1 Introduction

in Markusen (2013), into the existing oligopoly model of horizontal multinational enterprises

This paper adopts an advanced estimator of the generalized methods of moments (GMM) approach, referred to as the system GMM (hereafter, System GMM), given the availability of a dynamic panel data. The System GMM estimator has little been employed in estimating the KC model though the estimator controls for all econometirc issues and concerns to be considered.

The remainder of this paper is organized as follows. Section 2 presents a simple Cournot oligopoly model with homogeneous goods and horizontal MNEs where preferences are nonhomothetic. Section 3 conducts the so-called impact e ects in order to grasp intuition to results in a general equilibrium for demand-driven determinants of FDI. Section 4 describes a numerical model of general equilibrium and shows simulation results. Section 5 describes the patterns and trends of Korean outward FDI in multiple aspects to help understand empirical analysis later. Section 6 sets up the empirical model, considers the estimation methodology, presents the data, and discusses the estimation results. Section 7 concludes.

2 The Model

The model is a 2 3 2 traditional Heckscher-Ohlin model. It has two countries, i and j. The countries produce two di erent homogeneous goods, Y and X. They also have a non-rivaled and non-excludable endowment good Z as given. Good Y is produced with constant returns to scale by a competitive industry. It is used as numeraire. Good X is produced with increasing returns by imperfectly competitive Cournot rms. There are two production factors, S (skilled labor) and L (unskilled labor). S is mobile between industries but internationally immobile.

In this paper, as I solely focus on horizontal motivation among diverse motivations of FDI, it is assumed that all costs of X require factors in the same ratio. Thus, the further assumption is adopted: the X industry utilizes only skilled labor and unskilled labor is utilized only in the

Y

(Markusen, 2013).[3]

Let m^h, p_X, p_Y be household h's income, X's price, Y's price, respectively. Then, household budget constraint is:

$$m^h = p_X \quad x + p_Y \quad y: \tag{2}$$

Maximization of (1) subject to (2) yields the Marshallian demand function:

$$x^h = \max \quad 0; \frac{m^h}{p_X} \quad (1 \quad)z \quad ; \tag{3}$$

$$y^h = \min \quad \frac{m^h}{p_Y}; \frac{(1 \quad)(m^h + p_X \quad z)}{p_Y} \quad : \tag{4}$$

If $x^h = \frac{m^h}{\quad}$

Figure 1 illustrates the properties of the assumed non-homothetic preferences. The representative consumer begins to buy X above the threshold income indicated by m^0 in the equation (5), while she consumes only good Y at low levels of income. This makes demand structure more realistic, and further implies that aggregate demand depends on the income distribution. Assume in this paper that the equation (5) holds with strict inequality for all households.

2.1.2 Aggregate Demand

Let H be the number of households. Then, $Z = z \quad H$ be the economy-wide endowment of z. z is a parameter and Z is strictly proportional to the number of households H. Thus, we have the following expression for aggregate demand X_c for good X.

$$X_c = \sum_{h=1}^{H} x^h = \frac{M}{p_X} \quad (1 \qquad)Z, \text{ where } Z = zH \text{ and } M = \sum_{h=1}^{H} m^h: \tag{6}$$

Again, if the equation (5) holds for all households, then aggregate demand for X is independent of the income distribution.

In non-homothetic preferences, in order to look at fundamental factors which a ect the aggregate demand, I slightly modify the equation (6) as follows, with denoting per-capita income as m.

$$X_c = \frac{M}{}$$

2.1.3 Elasticities of Demand for good X

In this sub-section, I consider three elasticities of demand for good X. First, I compare per-capita income elasticity of demand with neutral factor elasticity of demand. Second, I obtain price elasticity of demand.

Suppose rst that a productivity (and therefore per-capita income) increases, holding the number of households H and therefore

2.1.4 Implications of Non-homothetic Preferences

Before presenting the production-side of this model, it needs to be noted that nonhomotheticity gives rise to two important implications. First, the impacts of neutral factor accumulation on aggregate demand vary according to the assumed preference structures (homotheticity vs non-homotheticity). Previous studies, Markusen and Venables (1998), and Markusen (2002), have assumed an identical Cobb-Douglas utility function for the representative individual:

$$u = x \quad y^{1} \quad : \tag{11}$$

This homothetic utility function gives aggregate demand for good X as follows:

$$X_c = \frac{}{p_X} \quad M = \frac{}{p_X}(m \quad H): \tag{12}$$

In homothetic preference structure, the neutral factor accumulation yields a proportional increase in the total income M and therefore a proportional increase in the aggregate demand X_c. On the other hand, in nonhomotheticity, the neutral factor accumulation also yields an total income M increase in the same proportion, but it would have a less impact on the aggregate demand due to the second term in equation (7), $\quad (1 \quad)(zH)$. This is one of the most important features from the nonhomothetic preferences, making a distinction in the size of the e ect of neutral factor accumulation on aggregate demand between homotheticity and nonhomotheticity.

Second, within nonhomothetic preference structure, the positive impacts of neutral factor accumulation on aggregate demand can be distinguished from those of per-capita income growth in a quantitative term. Nonhomotheticity clearly implies that the e ect of per-capita income growth on aggregate demand is greater than that of neutral factor accumulation as shown in the equation

(7). Due to this discrepancy in effect size, a divergence in per-capita income, relative to a divergence in neutral factor, leads to a larger difference in aggregate demand between two countries,

2.2.1 Y Industry

Let L_l be country l's endowment of L. Production function for Y is given by:

$$Y_l = S_{lY} \quad L_l^{1} \quad , l = i; j; \tag{13}$$

where S_{lY} and L_l are skilled and unskilled labor used in Y industry in country l, respectively.

Let w^S be skilled wage rate and w^L be unskilled wage rate. Then, marginal products of these factors in Y production are

$$w_l^S = \quad \frac{S_{lY}}{L_l}^{\quad 1} \text{ and } w_l^L = (1 \quad) \quad \frac{S_{lY}}{L_l} \quad , l = i; j: \tag{14}$$

Expansion of X industry would lead to the movement of skilled labor from Y to X industry, lowering $\frac{S}{L}$ ratio in Y industry and thus raising skilled labor costs in terms of Y. Consequently, skilled labor supply to X industry increases with its wage rate, increasing some convexity to the model (Markusen and Venables, 1998).

2.2.2 X Industry

Let c be the constant marginal production cost, t the transport costs that a national rm exporting X to foreign market should pay, and G the plant-speci c xed costs and F the rm-speci c xed costs. Assume that all of these cost parameters are measured in units of skilled labor and are the same for both countries.

in order to serve foreign market. Thus, one national firm's skilled labor demand in country i is:

$$cX_{ii}^{n} + (c + t)X_{ij}^{n} + G + F; \; i \neq j. \tag{15}$$

Let X_{ij}^{m} denote the sales of a country i-based horizontal multinational firm in market j. A multinational firm also needs both fixed costs for sales in its base country. One country i-based multinational firm's skilled labor demand in market i is:

$$cX_{ii}^{m} + G + F. \tag{16}$$

To serve foreign market, the country i-based multinational firm should incur plant-specific fixed costs G instead of transport costs in the foreign country j. Thus, one country i-based multinational firm's skilled labor demand in market j is:

$$cX_{ij}^{m} + G; \; i \neq j. \tag{17}$$

Let S_i be total skilled-labor endowment of country i. Let N_i^k ($k = n$ or m) be the number of type-k firms in country i. Then, market clearing of skilled labor factor in country i is given by

$$S_i = S_{iY} + (cX_{ii}^{n} + (c + t)X_{ij}^{n} + G + F)N_i^{n} + (cX_{ii}^{m} + G + F)N_i^{m} + (cX_{ij}^{m} + G)N_j^{m}. \tag{18}$$

