Three Essays on the Determinants of FDI

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Contents

Chapter 3 The Effect of Free Trade Agreement on Foreign Direct Investment Flows

Abstract

This dissertation is comprised of three empirical research papers for study of determinants of FDI (Foreign Direct Investment).

Chapter one identifies whether Korean outbound FDI is affected by environmental regulation and agglomeration effects. Following the pollution haven hypothesis, stringent environmental regulation in a host country deters FDI inflows. In other words, countries with regulations lower than the social efficient level attracts FDI inflows from countries with high regulations.

Chapter one adopts the regression model by Wagner and Timmins (2009) which take into consideration the agglomeration externalities. Therefore, this chapter utilized industry level of FDI outflows from Korea in considering agglomeration effect and environmental regulation. The OLS estimator and the Arellano-Bond estimator were utilized as econometric tools. As expected, the OLS results suggested that both agglomeration and environmental regulations significantly affect the Korean manufacturing FDI. This result indicates that Korean FDI is affected by lower regulations which is consistent with the prediction of the pollution haven hypothesis. However, results of the Arellano-Bond estimator suggested that agglomeration played an important factor in attracting FDI, but environmental regulations showed no impact.

In chapter two, I investigated the role of labor regulations on the Korean industry-level of FDI outflows. To analyze the race to the bottom hypothesis, this paper utilizes two types of labor standards for both developed and developing countries. Moreover, this chapter divides the Korean FDI outflow data into four different groups to find further information.

Chapter two adopts the regression model by Olney (2013) which take into consideration the lagged independent variables. To analyze the race to the bottom hypothesis, this chapter utilizes two types of labor standards for both developed and developing countries. Moreover, this paper divides the Korean FDI outflow data into four different groups to find further information: (1) the IMF Supervision periods, (2) factor intensity, (3) concentration by the top five companies' sales share and (4) combination of factor intensity and concentration. This chapter also utilized industry level FDI outflows from Korea. The empirical results suggest that labor standard show negative coefficients constantly as expected, but only significant in employment protection.

In cooperation with Professor Chan-Hyun Sohn, chapter three investigated the effect of both bilateral and comprehensive FTAs on FDI inflows. Using the knowledge capital model by Carr et al. (2001), this chapter develops new continuous bilateral FTA variables. In addition, comprehensive FTA variables and FTA decomposition for trade cost and investment cost were generated for identifying that effects of FTAs on FDI. Furthermore, this chapter utilizes bilateral FDI data from OECD by four different sample groups.

As expected, OLS regression results suggested that FTA has a positive and statistically significant effect on FDI inflows. Also, almost all explanatory variables are showing the expected sign. However, WLS estimator found weaker evidence of FTA that only whole and North-to-North group show significance. This result consistently shows with the FTA decomposition results. Finally, the result of PPML and binary FTA variables also provides a weak effect of FTAs on FDI inflows.

List of Tables

List of Appendix Tables

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CHAPTER 1

Agglomeration or Regulation?

The Case of Korean Industry FDI Outflows

1.1 Introduction

This paper attempts to identify whether Korean FDI (Foreign Direct Investment) outflows influenced by environmental regulation and the agglomeration effect. To do so, this paper utilizes pollution haven hypothesis to examine its effect on FDI outflows. According to the pollution haven hypothesis, stringent environmental regulation in a host country deters FDI inflows. In addition, the agglomeration effects are well known for being one of the exogenous factors for FDI determinants (Lee et al., 2012). This paper utilized industry level of FDI outflows from Korea in considering agglomeration effect and environmental regulation. The empirical results suggest an existence of pollution haven on the Korean FDI outflows.

The Korean FDI outflows has been increased gradually except during the two important financial crisis namely Asian Financial Crisis and the Global Financial Crisis. Even Korea has limited background on the FDI flows (Chung, 2014), it is noteworthy to analyze the Korean FDI case. One of the reason is that the characteristics of Korean industry could affect to FDI pattern in manufacturing industry.

With high growth rates in the past decades, Korea experienced not only the expansion of its economic size but also the concentration of its manufacturing industry. More specifically, energy intensive industries dominated the manufacturing sector in Korea due to traditional export-led economic policy of the country. However, with the accession to OECD, Korea adopted a new environmental policy. In spite of new environmental legislations, the Korean industry is characterized by its manufacturing sector which still rely on energy intensive production technology (OECD, 2006)[1]. Additionally, among OECD countries, Korea is reported as the tenth largest energy consuming country (Kamal-Chaoui et al., 2011)[2].

However, since Korean industry focused on the manufacturing sector, adopting new stringent environmental regulations in industries may affect the production process. In other words, the stringent environmental regulations implemented by the government may bring additional cost for manufacturing industries especially the energy intensive manufacturing sector. Particularly, stringent environmental regulations affect production costs negatively, thus firms will decide whether or not to relocate the production into a place with a lower level of regulation. For instance, building new environmental friendly production will be very costly for firms because not only applying new innovated technology for processing is needed, but also preparing new equipment is required. Therefore, if the firm is included in an energy intensive or a pollution intensive industry, they will be motivated to relocate their

[1] The Korean FDI outflows has been increased gradually except for during the Asian Financial Crisis (1997 to 1998) and the Global Financial Crisis (2008 to 2009). Also, the statistics of the Korean manufacturing industry show large amounts of energy increase rates in the industrial sector in the past decades. For instance, Korea's industry energy consumption increased 506%, while the share of total energy consumption growth is 13.9% during the period of 1980 to 2009 (Kamal-Chaoui et al., 2011). This amount is almost half of the total energy consumption in Korea (OECD, 2006).

[2] The statistics of the Korean manufacturing industry show large amounts of energy increase rates in the industrial sector in the past decades. For instance, Korea's industry energy consumption increased 506%, while the share of total energy consumption growth is 13.9% during the period of 1980 to 2009 (Kamal-Chaoui et al., 2011). This amount is almost half of the total energy consumption in Korea (OECD, 2006).

production process in order to avoid costs (Kirkpatrick and Shimamoto, 2008; Wagner and Timmins, 2009; Rezza, 2013).

Currently, as increased of its importance, environmental regulation became debatable issue in industrialized countries. Energy intensive industries relocate their production to developing countries with lax environmental regulations for avoiding strict environmental regulation (Neumayer, 2001; Levinsin and Taylor, 2008; Rezza, 2013). The reason behind this is that energy restriction relates with production cost that reducing competitiveness of the production process in manufacturing industry. For instance, if a country imposes strict environmental regulations then firms are facing with high production costs including having to adopt new technology for environmental friendly production processes (Wagner and Timmins, 2009; Rezza, 2013). Therefore, manufacturing firms that produces environmental pollutions have an incentive to shift their production process to lower environmental regulated countries.

This relocation activity by company is known as the "pollution haven hypothesis". In particular, this hypothesis explains whether host countries attract FDI inflows by lax environmental regulations or not. In other words, countries with lower regulations than the social efficiency level attracts FDI inflows from countries with higher regulations. The raising of pollution havens in FDI happens because of trade barriers have been reduced or eliminated that industry competitiveness rely on the regulations (Cole and Elliott, 2005)[3].

[3] For the purpose of raising pollution havens, Cole et al. (2006) mentioned the local government's role of bribery. The local government has an incentive to lower the environmental regulations due to the expectation of a large amount of FDI inflows which relates with the increasing output and the consumer surplus in the domestic market (Cole et al., 2006). Therefore, offering a bribe to government will increase the chances of lower environmental regulations. The authors finalized that a high level of corruption within the local government leads to lower environmental regulations. The authors also mentioned that a strict regulation relates to welfare effect. However, the welfare effect would cancel out when additional foreign

Further, manufacturing industries are more like to consuming for the natural resources due to the economic development so that related pollution level become greater (Kim and Adilov, 2012). However, from previous literatures, it is hard to find out the clear evidence of pollution haven (Eskeland and Harrison, 2003). One of the reason for the ambiguous results is that previous literatures were not much considered on the role of factor endowments (Cole and Elliott, 2005).

Therefore, in the context of pollution havens, Korean multinationals' FDI has a close relationship with the cost created by the strict regulate on such as environmental regulation (OECD, 2006). That means, the level of pollution intensity in the Korean manufacturing industry is still higher than other industrial and advanced economies even earlier policies implemented by the Korean government (Chung, 2014).

Meanwhile, Wager and Timmins (2009) pointed out that elimination of exogenous factors such as agglomeration and pollution intensity may lead to biased results. As an exogenous factor, the agglomeration effect is used in two different ways in previous empirical literatures. For example, the country level and organization level of the agglomeration effects used for the purpose of analysis. In previous empirical literatures, the agglomeration effect is generally explained as the number of companies in a specific geographic area that positively affect foreign investors in their relocation process (Debaere et al., 2010). Especially, if the plant belongs to a production network, it is obvious that the plant will relocate to a nearby agglomerate place.

The importance of agglomeration is that it relates to the gains of productivity and cost saving (Lee et al., 2012). Specifically, the agglomeration effect is defined as a group of

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investor involves bribery. See more details in Cole et al., (2006).

economic activities in a certain space for generating their externalities on agglomeration. Therefore, agglomerated geographic space attracts the same industry that exploits agglomerate externalities (Lee et al., 2012). Additionally, since the location choice for domestic and foreign firms are different with each other, establishment costs in foreign countries will be costly for foreign firms (Lee et al., 2012). In other words, companies that have same nationality show different location choice or externalities due to their business link and relationship (Lee et al., 2012).

However, the results of previous studies ambiguously supported this point. In other words, limited results of previous literatures were due to the non-consideration of external variables in their analysis (Lee et al., 2012). Hence, this paper carefully considers the concept of pollution haven hypothesis and the FDI motivation by Wagner and Timmins (2009) when analyzing the Korean FDI outflows.

Therefore, considering the results of Wagner and Timmins (2009), this paper explores whether stringent environmental regulations have an effect on FDI while taking into account external factors. The stringent environmental regulation increases the company's production cost shown in the previous literatures (Wagner and Timmins, 2009). Even with supporting results for the existence of environmental regulations on FDI flows, the issue still remains arguable because of problems with the standardized of environmental regulation variable.

The contribution of this paper focuses on empirically testing the effects of the pollution haven hypothesis and the agglomeration effect on Korea's industry level of FDI outflows. To do so, this paper utilized two types of environmental regulation which covers more than previous literatures.

Especially, this paper differs from previous general empirical studies on pollution

haven and FDI that take into account of several econometric concerns (i.e. inclusion of exogenous factor and other institutional quality) in the analysis. Moreover, this paper tries to determine which effect has a more appropriate explanation for Korean FDI outflows in comparison with other host countries.

Section 2 shows a brief discussion on literature reviews about the relationship between environmental regulations and FDI flows as well as the relationship between the agglomeration effect and FDI flows. Section 3 explains the methodology and detailed data which was used for empirical analysis. The empirical results are shown in Section 4 while the conclusion is provided in Section 5.

1.2 Literature Review

This section describes the relationship between environmental regulation and FDI as well as the agglomeration effect on FDI flows based on previous empirical literatures. Although there has been little attention to relationship between pollution haven and FDI flows, various empirical studies were attempting to analyze the impact of pollution abatement cost on FDI flows. However, previous literatures could not explain whether strict environmental regulation has an impact on FDI flows (Eskeland and Harrison, 2003; Dean et al., 2009). Meanwhile, recent empirical studies support the evidence of pollution haven (Keller and Levinson, 2002; Wagner and Timmins, 2009) or partially supported (Cole and Elliott, 2005; Leiter et al., 2011; Kim and Adilov, 2012; Rezza, 2013).

In the empirical studies, an early study of pollution haven by Bartik (1988) shows insignificant results while current studies provide the evidence of the pollution haven effect

(Cole and Elliott, 2005; Dean et al., 2009; Wagner and Timmins, 2009; Kellenberg, 2009; Kheder and Zugravu, 2012; Chung, 2014).

Using the industry level of German FDI data, Wagner and Timmins found an evidence of pollution haven that strict environmental regulations deter the FDI. In addition, Chung (2014) investigates the effect of the clean energy technology adoption in Korea and found evidence of outbound investment generated by low environmental regulations of host country in polluting industry. In the consideration of both country level and industry level, Leiter et al (2011) suggested that diminishing evidence of environmental regulations, even the pollution haven effect exists in twenty-one European countries. Considering both theoretical and empirical aspects, Cole et al. (2006) developed a political economy model and examined the effects of the pollution haven effect. They found a conditional environmental regulation effect on FDI under the government corruption. Additionally, Cole and Elliot (2005) found weak evidence of pollution haven using US FDI outward data. They suggested a partial explanation that the reason of pollution havens cannot be widespread across the industries. By using French firm-level data, Kheder and Zugravu (2012) identified developed, emerging and the Central and Eastern European countries were affected by a pollution haven effect. On the contrary, they found that a strict regulation could increase French FDI in CIS and developing countries.

However, there are different views for the environmental regulation impact on the FDI. Previous study by Eskeland and Harrison (2003) showed the four developing countries case in industry sector base then suggested a weak effect of pollution havens on foreign investment. Using the pollution abatement cost, they found that foreign plants are less polluted than the plants in developing countries. They concluded that the pollution abatement

cost is not related with FDI in developing countries. Similarly, used highly disaggregated Norwegian firm-level FDI data, Rezza (2013) found no evidence of a direct impact for environmental regulations but found a negative relationship with vertical FDI motivations. Hence, empirical results for the pollution haven effect can be different due to their model and variables.

Additionally, since there is no direct way to measure environmental regulation on FDI, most empirical literatures used limited indirect measurements to overcome data limitations. The various measurements were used including comparable data collection (Kirkpatrick and Shimamoto, 2008), or utilized pollution intensity (Cole and Elliott, 2005). Other indirect measurement would be the environmental regulation provide by the World Economic Forum (WEF), the pollution abatement cost (Eskeland and Harrison, 2003; Elliott and Shimamoto, 2008) and the environmental agreement (Kirkpatrick and Shimamoto, 2007). The measurements in the previous literatures imply that the standardization of the data does not exist.

In addition, previous literatures tend to depend more on developed country cases. For instance, Wagner and Timmins (2009) identified the German industry level of FDI while Eskeland and Harrison (2003) and Kellenberg (2009) revealed the pollution haven in the US with various empirical methodologies. Further, various studies investigated the location choice of Japanese FDI with pollution haven (Kirkpatrick and Shimamoto, 2008; Elliott and Shimamoto, 2008; Cole et al., 2010) meanwhile Rezza (2013) shows interaction between pollution haven and the Norwegian industry level of FDI. In recent papers, there are few papers that empirically examined industrialized or developing country cases, such as Korea (Kim and Adilov, 2012; Chung, 2014) and China (Dean et al., 2009).

On the other hand, the studies on the agglomeration effect are broadly covered in the previous literatures. Du et al. (2008) suggested that FDI has a positive relationship with latent agglomeration by intermediate production in China. Additionally, Debaere et al. (2010) found that FDI possibility increased in Chinese specific regions where there is an existence of upstream and downstream Korean affiliates. Using Korean FDI outflows into US, Lee et al. (2012) found agglomeration plays different role by different industries.

At the same time, the ambiguous results found in the literatures are due to their different measurements on the Agglomeration. Agglomeration affects the location choice by MNEs either positively (Du et al., 2008; Gauselmann and Marek, 2012; Lee et al., 2012; Lee et al., 2013), or ambiguously (Chen, 2009; Rodríguez-Pose et al., 2013). Most studies using ratio from number of firms in specific industry by total firms in same region. Du et al. (2008) suggest the agglomeration effect of intermediate goods has a positive effect on FDI. Meanwhile, Gauselmann and Marek (2012) used four agglomeration factors (specialization, supplier linkages, potential knowledge spillovers and capital regions) for their analysis. The result shows a positive impact of agglomeration on FDI. By exploiting the Korean micro level data, Lee et al. (2012) show the location choice of Korean firms in the US are more affected by factor endowment differences than the agglomeration effect.

In summary, various empirically limitations are remained in the previous literatures for both environmental regulations and agglomeration effects. The most critical limitation is that previous literatures focus on either the agglomeration effect or the Pollution Haven Hypothesis for their analysis. Therefore, this paper attempts to consider both the external factors and environmental regulations in the analysis.

