} (1.148)	-3.342 ^{***} (1.154)		-1.217 (.781)	-1.476 [*] (.787)
<i>ln(OPEN)</i>	-.068 (.396)	-.041 (.398)	-.079 (.397)	1.088 ^{***} (.276)	1.088 ^{***} (.277)	1.043 ^{***} (.277)
<i>BIT</i>	.409 [*] (.222)	.432 ^{**} (.223)	.333 (.230)	-.062 (.156)	-.062 (.157)	-.109 (.158)
<i>FTA</i>	.468 ^{**} (.233)	.467 ^{**} (.233)	-.842 (.539)	-.168 (.169)	-.168 (.169)	-.815 [*] (.456)
<i>ln(DIFF_{>1}) • FTA</i>			.552 ^{**} (.254)			.155 (.204)
<i> ln(DIFF_{<1}) • FTA</i>			1.801 ^{***} (.594)			1.072 ^{**} (.476)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R squared	.26	.26	.27	.39	.40	.41
Observations	884	884	884	926	926	926

Note: 1) Robust standard errors are in parentheses.

2) ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

5. Robustness Checks

We examine whether or not our baseline estimators are robust in the three aspects concerning the characteristics of the data employed. Firstly, some of Korea's 184 partners are very small economies. The observations from these countries form outliers in the dataset and may distort estimation results. Therefore, we re-estimate equation (1) after discarding the outliers, in particular, 38 small countries mostly in the Pacific or Caribbean region.

Secondly, we handle a problem with zero FDI in a given year between Korea and its partner. Although bilateral FDI is measured in stock, our primary FDI data present a lot of zeroes and even negative values. The zeroes (negatives) occupy 16% (0.2%) and 51% (1.8%) of the total number of observations for outward and inward FDI, respectively. The negative stock values are generally caused by accounting errors and we will treat them as zero as in Gouel, Guimbar, and Laborde (2012). In the previous section, we estimate the models truncating the sample by dropping the observations with zero investment. This method is fine if the zeroes are randomly distributed, which means that they are not informative. However, when zero observations contain useful information for understanding the patterns of FDI, discarding them out of the sample will bias empirical results. For example, zeroes may be originated simply from rounding errors or from decisions whether or not countries, more exactly firms, to make overseas investments. If this is the case, the zeroes should not be deleted a priori. Dealing with zero observations in the sample requires applying appropriate empirical methodology. We adopt the three approaches widely used in tackling the problem of the gravity equation with zero trade flows. One is a censored regression model such as a Tobit estimator with left-censoring at zero. This can be applied to a situation where FDI cannot be observed over some ranges and mapped to zero because the outcomes are not desirable, for example, negative FDI stocks or due to measurement inaccuracy such as rounding errors. Another is a selection model, called a Heckman's two step estimator. In the absence of censoring, it is likely that the zero observations of FDI are produced by investors' binary decision. This situation is embodied by a Probit model, whereby the selection bias of estimation on FDI can be corrected. The third is a Poisson Quasi Maximum Likelihood (PQML) estimator suggested by Santos Silva and Teneyro (2006). The Poisson estimator is naturally includes zero FDI observations because it is not specified with the logarithmic value of dependent variable. In particular, as the most desirable property of PQML, in

the presence of heteroskedasticity it produces unbiased and consistent estimators, which is highly probable in the estimation of FDI equations.

Lastly, it is likely that FTAs are potentially endogenous rather than purely exogenous; similarly to the relationship between FTA and trade, mentioned in Baier and Bergstrand (2007) and Egger *et al.* (2011), if FTAs tend to be formed between two countries that already have an investment relationship with each other. In this context, the FTA variable is correlated with the error term in the regression equation, and therefore, the OLS estimator is biased. In general, an instrumental variable approach can be taken for this case. However, it is actually hard to find an appropriate instrument that is highly correlated with *FTA*, but not correlated with the error term. Alternatively, we use the Arellano-Bond dynamic panel GMM estimation technique. Since our dataset has a relatively short time series of only 11 years, we choose system GMM rather than difference GMM. The endogenous variable should be instrumented with appropriately lagged values of the variables in levels. We treat *BIT* as well as *FTA* as endogenous and use up to third lags as their instruments.

Tables 6 and 7 present the results from the alternative estimation techniques mentioned above. In the tables, column (1) indicates an OLS estimator after removing outliers, columns (2) and (3) represent Tobit and Heckman two-step estimators, respectively, column (4) is a PQML estimator to deal with zero stock values as well as heteroskedasticity, and column (5) shows the results from the two-step system GMM estimation.

Table 6 reports the estimators obtained from taking outward FDI as a dependent variable. The findings are generally in line with the original regression in Table 5. As seen in column (1), dropping 38 small countries out of the sample cause little change in our previous results. The coefficient of the FTA variable remains unchanged. In column (2) the estimates of average marginal effects are reported because the Tobit model is non-linear. We find that there is a significant increase in the Tobit estimator of *FTA*, and considering the censored zero outward FDI strengthens the estimated impact of FTA.