2.3 Equilibrium

Pricing equations and free-entry conditions determine equilibrium in X industry. First, in order to derive pricing equations, I begin with revenues for a country i-based type-k Cournot firm serving market j: $R_{ij}^k = p_j(X_{jc}) \cdot X_{ij}^k$, $k = n$ or m.[5] Since the price elasticity of demand is defined as ε in the equation (10) and $\frac{\partial X_{jc}}{\partial X_{ij}^k} = 1$ by Cournot conjectures (i.e. an increase in one unit of X in one's own supply equals an increase in one unit of X in market supply), marginal revenues are:

$$
\begin{aligned}
\frac{\partial R_{ij}^k}{\partial X_{ij}^k} &= p_j + X_{ij}^k \frac{\partial p_j}{\partial X_{ij}^k} = p_j + X_{ij}^k \frac{\partial p_j}{\partial X_{jc}} \frac{\partial X_{jc}}{\partial X_{ij}^k} \\
&= p_j + p_j \frac{X_{ij}^k}{X_{jc}} \left(\frac{X_{jc}}{p_j} \frac{\partial p_j}{\partial X_{jc}} \right) \frac{\partial X_{jc}}{\partial X_{ij}^k} = p_j \left(1 - \frac{X_{ij}^k}{X_{jc}} \frac{1}{\varepsilon_j} \right).
\end{aligned}
\tag{19}
$$

Pricing equations can be written in complementary-slackness form with associated variable. Here, complementary variables are output of firms of each type in brackets. Therefore, the expressions for pricing equations (marginal revenue - marginal cost 0) are:

$(X$

$$X_{ij}^{n} \quad \frac{p_j \quad q_i(c+t)}{p_j} \quad ''_j \quad X_{jc} = \quad \frac{p_j \quad q_i(c+t)}{{p_j}^2} \quad m_j \quad H_j; \tag{25}$$

$$X_{ii}^{m} \quad \frac{p_i \quad q_i c}{p_i} \quad ''_i \quad X_{ic} = \quad \frac{p_i \quad q_i c}{{p_i}^2} \quad m_i \quad H_i; \text{ and} \tag{26}$$

$$X_{ij}^{m} \quad \frac{p_j \quad q_j c}{p_j} \quad ''_j \quad X_{jc} = \quad \frac{p_j \quad q_j c}{{p_j}^2} \quad m_j \quad H_j: \tag{27}$$

Each of these inequalities holds with equality if the right hand side is greater than zero, otherwise output is zero.

Production regime is the combination of firm types that operate in equilibrium. Zero-profit conditions represent free entry of firms of each type and determine the production regime.

Let $_{ij}^{k}$ (k = n or m) denote proportional markups of price over marginal cost. For example, $_{ij}^{m}$ is one country i-based multinational firm's markup in market j. That is, $_{ij}^{m} = \frac{X_{ij}^{m}}{X_{jc}} \frac{1}{''_j}$. I can then obtain markup revenues per unit on a type-k firm as market price times its markup in that market. For instance, marginal markup revenues on a country i-based multinational firm in market j are $p_j \, _{ij}^{m} = p_j \quad q_j c$ from the equation (23). Subsequently, total markup revenues on type-k firms can be written as:

$$\text{for a country } i\text{-based national firm} : p_i \, _{ii}^{n} X_{ii}^{n} + p_j \, _{ij}^{n} X_{ij}^{n}; \tag{28}$$

$$\text{for a country } j\text{-based national firm} : p_j \, _{jj}^{n} X_{jj}^{n} + p_i \, _{ji}^{n} X_{ji}^{n}; \tag{29}$$

$$\text{for a country } i\text{-based multinational firm} : p_i \, _{ii}^{m} X_{ii}^{m} + p_j \, _{ij}^{m} X_{ij}^{m}; \text{ and} \tag{30}$$

$$\text{for a country } j\text{-based multinational firm} : p_j \, _{jj}^{m} X_{jj}^{m} + p_i \, _{ji}^{m} X_{ji}^{m}: \tag{31}$$

If outputs are positive, then the equations (24)-(27) and (28)-(31) can be used for generating the free entry conditions (i.e. profits = total markup revenues - total fixed costs 0), where complementary variables are the number of firms of each type.

$$(N_i^n): \quad \left[\left(\frac{p_i - c}{p_i}\right)^2 (m_i - H_i) + \left(\frac{p_j - c - t}{p_j}\right)^2 (m_j - H_j) \right] \leq q_i(G+F); \tag{32}$$

$$(N_j^n): \quad \left[\left(\frac{p_j - c}{p_j}\right)^2 (m_j - H_j) + \left(\frac{p_i - c - t}{p_i}\right)^2 (m_i - H_i) \right] \leq q_j(G+F); \tag{33}$$

$$(N_i^m): \quad \left[\left(\frac{p_i - c}{p_i}\right)^2 (m_i - H_i) + \left(\frac{p_j - c}{p_j}\right)^2 (m_j - H_j) \right] \leq q_i(G+F) + q_j G; \text{ and} \tag{34}$$

$$(N_j^m): \quad \left[\left(\frac{p_j - c}{p_j}\right)^2 (m_j - H_j) + \left(\frac{p_i - c}{p_i}\right)^2 (m_i - H_i) \right] \leq q_j(G+F) + q_i G. \tag{35}$$

3 Impact Effects

To grasp intuition to results in the general equilibrium for demand-driven factors, this section conducts the impact effects explicated in Markusen (2002).[7] Here, using the free entry conditions (32)-(35) derived the above, I analyze how a change in one variable leads to changes in both the aggregate demand and equilibrium regimes.

To easily understand the impact effects, I first need to simplify the free entry conditions (32)-(35). Let $\left(\frac{p_l - c}{p_l}\right)^2$, $\left(\frac{p_l - c - t}{p_l}\right)^2$, $q_l(G+F)$, and $q_l G$ denote a_l, b_l, d_l, and e_l ($l = i$ or j), respectively. Then, transposition of all terms of fixed costs to the left hand side in the equations (32)-(35) gives expressions for profits of country l-based type-k firm, denoted by π_l^k ($l = i$ or j, and $k = n$ or m). Thus, the free entry conditions (32)-(35) can be simplified as the following profit equations:

$$\pi_i^n = a_i (m_i - H_i) + b_j (m_j - H_j) - d_i \tag{36}$$

[7]Given that all other endogenous variables are fixed, this analysis technique demonstrates how a change in one variable yields a change in an equilibrium result. Even though this is not the effects of general equilibrium, the analysis helps predict results in the general equilibrium.

$$\pi_j^n = a_j (m_j - H_j) + b_i (m_i - H_i) - d_j \quad (37)$$

$$\pi_i^m = a_i (m_i - H_i) + a_j (m_j - H_j) - d_i - e_j; \text{ and} \quad (38)$$

$$\pi_j^m = a_j (m_j - H_j) + a_i (m_i - H_i) - d_j - e_i; \quad (39)$$

where $a_l; b_l; d_l;$ and e_l ($l = i$ or j) are all strictly positive. For more simplicity of analysis, I add one more assumption that both countries are initially identical. Accordingly, price elasticities, per-capita incomes, the numbers of population (neutral factor), threshold incomes, all kind of prices, all kind of fixed costs, and so forth are initially equal in the two countries. That is, $\varepsilon \equiv \varepsilon_i = \varepsilon_j$, $m \equiv m_i = m_j$, $H \equiv H_i = H_j$, $m^0 \equiv m_i^0 = m_j^0$, $a \equiv a_i = a_j > b \equiv b_i = b_j$, $d \equiv d_i = d_j$, and $e \equiv e_i = e_j$.