1.3 Methodology

To examine the effect of environmental regulation and agglomeration effect on Korean FDI outflows, this paper uses industry level of FDI data to examine the effect of host countries' characteristics and environmental regulations for Korean FDI outflows. However, when analyzing the environmental regulations, it is important to consider the external effects such as agglomeration (Wagner and Timmins, 2009) and due to exception of such external variables in the analysis, it could lead to bias in the results (Lee et al., 2012). Hence, by using the industry level of outward FDI data, this paper tries to identify which agglomeration or environmental regulations influence Korean FDI outflows more. Additionally, this paper considers the regression model of Wagner and Timmins (2009) which take into consideration the agglomeration externalities in the regression. The basic model shows as follows:

$$FDI_{ij,t} = \beta_0 + \beta_1 X_{j,t} + \beta_2 Dist_j + \beta_3 Road_j + \beta_4 Pollution\_intensity_{i,t} + \beta_5 Envt\_Reg \times Pol_{ij,t} + \mu_j + \eta_t + \varepsilon_{ij,t} \quad (1.1)$$

Dependent variable $FDI_{ij,t}$ denotes log of Korean FDI outflows of the manufacturing sector in the host countries[4]. This paper uses industry level of manufacturing FDI. The manufacturing industry of Korea is represented as as i and each host country is represented as j while t denotes the time periods, respectively. The industry covers two-digit

[4] The FDI data has taken from KEXIM bank. The FDI outflow data set constructed based on a Korean Standard Industrial Classification (KSIC), which is harmonized with an International Standard Industrial Classification (ISIC). More specifically, KEXIM Bank provides yearly, regionally, industrial based comprehensive data set. Detailed information of the data shown in the KEXIM bank website (https://www.koreaexim.go.kr).

21 manufacturing sectors of Korea and the host country covers 116 countries around in the world[5]. The time period used was from 1997 to 2011 for capturing the periods after the accession of OECD with data availability. Additionally, the periods include Korea's domestic environmental regulation changes due to the accession of OECD membership. Furthermore, the nominal FDI data taken from the Export-Import Bank of Korea (KEXIM) and converted into real FDI stock by Korean GDP deflator with 2005 as the base year. The GDP deflator data taken from the Bank of Korea.

The vector of time-varying attributes of host countries are represented by $X_{j,t}$. The time varying variables denotes environmental regulations, agglomeration effects, human capital, capital-labor ratio, labor intensity, industry specific tariff rates, wage rates and finally, rule of law and the regulatory quality. The institutional quality variables, rule of law and regulatory quality used in the empirical analysis to assess whether other institutional regulation also affect FDI outflows or not. Since the foreign firm's location choice is different with domestic market, this paper assumes that the host countries' labor market conditions and infrastructures play an important role for manufacturing industries when making FDI decisions.

For identifying the Pollution haven hypothesis and the agglomeration effect on FDI outflows, this paper utilizes environmental regulations and two types of agglomeration effects. First, the environmental regulation utilizes stringency of environmental regulations of the World Economic Forum (WeF)[6]. Lax environmental regulations of host countries will attract

[5] For more detailed information, refers to Appendix Table 1

[6] The executive survey of World Economic Forum (WeF) covers almost all the countries in the world. The data derived from the survey and conducted annually. Each indicator was been published through several steps for ensuring its robustness. Since there is no standardized environmental regulation data available, this paper utilizes the data provided by WeF. Detailed information and methodology of this data shown in

FDI inflow from strict regulation countries. Hence, this paper expects the negative sign for environmental regulations. Second, the agglomeration effect is divided into two specified variables such as total stock of Korean FDI flows into each host country (Wagner and Timmins, 2009) as namely agglomeration 1 while the Korean affiliate numbers of each manufacturer in the host country namely agglomeration 2. The Korean affiliate numbers in each host country denotes the geographical agglomerate effect for each industry. The agglomeration in the host country will affect the firm's decision of home country due to the production process (Lee et al., 2012). Therefore, this paper expects the outbound industry level FDI from Korea to have a positive effect.

The previous literatures pointed out that the reason for weak evidence of pollution haven is non-recognition of factor endowments (Cole and Elliott, 2005). Therefore, various factor intensities, such as capital and labor, pollution and raw material intensity are considered in the analysis. Also, higher return of FDI substitutes the trade between Korea and host countries. Therefore, this paper uses each host country's industry level of tariff rates to control the relationship between FDI and trade between Korea and other countries.

Human capital and log of industry wage rates are included to examine whether Korean FDI exploits the factor differences between Korea and other host countries. The rule of law and regulatory quality represents the host countries' institutional quality. Institutional qualities have an impact on the home country. The distance represents the geographic distances between Korea and each host country. This variable will capture the effect of resistance between Korea and each host country. Road denotes infrastructure of each host country.

The Travel & Tourism Competitiveness Report.

The rule of law and regulatory quality utilized as robustness check for this paper to capture whether other regulations have an effect on FDI. This paper attempts to analyze each institutional variable including environmental regulations. The expected sign is to be negative.

The time-constant vector includes distance and road of the host countries. Finally, μ_{ij} denotes industries' unobservable fixed effect and η_t denotes year fixed effect while $\varepsilon_{ij,t}$ denotes error term. However, OLS (Ordinary Least Squares) estimator has possibility to shows biased results because of simultaneous of endogeneity. Hence, this paper uses industry and time fixed effects in all the analysis in order to avoid endogeneity and self-selection problems (Baier and Bergstrand, 2007).

In the previous literatures, energy usage was utilized as a proxy for pollution intensity (Eskeland and Harrison, 2003; Chung, 2014). Therefore, this paper uses a ratio between industry oil consumption and total oil consumption. The pollution intensity variable is designed for capturing whether polluted manufacturing industries are more sensitive to FDI outflows. More specifically, interaction term of environmental regulation and pollution intensity represents whether high environmental regulations and polluted manufacturing industries have more influence on FDI outflows.

Additionally, FDI itself considered as affected by past and following dynamic processes (Cole and Elliott, 2005; Roodman, 2009). Therefore, this paper utilizes the Arellano-Bond estimator, which is known as the Difference GMM (Roodman, 2009). The Arellano-Bond estimator has several advantages which it is well known for. First, explanatory variables are assumed as endogenous against the dependent variable - FDI outflows. More specifically, the FDI flows and the explanatory variables have causality that may correlate with error term. However, using the Difference GMM allows there to be no correlation

between error term and the endogenous variables.

Table 1.1 Data definitions and sources

Variable	Definitions	Source
FDI outflows	1000 USD, 1997-2011 converted by Korean GDP deflator	The Export-Import Bank of Korea
Distance	Geographical distance between Korea and host countries (Kilometers)	CEPII
Tariff rates	Industrial tariff rates, simple average	World Integrated Trade Solution, World Bank
Environmental Regulation	Stringency of environmental regulation (from 7, most strict to 1, lax)	World Economic Forum
Agglomeration Effect	1. Total Korean FDI stock into host countries 2. Number of affiliates in host countries	The Export-Import Bank of Korea
Wage rates	Industry level of wage for manufacturing sectors	UNIDO
Pollution intensity	Each industry's oil consumption by total oil consumption	Korean petroleum information system (Petronet)
Human Capital	Index based on Barro and Lee (2012) with Psacharopoulos (1994)	Penn World Table 8.1
Labor intensity	Total labor by land	World Development Indicator, World Bank
Capital-labor ratio	Ratio between capital formation and total labor force	
Regulatory Quality	Government performance index, from approximately -2.5 (weak) to 2.5 (strong)	World Governance Indicator, World Bank
Rule of Law	Government performance index, from approximately -2.5 (weak) to 2.5 (strong)	
Road	Roads, total network (km)	World Development Indicator, World Bank

Second, the time-invariant variable might be correlated with the explanatory variables. Especially, in equation (1), the error term is consistent with the observed and unobserved country characteristics. However, the problem on the correlation between explanatory variable and error term is also solved by the GMM estimator. In the first difference form, the country specific effect could be omitted in the analysis because it does not vary over time.

Third, short period (T=15) and large country samples (N=116) is used in the empirical analysis. However, since the GMM is originally designed for small time periods and large country panels, the Difference GMM estimator is more appropriates when analyzing the Korean FDI case. Hence, this paper utilizes the Difference GMM to exploit its advantages. The Difference GMM uses first difference form of given equation (1) as follows:

$$\begin{aligned}\Delta FDI_{ij,t} = {} & \beta_0 + \beta_1 \Delta FDI_{ij,t-1} + \beta_2 \Delta X_{j,t} + \beta_3 \Delta Dist_j + \beta_4 \Delta Road_j \\ & + \beta_5 \Delta Pollution\_intensity_{i,t} + \beta_6 \Delta Envt\_Reg \times Pol_{ij,t} + \Delta\mu_j \\ & + \Delta\eta_t + \Delta\varepsilon_{ij,t}\end{aligned} \tag{1.2}$$

In the first difference form in equation (2), lagged dependent variable included as past form for instrumented roll. Furthermore, error term transforms into first-difference form as other explanatory variables.

Table 1.2 Summary statistics

Variable	Mean	Std. Dev.	Min	Max	Obs
$FDI_{ij,t}$	3.08	2.59	-7.58	10.93	8145
$Environmental\ regulation_{j,t}$	4.21	1.17	1.20	6.80	16548
Agglomeration 1	10.31	2.83	1.61	17.17	27804
Agglomeration 2	17.53	100.20	0	2075	8769
$Human\ Capital_{j,t}$	2.56	0.53	1.29	3.62	31815
K/L	5537.31	6962.29	-22.03	43776.71	31542
$Labor\ intensity_{j,t}$	117.81	449.48	0.57	4316.74	38514
$Wage_{ij,t}$	19.31	2.62	6.50	25.09	14131
$Tariff_{ij,t}$	9.00	9.50	0	100	15871
$Road_j$	11.11	1.76	6.52	15.70	24465
$Dist_j$	8.99	0.56	6.86	9.88	38640
$Pollution\_intensity_{i,t}$	0.04	0.11	0.00	0.51	23896
Pollution intensity × *Environmental regulation*	0.16	0.50	0.00	3.26	10244
Rule of Law	0.05	1.05	-2.21	2.00	31668
Regulatory quality	0.18	0.99	-2.41	2.20	31668

1.4 Results

1.4.1. Main Variable Results

The basic model results shown in Table 1.3 and Table 1.4. Table 1.3 reports the OLS estimator with agglomeration 1 while Table 1.4 reports the results with agglomeration 2 effect. All variables show consistent signs of coefficients in both result tables. Each column included both agglomeration effect and regulation variable in order to find out which variable is more appropriate to explaining the Korean FDI outflows. First of all, (1) first column included environmental regulation, (2) second column included a pollution intensity as a proxy of regulation, (3) third column included interaction term between pollution intensity and environmental regulation, (4) fourth column included rule of law as a proxy of regulation and, finally, (5) last column included regulatory quality of host countries.

Table 1.3 Basic OLS estimation results with agglomeration 1

	(1)	(2)	(3)	(4)	(5)
$Environmental\ regulation_{j,t}$	-0.742***				
	(0.072)				
Agglomeration 1	0.540***	0.478***	0.504***	0.520***	0.536***
	(0.032)	(0.036)	(0.041)	(0.029)	(0.029)
$Human\ Capital_{j,t}$	-0.411***	-0.319*	-0.310	-0.355***	-0.221
	(0.140)	(0.166)	(0.191)	(0.128)	(0.136)
K/L	0.000	-0.000***	-0.000***	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Labor\ intensity_{j,t}$	0.000	0.001***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Wage_{ij,t}$	0.205***	-0.114**	-0.180***	0.122***	0.127***
	(0.045)	(0.053)	(0.063)	(0.039)	(0.039)
$Tariff_{ij,t}$	0.007	-0.010	-0.017	0.003	-0.003
	(0.009)	(0.010)	(0.011)	(0.008)	(0.008)
$Road_j$	0.035	0.356***	0.387***	0.137***	0.106**
	(0.050)	(0.060)	(0.070)	(0.045)	(0.047)
$Dist_j$	-0.075	-0.241***	-0.269***	-0.195***	-0.109
	(0.072)	(0.081)	(0.094)	(0.064)	(0.069)
$Pollution\_intensity_{i,t}$		-3.173			
		(3.377)			
Pollution intensity × *Environmental regulation*			1.017***		
			(0.365)		
Rule of Law				-0.472***	
				(0.094)	
Regulatory quality					-0.593***
					(0.127)
_cons	-2.142**	-0.127	0.303	-3.445***	-4.802***
	(1.008)	(1.129)	(1.313)	(0.912)	(0.977)
Obs.	2,371	1,853	1,417	2,932	2,932
R^2	0.411	0.361	0.368	0.390	0.389

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. The year and the industry fixed effects are included all the analysis. Dependent variable is $ln(FDI_{i,t})$.

As expected, negative results of environmental regulations indicate lower environmental regulations in recipient countries increased FDI outflows (Wagner and

Timmins, 2009). Also, as expected in previous literatures, agglomeration effects have a positive relationship with FDI (Lee et al., 2012). These results supporting pollution haven hypothesis on FDI flows (Cole and Elliott, 2005; Dean et al., 2009; Wagner and Timmins, 2009; Kellenberg, 2009; Kheder and Zugravu, 2012; Chung, 2014). However, the magnitudes of the both agglomeration effects are show mixed results when the environmental regulations are included in the analysis. This result indicates the complementary relationship of environmental regulation and agglomeration effect on FDI outflows.

While Industry's pollution intensity shows an insignificant level, while interaction term between environmental regulation and pollution intensity shows positive results. This positive interaction term implies that the Korean FDI outflows influenced by the environmental regulation measurement effect while results were not derived from pollution intensity of each manufacturing industry. Lastly, used as institutional variables for the analysis, rule of law and regulatory quality report constant negative results which indicate that lax or lenient institutional quality attracts Korean industry level of FDI into various countries. Therefore, consistent with previous literatures, FDI flows are affected by the various regulations (Lee et al., 2012). Therefore, Table 1.3 and Table 1.4, lower levels of regulation quality is found to be one of the FDI outflow determinants.

1.4.2. Other Explanatory Variable Results

To explain the results of empirical model, this paper compares the Table 1.3 and Table 1.4. The lower level of capital-labor ratio in the host country increases the FDI reported in both tables. The human capital variable provides negative values in Table 1.3 but turn into insignificant in Table 1.4.

These results indicate that Korean multinationals focus on the share of labor more than capital in the host country while human capital does not play an important role. It is supporting by the positive coefficients of labor intensity in both tables. Also, as expected, tariff rate and geographical distance have a negative effect on the FDI meanwhile improvement of infrastructures increase the FDI. However, negative sign of human capital with agglomeration 1 implies that manufacturing industry relocate their production through FDI affected by unskilled labor. Nevertheless, wage rates show mixed results.

After estimated a basic regression in Table 1.3 and Table 1.4, this paper tried to analyze a regression with shortened the periods. In particular, this paper omits the periods of Asian Financial Crisis (from 1997 to 1999) due to a considerable bias. However, the empirical result provides almost similar results with the previous regression results. Therefore, this paper does not report any results using shorten periods.

Table 1.4 Basic OLS estimation results with agglomeration 2

	(1)	(2)	(3)	(4)	(5)
$Environmental\ regulation_{j,t}$	-0.795***				
	(0.075)				
Agglomeration 2	0.003***	0.007***	0.007***	0.004***	0.004***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
$Human\ Capital_{j,t}$	-0.210	-0.174	-0.160	-0.170	-0.057
	(0.145)	(0.156)	(0.193)	(0.128)	(0.136)
K/L	0.000	-0.000***	-0.000***	-0.000	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Labor\ intensity_{j,t}$	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Wage_{ij,t}$	0.337***	-0.019	-0.076	0.253***	0.258***
	(0.046)	(0.050)	(0.063)	(0.038)	(0.039)
$Tariff_{ij,t}$	-0.006	-0.019**	-0.026**	-0.014*	-0.020***
	(0.009)	(0.009)	(0.011)	(0.008)	(0.008)
$Road_j$	0.307***	0.558***	0.617***	0.385***	0.368***
	(0.048)	(0.053)	(0.067)	(0.041)	(0.043)
$Dist_j$	-0.163**	-0.087	-0.214**	-0.199***	-0.110
	(0.077)	(0.080)	(0.100)	(0.067)	(0.072)
$Pollution\_intensity_{i,t}$		1.721			
		(2.785)			
Pollution intensity × *Environmental regulation*			1.266***		
			(0.373)		
Rule of Law				-0.540***	
				(0.094)	
Regulatory quality					-0.590***
					(0.127)
_cons	-1.394	-2.004*	0.241	-3.670***	-4.295***
	(1.047)	(1.098)	(1.339)	(0.912)	(0.950)
Obs.	2,375	2,057	1,420	3,062	3,062
R^2	0.360	0.328	0.344	0.342	0.339

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. The year and the industry fixed effects are included all the analysis. Dependent variable is $ln(FDI_{i,t})$.

