Welfare Impacts of Cross-border M&A and Optimal Policy Measures

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Abstract: This paper examines the welfare effects of various types of FDI resulting from economic integration especially comparing the welfare effects of greenfield FDI and cross-border M&A among asymmetric economies. Traditionally, greenfield FDI has been preferred by developing host countries while recent researches show that cross-border M&A also has strong welfare improving effects. We demonstrate that country asymmetries in terms of technologies and market sizes among integrating countries explains why greenfield investments are preferred to cross-border acquisitions in the East Asian economies. More specifically, when the host country has comparative advantage in production factor cost or market size, vertical greenfield FDI is the optimal investment regime while cross-border M&A might be the optimal policies in the adverse case as widely observed in recent FDI features of South Korea and China.

JEL Classification: F13, F12, F11
Key words: cross-border M&A, Greenfield direct investment, regional integration, technology transfer

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I. Introduction

A major driving force for the upsurge of preferential trade arrangements in the East Asian economies, especially from the perspective of Korea, is the expectation that FTA arrangement will increase FDI inflows into the integrated region. After the liquidity crisis of Asian region in the late 1990s, foreign capital inflows have been regarded as another engine for the sustainable economic growth. However, the majority of capital inflows after the liquidity crisis took the form of cross-border M&A rather than the greenfield investment. For example, in the second quarter of 2006, the share of the cross-border M&A in total FDI inflows into Korea reached 67%, and the growth rate of the cross-border M&A reached 500.6% while green-field investment decreased by 29.6%.

However, quite a few cases of cross-border M&As by the western private equity funds have been criticized as speculative funds seeking only the arbitrage profits with no value-adding contribution such as the technology transfer or new investment for technological innovation. One recent anecdotal example is the case of a Korean car producer, Ssangyong motors, which was merged by a Chinese car producer, Shanghai Motors in 2004. In mid 2006, the labor union of Ssangyong Motors went into a serious strike criticizing that the Chinese investor has made little investment after the merge, and just tries to take out the technologies developed by Ssangyong motors to China. The labor union became suspicious about the Chinese investor’s strategy that the company might close the production line of the merged firm after they take all available technologies from it.

As shown in the example, FDI inflows have different impacts on the host countries depending on the types of FDI such as greenfield FDI or cross-border M&A based on two different motivation of FDI, i.e., market access motivation via horizontal FDI or cost reduction motivation via vertical FDI. According to a traditional view on the welfare impacts of each different types of FDI, greenfield FDI is expected to increase the capital formation and productivity of host countries, while cross-border M&A is expected not to increase host country’s capital formation or productivity, but to transfer host country’s income to foreign countries. This traditional view on the role of the cross-border M&A is consistent with the recent Korean attitude towards the western

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1 MOCIE, Statistics on FDI Inflows into Korea Statistics on FDI Inflows into Korea, 2006.
2 Refer to ‘Korea Times’ (August 28, 2006) for the detailed description about the case.
private equity funds that merged many Korean firms suffering from liquidity mismatches. In addition, there are increasing concerns against the cross-border M&A not only from industrial nationalism, but also from welfare consideration focusing on the technology transfer effects and the resulted cost reduction effects due to FDI inflows.

The purpose of this paper is to examine the impacts of the regional integration on FDI structures especially focusing on its impacts on the choice of FDI mode among greenfield direct investment and cross-border M&A. Moreover, based on the analysis of the change in FDI structures after the regional integration, this paper aims to examine the impacts of regional integration on the investment for technology innovation of industries with the technology transfer effects and resulting welfare effects.

There are a few literatures on the impacts FTA formation on FDI structures, and the welfare impacts of cross-border M&A and direct investment. Norback and Persson (2005) provide an interesting evaluation of the impacts of cross-border M&A on the host economies. They identify an asset complementary effect, which implies that the acquisition price is substantially higher than the domestic seller’s profit. In addition, they show that the merging MNE must be sufficiently efficient, and therefore, restricting cross-border M&As may deteriorate consumer surplus of the host country. These arguments were based on the assumption that the bidding market of cross-border M&A is a competitive market with intense competition among the prospective mergers. However, in most cases of cross-border M&As occurred since the liquidity crisis in the East Asian countries, especially in Korea, the western mergers have played significant market power in the bidding process, which is contrary to the assumption of Norback and Persson (2005).