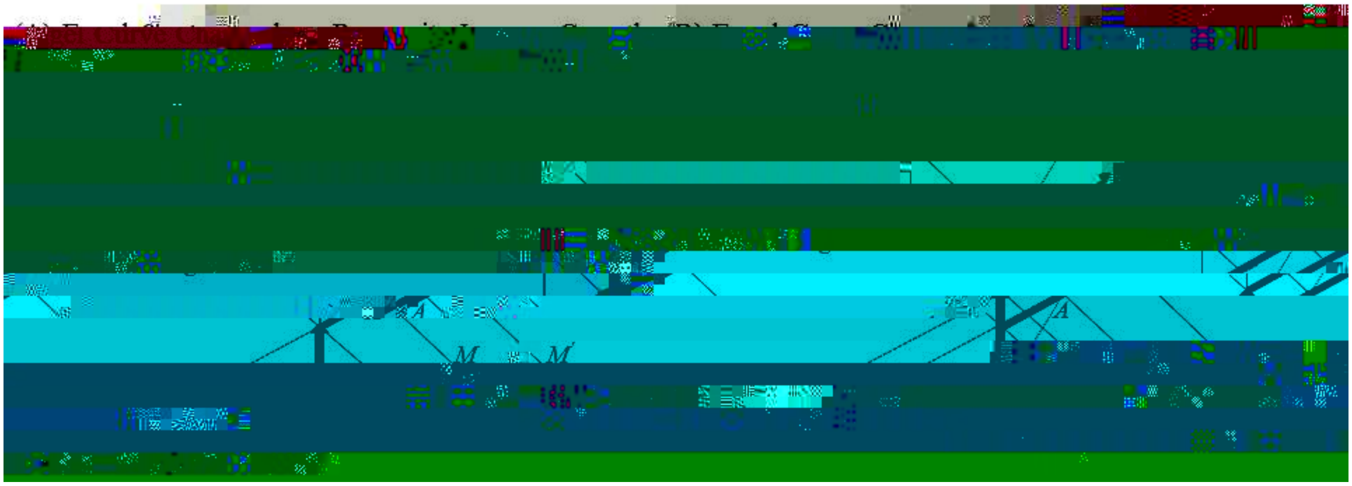
For convenience, let $\pi^n \equiv \pi_i^n = \pi_j^n$ denote initial (ex-ante) profits of a national firm, $\pi^m \equiv \pi_i^m = \pi_j^m$ denote initial (ex-ante) profits of a multinational firm, and π^{n0} and π^{m0} denote ex-post profits of a national and multinational firm, respectively.

3.1 Impacts of a Change in World Aggregate Demand (per-capita income vs population)

As the first analysis of impact effects, consider the impacts of a change in world aggregate demand, all other things unchanged.[8] Recall that aggregate demand grows through an increase either in *per-capita income (productivity)* or in *neutral factor (population)*. First, consider the impacts of world aggregate demand growth arising from an equal *per-capita income* increase in both countries. An equal per-capita income increase in both countries would lead to world total income growth and subsequently world aggregate demand (see the equation (7)). Figure 2 (A) illustrates an Engel

[8] Here, I consider the case of an increase in aggregate demand only. The results from a decrease in aggregate demand would be directly opposite to the increase case.

curve in the case of a per-capita income growth for a country, and describes how aggregate demand varies with total income arising from a per-capita income growth. The growth of per-capita income leads to an increase in both total income level (from M to M^0) and aggregate demand (from point A to B).



$$
\begin{aligned}
{}^{m0} = \; {}_{i}^{m0} = \; {}_{j}^{m0} &= a \;\; m \;\; (H + \quad H) + a \;\; m \;\; (H + \quad H) \quad d \quad e \\
&= \; {}^{m} + 2a \;\; m \quad H
\end{aligned}
\qquad (43)
$$

Whenever $\frac{m}{p} \quad (1 \quad)z > 0$, a less increase in aggregate demand through a neutral factor growth also shows the general result that $\; {}_{i}^{m} = \quad {}^{m}$

In this case, as two countries differ in per-capita income, suppose that country i's per capita income level increases by m while country j's per capita income level decreases by m in order to make all other things including total world income unchanged. Then, the ex-post profits of firm type-k are:

$$
\begin{aligned}
{}^{n0}_{i} &= a \quad H(m_i + \quad m) + b \quad H(m_j \quad m) \quad d \\
&= {}^{n}_{i} + (a \quad b) \quad H \quad m
\end{aligned}
\tag{44}
$$

$$
\begin{aligned}
{}^{n0}_{j} &= a \quad H(m_j \quad m) + b \quad H(m_i + \quad m) \quad d \\
&= {}^{n}_{j} + (b \quad a) \quad H^{0} = m) + b \quad a \quad (\quad H \quad (m_i + \quad H(m_j) \quad d \\
&= {}^{n}{}_{j} + d \quad (
\end{aligned}
$$

factor di er in the size of their e ect on aggregate demand, the changed size of the pro ts that the di erence in aggregate demand generates also varies with where the di erence in aggregate demand comes from.

So far, a change in either per-capita income or neutral factor makes not only a change in total income but also a change in aggregate demand. To remove the e ect of a change in total income on aggregate demand, now consider that a per-capita income increases but a neutral factor decreases for country *i*, whereas reversely a per-capita income decreases but a neutral factor increases for country *j*, *holding total income in both countries constant and identical*.

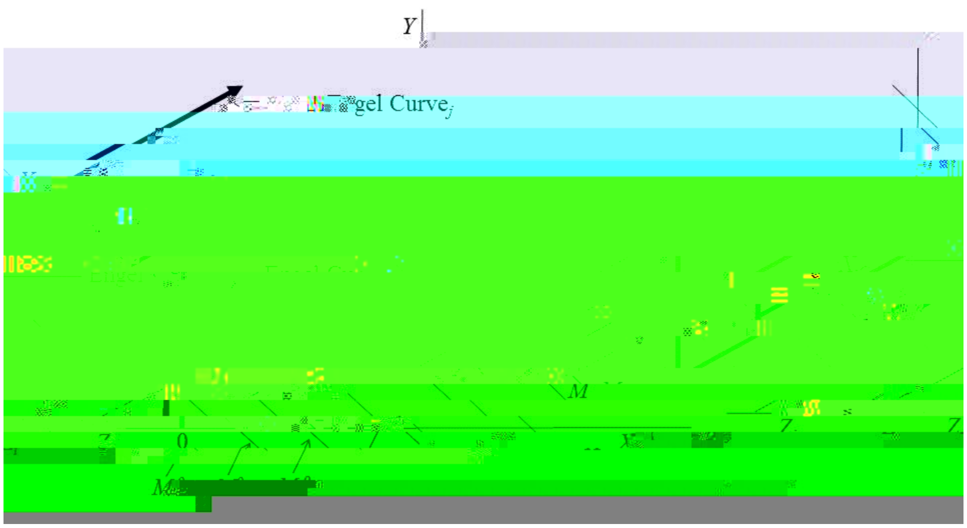


Figure 4: Engel Curves in a Reverse Divergence in Per-capita Income and Neutral Factor between Two Countries, Holding Total Incomes for Two Countries Identical and Constant

Figure 4 illustrates this situation, which implies that the two countries have an identical level of total income, but country *i* has a larger aggregate demand than country *j* due to a higher per-capita income in spite of a less level of neutral factor. Therefore, the changed pro ts for each type rm are also qualitatively simi a hvhv70(23Civ)27(ergence)-253(in)-2(23p)-27(er-capita)-253(income.)-4 both countries remain unchanged. The analysis which is exactly the same as here can be found in Markusen (2013). In this paper, it is included to show the importance of a similarity in per capita income for horizontal multinational firms, regardless of whether two countries have an identical total income. Later, this important result is associated with a main empirical specification.

4 Simulation

In this section, I first show a benchmark simulation result after describing a numerical general-equilbrium model under non-homothetic preferences. Then, I analyze how various changes in demand-driven characteristics for two countries influence equilibrium regimes (See Appendix A.2 for impacts of a change in each production-side factor on equilibrium regimes).

4.1 Benchmark Simulation Result under Non-homothetic Preferences

There are difficulties when one analytically solves the general equilibrium model outlined above because the model has many demensions and many inequalities. Alternatively, I first formulate the model as a nonlinear complementary problem in which there are a set of inequalities and each of these inequalities is expressed with an associated non-negative variable.[10] Then, I exploit MPSGE (mathematical programming system for general equilibrium), a sub-system of GAMS (general algebraic modelling system), developed by Rutherford (1999) in order to solve the model numerically. The numerical model of general equilibrium includes forty-three inequalities each with complementary variables in forty-three unknowns (See Appendix A.1 for the numerical model and the initial calibration of the model).

In the benchmark simulation, I use the values of parameters as follows: non-country-specific z

[10] Two possibilities exist. The variable is strictly positive if equality holds for the inequality in equilibrium. On the other hand, it has the value of zero if strict inequality holds in equilibrium.

as the endowment good is 30, the transport cost t is 0.15, and the ratio of a multinational rm's xed costs to national rm's xed costs is 1.45 (= $\frac{8}{5.5}$) if wages between two countries are the same.