1.4.3. Robustness Check

To avoid the endogenity problem and to exploit the various advantages of GMM by estimation equation (2), Table 1.5 reports the results of the Arellano-Bond estimator. The high Hansen p-value represents chosen instruments are valid restriction of over identification is satisfied. Estimation result by difference in GMM implies that the agglomeration effect, especially agglomeration 1, has more influences on Korean FDI outflows than other variables. In particular, agglomeration 1 has a most strong effect on FDI. According to the Hansen test and the AR test suggest that Difference GMM is an appropriate estimator for pollution haven hypothesis. However, according to Table 1.5, environmental regulation has no longer shows significant level as well as agglomeration 2. Additionally, previous year of FDI provides the result with significant level but this paper could not find any pollution haven in the results by Difference GMM estimator.

The results of robustness check are shown in Table 1.6 and Table 1.7. Similar with the previous results in Table 1.3 and Table 1.4, environmental regulation has negative impact on FDI outflows for all regional blocs. This results show consistently that existence of pollution haven. However, regional bloc has different magnitude to each other even negative sign of environmental regulation shown for all regional blocs. These different magnitude coefficients suggest that some regional bloc has the relatively high impact on Korean FDI outflows.

Table 1.5 Difference GMM estimator results

	(1)	(2)	(3)	(4)	(5)	(6)
$ln\,FDI_{i,t-1}$	0.413***	0.420***	0.345***	0.423***	0.450***	0.351***
	(0.128)	(0.097)	(0.118)	(0.126)	(0.093)	(0.114)
$Environmental\ regulation_{j,t}$	0.072			0.205		
	(0.051)			(0.153)		
Agglomeration 1	0.129**	0.153***	0.176**			
	(0.054)	(0.059)	(0.078)			
Agglomeration 2				0.001	0.001**	0.001
				(0.000)	(0.001)	(0.001)
$Human\ Capital_{j,t}$	0.955	1.153	1.702	0.721	1.777	1.742
	(1.486)	(1.429)	(1.923)	(1.665)	(1.504)	(2.164)
K/L	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Labor\ intensity_{j,t}$	0.001	0.001	0.002	0.001	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Wage_{ij,t}$	-0.019	-0.037	-0.085	-0.022	-0.051	-0.090
	(0.067)	(0.060)	(0.074)	(0.067)	(0.058)	(0.073)
$Tariff_{ij,t}$	0.005	0.009	0.004	0.006	0.009	0.004
	(0.006)	(0.010)	(0.008)	(0.006)	(0.008)	(0.008)
$Road_j$	0.009	0.224	0.362*	-0.020	0.107	0.293
	(0.194)	(0.246)	(0.210)	(0.231)	(0.207)	(0.251)
$Pollution\_intensity_{i,t}$		2.227			2.167	
		(2.700)			(2.540)	
Pollution intensity × *Environmental regulation*			-0.129			-0.133
			(0.396)			(0.397)
Obs.	1,380	1,380	822	1,383	1,486	825
Hansen Test	32.68	77.42	37.10	36.62	78.87	37.04

	(0.848)	(0.433)	(0.686)	(0.665)	(0.42)	(0.688)
AR 1	-1.98	-1.94	-0.80	-2.06	-2.27	-0.8
	(0.047)	(0.053)	(0.423)	(0.04)	(0.023)	(0.425)
AR 2	-0.61	-1.61	-1.52	-0.84	-0.54	-1.51
	(0.54)	(0.107)	(0.129)	(0.4)	(0.59)	(0.13)

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. The year and the industry fixed effects are included all the analysis. Dependent variable is $ln(FDI_{i,t})$.

Table 1.6 Robustness check: Agglomeration 1

	Europe	Asia	Africa	North America	Latin America	Middle East	CIS	Oceania
$Environmental\ regulation_{j,t}$	-0.733***	-0.742***	-0.724***	-0.628***	-0.726***	-0.728***	-0.894***	-0.743***
	(0.072)	(0.075)	(0.072)	(0.073)	(0.072)	(0.072)	(0.075)	(0.072)
Agglomeration 1	0.534***	0.540***	0.551***	0.491***	0.543***	0.543***	0.488***	0.538***
	(0.033)	(0.034)	(0.032)	(0.033)	(0.032)	(0.032)	(0.033)	(0.032)
$Human\ Capital_{j,t}$	-0.435***	-0.411**	-0.373***	-0.778***	-0.431***	-0.416***	0.090	-0.431***
	(0.142)	(0.162)	(0.140)	(0.149)	(0.140)	(0.140)	(0.160)	(0.141)
K/L	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Labor\ intensity_{j,t}$	0.000	0.000	0.000	-0.000	0.000	0.000	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Wage_{ij,t}$	0.217***	0.205***	0.214***	0.273***	0.228***	0.193***	0.216***	0.222***
	(0.046)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)	(0.044)	(0.046)
$Tariff_{ij,t}$	0.005	0.007	0.002	0.008	0.010	0.005	0.010	0.006
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
$Road_j$	0.020	0.035	0.050	-0.119**	0.022	0.058	0.089*	0.030
	(0.051)	(0.050)	(0.050)	(0.054)	(0.050)	(0.051)	(0.050)	(0.050)
$Dist_j$	-0.059	-0.075	-0.089	-0.273***	0.042	-0.080	-0.075	-0.070
	(0.073)	(0.117)	(0.072)	(0.077)	(0.078)	(0.072)	(0.071)	(0.072)
Regional Dummy	-0.131	-0.001	1.224***	1.520***	-0.733***	0.853*	-1.616***	0.364
	(0.119)	(0.222)	(0.331)	(0.223)	(0.201)	(0.462)	(0.257)	(0.242)
_cons	-2.192**	-2.137	-2.650***	1.242	-3.429***	-2.195**	-2.917***	-2.327**
	(1.009)	(1.476)	(1.014)	(1.115)	(1.065)	(1.008)	(1.007)	(1.015)
Obs.	2,371	2,371	2,371	2,371	2,371	2,371	2,371	2,371
R^2	0.411	0.411	0.415	0.423	0.414	0.412	0.421	0.412

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. The year and the industry fixed effects are included all the analysis.

Table 1.7 Robustness check: Agglomeration 2

	Europe	Asia	Africa	North America	Latin America	Middle East	CIS	Oceania
$Environmental\ regulation_{j,t}$	-0.750***	-0.919***	-0.788***	-0.620***	-0.775***	-0.788***	-1.008***	-0.797***
	(0.076)	(0.077)	(0.075)	(0.076)	(0.075)	(0.075)	(0.078)	(0.075)
Agglomeration 2	0.004***	0.004***	0.003***	0.003***	0.004***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Human\ Capital_{j,t}$	-0.315**	0.292*	-0.189	-0.767***	-0.235	-0.211	0.474***	-0.236
	(0.147)	(0.162)	(0.146)	(0.154)	(0.145)	(0.145)	(0.162)	(0.146)
K/L	0.000	0.000**	0.000	-0.000*	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Labor\ intensity_{j,t}$	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Wage_{ij,t}$	0.374***	0.376***	0.343***	0.415***	0.363***	0.330***	0.336***	0.357***
	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.045)	(0.047)
$Tariff_{ij,t}$	-0.013	-0.006	-0.009	-0.004	-0.003	-0.007	-0.000	-0.007
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
$Road_j$	0.234***	0.228***	0.318***	0.047	0.292***	0.320***	0.345***	0.298***
	(0.051)	(0.049)	(0.048)	(0.054)	(0.048)	(0.050)	(0.047)	(0.048)
$Dist_j$	-0.081	0.531***	-0.177**	-0.418***	-0.026	-0.167**	-0.156**	-0.158**
	(0.079)	(0.128)	(0.077)	(0.080)	(0.084)	(0.077)	(0.075)	(0.077)
Regional Dummy	-0.509***	1.481***	0.572*	2.175***	-0.820***	0.471	-2.305***	0.475*
	(0.122)	(0.221)	(0.342)	(0.225)	(0.210)	(0.481)	(0.260)	(0.254)
_cons	-1.612	-8.749***	-1.556	3.371***	-2.765**	-1.340	-2.500**	-1.565
	(1.038)	(1.514)	(1.049)	(1.129)	(1.101)	(1.040)	(1.031)	(1.047)
Obs.	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375
R^2	0.365	0.372	0.361	0.384	0.364	0.360	0.381	0.361

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. The year and the industry fixed effects are included all the analysis.

1.5 Conclusion

This paper investigates the effect of the environmental regulation and the agglomeration effects on the Korean outbound FDI. To do so, this paper follows the concept of pollution haven by Wagner and Timmins (2009). This paper has found evidence of the pollution haven effect on FDI. Additionally, the result suggests that agglomeration has more important role for Korean FDI outflows.

As expected, the main regression results suggested that both agglomeration and environmental regulations significantly affect the Korean manufacturing FDI. Furthermore, other regulation variables, such as, rule of law and regulatory quality show strong negative results. This result indicates that Korean FDI is affected by lower regulations in the recipient countries that supporting the prediction of the pollution haven hypothesis (Wagner and Timmins, 2009; Chung, 2014). This results also supported by robustness check results that divided the data by various regions. Even the pollution intensity shows an insignificant result, other explanatory variables show the relatively significant result.

To avoid the endogeneity and in an attempt to capture the effect of the previous location decision, the Difference GMM was utilized as another econometric tool. Although agglomeration variables played an important factor for attracting FDI, but environmental regulations showed no impact for catch the evidence of pollution haven. Therefore, different environmental measurements are need to consider in the future empirical research.

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CHAPTER 2

FDI and Labor Regulation: Evidence from Korea

2.1 Introduction

This paper analyzes the role of labor regulations on the Korean industry level of FDI (Foreign Direct Investment) outflows. More specifically, this paper tries to identify whether the investment recipient countries on low labor standards to attract foreign investment. This phenomenon is well known as the “race to the bottom hypothesis”. However, unlike other institutional measurements, labor standards are paid little attention compared to environmental regulations and tax policy for a determinant of race to the bottom hypothesis. This paper assumes that the Korean industry FDI outflow is affected by the labor market of host countries with especially low labor standards. To analyze the race to the bottom hypothesis, this paper utilizes two types of labor standards for developed and developing countries. Moreover, this paper divides the Korean FDI outflow data into four different groups (i.e. time, factor intensity, concentration shares etc.) to find further information. The regression results suggest that the race to the bottom hypothesis in Korean outbound FDI does indeed exist.

During the last decades, the labor market condition has been changed dramatically. Especially, labor standard became debatable issue in globalization that intentional low standards can attract the foreign investments (Olney, 2013). According to the race to the

bottom hypothesis, countries are attracted to FDI by undercut labor standards even it has several advantages in the social level (Davies and Vadlamannati, 2013). Also, the race to the bottom hypothesis explain the labor standard is related to the companies' production cost [7]. That is, a low level of labor standard arises unnaturally because of production cost. In other words, a labor-intensive industry exploits the low level of labor standard advantages to enhancing their cost competitiveness (Martin and Maskus, 2001).

However, this paper assumes that Korean manufacturing FDI outflows have certain relationship with low labor standards in FDI recipients. For instance, labor cost is the most obvious factor for labor standards (Delbecque et al., 2014). Since the labor cost is one of the important factor endowments in FDI, it is important to consider the labor cost factor. The reason behind this is that labor is important production factor for manufacturing industry in Korea. However, labor market condition is controlled by government. Therefore, manufacturing companies should consider either domestic high standard or relocate their production into low standard country. That is strict labor standards tend to have a higher labor cost which restrain organizations to settle down in that particular country.

In other words, strict labor standards give the motivation to manufacturing industries for swift their production in order to avoid the additional production costs. Since Korea experienced rapid improvements on the labor market, Korean manufacturing industry is assumed to affected by labor standards.

The labor market in Korea faces some challenges. In the sense of labor cost, Korea's minimum wage rate was 44.2% from median income in 2013 which is lower than the average

[7] Additionally, the race to the bottom hypothesis also appears when the governments believes that the reduction of labor standards are related to investment flows though FDI generated as a result of other factors (Davies and Vadlamannati, 2013).

OECD minimum wage rate[8] (OECD, 2015). However, compared to 28.8% in year of 2000, the increase rate of minimum wage in Korea is one of the largest among OECD countries (OECD, 2015), as well as high labor-management conflict during the last decades. Thus, the Korean manufacturing industry suffered from an increase in domestic wage rate while the industry structure also changed into a capital-intensive industry. In that respect, this paper assumes that weak labor standards in other countries would have an effect on Korea's outbound FDI location decision.

As one of the institutional effects, labor standard was studied in perspective of organizations activities on labor demand. Recent studies have been interested in the institutional role and how it affects economic performance, such as multinational companies' (MNCs) decision on FDI (Bénassy-Quéré et al., 2007). However, despite previous literatures exploiting the wage rates as consideration of the labor cost, more recent papers have started to take labor standards into account in the relationship with FDI (Gross and Ryan, 2008). The reason behind this is that wage in host countries is not address the overall costs based on labor standards (Gross and Ryan, 2008). Therefore, the various papers have argued about whether the difference of labor standards across the countries would affect FDI location choices (Gross and Ryan, 2008). However, overall results from previous literatures supported the above predictions limitedly (Olney, 2013).

More specifically, in the empirical field, environmental regulations, tax and labor regulations are mainly used for the race to the bottom hypothesis. While there is an increasing amount of literature on the relationship between FDI, environmental regulation and tax competition, the interaction between labor regulations and FDI is still limited. One of the

[8] An average minimum wage rate of OECD is 49.3% in 2013 (OECD, 2015).

reasons for this is that literature on FDI location decisions made by multinationals were used to consider labor costs as one of the determinants in the estimation. Therefore, based on the race to the bottom hypothesis, this paper tries to shed light on the determinants of Korean FDI outflows. To do so, this paper takes into account the host countries' labor regulations in the analysis. Main contribution of this paper is identifying the effects of the host countries' labor standards on Korean FDI outflows. In addition, this paper attempts to investigate labor standard effects in various sample groups for further information.

The paper proceeds as follows. Section 2 introduces recent literature on the role of labor standards in FDI. Section 3 describes the data and methodology which are used in the empirical analysis. Finally, the empirical results are shown in Section 4 and the conclusion in Section 5.

2.2 Literature Review

The literature on the institutional quality on FDI is widely developed. The main argument of institutional quality on FDI is whether better quality attracts more FDI inflows or not (Bénassy-Quéré et al., 2007). Starting from the early work of Wheeler and Mody (1992), the analysis on the role of institutional quality on FDI has been activated. In the same context, the impact of labor standards on FDI decision became an attractive topic by applying interests emerge on the role of institution on economic performance (Botero et al., 2004; Gross and Ryan, 2008).

Unlike literature on environmental protection and tax competition, labor standards has been relatively limited work even the main argument is similar with each other (Davies and

Vadlamannati, 2013). As discussed, the main interpretation of labor standard is the same with other institutional measurements. However, recent literatures show some evidences of a relationship between labor standard and FDI, nevertheless the race to the bottom hypothesis still remains as an arguable issue. According to the race to the bottom hypothesis, the relationship between labor standards and FDI is clear that foreign investment will emerge in places with a lower labor cost under weak labor standards (Olney, 2013). In other words, differences of labor standards among host countries will lead to factor endowment differences for the production process. Additionally, the race to the bottom hypothesis explains that host countries' labor standards were decreased to be competitive enough for promoting FDI inflows (Martin and Maskus, 2001; Olney, 2013).

By theoretical consideration, Martin and Maskus (2001) show skeptical opinion for the race to the bottom hypothesis. In the empirical studies, Mosley and Uno (2007) find labor rights to have a positive correlation with FDI inflows using collective labor rights. This result is also shown in the Kucera (2002) which opposes the race to the bottom hypothesis. Additionally, Leibrecht and Scharler (2009) find low production costs are more relevant in attracting FDI rather than employment protection legislations in transitional economies. Therefore, the race to the bottom hypothesis still remains an arguable issue (Olney, 2013).