Moreover, based on a two country model of oligopoly in general equilibrium, Neary (2005) examines how changes in market structure accompany the process of trade and capital market liberalization, and shows that trade liberalization can trigger international merger waves, in the process encouraging countries to specialize and trade more in accordance with comparative advantage. In addition, Eicher & Kang (2005) examine multinationals’ optimal entry modes into foreign markets as a function of market size, FDI fixed costs, tariffs and transport cost. They demonstrate that large countries are more likely to attract acquisition investment, while intermediate sized countries may be served predominantly through trade even in the presence of high
tariffs. Small countries are most likely to experience either FDI or no entry while these results may vary with the competition intensity in the host country.\(^3\)

While earlier studies examined the optimal FDI modes considering different market conditions and policy shocks, they do not consider the impacts of asymmetric technologies and market sizes on choice of M&A and greenfield investment. Based on these backgrounds, this paper examines whether the traditional negative view on the cross-border M&A as shown in the case of Ssangyong Motors is a grounded argument or a groundless one through a welfare analysis of cross-border M&A in comparison with greenfield FDI after a regional integration. Especially, to reflect the sharp asymmetry in the technology levels of the East Asian countries, the analytical model of this paper assumes the technology asymmetry and market size asymmetries among the integrating countries.

Through the oligopoly model analysis, it is found that when the host country has the comparative advantage in marginal production cost and market size, vertical greenfield investment is the optimal strategy for a multinational corporation in non-member countries, while horizontal cross-border M&A provides the lowest profit level. When host country shows comparative disadvantage in the marginal production cost and market size, horizontal cross-border M&A might be a dominant strategy. This latter result provides a theoretical clue to understand the recent trends of FDI in Korea and China. Moreover, we demonstrate that the social welfare level of the host country under vertical greenfield FDI is higher than the case under cross-border M&A.

This paper is structured as follows. Section 2 discusses the features of the analytical model structure, and section 3 examines the equilibrium when greenfield FDI is an optimal strategy against cross-border M&A after FTA formation. Section 4 determines the welfare impacts of two types of greenfield FDI versus cross-border M&A focusing on technology transfer effects, and section 5 concludes.

\(^3\) Raff (2004) and Yeaple (2003) discuss the strategic choice between different regimes of FDI while Gao (2005) examines the developmental implication of FDI flows after the economic integration. In addition, Kim (2007) examines the asymmetric FDI inflows among intra and inter-bloc FDI after regional integration without considering the welfare implication discussed in this paper.
2. The model

We assume that there are 3 countries, \( h \), \( m \) and \( l \), with asymmetric technologies and asymmetric market sizes. Each country has one representative firm, and the representative firm in country \( l \) has the lowest marginal production cost level, while firm \( h \)’s marginal cost is highest: \( c_i < c_m < c_l \). There are two types of fixed cost, i.e., a firm specific fixed cost, and a plant specific fixed cost. The firm specific fixed cost of each country, i.e., a fixed cost of headquarter services such as the cost involved with R&D process and other technology intensive headquarter services, is assumed to be in adverse direction: \( F_i > F_m > F_h \).

However, the plant specific fixed cost, which involves the fixed costs of setting up production plants and assembly lines and other physical costs at the setting up stage, is assumed to be in the same line as the marginal production cost: \( G_i < G_m < G_h \). In terms of market sizes, country \( h \) is largest while country \( m \) is smallest: \( a_m < a_i < a_h \). Each firm produces products not only for the domestic market, but for two foreign markets. Each firm can enter into foreign markets by exporting or through foreign direct investment while competing in Cournot fashion.

There are two motivations of foreign direct investment, i.e., to improve the market access chances and to reduce the production cost. Market access chances can be enhanced through horizontal FDI by jumping over the trade barriers, and global production cost can be reduced through vertical FDI by locating each production process at a country with the cheapest production factor cost.

In addition to the two motivation of FDI, there are two modes of FDI such as cross-border M&A and new greenfield investment. Greenfield investment is a new investment involving additional plant specific fixed cost in building new plant, while cross-border M&A is an investment on already existing plant by purchasing the majority share of the existing plant at a negotiated price.