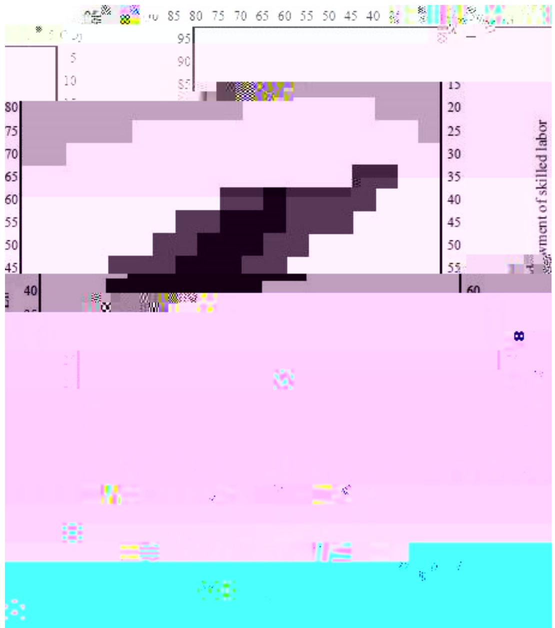


Figure 5: Equilibrium Regimes under Non-homothetic Preferences ($z = z_i = z_j = 30$)

Figure 5 shows the equilibrium regimes over these parameter values in the world Edgeworth box, in which horizontal axis is the total world endowment of unskilled labor, and vertical axis is the total world endowment of skilled labor.[11] The origin of country i is the southwest (SW) corner in the box while the origin of country j is the northeast (NE) corner.[12] Note that any point on the NW-SE diagonal of the box implies that the two countries di er in relative endowments, while any point on the SW-NE diagonal implies that the countries have the same relative endowments but di er in the number of total labor forces.

Figure 5 is derived from the assumption that the countries have identical but non-homothetic

[11] Each axis is divided into [illegible] TJTf 8.dja32(is)]TJ 0[(Emen)27(t8(n)-3r.2cell1(a-470F29 9.9626xis)-3239(o)2J -376J 0 -Fe27(he)9880(cou988al

preferences, where $z_i = z_j = 30$ in the equation (1). A color of each cell in the panel represents an equilibrium regime. The figure is similar to the Figure 5.1 of Markusen (2002), which is derived from the assumption that the countries have identical homothetic preferences ($z_i = z_j = 0$), in that only multinational firms are active in general equilibrium around the center of the Edgeworth box, only national firms exist in equilibrium at the edges of the box, and in between are co-existence area of both multinational and national firms. Therefore, regardless of whether assumed preferences are homothetic or non-homothetic, the central findings in Markusen and Venables (1998) and Markusen (2002) are preserved: horizontal multinational firms are more likely found in equilibrium when both market size and relative endowments are similar between the two countries.

4.2 Impacts of a Change in World Aggregate Demand in General Equilibrium

First, consider the impacts of a change in world aggregate demand in general equilibrium. As mentioned in the previous section, aggregate demand growth comes through an increase in either per-capita income or neutral factor. I predict that equilibrium regimes by these two demand factors are qualitatively similar in that an increase in either per-capita income or neutral factor gives a more advantage to multinational firms, but quantitatively different each other because the effect of per-capita income growth on aggregate demand is greater than that of neutral factor.

As the first experiment, suppose that world aggregate demand growth comes through an increase in per-capita income. Figure 6 (A) shows the equilibrium regimes solved numerically for this first experiment. While all parameter values are the same as in the benchmark case (Figure 5), only scale parameters of per-capita income for two countries equally rise by 33%. As predicted, Figure 6 (A) shows that the regions in which only national firms are active shrink, and the area in which multinational firms exist expand. The equally increased per-capita income in the two countries leads to an increase in the world total income, and also extends world aggregate demand. As total markup revenues are differently affected across firm types, multinational firms has an advantage in profits over national firms.

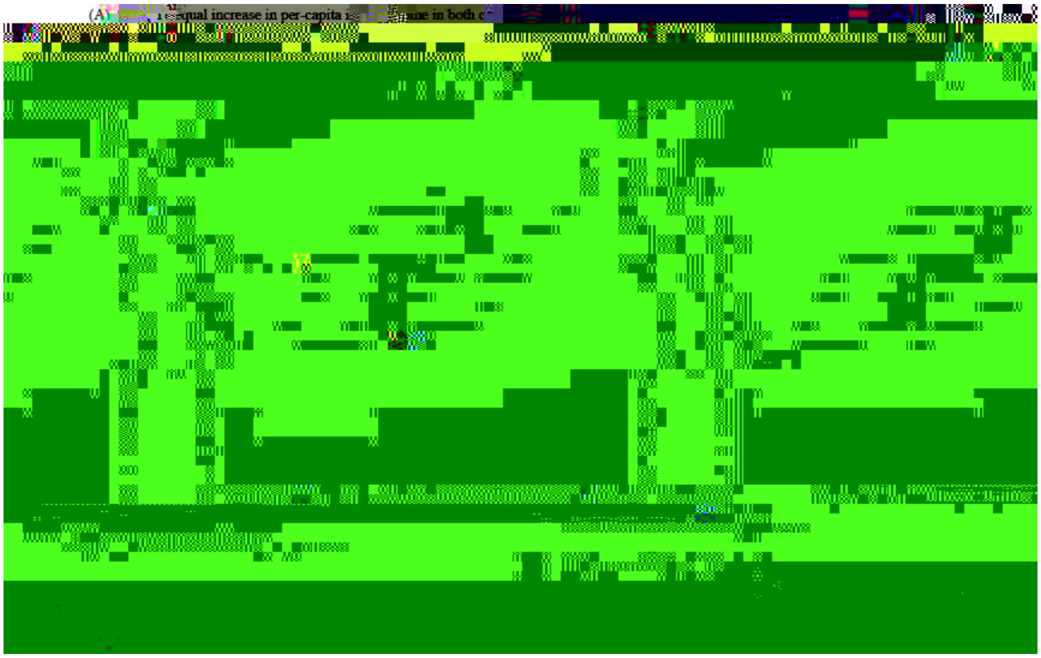


Figure 6: Equilibrium Regimes under World Aggregate Demand Growth through Per-capita Income (A) vs Neutral Factor Accumulation (B)

Second, suppose that world aggregate demand growth comes through an accumulation of neutral factor. In previous section, I analyze that a neutral factor accumulation leads to a less increase in aggregate demand, relative to the above case. It is thus conjectured that multinational firms has a less advantage in total markup revenues, compared to the above case. Figure 6 (B) shows the equilibrium regimes solved numerically in the case of an equal accumulation of neutral factor. While all parameter values are the same as in benchmark case, only scale parameters of population in the two countries rise by 33%. Note that the level of total income increase by 33% in both cases (per-capita income growth and neutral factor accumulation). As predicted, Figure 6 (B) shows a similar change in the equilibrium regimes compared to the Figure 6 (A), but the area that support the existence of multinational rms is smaller with Figure 6 (B). The equal population growth in the two countries leads to an increase in the world total income. It also increases the threshold income level to buy good X as another important component in determining aggregate demand, forcing an increased size of aggregate demand in the population growth smaller than in the per-capita income growth. Hence, the population growth in the two countries makes a less change in the equilibrium regimes.

4.3 Impacts of a Di erence in Aggregate Demand in General Equilibrium

Next, I consider how a di erence in aggregate demand between the two countries a ects the equilibrium regimes. First, I make a divergence of per-capita income between the two countries. As analyzed in earlier section, this creates considerably di erent aggregate demand between the two local markets. I conjecture that larger demands in the country i reinforce country i-based national rm's pro ts while smaller demands in the country j reduce country j-based national rm's pro ts. On the other hand, the pro ts of multinational rms remain unchanged.

Figure 7 (A) shows how equilibrium regimes change from the benchmark result when per-capita income levels between the two countries are not symmetric. Per-capita income level is 33% larger than the benchmark case for country i, but 33% smaller for country j. As expected, the existence

,rowth. Hence72(7)-241((A(etap)-20he

same in both countries. On the SW-NE diagonal, the southwest part from the central point indicates that wages for skilled labor in country i with large demands are lower, while northeast part indicates that wages for skilled labor in country j with small demands are lower. Thus, these features discourage the existence of horizontal multinational rms in the northeast part.