At the same time, some evidence of the race to the bottom hypothesis and FDI revealed by empirical literature (Bénassy-Quéré et al., 2007; Gross and Lyan, 2008; Dewit et al., 2009; Davies and Vadlamannati, 2013; Olney, 2013; Delbecque et al., 2014; Duanmu, 2014). Using OECD data set, Olney (2013) shows supporting evidence that host countries compete with each other while lower levels of labor standards attract FDI. Also by FDI outward analysis, Dewit et al. (2009) shows that outward FDI is discouraged by high levels

of employment protection in domestic markets. In more detail, Bellak and Leibrecht (2011) suggested that high employment protection negatively affects FDI especially in low skilled intensive manufacturing industries. Using FDI outflows from BRIC countries (Brazil, Russia, India and China), Duanmu (2014) found the race to the bottom hypothesis that low labor standards in host countries are attract FDI outflows. Likewise, most previous literature focused on whether lower regulations attract FDI inflows or not. Furthermore, Delbecque et al. (2014) demonstrated that the strict labor market decreased FDI inducement by using French firm level data. It indicates FDI location choice is affected by the labor institution.

However, empirical studies done by Olney (2013), and empirical work done by Davies and Vadlamannati (2013), identified not only a relationship between labor regulations and FDI but also found more detailed information for whether host countries compete with each other to undercut their labor standards. However, conclusions were limited because cross sectional data of both studies found evidence of competition on labor market standards.

The numerous measurements were used as a labor standard in previous empirical studies. First of all, employment protection measurement from the OECD (Boeri and Jimeno, 2005; Gross and Ryan, 2008; Dewit et al., 2009; Bellak and Leibrecht, 2011; Olney, 2013; Delbecque et al., 2014). Second, all-inclusive labor rights measurement developed by Mosley and Uno (2007) utilized in Berliner et al. (2015); Davies and Vadlamannati (2013); Duanmu (2014). Finally, Duanmu (2014) and Dewit et al. (2009) used labour standards from the world economic forum (Wef) while Delbecque et al., (2014) utilized the economic freedom index from Fraser Institute.

In sum, contribution of previous literature found that evidences of rigidity in labor legislation deter the location choice of organizations in the country level analysis.

2.3 Methodology and Data

This section briefly explains the data and the methodology. The base model is designed for estimating the industry level of Korean FDI outflows by a set of various host country specific variables. Using one country's FDI data has an advantage because it reduces the home country's characteristics that may affect FDI flows (Olney, 2013). The base model utilized the gravity equation as well as taking into account the host country specific variables. Furthermore, this paper tries to build the two types of labor standard data for identifying the effect of labor standard on FDI.

The basic estimator of this paper is shown as follows.

$$\begin{aligned} ln(FDI_{i,t}) = \beta_0 + \beta_1(labor\ standard_{j,t}) + \beta_2 ln(GDP_{j,t}) \\ + \beta_3 ln(labor\_force_{j,t}) + \beta_4\, ln(dist_j) + \beta_5(tax_{j,t}) \\ + \beta_6 ln(wage_{ij,t}) + \mu_j + \eta_t + \varepsilon_{j,t} \end{aligned} \quad (2.1)$$

The *i* represents each manufacturing industry while *j* representing each host country. The 116 host countries in the data set are carefully chosen based on FDI data availability. Finally, the time periods from 1997 to 2012 is represented as *t.*

The dependent variable, $ln(FDI_{i,t})$ represents the log of Korean industry FDI into each host country at time *t*. The 21 manufacturing industries used in the analysis which is taken from The Export-Import Bank of Korea. Since the data is provided nominal value, this paper converted them into real values expressed in US dollar based on 2005 prices using then Korean GDP deflator from the Bank of Korea.

The labor standard of each FDI recipient country is represented as $(labor\ standard_{j,t})$. This paper utilizes two different types of labor standards which are taken from different sources. First of all, in the case of developed countries, this paper utilized employment protection measurements from OECD. The employment protection measurement is composite index constructed from 21 individual indices which cover the aspects for strictness of dismissal regulation on the regular and temporary contracts workers[9]. However, the employment protection index covers 43 countries from 1985 to 2013. Second, for estimating developing countries, this paper used all-inclusive labor rights[10]. Constructed by Mosley and Uno (2007), all-inclusive labor rights designed for capturing collective labor rights in various countries (Davies and Vadlamannati, 2013). all-inclusive labor rights data constructed under the six categories and covered almost all the countries in the world. Low labor rights value indicates inferior labor rights in that country. However, the data does not cover recent years and only captures the time period from 1985 to 2002. According to the prediction of the Race to the Bottom Hypothesis, this paper expects more rigid labor standards to deter FDI.

[9] OECD provides a data set for the employment protection measurement by composite indicator of strictness of dismissal regulation of the employees. As pointed by Olney (2013), the OECD data set has two limitations. First, the employment protection data is wider concept than the labor standard. Second, the employment protection data only covers its member countries (Thirty-nine countries). However, even existence of some disadvantages, use of the employment protection measurement is noteworthy because change of protection data is exogenous factor for FDI flows. Further information and detailed methodology for employment protection indicator can be found in OECD website.

[10] Mosley and Uno (2007) provides the all-exclusive labor rights annually from 1985 to 2002 for 90 countries. Based on Kucera (2002)'s templates, an index constructed from sum of violation of indicators. The index includes thirty-seven dimensions from six categories. The six categories are (1) freedom of association and collective bargaining-related liberties, (2) right to establish and join worker and union organizations, (3) other union activities, (4) right to bargain collectively, (5) right to strike and (6) rights in export processing zones. However, this data does not contain other important labor rights such as minimum labor cost (Davies and Vadlamannati, 2013). Also, recent years were not included in the index. The range of data put on record from 0 (lowest score) to76.5 (highest score). The high score of indicator represents the better labor rights in that country (Mosley and Uno, 2007).

The other explanatory variables are selected based on previous literature (Davies and Vadlamannati, 2013; Olney, 2013). The host country's GDP represented as $ln(GDP_{j,t})$ for capturing the host country's market size. The share of total labor force by host country's population denotes as $ln(labor\_force_{j,t})$. This variable captures the relationship between demand of the share of the labor force and FDI. If there is a higher share of the labor force then movement of protects labor right would be active (Davies and Vadlamannati, 2013). Therefore, share of labor force affects FDI indirectly. The geographical distance between Korea and each host country is represented as $ln(dist_j)$ which captures the cost for monitoring affiliates by headquarters. The corporate tax of the host countries is represented as $(tax_{j,t})$ to control the difference tax rates across the host countries. The log of industry level of wage is represented as $ln(wage_{ij,t})$ to control the wage differences between host countries and differences between industries. Since this paper focuses on the host countries' labor standard implications, including the host countries' labor market characteristics are important in the empirical analysis. The industry specific fixed effects and the time fixed effects are denoted as μ_j and η_t, respectively. Finally, $\varepsilon_{j.t}$ represents error term.

Due to the different effects by two different types of labor standards, this paper divides the data into various types of groups to show more detailed results for identifying the effect of labor standards on FDI outflows. First, the data set is divided by the IMF supervision (from 1997 to 2001) and after the supervision (from 2002 to 2012). Korea experienced the IMF supervision period during the Asian Financial Crisis. This paper expects that drastic changes in the economic environment during the IMF supervision period will affect the Korean FDI outflow pattern.

Table 2.1 Data definition and sources

Variable	Definition	Source
$ln(FDI_{i,t})$	Log of industrial level of FDI, Thousands of USD	The Export-Import Bank of Korea
$(labor\ standard_{j,t})$	1. Employment protection indicator 2. All-exclusive labor rights index	1. OECD 2. Mosley and Uno (2007)
$ln(GDP_{j,t})$, $ln(labor\_force_{j,t})$	GDP 2005 constant prices, total labor force in host countries	World Development Indicator, World Bank
$ln(dist_j)$	Distance between Korea and host countries, 1000 km	CEPII
$(tax_{j,t})$	Annual corporate tax by host countries	KPMG
$ln(wage_{ij,t})$	Wage rates by each manufacturing industries (based on ISIC)	UNIDO

Second, the FDI data divided based on the labor and capital-intensive manufacturing industry. Since twenty-one manufacturing industries are used for the analysis, it is noteworthy to divide the data based on their factor intensity. The data set is divided based on the Bank of Korea's capital formation of each industry. After the division, the capital-intensive industry selected ten manufacturing industries while eleven manufacturing industries are selected for labor-intensive industries. This paper expects the labor-intensive industry to be more sensitive to the host countries' labor standards (Bellak and Leibrecht, 2011).

Third, the data set is divided by concentration by the top five companies (C5) sales share based on the year 2011. More specifically, this paper divides groups based on 30% of threshold by top five companies' sales share in each manufacturing industry. More than 30% of concentration share indicates the high share in sales of conglomerates in the industry. This paper expects smaller firms to be more sensitive to labor standards.

Fourth, the sample is divided by combination of factor intensity and concentration by sales share. This kind of group division is designed to find out whether smaller firms with

capital intensity or smaller firms with labor intensity are sensitive to labor standard or not. The combination is (1) capital-intensive and high concentration Shares, (2) capital-intensive and low concentration shares, (3) labor-intensive and high concentration shares and (4) labor-intensive and low concentration shares. This paper expects that smaller and labor-intensity firms to be sensitive to labor standards of the host countries.

Finally, this paper uses the Ordinary Least Squares (OLS) estimator and Weighted Least Squares (WLS) as basic estimator. However, to avoid the endogenity problem in the explanatory variables and OLS estimator, the industry and time fixed effect are included in the analysis (Baier and Bergstrand, 2007). Also, one year lagged independent variables in the WLS estimation utilized for the analysis following by Olney (2013) that firms cannot adjust promptly to characteristics of host country. One year lagged independent variables in regression will suggests whether Korean outbound FDI is affected by previous FDI determinants or not. Bilateral Investment Treaty (BIT) included in the analysis as a robustness to check whether the investment treaty affects Korean FDI outflows.

Table 2.2 Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
$ln(FDI_{i,t})$	3.08	2.59	-7.58	10.93	8145
(Employment protection)	2.18	0.81	0.26	4.58	9933
(Labor rights)	18.44	7.60	0.50	34.50	9576
$ln(GDP_{j,t})$	24.65	2.05	19.17	30.29	37863
$ln(labor\_force_{j,t})$	15.56	1.63	10.48	20.48	38640
$ln(dist_j)$	8.99	0.56	6.86	9.88	38640
$(tax_{j,t})$	27.59	9.43	0.00	55.00	23311
$ln(wage_{ij,t})$	19.31	2.62	6.50	25.09	14131

2.4 Results

2.4.1 Basic Model Estimation

The results of the Hausman test for both labor standards suggest that fixed effect is a more appropriate estimator than the random effect estimator for the base model. However, since the fixed effect estimator omits the distance, this paper chooses the WLS to be the main estimator. The Table 2.3 shows the OLS results by equation (1) while Table 2.4 provides the fixed effect results.

The labor standard shows negative coefficients constantly as expected but only significant in the case of employment protection. The reason behind this is the coverage of data of labor rights might be affected in the analysis. Since Mosley and Uno's (2007) data cover until 2002, it is difficult to capture the long-term effect of labor standards on FDI. Especially, this paper covers from 1997; it is difficult to captures the long-term labor standards in developing countries.

The host country's GDP, corporate tax rate and tariff rates show negative coefficients while labor force and wage rate are positive. Sign of coefficients do not change when the analysis is applied with year and industry fixed effects. In column (3) and (4), only corporate tax and labor force are significant. The results of column (1) and (2) indicate that regulations of developed country's employment protection deter the FDI outflows in Korea. This result is consistent with previous literature and even column (3) and (4) do not show significant results. In developed countries, a smaller but high labor force and high wage rates attract FDI while high labor force and low corporate tax rate attracts FDI in developing countries.

Negative signs of GDP and distance indicate that Korean multinationals prefer the

closer and smaller market rather than the big market in developed countries. The host country's share of labor force presented as positive while wage rate also is positively. The one reason for unconventional results is because OECD member countries are treated as developed countries therefore Korean FDI manufacturing FDI show a different pattern with developing countries. In the case of developing countries, high labor force population and lower corporate tax rate attract FDI in developing countries.

Table 2.3 Basic estimation result: OLS

	Employment Protection		Labor Rights	
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.594***	-0.662***	-0.000	-0.011
	(0.070)	(0.066)	(0.020)	(0.019)
$ln(GDP_{j,t})$	-1.059***	-1.046***	0.031	0.112
	(0.106)	(0.113)	(0.188)	(0.193)
$ln(labor\_force_{j,t})$	1.251***	1.334***	0.262**	0.278**
	(0.065)	(0.063)	(0.127)	(0.125)
$ln(dist_j)$	-0.073***	-0.082***	-0.008	-0.007
	(0.010)	(0.010)	(0.024)	(0.023)
$(tax_{j,t})$	0.083	0.048	-0.500**	-0.784***
	(0.077)	(0.073)	(0.218)	(0.210)
$ln(wage_{ij,t})$	0.567***	0.565***	0.042	-0.139
	(0.049)	(0.064)	(0.110)	(0.117)
_cons	1.693	1.594	1.673	6.497**
	(1.910)	(1.852)	(3.264)	(3.177)
Obs.	2,281	2,281	345	345
R^2	0.243	0.353	0.062	0.283

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the column (2) and (4); Employment protection is used for developed countries where labor rights uses for developing countries.

2.4.2 Fixed Effect Results

This paper tries to compare the results between WLS and fixed effect as a robustness check. Table 2.4 shows estimation results by WLS has clear evidence of race to the bottom hypothesis than fixed effect. Therefore, this paper assumes that results reported by WLS are reliable. It is because, even fixed effect shows inconsistent result, WLS still shows consistent result. Further, since fixed effect does not include host country and time specific fixed effect in the analysis, ordinary fixed effect could not catch the unobserved characteristics of Korea.

Table 2.4 Basic estimation result: Fixed Effect

	Employment Protection		Labor Rights	
	WLS	Fixed Effect	WLS	Fixed Effect
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.482***	0.154	-0.018	-0.022**
	(0.162)	(0.204)	(0.033)	(0.009)
$ln(GDP_{j,t})$	-1.154***	1.112**	0.148	1.616
	(0.284)	(0.472)	(0.310)	(1.288)
$ln(labor\_force_{j,t})$	1.270***	-4.980***	0.262	-1.752
	(0.194)	(0.771)	(0.212)	(3.361)
$ln(dist_j)$	0.079	(omitted)	-0.731**	(omitted)
	(0.214)		(0.340)	
$(tax_{j,t})$	-0.118***	-0.006	-0.016	0.020**
	(0.027)	(0.007)	(0.043)	(0.009)
$ln(wage_{ij,t})$	0.659***	0.062	-0.122	0.180
	(0.162)	(0.075)	(0.185)	(0.113)
_cons	-1.768	57.295***	4.840	-12.442
	(6.371)	(15.343)	(5.079)	(60.260)
Obs.	2,281	2,281	345	345
R^2	0.478	0.341	0.291	0.343

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the analysis. Employment protection is used for developed countries where labor rights uses for developing countries.

The fixed effect results for basic estimation from equation (1) are presented in Table 2.4. The distance omitted in both fixed effect results in column (2) and (4). To compare the results with the WLS results, column (1) and (3) report the WLS results. However, the results show labor rights is significant when the fixed effect estimator is used, while employment protection is significant in the WLS estimator.

The results suggest that Korean FDI outflows are affected by small markets, high share of labor force in developed countries under the WLS estimation. Meanwhile, higher corporate tax rates and closer geographical distance relate with FDI in developing countries. As shown through the results Tables, the results indicate FDI determinants between developing and developed countries are different.

2.4.3 Group Division Results

Table 2.5 and Table 2.6 present the results of group division based on before and after the IMF supervision periods. Column (1) and (3) shows regression with lagged independent variables because of the possibility for multinationals' decision to be affected by previous characteristics of the host country. Table 2.5 shows the case of being under the IMF supervision periods (from 1997 to 2001) while Table 2.6 provides statistics on after the IMF supervision periods (from 2002 to 2012). The purpose of first group division is to figure out whether there is difference between before and after the Asian Financial Crisis. This period is important to Korean industry because they experienced structural changes in very short time.

The labor standards show significantly only at after the IMF supervision case. Additionally, size of coefficients indicates that previous labor standards have a stronger effect

on FDI outflows. This result can be explained by time specific characteristics. Under the IMF supervision periods, Korea experienced policy reform including industry structures. Therefore, this IMF supervision period has some possibilities for insignificant result.

However, other variables also show similar results with base estimation. It implies the model and result are shown consistently even estimates by group division.