When firm \( h \) chooses to enter market \( l \) by cross-border M&A of firm \( l \), the competition in all three markets is reduced. The cost of M&A is the purchasing price of the existing firm, which is equivalent to the profit level which firm \( l \) can obtain when firm \( h \) enter the market by choosing greenfield investment. When firm \( h \) chooses to enter market \( l \) by setting up its affiliate by greenfield investment, it will incur the plant

\[ 4 \] The assumptions of the model try to describe the East Asian economies such as Korea having the intermediate level of technology compared to Japan and China while the domestic market size is smallest.

\[ 5 \] In this paper, horizontal FDI to enhance foreign market access chances, is characterized by the local sales only by affiliates. In addition, vertical FDI, which targets to reduce the global production cost is characterized by fragmentation including the re-exports of the finished goods to the home country.
specific cost, $G_l$. In both cases of direct investment, the sales in the country $l$ will not incur the trade cost and transaction cost. Moreover, the basic production marginal cost will be the cost of host country, $c_l$. The technology level will be reflected in the firm specific fixed cost, while production factor cost is reflected in the marginal cost.

In both countries, the technology transfer cost is: $C(k) = \frac{v k^2}{2}$ where $k$ is the level of transferred technology, and $v = \frac{\partial^2 C}{\partial k^2}$ determines the convexity of the cost of technology transfer.\(^6\)

i) The cost of firm $h$ when firm $h$ chooses horizontal greenfield investment in country $l$:

$$F_h + c_h x_h + G_h + G_l + (c_i - k) x_{hl} + (c_i + t_m - k) x_{hm} + vk^2 / 2$$

where the $F_h$ is the firm specific fixed cost, while $G_l$ is the plant specific fixed cost, and $x_{hl}$ represents the outputs of firm $h$ sold in market $l$.

ii) The cost function of firm $h$ when it chooses horizontal M&A in country $l$:

$$F_h + G_h + c_h x_h + (c_i - k_m) x_{hl} + (c_i + t_m - k_m) x_{hm} + vk^2 / 2 + \mu$$

where $\mu$ is the payment for the purchase of firm $l$.

In this case, the number of firms competing in all three markets will be two. Moreover, the amount of the payment for the purchase of firm $l$ would be the maximum profit that firm $l$ can make with firm $h$’s entry with greenfield investment.

iii) The cost of firm $h$ when firm $h$ chooses vertical greenfield investment in country $l$:

$$F_h + (c_i + t_h - k) x_h + G_l + (c_i - k) x_{hl} + (c_i + t_m - k) x_{hm} + vk^2 / 2$$

where the $F_h$ is the firm specific fixed cost, while $G_l$ is the plant specific fixed cost.

iv) The cost of firm $h$ when it chooses vertical M&A in country $l$:

\(^6\) The level of transferred technology, $k$, can be regarded as equivalent to the investment level for technology innovation, and ‘$v$’ can be interpreted as the investment cost for technology innovation.

\(^7\) Markusen (2003) and Navaretti and Venables (2004) provide classic definition of horizontal FDI and vertical FDI as follows: “Horizontal direct investment refers to the foreign production of products and services roughly similar to those the firm produces for its home markets. Vertical investment refers to those that geographically fragment the production by stages of production. By horizontal FDI, we refer to firms producing roughly the same final products in multiple countries even though foreign plants are supplied with headquarters services. Vertical firms generally produce outputs not produced by the parent-country operation. A parent firm may ship designs and/or intermediate inputs to a foreign assembly plants and export the final output back to the parent country market.”

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\[ F_h + (c_i + t - k)x_h + (c_i - k)x_{hl} + (c_i + t_m - k_m)x_{hm} + vk^2 / 2 + \mu \]

The consumer preference in each market is assumed to be symmetric with the inverse demand function in country \( m \) given as: \( P_m = a_m - b_m (x_m + x_{hm} + x_{lm}) \).

The structure of game is as follows: In the first stage, the government of each country decides its trade policy including its tariff rate and arranging preferential trade agreement in the form of free trade agreement. In the next stage, each representative firm observes the government policies and makes the decision on market entry mode such as FDI types and makes its decision on investment for innovation and then on output level competing in each market with 2 other countries’ firms in Cournot fashion. In the choice of entry mode, a firm has to choose between ‘Cross-border M&A’ and ‘Greenfield Investment’ in each different motivation for FDI such as horizontal and vertical FDI. After the choice of entry mode, it has to decide its optimal level of investment for technology innovation and output level.