Figure 7: Equilibrium Regimes under Di erence in Aggregate Demand through Per-capita Income Divergence (A) vs Neutral Factor Divergence (B)

Second, I make a divergence of population size between the two countries. As also analyzed in earlier section, this divergence creates a less di erent aggregate demand between the two local markets, relative to the above case of the per-capita income divergence. I thus conjecture that a divergence in neutral factor in uences equilibrium regimes in a similar manner to the above case, but less a ects their changes.

Equilibrium regimes are shown in Figure 7 (B) when world distribution of population between the two countries is asymmetric. The number of population is 33% larger than the benchmark case for country i, but 33% smaller for country j. As expected, the region where country i-based national rms operate somewhat expands, but the existence area of country i-based national rms and that of multinational firms slightly decline.

Finally, without any total income change in each country compared to the benchmark case, I make an inverse change in per-capita income and population size for each country. Per-capita income and population size are double and half those in the benchmark case for country i, respectively, while they reversely change for country j. Note that country i is 4 times larger in per-capita income than country j, but 4 times smaller in population size. Figure 8 shows that the changed profits for each type firm are also qualitatively similar to the case of a divergence in per-capita income, but some of the effect of a divergence in per-capita income on profits is offset by that of a divergence in neutral factor. It also highlights that a similarity in per-capita income plays a major role on horizontal FDI.

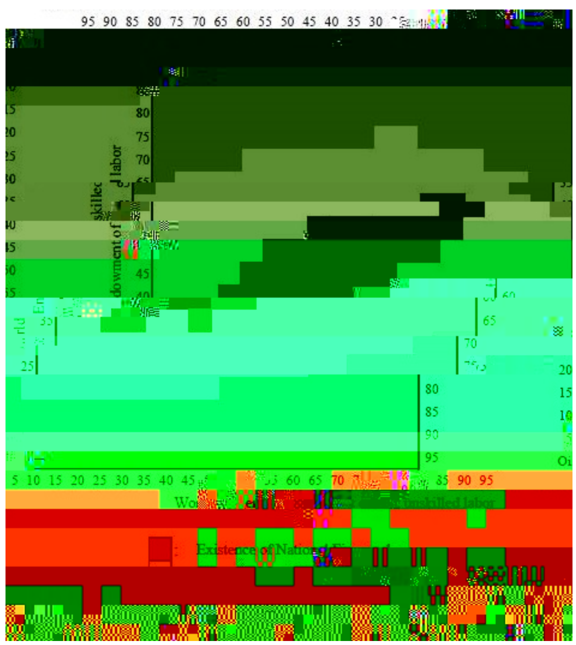
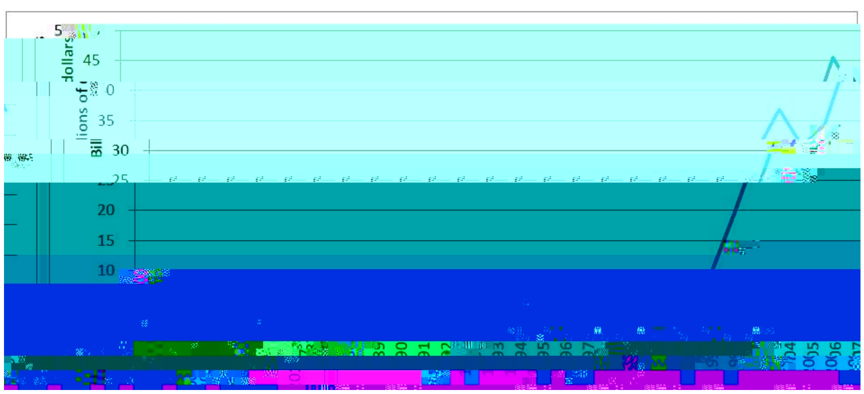


Figure 8: Equilibrium Regimes for a Reverse Divergence in Per-capita Income and Neutral Factor between Two Countries, Holding Total Incomes for Two Countries Identical and Constant

5 Patterns and Structural Features of Korean Outward FDI

This section summarizes patterns and structural features of Korea's outward FDI. It presents common views shown in previous studies for Korea's outward FDI.[13]

There has been a number of changes in various aspects of Korea's outward FDI. First, in Korean policy and system toward FDI, Korean government has gradually liberalized FDI since foreign investment began to be institutionalized in 1968. In 1997, it completed to liberalize FDI by allowing multinational firms a simple report without prior government approval. In annual total volume (see Figure 9), outward FDI accordingly amounted to US$1 billion in the late 1980s, rose steadily after then, and reached US$7.1 billion in 1996. It dwindled during the financial crisis of 1997-98, but it has turned to a rising streak since 2000 (US$6.2 billion). Since 2005 (US$9.7 billion), it has shown a rapid increase (US$19.4 billion in 2006 and US$36.8 billion in 2008). Therefore, an analysis over the period after both achieving the liberalization of FDI and escaping from the financial crisis impact might be reasonable for Korea.



Source: Export-Import Bank of Korea (http://www.koreaexim.go.kr/kr/work/check/oversea/use.jsp)

Figure 9: Trends of Korean Outward FDI

[13] The previous studies include Ha (2010), Chun and Kwon (2007), Lee (2003 and 2004), and Kim and Rhe (2009).

Second, I look at changes of Korean outward FDI in structural features, helping my analysis on the determinants of Korean outward FDI. According to the comparison of outward FDI by Korean multinationals across regions (Table 1), Asia ranks rst in the cumulative amount of Korean outward FDI. FDI into the Asian region is mainly driven by medium and small businesses, and it is characterized by the highest proportion of FDI into manufacturing industry. Over the period of 1999-2010, it is also about half of the share of total volume of Korean outward FDI. Because almost all countries in the Asian region, excluding Japan, are developing countries, it has a motivation of vertical FDI that exploits low wage rates from abundant unskilled labor endowments in this region.

Table 1: Trends of Korean Outward FDI across Regions

Regions	1999-2004 Total sum for 6 years (Millions of dollars)	Share (%)	2005-2010 Total sum for 6 years (Millions of dollars)	Share (%)	1980-2012 Total sum for entire years (Millions of dollars)	Share (%)
Asia	18,664	46	70,050	45	132,850	41
North America	9,106	24	29,760	21	75,180	23
Europe	6,015	15	25,083	14	46,133	14
Other America	1,153	3	6,913	4	14,604	4
Others	4,630	12	29,261	18	58,776	18

Source

the U.S. and China have attracted 20% and 17% of Korean outward FDI, respectively. Another trend is that there have been diversi ed in host countries after the beginning of a surge in outward FDI since 2005.

Table 2: Trends of Korean Outward FDI across Countries

Countries	1999-2004 Total sum for 6 years (Millions of dollars)	1999-2004 Share (%)	2005-2010 Total sum for 6 years (Millions of dollars)	2005-2010 Share (%)	1980-2012 Total sum for entire years (Millions of dollars)	1980-2012 Share (%)
United States	8,877	22	23,337	14	64,338	20
China	11,295	29	27,300	17	56,687	17
Hong Kong	1,511	4	10,403	6	17,524	5
Vietnam	1,740	4	9,988	6	15,307	5
Australia	510	1	3,147	2	14,450	4
Netherlands	2,202	6	5,404	3	11,255	3
Indonesia	877	2	4,021	2	10,894	3
Canada	229	1	6,423	4	10,842	3
United Kingdom	1,041	3	6,271	4	10,639	3
Malaysia	302	1	8,459	5	10,320	2
Others	10,984	28	56,315	35	105,287	32

Source: Export-Import Bank of Korea (http;//www.koreaexim.go.kr/kr/work/check/oversea/use.jsp)

By industry, Korean outward FDI has mostly been headed for manufacturing and service industries. It is re

By purpose of outward FDI, two main, horizontal and vertical, incentives for FDI have attracted most Korean outward FDI as well. In both total volume of FDI and FDI into the manufacturing industry, this pattern is similar. A recent distinct difference of trends between horizontal and vertical FDI is that Korean mutinationals are sharply expanding their horizontal investment, but vertical FDI is somewhat on the decline (See Kim and Rhe, 2009).