Table 2.5 Group division 1: IMF supervision
(Under the IMF supervision periods from 1997 to 2001)

	Employment Protection		Labor Rights	
	t-1	t	t-1	t
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.130	-0.195	-0.030	-0.028
	(0.325)	(0.216)	(0.033)	(0.023)
$ln(GDP_{j,t})$	-1.923**	-2.701***	0.129	0.125
	(0.910)	(0.644)	(0.277)	(0.223)
$ln(labor\_force_{j,t})$	1.532**	2.039***	0.320*	0.270*
	(0.638)	(0.476)	(0.177)	(0.141)
$ln(dist_j)$	1.221***	1.148***	-0.794**	-0.700***
	(0.297)	(0.210)	(0.367)	(0.250)
$(tax_{j,t})$	-0.088**	-0.056*	-0.021	-0.021
	(0.041)	(0.032)	(0.036)	(0.028)
$ln(wage_{ij,t})$	1.200***	1.436***	-0.090	-0.119
	(0.416)	(0.286)	(0.188)	(0.143)
_cons	0.901	8.667	5.263	5.786
	(11.105)	(7.519)	(4.792)	(3.592)
Obs.	100	183	131	236
R^2	0.510	0.508	0.285	0.288

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the regression analysis. Employment protection is used for developed countries while labor rights uses for developing countries.

Table 2.6 Group division 1: IMF supervision
(After the IMF supervision periods from 2002 to 2012)

	Employment Protection		Labor Rights	
	t-1	t	t-1	t
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.735***	-0.708***	0.055	0.036
	(0.071)	(0.070)	(0.037)	(0.039)
$ln(GDP_{j,t})$	-1.017***	-1.026***	-0.131	0.150
	(0.118)	(0.116)	(0.452)	(0.506)
$ln(labor\_force_{j,t})$	1.407***	1.333***	0.271	0.232
	(0.065)	(0.064)	(0.310)	(0.333)
$ln(dist_j)$	-0.041	-0.063	-1.540***	-1.297***
	(0.079)	(0.077)	(0.426)	(0.445)
$(tax_{j,t})$	-0.086***	-0.085***	0.054	0.047
	(0.010)	(0.010)	(0.053)	(0.056)
$ln(wage_{ij,t})$	0.521***	0.555***	-0.024	-0.203
	(0.066)	(0.066)	(0.230)	(0.243)
_cons	1.384	2.259	14.708*	9.756
	(1.954)	(1.919)	(7.730)	(8.708)
Obs.	2,024	2,098	117	109
R^2	0.381	0.358	0.363	0.351

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the regression analysis. Employment protection is used for developed countries while labor rights uses for developing countries.

Similar with the WLS, Korean FDI outflows are more sensitive in developed countries at the end of IMF supervision while high wage rates, high labor force with small market affect Korean investment flows. Also, Korean FDI affected by closer distance in developing countries. As mentioned in the previous results, the number of observation may affect the results in column (3) and (4).

The next Table 2.7 and Table 2.8 report the second case of group division according to the factor intensity of industry. All coefficients of labor standards show negatively in developed countries. The results suggested that a labor-intensive industry is more sensitive

than a capital-intensive industry for FDI in developed countries. This result strongly supports the race to the bottom hypothesis. That is, labor-intensive industry is more sensitive to labor costs in production process. Therefore, labor-intensive industries have an incentive to locate their production in countries with low standards.

Additionally, the sizes of the coefficients suggest that Korean FDI is more affected by previous host country specific factor. On the other hand, labor standard does not show any significance in developing countries.

Table 2.7 Group division 2: Factor intensity
(Capital-intensive industry)

	Employment Protection		Labor Rights	
	t-1	t	t-1	t
	(1)	(2)	(1)	(2)
$(labor\ standard_{j,t})$	-0.649***	-0.642***	-0.007	-0.010
	(0.100)	(0.099)	(0.026)	(0.027)
$ln(GDP_{j,t})$	-1.096***	-1.161***	-0.470	-0.379
	(0.187)	(0.184)	(0.354)	(0.371)
$ln(labor\_force_{j,t})$	1.417***	1.360***	0.636***	0.562**
	(0.100)	(0.100)	(0.213)	(0.220)
$ln(dist_j)$	-0.049	-0.072	-0.452	-0.426
	(0.120)	(0.118)	(0.373)	(0.387)
$(tax_{j,t})$	-0.060***	-0.052***	-0.079*	-0.065
	(0.015)	(0.015)	(0.044)	(0.045)
$ln(wage_{ij,t})$	0.430***	0.483***	0.243	0.175
	(0.103)	(0.102)	(0.173)	(0.181)
_cons	4.665	6.263**	7.551	7.185
	(2.936)	(2.895)	(5.204)	(5.370)
Obs.	1,098	1,122	168	164
R^2	0.344	0.319	0.290	0.288

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the analysis. Employment protection is used for developed countries where labor rights uses for developing countries.

Table 2.8 Group division 2: Factor intensity
(Labor-intensive industry)

	Employment Protection		Labor Rights	
	t-1	t	t-1	t
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.742***	-0.714***	0.013	-0.007
	(0.089)	(0.089)	(0.026)	(0.027)
$ln(GDP_{j,t})$	-0.970***	-0.939***	0.232	0.367
	(0.142)	(0.139)	(0.222)	(0.224)
$ln(labor\_force_{j,t})$	1.396***	1.321***	0.281*	0.183
	(0.081)	(0.080)	(0.154)	(0.154)
$ln(dist_j)$	0.172*	0.135	-0.952***	-0.912***
	(0.092)	(0.090)	(0.258)	(0.256)
$(tax_{j,t})$	-0.110***	-0.114***	0.001	0.009
	(0.013)	(0.013)	(0.028)	(0.028)
$ln(wage_{ij,t})$	0.649***	0.661***	-0.397**	-0.461***
	(0.081)	(0.081)	(0.167)	(0.169)
_cons	-4.067*	-3.541	8.606**	7.864*
	(2.375)	(2.338)	(3.997)	(4.025)
Obs.	1,128	1,159	191	181
R^2	0.404	0.385	0.295	0.314

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the analysis. Employment protection is used for developed countries where labor rights uses for developing countries.

Table 2.9 and Table 2.10 report the results with group based by concentration rates by sales share in each manufacturing industry. Considering existence of conglomerates in Korean manufacturing industries, this paper divided the group based on 30% of threshold by top five most sales share companies. As shown in previous result tables, labor standards show significant and negative results in the case of developed countries.

However, the coefficient levels show a different and sales share of conglomerates is less sensitive to labor standards. Therefore, the results are consistent with general logic and expectation that small and medium enterprises are more sensitive to labor standards than conglomerates. Additionally, lagged independent variables are more sensitive to FDI.

Therefore, FDI outflows by small and medium manufacturing enterprises affected not only current labor standards but also previous labor standards in host countries.

Table 2.9 Group division 3: Concentration rates by sales share of company:
(More than 30% threshold of concentration share, C5 > 30%)

	Employment Protection		Labor Rights	
	t-1	t		t-1
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.561***	-0.547***	-0.033	-0.037
	(0.124)	(0.124)	(0.032)	(0.033)
$ln(GDP_{j,t})$	-1.206***	-1.234***	-0.851**	-0.704
	(0.226)	(0.224)	(0.422)	(0.442)
$ln(labor\_force_{j,t})$	1.547***	1.467***	0.782***	0.690***
	(0.124)	(0.125)	(0.259)	(0.266)
$ln(dist_j)$	0.157	0.122	-0.180	-0.144
	(0.150)	(0.150)	(0.476)	(0.492)
$(tax_{j,t})$	-0.084***	-0.079***	-0.053	-0.032
	(0.020)	(0.020)	(0.056)	(0.057)
$ln(wage_{ij,t})$	0.556***	0.607***	0.356*	0.258
	(0.125)	(0.125)	(0.193)	(0.200)
_cons	1.701	2.652	10.186	8.706
	(3.661)	(3.621)	(6.430)	(6.531)
Obs.	784	793	118	114
R^2	0.344	0.320	0.307	0.310

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the analysis. Employment protection is used for developed countries where labor rights uses for developing countries.

Table 2.10 Group division 3: Concentration rates by sales share of company:
(Less than 30% threshold of concentration share, C5 < 30%)

	Employment Protection		Labor Rights	
	t-1	t		t-1
	(1)	(2)	(3)	(4)
$(labor\ standard_{j,t})$	-0.759***	-0.738***	0.017	0.003
	(0.078)	(0.078)	(0.022)	(0.023)
$ln(GDP_{j,t})$	-0.968***	-0.973***	0.324	0.444**
	(0.131)	(0.128)	(0.207)	(0.211)
$ln(labor\_force_{j,t})$	1.339***	1.279***	0.226	0.135
	(0.072)	(0.071)	(0.138)	(0.140)
$ln(dist_j)$	0.039	0.014	-0.980***	-0.960***
	(0.083)	(0.081)	(0.228)	(0.228)
$(tax_{j,t})$	-0.085***	-0.085***	-0.011	-0.004
	(0.011)	(0.011)	(0.025)	(0.025)
$ln(wage_{ij,t})$	0.547***	0.562***	-0.398***	-0.459***
	(0.074)	(0.073)	(0.149)	(0.152)
_cons	-0.596	0.366	7.764**	7.278**
	(2.120)	(2.083)	(3.464)	(3.501)
Obs.	1,442	1,488	241	231
R^2	0.367	0.344	0.288	0.302

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the analysis. Employment protection is used for developed countries where labor rights uses for developing countries.

Finally, Table 2.11 and Table 2.12 show the combination of group division. Similar with the previous group division, the labor standards show significance only in the case of developed countries. In addition, independent variables show the same results as other result Tables. However, the results suggest that labor-intensive and low concentration rate by sales share industry is most sensitive to FDI outflows. Overall, both Table 2.11 and Table 2.12 show consistent results with previous group division results.

Table 2.11 Group division 4: Combination of factor intensity and concentration shares with lagged independent variables

	Employment Protection			Labor Rights		
	Capital-intensive and high share	Capital-intensive and low share	Labor-intensive and low share	Capital-intensive and high share	Capital-intensive and low share	Labor-intensive and low share
	(1)	(2)	(3)	(4)	(5)	(6)
$(labor\ standard_{j,t})$	-0.561***	-0.750***	-0.756***	-0.033	0.037	0.013
	(0.123)	(0.167)	(0.088)	(0.032)	(0.041)	(0.026)
$ln(GDP_{j,t})$	-1.237***	-0.586*	-1.020***	-0.851**	0.901	0.232
	(0.227)	(0.325)	(0.141)	(0.422)	(0.664)	(0.222)
$ln(labor\_force_{j,t})$	1.587***	1.047***	1.431***	0.782***	0.015	0.281*
	(0.123)	(0.163)	(0.080)	(0.259)	(0.359)	(0.154)
$ln(dist_j)$	0.050	-0.227	0.106	-0.180	-0.637	-0.952***
	(0.150)	(0.189)	(0.091)	(0.476)	(0.540)	(0.258)
$(tax_{j,t})$	-0.087***	-0.018	-0.112***	-0.053	-0.092	0.001
	(0.020)	(0.023)	(0.013)	(0.056)	(0.064)	(0.028)
$ln(wage_{ij,t})$	0.583***	0.030	0.688***	0.356*	-0.544	-0.397**
	(0.125)	(0.178)	(0.080)	(0.193)	(0.416)	(0.167)
_cons	2.323	4.560	-3.405	10.186	-2.381	8.606**
	(3.649)	(4.735)	(2.338)	(6.430)	(8.118)	(3.997)
Obs.	767	331	1,111	117	51	190
R^2	0.361	0.251	0.421	0.306	0.368	0.295

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in all analysis. Employment Protection used for developed countries where labor rights used for developing countries.
Note 2: Combination for labor intensity and high concentration share industry omitted due to not sufficient observation.

Table 2.12 Group division 4: Combination of factor intensity and concentration shares without lagged independent variables

	Employment Protection			Labor Rights		
	Capital-intensive and high share	Capital-intensive and low share	Labor-intensive and low share	Capital-intensive and high share	Capital-intensive and low share	Labor-intensive and low share
	(1)	(2)	(3)	(4)	(5)	(6)
$(labor\ standard_{j,t})$	-0.547***	-0.772***	-0.727***	-0.037	0.037	-0.007
	(0.123)	(0.166)	(0.087)	(0.033)	(0.045)	(0.027)
$ln(GDP_{j,t})$	-1.262***	-0.743**	-0.981***	-0.704	0.717	0.367
	(0.224)	(0.320)	(0.138)	(0.442)	(0.696)	(0.224)
$ln(labor\_force_{j,t})$	1.501***	1.052***	1.349***	0.690***	0.038	0.183
	(0.124)	(0.162)	(0.079)	(0.266)	(0.380)	(0.154)
$ln(dist_j)$	0.022	-0.231	0.076	-0.144	-0.616	-0.912***
	(0.150)	(0.184)	(0.089)	(0.492)	(0.566)	(0.256)
$(tax_{j,t})$	-0.081***	-0.008	-0.115***	-0.032	-0.095	0.009
	(0.020)	(0.023)	(0.013)	(0.057)	(0.067)	(0.028)
$ln(wage_{ij,t})$	0.630***	0.095	0.695***	0.258	-0.455	-0.461***
	(0.125)	(0.177)	(0.080)	(0.200)	(0.437)	(0.169)
_cons	3.655	7.085	-3.005	8.706	-0.284	7.864*
	(3.627)	(4.620)	(2.313)	(6.531)	(8.453)	(4.025)
Obs.	777	345	1,143	114	50	181
R^2	0.337	0.220	0.402	0.310	0.337	0.314

Note 1: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in all analysis. Employment Protection used for developed countries where labor rights used for developing countries.
Note 2: Combination for labor intensity and high concentration share industry omitted due to not sufficient observation.

2.5 Conclusion

This paper tries to figure out whether Korean FDI outflows influenced by labor standards or not. At the same time, this paper tries to find more detailed labor standard effects under the four different Korean specific characteristics: (1) IMF supervision periods, (2) labor and capital-intensive industries, (3) concentration rate for sales share by top five companies in each manufacturing industry and finally (4) combination of factor intensity and concentration rates.

The empirical results suggest that Korean FDI outflows affected in the case of developed countries and found evidence of the race to the bottom hypothesis. Additionally, the low labor standards tend to attract Korean FDI more when lagged independent variables are used (Olney, 2013). The reason for weak evidence of labor right index by Mosley and Uno (2007) is that limited time periods do not affect labor standards on FDI. However, results for GDP, wage rates and other variables indicate that Korean FDI is affected by small markets with a high labor force and high wage rates while a high labor force and low corporate tax rates attract FDI in developing countries.

Finally, regression results for group division suggest (1) employment protection is more sensitive after the IMF supervision rather than while under the supervision, (2) labor-intensive industry is more sensitive and (3) lower concentration numbers by sales share of top five companies are more sensitive to FDI outflows. These results are also reflected in Table 2.10 and Table 2.11 showing labor-intensive and low concentration share by industry is most sensitive to FDI. The limitation of a labor rights derives weak evidences throughout the result. Therefore, in the future study, this paper expects an inclusion of long-term labor standard in the data would bring different results. Also, in consideration of an alternative measurement of

labor standards enables appropriates results for developing countries.

Table 2.13 Robustness check

	Employment protection	Labor right
$(labor\ standard_{j,t})$	-0.461***	0.005
	(0.089)	(0.019)
$ln(GDP_{j,t})$	-1.043***	0.119
	(0.125)	(0.268)
$ln(labor\_force_{j,t})$	1.380***	0.435**
	(0.077)	(0.172)
$ln(dist_j)$	-0.219**	-1.537***
	(0.092)	(0.304)
$(tax_{j,t})$	-0.084***	0.028
	(0.010)	(0.025)
$ln(wage_{ij,t})$	0.565***	-0.171
	(0.065)	(0.135)
$(Tariff_{ij,t})$	-0.035**	-0.043***
	(0.014)	(0.014)
$(inv\_cost_{j,t})$	0.074***	0.062***
	(0.013)	(0.021)
BIT	-0.371**	-1.101***
	(0.161)	(0.370)
_cons	2.273	10.066**
	(1.886)	(4.423)
Obs.	2,249	297
R^2	0.369	0.381

Note 1: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Dependent variable is $ln(FDI_{i,t})$. Year and industry fixed effects are included in the analysis. The employment protection is uses for developed countries where the labor rights uses for developing countries.
Note 2: To examine the effect of labor market condition to FDI, this Table 2.13 includes another host country and industry specific variables. That is Tariff rates and investment cost of host countries.
Note 3: The negative and significant result of employment protection variable in column (1) represents consistency with previous results in this paper. However, the effect of BIT indicates without BIT between Korea and other host countries are more attract the FDI.
Note 4: For the robustness check, I examined same regression model which exclude the year of 1997, 1998 and 1999. However, a result shows similarly with the previous result tables. Therefore, the results with shorten periods are not shown in the paper.