It is shown in column (3) that the two-step Heckman procedure yields almost the same magnitude and significance of the *FTA* coefficient with column (1) in Table 5. However, the estimate on the inverse Mill's ratio is not significant. We are not sure that the correction for selectivity is really needed. In column (4) estimating with the PQML to correct a possible bias caused by zero FDI and heteroskedasticity does not change the previous result very much, particularly for the estimate on *FTA*. Finally, when applying the system GMM

to avoid endogeneity bias in column (5), the estimated coefficient of *FTA* stands at 0.371, little different from the previous result. Hansen’s test cannot reject the null hypothesis that the instruments as a group are exogenous. AR(1) and AR(2) tests do not detect the presence of autocorrelation and thus always confirm the validity of the specification.

Table 6. Robustness check for outward FDI

	Dependent variable: Outward FDI				
	(1)	(2)	(3)	(4)	(5)
<i>ln(GDPSUM)</i>	7.496 ^{***} (2.069)	3.746 ^{***} (1.431)	7.196 ^{***} (1.856)	4.720 ^{***} (1.652)	.609 ^{***} (.169)
<i>ln(SM)</i>	3.353 ^{***} (.991)	1.429 ^{**} (.704)	3.112 ^{***} (.888)	2.399 ^{***} (.835)	.120 ^{***} (.046)
<i>ln(DIFF)</i>	3.423 ^{***} (.976)	1.189 [*] (.705)	3.337 ^{***} (.879)	2.172 ^{***} (.843)	.029 (.034)
<i>ln(OPEN)</i>	.108 (.405)	.267 (.297)	-.082 (.360)	.530 (.389)	.385 ^{**} (.182)
<i>BIT</i>	.404 [*] (.226)	.266 (.174)	.400 ^{**} (.204)	.225 (.165)	-.075 (.086)
<i>FTA</i>	.479 ^{**} (.235)	.691 ^{***} (.183)	.452 ^{**} (.214)	.459 ^{**} (.187)	.371 ^{***} (.083)
Inv. Mill’s ratio			-.103 (.219)		
AR(1) test Prob>z					.008
AR(2) test Prob>z					.630
Hansen J test Prob>chi2					.213
Observations	848	1,147	1,835	928	563
Uncensored		884	884		
Censored		263	951		
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R squared	.27	.54			

Note: 1) Model (1) indicates the OLS estimation after removing outliers, models (2) and (3) are the Tobit and Heckman 2-step estimations, respectively, model (4) is the PQML, and model (5) is the system GMM estimation. 2) Average marginal effects are reported in model (2). 3) *GDPSUM* is rescaled due to a computational difficulty in model (4). 4) *FTA* and *BIT* are regarded as endogenous in model (5). 5) All equations include country-pair and year fixed effects. 7) Robust standard errors are in parentheses. 7) ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 7 shows the estimators when we use inward FDI as a dependent variable. In columns (1) through (3), the coefficients of the first four variables are correct in signs. Different from the previous regressions, all estimates except trade openness lose statistical significance in column (4), and similarity (*SM*) and per capita GDP difference (*DIFF*) have a negative coefficient, but not significant in column (5). The coefficient of the FTA variables is estimated to be insignificantly negative in all specifications. We find no evidence that FTAs affect inward FDI to Korea. This is exactly the same with our previous result. As a consequence, we conclude that the effects of FTAs on FDI, estimated in the preceding section, remain robust to the alternative models.

Table 7. Robustness check for inward FDI

	Dependent variable: Intward FDI				
	(1)	(2)	(3)	(4)	(5)
<i>ln(GDPSUM)</i>	4.860*** (1.458)	.594*** (.124)	3.468** (1.375)	.105 (2.614)	.240*** (.046)
<i>ln(SM)</i>	2.812*** (.680)	.303*** (.039)	2.000*** (.668)	.324 (1.320)	-.010 (.015)
<i>ln(DIFF)</i>	1.701** (.689)	.237*** (.049)	1.109* (.640)	-.252 (2.969)	-.015 (.012)
<i>ln(OPEN)</i>	1.118*** (.278)	.157** (.080)	1.056*** (.256)	1.041** (.437)	.192*** (.030)
<i>BIT</i>	-.072 (.154)	.014 (.030)	-.073 (.146)	-.299 (.231)	.047 (.046)
<i>FTA</i>	-.156 (.166)	-.032 (.035)	-.330 (.225)	-.350 (.325)	-.043 (.036)
Inv. Mill's ratio			-.416 (.399)		
AR(1) test Prob>z					.009
AR(2) test Prob>z					.264
Hansen J test Prob>chi2					.210
Observations	896	1,835	1,835	1,176	811
Uncensored		926	926		
Censored		909	909		
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R squared	.41	.59			

Note: 1) Model (1) indicates the OLS estimation after removing outliers, models (2) and (3) are the Tobit and Heckman 2-step estimations, respectively, model (4) is the PQML, and model (5) is the system GMM estimation. 2) Average marginal effects are reported in model (2). 3) *GDPSUM* is rescaled due to a computational difficulty in model (4). 4) *FTA* and *BIT* are regarded as endogenous in model (5). 5) All equations include country-pair and year fixed effects. 6) Robust standard errors are in parentheses. 7) ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

6. Concluding Remarks

This study sheds light on the effects of FTAs on outward and inward FDI in Korea. According to previous studies on the Knowledge-Capital model, trade liberalization stimulates vertical FDI while attenuating horizontal FDI. In this context, we propose the hypotheses that the effects of FTAs on outward FDI are positive as vertical types of outward FDI dominate horizontal types. On the other hand, the effects on inward FDI are ambiguous as horizontal types of inward FDI dominate vertical types.