6 Empirical Analysis

6.1 Empirical Model

Basic theoretical foundations of this paper come from the standard KC model incorporating both horizontal and vertical motivations for FDI into a framework. The KC model provides its predictions as follows. Unless parent and host countries have similarities in both market size and relative factor endowment and trade costs are low, two major types of MNEs emerge. First, in the presence of both increasing returns and imperfect competition, horizontal MNEs will be dominant when two countries have similarities in both market size and relative factor endowment but trade costs are sufficiently high. If there is a difference in market size, MNEs in relatively large country would be unwilling to invest in costly capacity in relatively small country. If there is a difference in relative factor endowment, MNEs in relative skilled-labor-abundant country have incentives to outsource bene ts from reducing production costs and therefore it is unlikely associated with demand-driven determinants. However, my empirical investigation includes vertical motivations since the distinction between horizontal and vertical FDI is possible only in theory yet FDI data by the distinction are not available for most countries including Korea.

$HC\ Diff_{hft}$: Difference in index of human capital between Korea and a host country f

$GDP\ Diff_{hft} \times HC\ Diff_{hft}$: Product of difference in real GDP and difference in index of human capital

IB_{ft}: Barriers for FDI in a host country f

TC_{ht}: Costs when exporting final goods back from a host country f to Korea

TC_{ft}: Costs when exporting intermediate goods from Korea to a host country f

$HC\ Diff\ Sq_{hft} \times TC_{ft}$: Product of square of difference in index of human capital and costs when exporting intermediate goods from Korea to a host country f

$Sum\ GDPPC_{hft}$: Sum of real GDP per capita of Korea and a host country f (US$)

$GDPPC\ Diff\ Sq_{hft}$: Square of difference in real GDP per capita between Korea and a host country f

$GDPPC\ Diff_{hft} \times HC\ Diff_{hft}$: Product of difference in real GDP per capita and difference in index of human capital

ε_{hft}: Error term

The dependent variable, $ROFDI$, is defined as annual real FDI flows from Korea to a host country. The first explanatory variable, $ROFDI_{hft-1}$, represents a lagged value of the endogenous dependent variable. It captures that when MNEs have invested more in a country in the past year, they tend to invest more in the country in the present year, i.e. so-called self-reinforcing effect, learning-by-doing effect, or agglomeration effect (Noorbakhsh et al., 2001; and Wheeler and Mody, 1992) and the coefficient β_1 is expected to be positive. The second explanatory variable, $Sum\ GDP$, represents the sum of two countries' market size (i.e. the sum of Korean real GDP and host country's real GDP). The coefficient β_2 should be positive as a larger joint market size is expected to increase FDI. The standard KC theory predicts that the similarity in market size is also an important motivation for horizontal FDI and therefore β_3 should be negative.

In the paper, *HC Diff* is the difference in the index of human capital between Korea and a host country. Korea is relatively skilled-labor-abundant compared with host countries in most cases of my sample, and it thus has a higher value of human capital index than most host countries (see Table 5).[14] The difference becomes larger as the host country is more unskilled-labor-abundant. The standard KC theory suggests that horizontal FDI more likely occurs when two countries are similar in this relative factor endowments, but vertical FDI is more likely encouraged as Korean MNEs have more opportunity to reduce production costs when a difference in the relative factor endowments rises. Thus, the expected sign for $_{4}$ becomes ambiguous. If the *HC Diff* variable mainly captures horizontal motivation for FDI, $_{4}$ should be negative. On the other hand, if Korean FDI largely depends on vertical motivation, $_{4}$ would be positive. The fifth term is the product of *GDP Diff* and *HC Diff*. Awokuse et al. (2012) explain that this variable is included to capture that given a market size difference, larger difference in skilled-labor endowment would decline horizontal FDI relative to increased vertical FDI. Therefore, the expected sign for $_{5}$ is also ambiguous for Korean FDI.

The sixth variable is *IB* (Investment barriers), indicating perceived impediments of investing in a host country. As any investment impediments are expected to lower all types of FDI, $_{6}$ should be negative. The next two variables are related to trade costs. Higher trade costs in Korea (parent country) discourage vertical FDI because higher costs make importing of the final products back to Korea more costly. Thus, $_{7}$ is expected to be negative. On the other hand, higher trade costs in a host country foster horizontal FDI because MNEs should prefer affiliate production to costly export. Thus, $_{8}$ is expected to be positive. The variable *HC Diff Sq*   *TC* is an interaction term between squared human capital differences and trade costs in a host country. As mentioned

[14] In the Table 5 of Appendix A.3 presenting basic statistics of variables, it can be identified that Korea is a skilled-labor-abundant and human-capital-abundant country.

just before, a higher level of trade costs that Korean firms have to pay when exporting to the host country extends incentives for horizontal FDI, and the incentives for horizontal FDI expand when a difference in human capital is smaller. Thus, this variable captures the idea that given a level of trade costs in the host country, the effects of the trade costs on horizontal FDI rely on a difference in human capital. In other words, the direct positive effects of the trade costs on horizontal FDI decrease as a difference in human capital grows. The coefficient $_9$ is therefore expected to be negative.

factors, per-capita income and neutral factor. In theoretical considerations, it is analyzed that when comparing between the e ects of these two variables on aggregate demand in a country, their roles are qualitatively similar, but per-capita income plays a leading role in determining aggregate demand in a country.[15] Thus, my theoretical results conjecture that the similarity in per-capita income level encourages horizontal FDI regardless of controlling for variables of neutral factor, measured by the number of population. The following estimating equation adding population variables to the basic equation (50) instead of excluding GDP variables allow an examination on this alternative view.

$$ROFDI_{hft} = {}_0 + {}_1 \quad (ROFDI_{hft\ \ 1}) + {}_2 \quad (Sum\ GDPPC_{hft})$$

$$+ {}_3 \quad (GDPPC\ Diff\ Sq_{hft}) + {}_4 \quad ($$

using instrument variables is also appropriate because some of independent variables can have endogeneity problem including reverse causality. Fifth, I should consider heteroscedasticity and autocorrelation for the error term. Finally, the number of time series is small, but the number of analyzed host countries is large.

For the reasons with availability of panel data, the empirical analysis of this paper can use a GMM estimator. An estimator of System GMM in general shows a good performance in terms of bias and precision than that of Differenece GMM because the former uses additional instruments. I will again discuss this point shortly. Therefore, many applied studies with dynamic panel settings use it (e.g. Carkovic and Levine, 2005).

A GMM approach is a method in which it basically finds estimated parameters that minimize a weighted objective function. While an one-step estimator produces the estimated parameters using an initial weight matrix, a two-step estimator implements an additional procedure where the estimated results driven from the one-step process are used to minimize the weighted objective function again. It is well known that the two-step estimator is superior in terms of asymptotical properties to the one-step estimator (Min and Choi, 2009). Therefore, the two-step estimator of System GMM with robust errors considered for heteroscedasticity is employed to yield main estimation results.

6.2.2 Detailed Discussion on System GMM Estimator

Consider the following estimating equation:

$$\begin{aligned} FDI_{jt} - FDI_{jt-1} &= (\alpha - 1)FDI_{jt-1} + \beta' X_{jt} + \varepsilon_{jt} \\ \Leftrightarrow \Delta FDI_{jt} &= \gamma FDI_{jt-1} + \beta' X_{jt} + \varepsilon_{jt}, \end{aligned} \tag{52}$$

where FDI is my FDI measure as the dependent variable, X is the set of independent variables mator.

However, it is documented that this difference estimator may have statistical weaknesses. When independent variables are persistent over time, the used instruments can become weak predictors for the endogenous variables (Blundell and Bond, 1998). These weak instruments not only can lead to biased coefficients in small sample, but they can also asymptotically cause an increase in the variance of the estimated coefficients.