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CHAPTER 3

The Effect of Free Trade Agreement on Foreign Direct Investment Inflows

3.1 Introduction

This paper investigates the effect of both bilateral and comprehensive FTAs[11] (Free Trade Agreements) on FDI (Foreign Direct Investment) flows. Using knowledge-capital model by Carr et al. (2001), this paper tries to accomplish an analysis of the horizontal and vertical motivated FDI simultaneously. Furthermore, this paper utilizes bilateral FDI data from OECD by four different sample groups (the Whole sample, North-to-South, North-to-North and South-to-North). This paper uses country-pair (34 North and 43 South countries) of FDI inflows during 1985 to 2010.

With remarkable changes of economic environment in the past decades, the world economy experienced both increasing FDI flows and surging FTAs. For instance, since launching of WTO in 1990s, the FDI flows were increased dramatically with FTAs which include investment provisions (Thangavelu and Narjoko, 2014). These drastic changes attracted considerable attention. Hence, there has been numerous discussions on the effect of

[11] The concept of FTA has taken from classification of WTO. This paper uses concept of RTAs to identifying the impact of FTAs on FDI inflows. According to WTO, RTAs defined as reciprocal agreement between two or more countries. Additionally, the range of RTAs covers FTAs, Customs Union (CU) and Economic Integration Agreements (EIA). Hence, this paper considers both CU and EIA as types of FTAs.

FTAs in the various literatures. According to previous finding, the FTAs enable to integrate economies by increasing volume of trade between member countries through partial or full elimination of tariffs. Furthermore, FTAs improve terms of trade while attracts FDI into host countries as an effective measurement. Also, suggested by Blomström and Kokko (1997), FTAs increase not only volume of trade but also investment in the short term. Therefore, many countries try to enter FTAs as their one of the economic policy. One of the reasons behind this is that, FTAs enhance FDI flows even without restructuring of economic environment. This phenomenon known as export platform FDI (Baltagi et al., 2008).

Previous literatures pointed out that the FTAs have a certain relationship with FDI flows and therefore, provided empirical results about the effect of FTAs on FDI flows. However, the results of previous studies ambiguously support this point and still literatures are limited in capturing the real effect of market expansion by FTAs. Existing empirical analysis of impact of FTAs mostly depend on binary variable. However, even though significant evidences are shown in the results, they do not represent accumulated impact by FTAs. Moreover, most critical limitation of binary FTA is that, it is difficult to measure the market expansion effect by FTA partner countries. Additionally, it is difficult to capture more detailed information between trade and FDI flows.

More specifically, empirical analysis in the previous literatures has some limited features. First of all, most studies still rely on the gravity equation in cross country analysis (Baier and Bergstrand, 2007). However, using gravity equation may lead biased results that are designed to justify volume of trade instead of FDI flows. Therefore, an alternative empirical model is required for the FDI analysis. Also, previous literatures tend to focus on either vertical or horizontal FDI motivations, it is important to find appropriate alternative

model to get further information of FTA effect. Second, there is a limitation of FTA measurement. The previous empirical literatures have tendency to use a binary FTA variable. Even though it may lead to a general conclusion on impact of FTAs, detailed results may not be obtained from general information. However, from this point of view, new FTA variable set will be necessary for the analysis. For example, due to their economic size, each country experiences the effect of FTAs differently. To get further information, it is noteworthy to consider how much market expanded by FTAs. Third, previous literatures tend to focus on the single country even though in some cases FTAs are concluded by two or more countries. Therefore, comprehensive country pair analysis is needed for reflecting this feature.

The objective of this paper is to empirically examine the effect of FTAs on FDI flows. Therefore, this paper exploits the advantage of knowledge-capital model instead of general gravity model. In addition, this paper constructs new FTA variables instead of binary FTA variable. The new continuous FTA variables designed to capture the continuous effect of FTA as well as accumulated FTA effect on host country. Also, interaction term of trade and investment cost with FTA included for the empirical analysis as FTA decomposition. Further, to find out differential effect between North and South countries, this paper set up four types of group as Whole, North-to-North, North-to-South and South-to-North countries.

The paper proceeds as follow. Section 2 briefly explains the knowledge-capital model while discuss the previous literatures on a relationship between FTAs and FDI. Section 3 explains the methodology and data for empirical analysis. The results are shown in Section 4 while the conclusion is provided in Section 5.

3.2 Literature review

3.2.1 Knowledge-Capital model

In the previous literatures, the motivation of FDI could be explained by vertical and horizontal FDI. Introduced by Markusen (1984), the horizontal FDI arises from a location choice by a firm for activating same production process in various countries. According to the horizontal FDI, investment relates with economic similarity and comparable resources between source and recipient countries. In contrast, the vertical FDI is introduced by Helpman (1984). The vertical FDI arises from a location choice by a firm for production fragmentation in the various countries. According to the theory, the vertical FDI enjoys the different production cost advantages. Previous empirical results investigated that the horizontal FDI increased when host country and home country have similar market size and comparable factor endowments. In contrast, different factor endowments in host and home countries generate the vertical FDI. The various previous studies support the theoretical prediction of vertical and horizontal FDI. However, previous literatures have analyzed either the Horizontal or the Vertical FDI motivation. The limitation occurs because there are no certain FDI flows data set which is able to distinguish between vertical and horizontal FDI. To fill this gap, Carr et al. (2001) first introduced the model known as knowledge-capital model which integrates horizontal and vertical motivation of FDI into single equation.

Therefore, knowledge-capital model explains FDI emerged from factor endowments and market accessibility which represent vertical and horizontal motivations. More specifically, original knowledge-capital model includes explanatory variables to incorporate these investment motivations. For instance, market size similarity indicates existence of horizontal FDI while vertical FDI relates with different skill endowments and trade costs.

Carr et al. (2001) used US affiliate sales data onto various host countries that identify the evidence of knowledge-capital model. They found an evidence that the horizontal FDI dominates the vertical FDI. Especially, FDI increased if home country is at skilled labor abundant. In addition, factor differences between home and host country explain different direction. For example, convergence of skill difference denotes a negative sign of skill difference while a positively sign is shown in divergence.

The previous empirical results for knowledge-capital model show ambiguous evidence. Using OLS, weighted least squares and Tobit estimator, Carr et al. (2001) provide supporting results for knowledge-capital model. However, Markusen and Maskus (2002) show US data cannot distinguish between vertical and horizontal FDI. They provide the little evidence of knowledge-capital model. Also, Blonigen et al. (2003) find only horizontal FDI motivation supported by the data, thus, reject knowledge-capital model. Further, they suggest modified empirical estimation to avoid incorrect interpretation. However, Braconier et al. (2005) find strong evidence of knowledge-capital model sustainability. They conclude previous weak evidences of vertical FDI motivation were related with data limitation, which does not include assumption of vertical FDI. Using 30 OECD countries data set, Mariel et al. (2009) also provide fitness of knowledge-capital model. Lastly, Awokuse et al. (2012) extended knowledge-capital model for US sectoral FDI data. They find evidence that predictions of knowledge-capital model show different results by each industry.

3.2.2 Previous literatures on effect of FTA on FDI

The considerable argument still remains whether FTAs affect FDI positively or negatively. Therefore, mixed results shown in the previous empirical studies focused on the

major large FTAs instead of bilateral FTAs (Dixon and Haslam, 2015). Also, due to the data limitation, limited empirical results provide how FDI inflows affected FTAs directly. However, as number of FTAs and FDI flow growth have been increasing dramatically, theoretical and empirical studies increased due to the attention of relationship between FTAs and FDI flows.

Existing empirical studies tend to focus on single country case and single large FTA such as NAFTA and EU. However, even though limited on sample size, previous literatures found some interaction between FTAs and FDI flows. It may be explained by relationship between FTAs and FDI. For example, FTA may deter the horizontal motivated FDI when trade cost is reduced. In contrast, vertical based FDI may be generated when the trade cost is reduced by FTA. Vertical type of FDI is influenced by including investment cost and other trade related costs such as intermediate trade costs and final product trade costs (Dixon and Haslam, 2015). Hence, FTA may allow member countries to exploit factor endowment differences.

However, empirical studies focused on a relationship between regional FTA and FDI flows. For example, by using US manufacturing sector data, Mold (2003) identifies the impact of three phases of European Single Market-Program (SMP) on FDI. The result shows that European SMP has an insignificantly negative effect to FDI. Further, Egger and Pfaffermayr (2004) found an insignificant result on effect of EU enlargement on the FDI. Also, Ghazalian and Furtan (2009) provided FTA between Canada and US (CUSFA) has a negative impact on FDI in manufacturing sector. They concluded that even trade creation effect of Canada-US FTA is exaggerated. Using OECD FDI outflows in period from 1982 to 2005 and a binary FTA variable, Jang (2011) shows FTA has negative impacts on bilateral

FDI between developed countries.

On the other hand, there are different views for the FTAs effect on FDI flows. In particular, a positive effect of FTAs on FDI is generated by simultaneous implementation of a domestic investment policy and a regional agreement. The previous study by Ismail et al. (2009) suggests AFTA attracts FDI moderately. In particular, FDI arise in ASEAN region where the country entered the FTA with policy reform. Also, recent empirical evidence on ASEAN region found positive effect of AFTA on FDI inflows (Thangavelu and Narjoko, 2014). Using binary NAFTA data, Felis and Rahman (2008) found evidence of a positive effect of FTAs on FDI. Additionally, they found differential effects by individual countries: Negative impact to Mexico while Canada and US are affected positively. In the various regions study, Kreinin and Plummer (2008) have found evidence of positive effect to US FDI into NAFTA and EU, but a negative effect to Mercosur and ASEAN. Additionally, the positive effects from Japanese FDI into NAFTA and ASEAN while Mercosur and EU show negative effects.

Further, being a member of FTA increased nearly double the FDI (Yeyati et al., 2003), which supports that FTA expands markets between its member countries. By use of the level of investment provisions, te Velde and Bezemer (2006) shows empirically that regional FTA attracts FDI into the region as well as country's position matters on further FDI inflows. Similarly, Lesher and Miroudot (2006) suggest a positive effect by categorizing the provision qualities including investment related regulations. Further, they investigate liberalization of investment provision with other economic part have influence on investment intensively.

By considering preferential trade agreements (PTAs), Medvedev (2012) provides evidence that the PTA increases FDI flows. He also suggests that FDI encouraged from an

economic size of member countries. Bűthe and Milner (2008) used international institutions as one of the additional factor while considering FTAs. They suggested an accession to international institutions, such as WTO, increasing further FDI inflows.

In summary, previous literatures tried to examine the effect of bilateral FTA on FDI flows. However, the FTA variable is bounded that it does not reflect the market expansion effect as well as bilateral relationship between member countries. Moreover, analyzing a single large FTA would be biased to explain the relationship between FDI source and recipient countries. Also, single country case study does not capture the FDI flows between countries that reflects relationship of economic development.

3.3 Methodology and Data

3.3.1 Base Model

This paper utilizes knowledge-capital model for investigating effect of FTA on FDI. The knowledge-capital model is designed for distinguishing the horizontal and vertical motivated FDI by utilizing the country's specific characteristics (Carr et al., 2001). The model is constructed by combined market size, differences of market size, skill endowment differences, trade and investment costs, geographical distances and interactions terms (Carr et al., 2001). This paper firstly investigates the fitness of knowledge-capital model.

The basic model shows as follows:

$$
\begin{aligned}
ln(FDI_{ij,t}) = \beta_0 &+ \beta_1\left(GDP_{i,t} + GDP_{j,t}\right) + \beta_2(GDP_{i,t} - GDP_{j,t})^2 \\
&+ \beta_3\left(Skill_{i,t} - Skill_{j,t}\right) \\
&+ \beta_4\left\{(GDP_{i,t} - GDP_{j,t}) \times (Skill_{i,t} - Skill_{j,t})\right\} \\
&+ \beta_5(InvCost_{j,t}) + \beta_6\left(TradCost_{j,t}\right) \\
&+ \beta_7\left\{(TradCost_{j,t}) \times (Skill_{i,t} - Skill_{j,t})^2\right\} \\
&+ \beta_8(TradCost_{i,t}) + \beta_9(Dist_{ij}) + \mu_j + \mu_t + \varepsilon_{ij,t}
\end{aligned} \tag{3.1}
$$

The dependent variable $ln(FDI_{ij,t})$ denotes a log of stock of FDI inflow from home country to host country with period of 1985 to 2010. The home country and the host country are represented as *i, j* while *t* represents the time periods. This paper uses the real stock of FDI converted by GDP deflator[12]. The bilateral stock of FDI data covers 34 OECD member countries and 43 non-member countries[13]. For further information, this paper divided the country sample by North-to-North, North-to-South, South-to-North country-pairs[14] and finally Whole sample.

The sum of GDP $\left(GDP_{i,t} + GDP_{j,t}\right)$ denotes the sum of market size for home and host countries. This variable is one of the direct determinants of economic size. Based on horizontal FDI motivation, FDI inflows will increase when the market gets bigger. Hence, this paper expects the positive and significant coefficient.

The square of GDP differences is represented as $(GDP_{i,t} - GDP_{j,t})^2$ for differences of the economic size between home and host countries. This variable is also designed to

[12] The host country's FDI stock data converted by host country based GDP deflator from International Financial Statistics.

[13] List table of home and host countries is in the appendix table.

[14] This paper assumes that OECD member countries are the North countries while non-OECD as the South countries.

capture horizontal FDI motivation. The GDP difference shows negative sign when home and host countries have similarities in factor endowments (Carr et al., 2001). Further, if home country's GDP is constant, then GDP of host country will determine the differences. In particular, GDP differences will be negative when home country's GDP is constant so host country's GDP determines the market size differences. In this case, horizontal FDI arise from home country into host country to exploit economies of scale (Mariel et al., 2009). Hence, horizontal FDI will be larger if GDP is increased in host country (Carr et al., 2001; Braconier et al., 2005). However, horizontal FDI discouraged when home country's GDP is larger than host country. In other words, incentive on economies of scale is no longer exists in host country (Mariel et al., 2009). Therefore, this paper expects the negative sign of coefficients.

The difference in home and host country's skilled labor is denoted as $(Skill_{i,t} - Skill_{j,t})$. This variable is designed to capture factor endowment differences in relation to vertical FDI. According to vertical FDI motivation, the coefficient will be positive because of skill endowment differences between the home and host countries (Blonigen et al., 2003; Mariel et al., 2009). In contrast, negative coefficient appears if skill endowments converge between home and host countries (Carr et al., 2003). The expected sign will be positive if skilled labor diverges but negative when skilled labor differences become converges.

The interaction term of GDP differences and skill differences represents the relationship between GDP and skill differences. This variable captures the impact of vertical FDI. According to the theory, the vertical FDI increases when home country is small and skill abundant country (Markusen and Maskus, 2002). Therefore, this paper expects the negative sign of coefficients.

The investment cost of host country represented as $(InvCost_{j,t})$, while

$(TradCost_{j,t})$ and $(TradCost_{i,t})$ denote trade cost of host and home country respectively. The investment cost utilizes the financial risk index provided by ICRG[15]. This paper assumes that high value of investment cost represents higher risk in host country. Trade cost uses tariff rates of home and host country. Also, this paper assumes that trade cost is higher when high tariff rates exist in a country. Therefore, this paper expects the coefficients sign to be negative on investment cost and home country's trade cost while positive sign on trade cost of host country.

The interaction term between skill differences and host country's trade cost is designed for capturing whether trade cost increase horizontal type of FDI (Mariel et al., 2009). The expect sign will be negative and significant if host country's trade cost affect to the FDI. The bilateral distance $(Dist_{ij})$ denotes a log of distance between home and host countries for capturing transportation cost between countries. The host country specific fixed effect and time specific fixed effect represent as μ_j and μ_t respectively. Finally, $\varepsilon_{ij,t}$ denotes error term.