In this sequential game with perfect information, equilibrium is obtained through backward induction. First, we determine the optimal output and investment level for technology innovation. Then, by substituting these values of firms’ decision into the social welfare function, we derive the optimal policy measures of government because government can expect the firms’ response to its policy measure as a first mover. We determine the welfare level of each different types of entry mode, and the optimal FDI strategies and dominant policies are obtained by equilibrium dominance rule.\(^8\)

3. FDI strategies after FTA formation: Greenfield FDI or Cross-border M&A?

When country \( l \) and \( m \) form FTA and firm \( h \) from a non-member country enters the integrated market through FDI in country \( l \), firm \( h \) has to decide the mode of FDI between ‘Cross-border M&A’ and ‘Greenfield Investment’ in each motivation of FDI such as horizontal FDI and vertical FDI. There are four types of possible equilibria as follows:

i) When firm \( h \) chooses horizontal greenfield investment in country \( l \)
ii) When firm \( h \) chooses horizontal M&A in country \( l \)

\(^8\) It will be shown that the difference in the welfare effects of different modes of FDI under regional integration stems from the different levels of investment for technology innovation.
iii) When firm $h$ chooses vertical greenfield investment in country $l$

iv) When firm $h$ chooses vertical M&A in country $l$

The equilibrium FDI mode can be found through equilibrium dominance analysis, and the in case can be determined by backward induction. The profit functions of firm $h$, $l$, and $m$ when firm $h$ invests in country $l$ through horizontal FDI with greenfield investment mode under FTA regime are defined as follows:

\[
\prod_h^{FTA}(HGI_h^l) = (p_h - c_h)x_h + (p_m - c_l - k)x_{hm} + (p_l - c_l - k)x_{ml} - G_h - G_l - F_h - \frac{v}{k^2}/2
\]

\[
\prod_l^{FTA}(HGI_l^h) = (p_l - c_l)x_l + (p_m - c_l)x_{lm} + (p_h - c_l - t_h)x_{hl} - G_l - F_l
\]

\[
\prod_m^{FTA}(HGI_m^h) = (p_m - c_m)x_m + (p_l - c_m)x_{ml} + (p_h - c_m - t_h)x_{mh} - G_m - F_m
\]

The social welfare function is defined as summation of surplus of each sector, such as consumer surplus, producer surplus, and government surplus as follows:

\[
SW_h(FDI_l) = CS_h + PS_h + GS_h
\]

\[
= \int_{x^*_h}^{x^*_h + x^*_m} p_h(x_h, x_{lh}, x_{mh})dx - p_h^*(x^*_h + x^*_l + x^*_m) + \prod_l^{FTA} HGI_{l}^h + t_h(x_{lh} + x_{mh}) \quad (3)
\]

Each firm produces three types of outputs, a product for domestic market, and two types of products for two foreign markets. The equilibrium in each market is derived from backward induction. By solving the profit maximization problem of each firm in each market, we obtain the following equilibrium outputs in market $h$ for example:

\[
x_h^{FTA}(HGI_l^h) = \frac{a_h - 3c_h + c_l + c_m + 2t_h}{4}, \quad x_{lh}^{FTA}(HGI_l^h) = \frac{a_h + c_h - 3c_l + c_m - 2t_h}{4}
\]

\[
x_{mh}^{FTA}(HGI_l^h) = \frac{a_h + c_h + c_l - 3c_m - 2t_h}{4}
\]

Firm $h$ decides its optimal level of technology transfer with the greenfield investment to maximize its profit as follows:

\[
\text{Max} \prod_h^{FTA}(HGI_h^l)
\]

f.o.c.: \[ \frac{\partial \prod_h^{FTA}(HGI_h^l)}{\partial k} = 0 \Rightarrow k^*(HGI_h^l) = \frac{3(a_l + a_m - 4c_l + 2c_m)}{8v - 18} \]
Substituting these equilibrium outputs into social welfare functions, and solving for country $h$’s social welfare maximization problem, the following optimal tariff rate is derived:

$$t_h^{FTA}(HGI_h^b) = \frac{3a_h - c_h - c_l - c_m}{10}.$$ Then, substituting the optimal tariff rate into the output functions of each firm in country $h$, we obtain the final equilibrium value of each firm’s outputs as follows:

$$x_h^{FTA}(HGI_h^b) = \frac{2a_h - 4c_h + c_l + c_m}{5}, \quad x_{ih}^{FTA}(HGI_i^b) = \frac{a_h + 3c_h - 7c_l + 3c_m}{10},$$

$$x_{mh}^{FTA}(HGI_m^b) = \frac{a_h + 3c_h + 3c_l - 7c_m}{10}.$$

In the same way, we can obtain the equilibrium outputs of each firm in each market. Then, based on these equilibrium values, we obtain the equilibrium profits of firm $h$ as follows:

$$\prod_h^{FTA}(HGI_h^b) = \prod_h^{FTA}(HGI_h^b) = \left\{ \begin{array}{l}
\frac{1}{16} (-16b - 16ch - 16Gl + (al - 2cl + cm + 3k)^2 + (am - 2cl + cm + 3k)^2 + (ah - 3ch + cl + cm + 2th)^2 - 8k^2v)
\end{array} \right\}$$