To avoid the biases and imprecision with the difference estimator, Blundell and Bond (1998) suggest that additional moment conditions are available. If I adopt an assumption on a stationarity of the initial observation, the lagged differences of the endogenous variables can be used as extra instruments. Thus, the following additional moment conditions are:

$$E\left[(FDI_{jt-k} - FDI_{jt-k-1})\,\varepsilon_{jt}\right] = E\left[(FDI_{jt-k} - FDI_{jt-k-1})\,(\eta_j + u_{jt})\right] = 0; \text{ for } k = 1 \tag{56}$$

$$E\left[(X_{jt-k} - X_{jt-k-1})\,\varepsilon_{jt}\right] = E\left[(X_{jt-k} - X_{jt-k-1})\,(\eta_j + u_{jt})\right] = 0; \text{ for } k = 1. \tag{57}$$

This estimator based on the moment conditions (54) - (57) is referred to as System GMM estimator.

reliability issue of the above test of overidentifying restrictions.

Another test is associated with the assumption of no serial correlation of the error term $''_{hft}$ (before di erence process). By Arellano-Bond statistics, I assess whether the error term $''_{hft}$ is serially correlated. Note that if the error term $''_{hft}$ (before di erence process) is not serially correlated, then there may exist a rst-order serial correlation in the di erenced error term, but the di erenced error term should not present a second-order serial correlation (Awokuse et al., 2012). All tests and considerations conducted in this paper support that the analysis is statistically signi cant. I will not address this issue again.

6.3 Data

My analytical sample is a balanced panel data of 57 countries over the period 1999-2010.[16] Data on the dependent variable are annual data of Korean outward FDI ows and are from the Export-Import Bank of Korea. These raw data represent a nominal measure and are reported in thousands of U.S. dollars. The data were converted to a real measure in millions of 2005 dollars using a de ator from the World Bank.

Data on real GDP, population, and human capital used in constructing several variables are from Penn World Table 8.0 database. According to the de nition, GDP per capita is calculated by dividing real GDP by the number of population. Annual real GDP and population are measured in millions of 2005 U.S. dollars and in millions of people, respectively, and thus real GDP per capita used is measured in one 2005 U.S. dollar. As a proxy for skill endowments, this paper uses an

[16] The list of 57 host countries includes 13 Asian countries (Bangladesh, China, Hong Kong, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, Singapore, Taiwan, Thailand, and Vietnam), 2 North American countries (Canada and United States), 26 European countries (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, Turkey, Ukraine, and United Kingdom), and 16 other countries (10 Other American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mex-

index of human capital indicating the amount of human capital per worker. The index is created based on information on both the average years of schooling from Barro-Lee (2012) and the return to education from Psacharopoulos (1994). A number of studies estimating the KC model have used occupation data from International Labour Organization (ILO) to measure relative skilled-labor endowments. ILO data have shortcomings in that they are available for considerably limited countries and years.

Data on trade costs and investment barriers are taken from the Economic Freedom of the World (EFW) database of the Fraser Institute. As a proxy for trade costs, the index of regulatory trade barriers is employed. In the case of investment impediments, I use the index labeled as foreign ownership/investment restrictions. As both indexes have published for every 5 year before 2000, linear interpolation is conducted to obtain data in 1999. Both indexes commonly range from zero to 10, with 10 indicating the least trade costs and the lowest investment barriers, respectively. To construct my measures from these two indexes, I use the formula: $(10 - \mathit{index}) \times 10$. Thus, my measures commonly have a zero-to-100 scale and indicate that a higher value means a larger trade costs and a higher investment barriers.[17]

6.4 Empirical Results

I first estimate the equation (50) of the basic specification with confirming the standard empirical KC model as a preliminary analysis (Table 3). I then run additional regressions for relevant

Table 3: System GMM regression Results

Dependent Variable: ROFDI						
		For original KC model		For extended KC model		
Explanatory Variables	Expected Sign	(1) One-step	(2) Two-step	(3) One-step	(4) Two-step	
L.ROFDI	+	0:747	0:747	0:586	0:585	
		(0.0839)	(0.0838)	(0.107)	(0.107)	
Sum GDP	+	5:50*e* 05	5:50*e* 05	-6.33e-06	-7.89e-06	
		(3.06e-05)	(3.06e-05)	(3.95e-05)	(-3.78e-05)	
GDP Di Sq	-	3.08e-12	3.08e-12	1:26*e* 11	1:27*e* 11	
		(3.41e-12)	(3.41e-12)	(4.36e-12)	(4.36e-12)	
HC Di	- / +	164:2	165:9	210:2	203:4	
		(83.54)	(82.37)	(77.04)	(77.87)	
GDP Di HC Di	- / +	-2.71e-05	-2.69e-05	1:03*e* 04	1:05*e* 04	
		(-2.93e-05)	(-2.93e-05)	(3.58e-05)	(3.67e-05)	
Host Investment Barriers	-	-2.993	-3.001	-3.863	-3.775	
		(2.144)	(2.150)	(2.403)	(2.391)	
Home Trade Costs	-	-2.273	-2.287	10:78	10:66	
		(1.492)	(1.497)	(3.177)	(3.167)	
Host Trade Costs	+	2.333	2.327	4:959	4:874	
		(2.254)	(2.325)	(2.724)	(2.756)	
HC Di Sq Host Trade Costs	-	3:417	3:389	5:704	5:524	
		(1.760)	(1.800)	(2.165)	(2.161)	
Sum GDPPC	+			0:00733	0:00730	
				(0.00218)	(0.00219)	
GDPPC Di Sq	-			1:10*e* 07	1:06*e* 07	
				(6.37e-08)	(6.11e-08)	
GDPPC Di HC Di	- / +			0:00974	0:00963	
				(0.00485)	(0.00508)	
Number of Observations		529	529	529	529	
Number of Countries		57	57	57	57	
Number of Instrument Variables		53	53	49	49	
Arellano-Bond Statistics (1)		-1.92	-1.90	-2.18	-1.85	
Arellano-Bond Statistics (2)		-0.18	-0.18	-0.13	-0.12	
Hansen Statistics		49.06	49.06	48.95	48.95	

Notes: ( ) Standard Error, *** p<0.01, ** p<0.05, * p<0.1

Table 3 shows estimation results by the System GMM both for the standard empirical KC model (Columns (1) and (2)) and for the benchmark speci cation in this paper (Columns (3) and (4)). In Columns (1) and (2), I con rm the standard KC theory for Korean overseas direct investment as almost all estimated coe cients have their expected signs.

The Columns (3) and (4) of Table 3 fall under the benchmark empirical results for which the standard empirical KC model is re-estimated with per-capita income variables to examine the Linder e ect predicted theoretically. Most coe ecients show that it is likely that the results are consistent with the predictions from the KC theory. One-year-lagged endogenous variable

($L{:}ROFDI$) shows that its coe ecients are always positive and statistically signi cant. Past activities by Korean multinationals have a sigini cant positive impact on current (and future) FDI. Human capital di erence variable also shows signi cant positive coe cients, implying a vertical motive. The interaction variable between human capital di erence and market size di erence has a signi cantly negative impact, consistent with empirical results of previous studies such as tical motivation. Second, there are large changes in both sign and significance for the coefficients on *Sum GDP* and *GDP Diff Sq* between the two specifications. For the specification of the standard KC model, the coefficients on both variables seem to be consistent with the predictions from the KC theory, although the coefficients on words, if per-capita income divergences between Korea and host country shrink by US$330, the host country attracts, on average, more direct investment from Korea by US$22 million.