Estimates the model by OLS will be biased. For an alternative estimation, Baier and Bergstrand (2007) suggested the better estimator to avoid the endogeneity bias of variables in panel analysis. To avoid an endogenous and self-selection problem in the country pair, this paper includes host country specific fixed effect and year fixed effect in WLS (Weighted Least Square) estimator. Also, since FDI includes numerous zero observations, this paper

[15] The financial risk by ICRG (International Country Risk Guide) is composite index from PRS group. The data constructed from combination of exchange rate stability, foreign debt as a percentage of GDP, current account as a percentage of exports of goods and services, foreign debt service as a percentage of exports of goods and services, and net international liquidity of import. The original index explained high index as low financial risk. This paper uses reversed and yearly financial risk data as proxy of investment cost due to simplifying the interpretation. It means, high score represents high investment cost.

utilizes PPML (Poission Pseudo Maximum Likelihood) estimator as a robustness check.

3.2.2 FTA Decomposition

For examining the effects of bilateral FTA on FDI flows, this paper develops the FTA decomposition as follows.

$$\begin{aligned} ln(FDI_{ij,t}) = {} & \beta_0 + \beta_1\left(GDP_{i,t} + GDP_{j,t}\right) + \beta_2(GDP_{i,t} - GDP_{j,t})^2 \\ & + \beta_3\left(Skill_{i,t} - Skill_{j,t}\right) \\ & + \beta_4\left\{(GDP_{i,t} - GDP_{j,t}) \times (Skill_{i,t} - Skill_{j,t})\right\} \\ & + \beta_5(InvCost_{j,t} \times FTA_D) + \beta_6\left(TradCost_{j,t} \times FTA_D\right) \\ & + \beta_7\left\{(TradCost_{j,t}) \times (Skill_{i,t} - Skill_{j,t})^2\right\} + \beta_8(TradCost_{i,t}) \\ & + \beta_9(Dist_{ij}) + \beta_{10} ln(FTA_{ij,t}) + \beta_{11}(FTA_{HUB}) + \mu_j + \mu_t + \varepsilon_{ij,t} \end{aligned} \tag{3.2}$$

The equation (3.2) is also mainly based on knowledge-capital model by Carr et al. (2001) and augmented to demonstrate the effect of FTAs on FDI inflows. The interaction term of investment cost and trade cost with FTA dummy variables are designed to capture whether FTAs has impact on FDI by lowering trade and investment costs. At the same time, bilateral FTA and FAT hub variables considered for finding reciprocal relationship between FTA and FDI flows. First of all, this paper develops the bilateral effect of FTA between member countries. In other words, continuous FTA variable developed for examining the bilateral FTA effect. Instead of a binary FTA variable shown in the previous literatures, the data developed by the concept of market expansion effect of FTAs. For instance, FDI

encouraged among member countries but discouraged to non-member countries. Under this concept, a bilateral FTA variable could generate for each home country and host country.

The home country and host country's FTA effect constructed as follows:

$$FTA_{ij,t} = (GDP_{i,t} + GDP_{j,t})/GDP_{i,t} \text{ and}$$

$$FTA_{ji,t} = (GDP_{i,t} + GDP_{j,t})/GDP_{j,t}$$

More detailed, each country including host and home country has their own bilateral FTA effect. In this case, home country and host country's FTA effect will be different even if both countries enter the same FTA. An economic market expands differently in each country by its FTA partner[16]. This variable enables to capture the continuous effect of FTA in each country. Hence, when the country *i* and country *j* had the FTA, then market size of country *i* will increases as much as country *j*'s market size. Therefore, the coefficients sign for a bilateral FTA variable will be positive. Since some countries have huge number for its FTA effect, this paper uses log FTA to avoid outlier.

Additionally, FTAs enforceable by single country with various countries, FTA hub variable developed for capturing the comprehensive effect. Based on the host country, this paper presumes that one host country's economic market enlarges as much as all other member countries. Consequently, comprehensive FTA effect increases in single country when the country enters the numerous FTAs. The FTA hub effect expected to reflects where the

[16] If FTA member countries have different economic sizes, then the FTA effect will be different to each other. More specifically, the FTA effect is determined by partner country's market size. Therefore, each country, including home and host countries, has own bilateral FTA effect.

country has various FTA partners[17].

The FTA hub constructed as follows.

$$FTA_{HUB} = \left(\sum_{k=1}^{n} GDP_{k,t} + GDP_{j,t} \right) / GDP_{j,t}$$

The comprehensive market expansion represented as $GDP_{k,t}$ and it indicates all the FTA member countries where single host country concluded the FTA. Even though the effect of FTA will be different to each country, this paper expects the positive and significant coefficient results.

Moreover, there is a possibility that an FTA might affect investment cost and trade cost directly. For identifying a direct impact of FTA into host countries, this paper uses an interaction term for trade cost and investment cost with FTA dummy variable[18]. The coefficient sign for trade cost with FTA will be mixed based on a relationship between FTA and trade cost. Even previous study (Carr et al., 2001) predicts positive sign for trade cost that high trade cost increases FDI by firms, it would be changed based on a relationship between trade and FDI. The negative sign will be shown when complement relationship

[17] According to the hypothesis in previous literatures, the hub-and-spoke hypothesis relates with overlap of FTAs (Wonnacott, 1996). The effect of overlap case is generally not clear than bilateral FTA. However, hub country will take advantage when preferences exists from spoke countries while hub country attracts investments from third country as a market where accessible to spoke countries.

[18] This paper assumes that trade cost and investment cost become zero in country-pair after entering same FTA. This assumption based on general logic of FTA that FTA enforcing eliminate the trade barriers between member countries. However, since the coverage FTA includes not only trade related policy but also investment, therefore, this paper considers investment cost also affected from FTA. More detailed explanations on depth and coverage of FTAs are available at WTO website.

exists, but positive when substitute relationship exists. Additionally, the expecting sign for investment cost will be negative because FDI will be discouraged by high financial risk (or investment cost) in host country.

FTA decomposition for trade cost in host country represents as follows.

$$(Tradcost_{j,t} \times FTA_D)$$

Where, $(TradCost_{j,t} \times FTA_D)$ is 0 for FTA implemented, 1 otherwise

FTA decomposition for investment cost in host country represents as follows.

$$(InvCost_{j,t} \times FTA_D)$$

Where, $(InvCost_{j,t} \times FTA_D$ is 0 if FTA implemented, 1 otherwise

Table 3.1 Data explanation and sources

Variable	Definition	Source
$ln(FDIstock_{ij,t})$	Million USD, bilateral FDI converted by GDP deflator	OECD-International Direct Investment Data, IFS
(FTA_{HUB})	Comprehensive FTA effect using USD in constant 2005 prices	WDI and WTO, Author's calculation
$ln(FTA_{ij,t})$	Log of Free Trade Agreement index	WDI and WTO, Author's calculation
(FTA_D)	FTA dummy variable	WTO
$(GDP_{i,t} + GDP_{j,t})$	Trillion USD in constant 2005 prices, sum of GDP between *i* and *j*	WDI
$(GDP_{i,t} - GDP_{j,t})^2$	Trillion GDP squared difference between *i* and *j*	WDI
$(Skill_{i,t} - Skill_{j,t})$	Average years of secondary schooling for population over age 15	Barro and Lee(2010)
$(GDP_{i,t} - GDP_{j,t}) \times (Skill_{i,t} - Skill_{j,t})$	Interaction term between GDP difference and Skill difference	WDI, Barro and Lee(2010)
$(InvCost_{j,t})$	Range from 0 to 50. The higher the more financial risk in host country	WTO, Financial Risk by ICRG (PRS Group)
$(TradCost_{j,t})$, $(TradCost_{i,t})$	The higher the high trade cost	WTO, WDI-Tariff rate, Applied, weighted mean
$(TradCost_{j,t}) \times (Skill_{i,t} - Skill_{j,t})^2$	Interaction term between host country's trade cost and relative skill difference	WDI-Tariff rate, Applied, weighted mean, Barro and Lee(2010)
$(Dist_{ij})$	Geographical distance between *i* and *j*. 1000km	CEPII
$(Trade\ cost_{j,t} \times FTA_D)$	Interaction term between host country's trade cost and FTA dummy	WTO, WDI
$(Invest\ cost_{j,t} \times FTA_D)$	Interaction term between host country's investment cost and FTA dummy	WTO, Financial Risk by ICRG (PRS Group)

Table 3.2 Descriptive statistics (Whole sample)

Variable name	Mean	Std. Dev.	Min	Max	Obs
FDI stock	487.500	13417.82	-7926.667	575176.8	52153
$ln(FDI_{ij,t})$	-0.248	3.581	-11.513	13.262	31729
$(GDP_{i,t} + GDP_{j,t})$	1.304	2.278	0.009	27.370	96904
$(GDP_{i,t} - GDP_{j,t})^2$	5.468	23.041	0	187.209	96904
$(Skill_{i,t} - Skill_{j,t})$	0.001	1.683	-6.583	6.583	106080
$(GDP_{i,t} - GDP_{j,t}) \times (Skill_{i,t} - Skill_{j,t})$	1.536	5.549	-20.898	62.907	96904
$(TradCost_{j,t})$	4.872	9.259	0	254.580	71003
$(TradCost_{i,t})$	4.872	9.256	0	254.580	71037
$(Dist_{ij})$	6.980	4.589	0.019	19.630	106080
$(TradCost_{j,t}) \times (Skill_{i,t} - Skill_{j,t})^2$	15.311	45.143	0	2456.626	71003
$ln(FTA_{ij,t})$	0.156	0.593	0	7.219	105196
(FTA_{HUB})	2.247	6.008	0	42.079	101232
$(InvCost_{j,t})$	14.211	7.740	0	50	99820
$(InvCost_{j,t} \times FTA_D)$	12.471	9.102	0	50	99820
$(TradCost_{j,t} \times FTA_D)$	4.350	9.367	0	254.580	71003

3.4 Results

As an empirical methodology, this paper uses OLS, WLS and PPML estimator. In all cases, the dependent variable is log of FDI inflows.

3.4.1 Base Model Results

The Table 3.3 presents base estimation result by OLS estimator. It is worth to mention that, almost all explanatory variables are showing an expected sign except trade cost of host country. Additionally, investment cost of host country and skill differences show mixed results. However, the coefficients sign of explanatory variables is constant even though the bilateral FTA included in the analysis. Thus, these results indicate evidence on fitness of

knowledge-capital model. Moreover, knowledge-capital model is an appropriate estimator for analyzing an effect of FTA on FDI. Especially, variables that capture the factor endowment differences and market size are showing continuous appropriate signs (Carr et al., 2001; Markusen and Maskus, 2002). Further, bilateral FTA variables show strong positive coefficients in all samples.

However, the trade cost of the host country shows different values from an expected sign. This result is in contrast with predictions in a theoretical model. FDI is encouraged in a country with more trade openness (Mariel et al., 2009). Unlike previous literatures, the result indicates the complementary relationship between trade and FDI in a host country. The negative sign of skill differences (i.e. South-to-North country-pair) represents the differences of skilled labor converged. Meanwhile, distance shows negative coefficients as expected. Finally, economic market expansion by bilateral FTA increases FDI inflows in all country-pair.

Bilateral FTA variable shows positive coefficients in all cases except North-to-South country-pair. Thus, bilateral FTA attracts more FDI inflows into host countries. Additionally, this result shows consistence with previous literatures (Kreinin and Plummer, 2008; te Velde and Bezemer, 2006; Lesher and Miroudot, 2006). Even skill difference shows mixed result, market access variables (GDP sum and GDP different squares) show coefficient signs as expected. The convergence of skill difference exists in case of and South-to-North case while Whole, North-to-North and North-to-South cases still have differences.

Table 3.3 Base model: Knowledge capital model

	Whole sample		North-North		North-South		South-North	
$(GDP_{i,t} + GDP_{j,t})$	1.200***	1.198***	0.938***	0.940***	1.640***	1.640***	0.775***	0.782***
	(0.016)	(0.016)	(0.018)	(0.018)	(0.045)	(0.045)	(0.041)	(0.041)
$(GDP_{i,t} - GDP_{j,t})^2$	-0.065***	-0.064***	-0.046***	-0.045***	-0.095***	-0.095***	-0.035***	-0.036***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
$(Skill_{i,t} - Skill_{j,t})$	0.371***	0.349***	0.283***	0.261***	0.150***	0.149***	-0.124***	-0.119***
	(0.012)	(0.012)	(0.017)	(0.017)	(0.039)	(0.039)	(0.033)	(0.033)
$(GDP_{i,t} - GDP_{j,t}) \times (Skill_{i,t} - Skill_{j,t})$	-0.034***	-0.036***	-0.042***	-0.043***	-0.050***	-0.050***	-0.034***	-0.032***
	(0.005)	(0.005)	(0.007)	(0.007)	(0.014)	(0.014)	(0.012)	(0.012)
$(InvCost_{j,t})$	0.014***	0.010**	-0.021***	-0.026***	0.068***	0.068***	-0.023**	-0.025**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.008)	(0.008)	(0.011)	(0.011)
$(TradCost_{j,t})$	-0.014***	-0.013***	-0.013***	-0.012***	-0.038***	-0.038***	-0.013*	-0.013*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.010)	(0.010)	(0.007)	(0.007)
$(TradCost_{j,t}) \times (Skill_{i,t} - Skill_{j,t})^2$	-0.000	0.000	0.001	0.001	0.003***	0.003***	0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
$(TradCost_{i,t})$	-0.018***	-0.017***	-0.009***	-0.008***	0.006	0.006	-0.094***	-0.094***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.007)	(0.007)
$(Dist_{ij})$	-0.165***	-0.145***	-0.186***	-0.172***	-0.021*	-0.019	-0.044***	-0.044***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.012)	(0.012)	(0.010)	(0.010)
$ln(FTA_{ij,t})$		0.334***		0.229***		0.021		0.343**
		(0.026)		(0.030)		(0.046)		(0.164)
_cons	-0.967***	-1.180***	0.706***	0.554***	-3.060***	-3.079***	-2.119***	-2.137***
	(0.071)	(0.072)	(0.092)	(0.094)	(0.139)	(0.146)	(0.167)	(0.168)
Obs.	21,695	21,695	10,411	10,411	6,260	6,260	5,024	5,024
R^2	0.295	0.301	0.331	0.335	0.244	0.244	0.144	0.145

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Fixed effect is not included for base model analysis.

3.4.2 Fixed Effect result

As mentioned in the previous section, to avoid econometric concerns, this paper employs alternative econometric estimators. Table 3.4 presents the result using WLS estimator with host country specific and year fixed effects.

Table 3.4 WLS with fixed effects

	Whole	North-North	North-South	South-North
$(GDP_{i,t} + GDP_{j,t})$	0.905***	0.608***	1.132***	1.259***
	(0.056)	(0.077)	(0.125)	(0.186)
$(GDP_{i,t} - GDP_{j,t})^2$	-0.055***	-0.030***	-0.073***	-0.047***
	(0.005)	(0.008)	(0.010)	(0.016)
$(Skill_{i,t} - Skill_{j,t})$	0.622***	0.673***	0.497***	0.361***
	(0.049)	(0.078)	(0.107)	(0.114)
$(GDP_{i,t} - GDP_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})$	0.001	-0.016	0.021	0.033
	(0.014)	(0.022)	(0.031)	(0.036)
$(InvCost_{j,t})$	0.226***	0.203	-0.019	-0.025
	(0.053)	(0.126)	(0.086)	(0.118)
$(TradCost_{j,t})$	0.009	-0.050	0.069	0.003
	(0.035)	(0.060)	(0.082)	(0.052)
$(TradCost_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})^2$	-0.003	-0.013	-0.005*	-0.013*
	(0.002)	(0.009)	(0.003)	(0.007)
$(TradCost_{i,t})$	-0.093***	-0.026	0.055	-0.078***
	(0.015)	(0.029)	(0.035)	(0.025)
$(Dist_{ij})$	-0.144***	-0.195***	-0.226***	-0.029
	(0.014)	(0.021)	(0.038)	(0.023)
$ln(FTA_{ij,t})$	0.531***	0.451***	0.283	0.271
	(0.085)	(0.121)	(0.177)	(0.402)
_cons	0.113	17.361***	-8.223	-3.787
	(3.260)	(5.122)	(5.547)	(5.597)
Obs.	21,695	10,411	6,260	5,024
R^2	0.605	0.598	0.674	0.382

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Host country specific fixed effect and year fixed effect are included all the regression.

Note that coefficient of bilateral FTA variable in WLS estimator shows absolutely larger magnitude than OLS results in Whole and North-to-North country-pair. Even market size and factor endowments show significant effects, investment cost and trade cost tend to have insignificant effects. However, similar to OLS results, investment cost and trade cost are different with expected sign and insignificant.