When we substitute the optimal level of technology transfer, the optimal tariff, and the optimal outputs into the profit function, we obtain the following equilibrium profit levels:

$$\prod_h^{FTA}(HGI_h^b) = \frac{1}{16} (2ah - 4cl + 3cm)^2 - 16b - 16ch - 16Gl - 18 (al + am - 4cl + 2cm)^2 v (9 - 4v^2) + (al - 2cl + cm + \frac{9(al + am - 4cl + 2cm)}{-18 + 8v})^2 + (am - 2cl + cm + \frac{9(al + am - 4cl + 2cm)}{-18 + 8v})^2$$

$$\prod_m^{FTA}(HGI_m^b) = \frac{1}{25} (4ch - 3cl - 7cm - 16Fl - 16Gl + (al - 2cl + cm + \frac{3al + am - 4cl + 2cm}{-18 + 8v})^2 + (am - 2cl + cm + \frac{3al + am - 4cl + 2cm}{-18 + 8v})^2$$

$$\prod_m^{FTA}(HGI_m^b) = \frac{1}{25} (4ch - 3cl - 7cm - 4Fl - 4Gl + \frac{1}{4} (al - 2cl - 3cm + \frac{3al + am - 4cl + 2cm}{-18 + 8v})^2 + \frac{1}{4} (am - 2cl - 3cm + \frac{3al + am - 4cl + 2cm}{-18 + 8v})^2$$

Firm $h$’s strategy to invest in country $l$ through horizontal FDI with greenfield investment (GI) under FTA between country $l$ and $m$ is an equilibrium strategy when the following conditions are held:

i) $\prod_h^{FTA}(HGI_h^b) \geq \prod_h^{FTA}(HMA_h^b)$: Condition for firm $h$ has no incentive to deviate from horizontal greenfield investment to horizontal M&A in country $l$.  

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ii) $\prod_{h}^{FTA}(HGI_{h}^{b}) \geq \prod_{h}^{FTA}(VGI_{h}^{b})$: Condition for firm $h$ has no incentive to deviate from horizontal greenfield investment to vertical greenfield investment in country $l$.

The equilibrium under cross-borer M&A

When firm $h$ merges firm $l$, firm $h$ does not export to country $l$ and country $h$’s objective is to maximize the joint-profit function of firm $h$ and $l$ as follows:

$$\prod_{h}^{FTA}(HMA_{h}^{b}) = (p_{h} - c_{h})x_{h} + (p_{m} - c_{i} - k)x_{hm} + (p_{i} - c_{i} - k)x_{hi} - G_{h} - F_{h} - \mu_{h}^{h} - vk^{2}/2$$

where $\mu_{h}^{h}$ is the payment to merge firm $l$, that is equivalent to the market value of firm $l$ when firm $h$ enters with greenfield investment and $vk^{2}/2$ is the cost of technology transfer to reduce the marginal cost by $k$. As a result, the operating firms with the M&A are two firms, firm $h$ and firm $m$ because firm $l$ has been merged by firm $h$.

Then, the profit function of firm $m$ is as follows:

$$\prod_{m}^{FTA}(HM & A_{m}^{h}) = (p_{m} - c_{m})x_{m} + (p_{i} - c_{i})x_{ml} + (p_{h} - c_{h} - t_{h}x_{mh} - G_{m} - F_{m}$$

The inverse demand function in each market when $h$ merges $l$ is as follows:

$$P_{h} = a_{h} - b_{h}(x_{h} + x_{mh})$$
$$P_{m} = a_{m} - b_{m}(x_{m} + x_{hm})$$
$$P_{i} = a_{i} - b_{i}(x_{i} + x_{mi})$$

The best response function of each firm in each market is derived as follows:

$$x_{h}^{FTA}(HMA_{h}^{b}) = \frac{a_{h} - 2c_{h} + c_{m} + t_{h}}{3},$$
$$x_{mh}^{FTA}(HMA_{h}^{b}) = \frac{a_{h} + c_{m} - 2c_{h} - 2t_{h}}{3}$$

Then, substituting these equilibrium outputs into social welfare functions, and solving for country $h$’s social welfare maximization problem, the following optimal tariff rate is derived: $t_{h}^{FTA}(HMA_{h}^{b})^{*} = \frac{a_{h} - c_{m}}{3}$.