Table 4: System GMM regression Results

Dependent Variable: ROFDI						
		For replaced model		For decomposed model		
Explanatory Variables	Expected Sign	(1) One-step	(2) Two-step	(3) One-step	(4) Two-step
L.ROFDI	+	0:864	0:864	0:693	0:694
		(0.0481)	(0.0481)	(0.0485)	(0.0484)
Sum GDPPC	+	0:00735	0:00736	0:00730	0:00729
		(0.00221)	(0.00222)	(0.00238)	(0.00236)
GDPPC Di Sq	-	6:30*e* 08	6:58*e* 08	8:24*e* 08	9:23*e* 08
		(3.57e-08)	(3.43e-08)	(4.21e-08)	(3.62e-08)
HC Di	- / +	56.12	56.04	12.83	15.96
		(107.1)	(107.7)	(60.00)	(66.46)
GDPPC Di HC Di	- / +	0:0157	0:0157	0:0115	0:0117
		(0.00563)	(0.00565)	(0.00415)	(0.00425)
Host Investment Barriers	-	4:402	4:402	5:155	5:162
		(2.043)	(2.042)	(2.632)	(2.649)
Home Trade Costs	-	9:964	9:960	12:24	12:24
		(3.172)	(3.163)	(4.361)	(4.512)
Host Trade Costs	+	4:100	4:091	2.144	2.162
		(2.234)	(2.232)	(2.940)	(3.055)
HC Di Sq Host Trade Costs	-	5:452	5:435	-2.909	-2.991
		(2.442)	(2.461)	(1.782)	(2.084)
Sum POP	+			1:773	1:779
				(0.364)	(0.376)
POP Di Sq	-			3.75e-05	3.06e-05
				(0.000270)	(0.000279)
POP Di HC Di	- / +			1:300	1:300
				(0.159)	(0.158)
Number of Observations		529	529	529	529
Number of Countries		57	57	57	57
Number of Instrument Variables		56	56	48	48
Arellano-Bond Statistics (1)		-2.03	-1.94	-1.95	-1.92
Arellano-Bond Statistics (2)		-0.17	-0.17	-0.18	-0.16
Hansen Statistics		52.44	52.44	50.27	50.82

Notes: ( ) Standard Error, *** p<0.01, ** p<0.05, * p<0.1

The benchmark results are strengthened by additional regressions in Table 4, which consider variables, GDP per-capita and population, according to the definition of GDP. Columns (3) and (4) of Table 4 show the results for the estimating equation (51) reflecting this idea.

When I compare the results in all columns of Table 4 with those in Columns (3) and (4) of Table 3, the influences of $GDPPC$ variables on Korean overseas investment barely change in both the statistical significance and the expected signs, as predicted. I again confirm that the key hypothesis is reasonable i.e. FDI is likely to be greater between countries similar in individual income levels. The comparison implies that the Linder effect for FDI is important regardless of controlling for either total income variables or population variables. The other variables commonly show that their coefficients all still keep their expected signs but for some of them statistical significance varies across specifications. In Columns (3) and (4) of Table 4, a rise in $Sum\ POP$ or $POP\ Diff$ $HC\ Diff$ increases Korean outward FDI. Therefore, I also confirm that evidence from Korean FDI data is likely consistent with my predictions of interest and the basic KC theory simultaneously.

7 Summary and Concluding Remark

Recently trade literature has adopted nonhomothetic preferences in the demand-side of a traditional model. By doing so, a number of economists not only have acknowledged the importance of demand-side determinants in explaining trade flows and patterns but they have also helped understand diverse phenomena associated with international trade. Due to much more complicated patterns of MNE behavior and FDI, relative to trade, little investigation has concentrated on the demand-side issues in the FDI literature. Only market size variables have mainly been used as a demand-driven determinant of FDI, particularly within the KC framework.

In theoretical framework of this paper, a simple nonhomothetic preference structure was incorporated into the previous oligopoly model of horizontal MNEs underlying the standard KC theory. Connecting the implications from nonhomothetic preferences to the features of horizontal FDI suggests that the Linder effect matters for FDI, independent of roles of market size and neutral factor.

The paper empirically investigated testable hypotheses involving the Linder effect for FDI of central interest. Korean overseas investment experiences for 57 host countries over the period after the financial crisis were applied to the empirical KC model extended and motivated by my theoretical predictions for horizontal FDI. As conjectured, the similarity in per-capita income level was important for Korean investors, implying that the Linder hypothesis holds for FDI at highly aggregated level. There was no change in this main result regardless of controlling for either population variables or total income variables. Specifically, a 10% decrease in per-capita income divergences between Korea and an average host country leads to a 8.6% rise in Korean overseas direct investment.

In this paper, I contribute to the FDI literature by more detailed discussions on horizontal FDI determinants. The paper also has a novelty in that I analyzed Korean overseas investment experiences to find the Linder effect. Additionally, I make a contribution by suggesting an improved estimation approach, System GMM, to estimate the KC model.

This paper can be extended in several directions. First, there is a need to identify whether the Linder hypothesis holds both for many different countries including the U.S. and for sectoral or firm level. Second, another implication from nonhomothetic preferences is that aggregate demand also depends on income distribution (or income inequality). In the paper, I exclude this topic by adding a related assumption. To my knowledge, the FDI papers have not focused on the issue. Finally, the simple model of this paper does not highlight the roles of the government, rather than raising trade barriers and investment impediments. For example, the government can provide various forms of taxes and subsidies, contribute to income redistribution, or improve infrastructure and institution.

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A Appendix

A.1 Numerical Model and Its Initial Calibration

Table 5 shows the system of inequalities each with complementary variables in detail. In this paper, p_Y (Y's price) is a numeraire (i.e. $p_Y = 1$).

Table 5: Inequalities each with complementary variables

Inequalities	Complementary variable	Number of inequalities
Pricing inequalities	*Activity*	*Number*
$p_{Yi} \quad c_{Yi}$	Y_i	2
$p_{Ui} \quad c_{Ui}$	U_i	2
$p_i(1 \quad {}^{n}_{ii}) \quad q_i c$	X^n_{ii}	2
$p_j(1 \quad {}^{n}_{ij}) \quad q_i(c+t)$	X^n_{ij}	2
$p_i(1 \quad {}^{m}_{ii}) \quad q_i c$	X^m_{ii}	2
$p_j(1 \quad {}^{m}_{ij}) \quad q_j c$	X^m_{ij}	2
$p^k_{FCi} \quad FC^k$		

matrix,[20] columns display the activities of both production and consumption, and rows display markets. *COLSUM* means that zero pro t or product exhausition conditions hold for all activities as each of column sums is zero, and *ROWSUM* means that market clearing conditions hold for all markets as each of row sums is zero.

Table 6: Calibration of the model at the center of the Edgeworth box

	Production								Consumption			
	YI	YJ	XMI	XMJ	NMI	NMJ	WI	WJ	CONSI	CONSJ	ENTM	ROWSUM
CYI	100						-100					0
CYJ		100						-100				0
CXI			100				-130		30			0
CXJ				100				-130		30		0
FCM					20	20					-40	

simulation results.

First, consider the impacts of a difference in relative labor endowments. All figures in this paper commonly shows that a large divergence in relative labor endowments discourages the existence national rms.

A.3 Summary Statistics and Correlation Matrix

Table 7 and Table 8 provide summary statistics and correlation matrix on main estimation analysis, respectively.

Table 7: Summary statistics

Variable	Observations	Mean	Standard Error	Minimum	Maximum
ROFDI	588	246.80	688.83	0	5748.28
L.ROFDI	580	221.05	641.25	0	5748.28
Sum GDP	684	2011569	1939941	856614	1.46e+07

Table 8: Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) ROFDI	1.00												
(2) L.ROFDI	0.80	1.00											
(3) Sum GDP	0.68	0.67	1.00										
(4) GDP Di Sq	0.65	0.64	0.91	1.00									
(5) HC Di	-0.13	-0.13	-0.19	-0.24	1.00								
(6) GDP Di HC Di	-0.14	-0.16	-0.03	0.26	-0.14	1.00							
(7) Host Investment Barriers	0.01	0.05	-0.09	-0.01	0.28	-0.11	1.00						
(8) Home Trade Costs	-0.05	0.03	-0.03	-0.01	-0.02	-0.02	-0.06	1.00					
(9) Host Trade Costs	-0.08	-0.06	-0.03	-0.07	0.50	-0.04	0.66	-0.04	1.00				
(10) HC Di Sq Host Trade Costs	-0.06	-0.05	-0.03	-0.07	0.87	-0.04	0.31	-0.01	0.56	1.00			
(11) Sum GDPPC	0.17	0.15	0.18	0.19	-0.59	0.12	-0.38	-0.10	-0.69	-0.57	1.00		
(12) GDPPC Di Sq	0.03	0.03	0.01	0.07	0.27	0.09	0.06	-0.07	0.13	0.27	0.18	1.00	
(13) GDPPC Di HC Di	0.01	0.02	0.06	0.04	0.75	-0.02	0.42	-0.04	0.64	0.88	-0.76	0.11	1.00