In the empirical strategy we divide the differences of per capita GDP between Korea and its partners into two parts: one is the case where Korea's per capita GDP is greater than its partner's, and vice versa. In the former, we expect that Korea's outward FDI is more likely to be vertical types, and inward FDI tends to be horizontal types. In the latter, Korea's inward FDI would be largely vertical types, while outward FDI are likely to be horizontal types. In this respect, we expect that the positive impact of FTAs on outward FDI is more prominent when Korea's per capita GDP is greater than its partners. On the other hand, the impact on inward FDI is more positive when partners are developed countries with greater per capita GDP than Korea.

In testing for the hypotheses, we employ panel data on bilateral outward and inward FDI between Korea and its 184 partner countries, GDP, per capita GDP, the degree of openness, BITs, and FTAs between 2000 and 2010. We run the regressions controlling for country-pair fixed effects. Alternatively, we conduct robustness checks in the three aspects: discarding the outliers, handling zero FDI observations with Tobit, Heckman's two step estimators, and dealing with endogeneity of trade policies with the Arellano-Bond estimation. Additionally, we apply the PQML estimation to correct a potential bias caused by heteroskedastic disturbances.

Our empirical results in general support the hypotheses. First, we find that there has been an upsurge in overseas investments made by Korea through the FTAs. In particular, FTAs have greatly encouraged outward FDI to developing countries as cheap manufacturing bases. Second, there is no evidence as to the effects of FTAs on overall inward FDI. However, considering the difference in income level between Korea and its partners, FTAs have stimulated inward FDI to Korea mainly from high-income countries, implying that FTAs contribute to vertical types of FDI. Additionally, we find that there exists a promotion effect of FTA led by fostering FDI-friendly economic environment.

Appendix

Table A1. Korea's BIT as of 2012

Partners	Year	Partners	Year
Albania	2006	Latvia	1997
Algeria	2001	Lebanon	2006
Argentina	1996	Lithuania	1993
Austria	1991	Malaysia	1989
Azerbaijan	2008	Mauritania	2006
Bangladesh	1988	Mauritius	2008
Belarus	1997	Mexico	2002
Belgium and Luxembourg	2011	Mongolia	1991
Bolivia	1997	Morocco	2001
Brunei Darussalam	2003	Netherlands	2005
Bulgaria	2006	Nicaragua	2001
Cambodia	1997	Nigeria	1999
Chile	1999	Oman	2004
China	2007	Pakistan	1990
Congo	2011	Panama	2002
Costa Rica	2002	Paraguay	1993
Croatia	2006	Peru	1994
Czech Republic	1995	Philippines	1996
Denmark	1988	Poland	1990
Dominican Republic	2008	Portugal	1996
Egypt	1997	Qatar	1999
El Salvador	2002	Russian Federation	1991
Finland	1996	Saudi Arabia	2003
France	1979	Senegal	1985
Germany	1967	Slovakia	2006
Greece	1995	South Africa	1997
Guatemala	2002	Spain	1994
Guyana	2006	Sri Lanka	1980
Honduras	2001	Sweden	1997
Hong Kong, China	1997	Switzerland	2006
Hungary	1989	Tajikistan	1995
India	1996	Thailand	1989
Indonesia	1994	Trinidad and Tobago	2003
Iran, Islamic Republic	2006	Tunisia	1975
Israel	2003	Turkey	1994
Italy	1992	Ukraine	1997
Japan	2003	United Arab Emirates	2004
Jordan	2004	United Kingdom	1976
Kazakhstan	1996	Uruguay	2011
Kyrgyzstan	2008	Uzbekistan	1992
Lao, PDR	1996	Vietnam	2004

Source: UNCTAD

Table A2. Correlation matrix of independent variables

	<i>ln(GDPSUM)</i>	<i>ln(SM)</i>	<i>ln(DIFF)</i>	<i>ln(OPEN)</i>	<i>BIT</i>	<i>FTA</i>
<i>ln(GDPSUM)</i>	1.0000					
<i>ln(SM)</i>	0.4294	1.0000				
<i>ln(DIFF)</i>	-0.3643	-0.5306	1.0000			
<i>ln(OPEN)</i>	-0.2210	-0.1388	-0.2575	1.0000		
<i>BIT</i>	0.2528	0.5005	-0.1985	-0.0103	1.0000	
<i>FTA</i>	0.0954	0.1280	-0.0884	0.1033	0.1308	1.0000

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First version received on 13 November 2013

Peer-reviewed version received on 19 December 2013

Final version accepted on 26 December 2013