3.4.3 FTA Decomposition Results.

The Table 3.5 and Table 3.6 show the results of FTA decomposition with FTA variable. Both tables use WLS estimator. The results show the expected sign in market size (Carr et al., 2001). The positive sign of skill differences indicates low skilled labor in host country attracts FDI inflows. Therefore, FTA decomposition model is also in line with knowledge-capital model as previous literatures (Braconier et al., 2005).

In the results of Table 3.5, interaction term between investment cost and FTA shows consistent negative and significant coefficients. It represents that the investment cost will have a negative impact on FDI inflows in the FTA non-member host countries as expected. The interaction term between trade cost and FTA in North-to-North country-pair shows negative sign which represents complement relationship of trade and FDI. The bilateral FTA is positive and significant for Whole and North-to-North cases.

Meanwhile, in Table 3.6, interaction term between investment cost and FTA shows similar and weak result except North-to-North group. The negative signs of interaction term between trade cost and FTA are shown in the result table in North-to-North group.

Table 3.5 FTA decomposition1: FTA with trade and investment cost

	Whole	North-North	North-South	South-North
$(GDP_{i,t} + GDP_{j,t})$	0.947***	0.618***	1.203***	1.331***
	(0.056)	(0.078)	(0.125)	(0.189)
$(GDP_{i,t} - GDP_{j,t})^2$	-0.057***	-0.030***	-0.076***	-0.047***
	(0.005)	(0.008)	(0.010)	(0.016)
$(Skill_{i,t} - Skill_{j,t})$	0.617***	0.677***	0.493***	0.361***
	(0.049)	(0.078)	(0.106)	(0.114)
$(GDP_{i,t} - GDP_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})$	0.002	-0.017	0.016	0.035
	(0.014)	(0.022)	(0.030)	(0.036)
$(InvCost_{j,t}$ $\times FTA_D)$	-0.086***	-0.012	-0.194***	-0.052*
	(0.016)	(0.028)	(0.048)	(0.028)
$(TradCost_{j,t}$ $\times FTA_D)$	-0.023	-0.110**	0.031	-0.021
	(0.032)	(0.055)	(0.065)	(0.050)
$(TradCost_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})^2$	-0.001	-0.011	-0.005*	-0.012*
	(0.002)	(0.009)	(0.003)	(0.007)
$(TradCost_{i,t})$	-0.081***	-0.021	0.058*	-0.078***
	(0.015)	(0.029)	(0.034)	(0.025)
$(Dist_{ij})$	-0.100***	-0.177***	-0.199***	-0.007
	(0.015)	(0.025)	(0.038)	(0.026)
$ln(FTA_{ij,t})$	0.252***	0.371***	-0.048	-0.237
	(0.095)	(0.137)	(0.196)	(0.474)
_cons	6.070*	19.261***	-3.789	-3.624
	(3.119)	(4.711)	(5.185)	(5.308)
Obs.	21,695	10,411	6,260	5,024
R^2	0.608	0.599	0.681	0.386

Note 1: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. WLS used for the empirical analysis with host country specific fixed effect and year fixed effect are included all the regression.

Note 2: This paper estimated without the bilateral FTA variable in the regression. However, the result is similar with when FTA variable includes in the regression. Therefore, this paper does not provide the result when bilateral FTA is not included.

Table 3.6 FTA decomposition2: FTA hub effect

	Whole	North-North	North-South	South-North
$(GDP_{i,t} + GDP_{j,t})$	0.987***	0.694***	1.200***	1.332***
	(0.054)	(0.073)	(0.122)	(0.187)
$(GDP_{i,t} - GDP_{j,t})^2$	-0.060***	-0.036***	-0.076***	-0.045***
	(0.005)	(0.007)	(0.010)	(0.016)
$(Skill_{i,t} - Skill_{j,t})$	0.612***	0.700***	0.488***	0.385***
	(0.049)	(0.078)	(0.106)	(0.114)
$(GDP_{i,t} - GDP_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})$	0.003	-0.011	0.017	0.039
	(0.014)	(0.022)	(0.030)	(0.036)
$(InvCost_{j,t}$ $\times FTA_D)$	-0.065***	-0.031	-0.142**	-0.121***
	(0.023)	(0.039)	(0.063)	(0.046)
$(TradCost_{j,t}$ $\times FTA_D)$	-0.022	-0.111**	0.043	-0.026
	(0.032)	(0.055)	(0.066)	(0.050)
$(TradCost_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})^2$	-0.001	-0.010	-0.005*	-0.011
	(0.002)	(0.009)	(0.003)	(0.007)
$(TradCost_{i,t})$	-0.081***	-0.033	0.057*	-0.079***
	(0.015)	(0.029)	(0.034)	(0.025)
$(Dist_{ij})$	-0.099***	-0.173***	-0.195***	-0.012
	(0.015)	(0.026)	(0.038)	(0.025)
(FTA_{HUB})	0.037**	0.016	0.044	-0.065*
	(0.018)	(0.034)	(0.041)	(0.034)
_cons	5.844*	20.157***	-5.389	-2.595
	(3.129)	(4.725)	(5.294)	(5.324)
Obs.	21,695	10,411	6,260	5,024
R^2	0.608	0.596	0.682	0.389

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. WLS used for the empirical analysis with host country specific fixed effect and year fixed effect are included all the regression.

The bilateral FTA variable provides positive effect to Whole and North-to-North cases. However, Whole group shows relatively weak evidence of FTA effect than North-to-North group. In contrast, North-to-South and South-to-North group show no evidence for existence

of FTA effect. At the same time, the FTA hub shows positive coefficients in Whole group. It is an interesting result that South-to-North group has negative impact by comprehensive FTA. Therefore, FDI inflows increased if country involved various FTAs in whole data. On the contrary, South-to-North group is affected negatively by overlapping FTAs in terms of attracting FDI inflows. In general, this result represents the concept of bilateral market enlargements or becomes a bilateral FTA member country where FTA is taking an important role for attracting FDI inflows.

According to the results of Table 3.5 and Table 3.6, this paper confirms bilateral FTAs and comprehensive FTAs are may affect to FDI inflows positively. Additionally, this paper could find differences between group pairs in terms of FTAs effect.

Table 3.7 Differences between country-pair groups in FTA decomposition variables

	$(InvCost_{j,t} \times FTA_D)$	$(TradCost_{j,t} \times FTA_D)$	$ln(FTA_{ij,t})$	(FTA_{HUB})
Whole				
Table 3.5	−	n/s	+	
Table 3.6	−	n/s		+
North-to-North				
Table 3.5	n/s	−	+	
Table 3.6	n/s	−		n/s
North-to-South				
Table 3.5	−	n/s	n/s	
Table 3.6	−	n/s		n/s
South-to-North				
Table 3.5	−	n/s	n/s	
Table 3.6	−	n/s		−

Note: n/s represents not significant.

3.4.4 Robustness Check

First of all, since FDI includes numerous zero observations, this paper utilizes PPML (Poission Pseudo Maximum Likelihood) estimator as a robustness check. The numerous zero observations may have an important role in the regression. The Table 3.8 presents the result of PPML estimator. In fact, the observations between WLS estimator and PPML show critical differences.

The result suggested that bilateral FTA has positive impact on FDI inflows in Whole group. Moreover, the interaction between FTA and trade cost shows insignificant coefficient for all group except South-to-North country-pair. FTA decomposition for investment cost shows a negative sign for Whole and South-to-North group. The main variables that denote vertical and horizontal FDI motivation have weak evidences.

Secondly, the inclusion of FTA dummy is shown in Table 3.9. Similar with the previous empirical results, FTA binary variable has weak evidence. In this table, Whole and North-to-South country group show positive effect by FTAs on attracts FDI inflows. This result generally confirms the previous empirical literatures which suggests positive effect of FTAs on FDI. In addition, investment cost and trade cost of host countries have weak evidences.

Table 3.8 Robustness check: PPML estimator

	Whole	North-North	North-South	South-North
$(GDP_{i,t} + GDP_{j,t})$	0.650***	0.412***	1.137***	0.396***
	(0.080)	(0.053)	(0.203)	(0.095)
$(GDP_{i,t} - GDP_{j,t})^2$	-0.043***	-0.021***	-0.063***	0.001
	(0.007)	(0.005)	(0.011)	(0.008)
$(Skill_{i,t} - Skill_{j,t})$	0.363***	0.098	0.844***	-0.170
	(0.108)	(0.062)	(0.220)	(0.114)
$(GDP_{i,t} - GDP_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})$	0.070***	0.013	-0.002	-0.010
	(0.017)	(0.011)	(0.039)	(0.016)
$(InvCost_{j,t}$ $\times FTA_D)$	-0.033***	0.009	-0.001	-0.057**
	(0.012)	(0.019)	(0.003)	(0.026)
$(TradCost_{j,t}$ $\times FTA_D)$	0.016***	-0.000	0.148***	-0.059
	(0.005)	(0.003)	(0.041)	(0.095)
$(TradCost_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})^2$	-0.004**	0.001	-0.011***	-0.026**
	(0.002)	(0.002)	(0.004)	(0.013)
$(TradCost_{i,t})$	0.001	0.001	0.000	-0.188***
	(0.000)	(0.002)	(0.000)	(0.044)
$(Dist_{ij})$	0.148***	-0.216***	0.084*	-0.014
	(0.034)	(0.053)	(0.046)	(0.038)
$ln(FTA_{ij,t})$	0.372**	0.175	0.030	-0.679
	(0.163)	(0.118)	(0.140)	(0.559)
_cons	4.076***	6.299***	1.510*	3.388***
	(0.584)	(0.382)	(0.852)	(0.572)
Obs.	28,649	11,783	8,496	8,353
R^2	0.984	0.610	0.985	0.202

Note 1: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Host country specific fixed effect and year fixed effect are included all the regression.
Note 2: The negative value of FDI have been omitted for the analysis.

Table 3.9 Robustness check: FTA dummy

	Whole	North-North	North-South	South-North
$(GDP_{i,t} + GDP_{j,t})$	0.994***	0.698***	1.197***	1.318***
	(0.053)	(0.073)	(0.121)	(0.187)
$(GDP_{i,t} - GDP_{j,t})^2$	-0.060***	-0.036***	-0.077***	-0.048***
	(0.005)	(0.007)	(0.010)	(0.016)
$(Skill_{i,t} - Skill_{j,t})$	0.600***	0.695***	0.491***	0.362***
	(0.049)	(0.078)	(0.106)	(0.114)
$(GDP_{i,t} - GDP_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})$	0.001	-0.014	0.020	0.035
	(0.014)	(0.023)	(0.030)	(0.036)
$(InvCost_{j,t}$ $\times FTA_D)$	0.055*	0.033	-0.074	-0.021
	(0.032)	(0.056)	(0.069)	(0.067)
$(TradCost_{j,t}$ $\times FTA_D)$	-0.001	-0.097*	0.063	-0.019
	(0.032)	(0.056)	(0.066)	(0.051)
$(TradCost_{j,t})$ $\times (Skill_{i,t} - Skill_{j,t})^2$	-0.001	-0.010	-0.006**	-0.012*
	(0.002)	(0.009)	(0.003)	(0.007)
$(TradCost_{i,t})$,	-0.078***	-0.031	0.054	-0.077***
	(0.015)	(0.028)	(0.034)	(0.025)
$(Dist_{ij})$	-0.085***	-0.166***	-0.191***	-0.008
	(0.015)	(0.026)	(0.038)	(0.026)
(FTA dummy)	2.338***	1.180	1.918**	0.334
	(0.426)	(0.763)	(0.886)	(0.879)
_cons	3.206	18.296***	-7.604	-4.075
	(3.156)	(4.884)	(5.378)	(5.398)
Obs.	21,695	10,411	6,260	5,024
R^2	0.612	0.597	0.683	0.386

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors shown in parenthesis. Host country specific fixed effect and year fixed effect are included all the regression.

3.5 Conclusion

This paper has examined the effect of FTAs on FDI inflows using four different group divisions as Whole, North-to-North, North-to-South, and South-to-North group This paper finds supporting evidence for the knowledge-capital model in OLS estimator (Carr et al., 2001), which is consistence with previous results (Braconier et al., 2005).

Also, using WLS estimator, this paper found fitness of knowledge-capital model except investment cost and trade cost variables in host countries. However, interaction term of investment cost and trade cost of host countries with FTA dummy does not follow predictions of knowledge-capital model. As discussed in earlier section, empirical results suggest that FTA generally encourages FDI inflows in whole group. This positive effect is corresponding with other results by other FTA variables.

Refers to the previous results, both bilateral FTA and comprehensive FTA variables are found to have weak evidence. Specifically, effects of FTA show different from each group in terms of coefficient sign. There could be several reasons for this. One of the reason is the limited time periods. Since the data is end up to 2010, the period should be extended to more recent year.

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Appendix

Appendix Table 1 List of host countries for Chapter 1 and 2

Country List			
Argentina	Fiji	Luxembourg	Senegal
Australia	Finland	Madagascar	Serbia
Angola	France	Malawi	Sierra Leone
Armenia	Germany	Malaysia	Singapore
Austria	Ghana	Malta	Slovak
Bahamas	Guatemala	Mauritius	Slovenia
Bahrain	Guinea	Mexico	South Africa
Bangladesh	Haiti	Mongolia	Spain
Belgium	Honduras	Morocco	Sri Lanka
Bolivia	Hong Kong	Myanmar	Sudan
Brazil	Hungary	Nepal	Sweden
Brunei Darussalam	India	Netherlands	Switzerland
Bulgaria	Indonesia	New Zealand	Taiwan
Cambodia	Iran	Nicaragua	Tajikistan
Canada	Ireland	Nigeria	Tanzania
Chile	Israel	Norway	Thailand
China	Italy	Oman	Togo
Colombia	Jamaica	Pakistan	Tonga
Congo Dem Rep	Japan	Panama	Tunisia
Costa Rica	Jordan	Papua New Guinea	Turkey
Cote d'Ivoire	Kazakhstan	Paraguay	UAE
Cyprus	Kenya	Peru	Ukraine
Czech	Kuwait	Philippines	United Kingdom
Denmark	Kyrgyz	Poland	USA
Dominican Rep	Laos	Portugal	Uzbekistan
Ecuador	Latvia	Qatar	Venezuela
Egypt	Liberia	Romania	Vietnam
El Salvador	Libya	Russia	Yemen Rep.
Ethiopia	Lithuania	Saudi Arabia	Zambia

Appendix Table 2 List of manufacturing industries
(Based on KSIC)

Name of Manufacturing Industries
1. Manufacture of Basic Metal products
2. Manufacture of Furniture
3. Tanning and Dressing of Leather, Manufacture of Luggage and Footwear
4. Manufacture of Rubber and Plastic Products
5. Manufacture of Fabricated Metal Products, Except Machinery and Furniture
6. Manufacture of Other Machinery and Equipment
7. Manufacture of Other Transport Equipment
8. Manufacture of Tobacco Products
9. Manufacture of Wood Products of Wood and Cork, Except Furniture
10. Manufacture of Other Nonmetallic Mineral Products
11. Manufacture of Textiles, Except Apparel
12. Manufacture of Food Products
13. Manufacture of Beverages
14. Manufacture of Medical Precision and Optical Instruments Watches and Clocks
15. Manufacture of wearing apparel clothing Accessories and Fur articles
16. Manufacture of Motor vehicles_ trailers and Semitrailers
17. Manufacture of electrical equipment
18. Manufacture of electronic components computer, radio, television and communication equipment and apparatuses
19. Manufacture of coke, hard coal and lignite fuel briquettes and refined petroleum
20. Manufacture of pulp paper and paper products
21. Manufacture of chemicals and chemical products except pharmaceutical medicinal chemicals

Appendix Table 3 List of countries for Chapter 3

OECD countries	Non- OECD countries
Australia, Austria, Belgium, Canada, Chile, Czech Rep., Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Rep. of Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, USA	Argentina, Brazil, Brunei Darussalam, Bulgaria, Cambodia, China, Colombia, Costa Rica, Cuba, Cyprus, Dominican Rep., Egypt, Hong Kong, India, Indonesia, Iran, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz, Lao PDR, Latvia, Lithuania, Malaysia, Mongolia, Morocco, Panama, Paraguay, Peru, Philippines, Qatar, Romania, Russia, Saudi Arabia, Singapore, South Africa, Thailand, UAE, Ukraine, Uruguay, Venezuela, Vietnam