When we substitute the optimal tariff rate into the output functions of each firm in country $h$, the equilibrium values of each firm’s outputs are derived as follows:

$$x_{h}^{FTA}(HMA_{h}^{b}) = \frac{2(2a_{h} - 3c_{h} + c_{m})}{9},$$
$$x_{mh}^{FTA}(HMA_{h}^{b}) = \frac{a_{h} + 3c_{h} - 4c_{m}}{9}$$

Then, the equilibrium profit of firm $h$ is derived as follows:
\[
\prod_{h}^{FTA} (HMA_{h}^{b}) =
\frac{1}{6} \left( -6F - 6Gh + \frac{2}{3} (a_l - 2c_l + cm + 2k)^2 + \frac{2}{3} (am - 2c_l + cm + th)^2 + \frac{2}{3} (ah - 2c_l + cm + th)^2 - 6u - 3k^2 v \right)
\]

Firm \( h \) decides its optimal level of technology transfer with the cross-border M&A to maximize its profit as follows:

\[
\max \prod_{h}^{FTA} (HMA_{h}^{b})
\]

f.o.c.: \[ \frac{\partial \prod_{h}^{FTA} (HMA_{h}^{b})}{\partial k} = 0 \]

\[ k^* (HMA_{h}^{b}) = 4(a_i + a_m - 4c_l + 2c_m) \]

\[
\text{When we compare the investment level for technology innovation under greenfield investment and the cross-border M&A, it turns out that the investment level for technology innovation under greenfield investment is always higher than the cross-border M&A case as follows:}
\[
\frac{(al + am - 4 cl + 2 cm) (-24 + 5 v)}{288 - 290 v + 72 v^2} < 0 \text{ when } v < 4.8
\]

Above results can be summarized in Proposition 1:

**Proposition 1.** When an inter-bloc FDI takes the form of horizontal cross-border M&A rather than horizontal green-field investment, the investment level for technology innovation by the multinational corporation which chose M&A is lower than the case that chose green-field investment. Consequently, the marginal production cost and the resulted price level of the product under horizontal green-field investment is lower than that under horizontal cross-border M&A.

Economic intuition behind this result is as follows. Cross-border M&A in oligopoly industries reduces market competition, and therefore, it is not required for a multinational firm to exert expensive efforts for technology innovation. However, when a multinational firm enters an integrated market by choosing greenfield investment, it is required for the MNC to make further efforts for technology innovation to obtain cost competitiveness with the increased market competition in the integrated market.

When we substitute the optimal level of technology transfer into the profit function, we obtain the following equilibrium profit level:

\[
\prod_{h}^{FTA} (HMA_{h}^{b}) =
\frac{1}{6} \left( \frac{8}{27} \left( 2ah - 3c_l + cm - 6F - 6Gh \right) + \frac{48 (al + am - 4cl + 2cm)^2 v}{(16 - 9v)^2} \right)
\]

\[ + \frac{2}{3} \left( \frac{8 (al + am - 4cl + 2cm)}{-16 - 9v} \right)^2 + \frac{2}{3} \left( am - 2cl + cm - \frac{8 (al + am - 4cl + 2cm)}{-16 - 9v} \right)^2 \]

\[ + \frac{3}{8} \left( \frac{8 (ah - 3c_l + cm - 16F - 16Gh) (al - 2cl + cm - \frac{3 (al + am - 4cl + 2cm)}{-18 + 8v})^2}{(am - 2cl + cm - \frac{3 (al + am - 4cl + 2cm)}{-16 + 9v})^2} \right) \]
If the following condition holds, greenfield investment is an equilibrium dominant strategy for a multinational firm to enter integrated markets:

\[
\prod_{ft}^{FTI}(HGI^l) - \prod_{ft}^{FTI}(HMA^l) \geq 0
\]

\[
\begin{align*}
\frac{1}{16} & \frac{16}{25} (2ah-4cl+cm^2-16gl-16cl-16hl-16h) \nonumber \\
& \times \left( \frac{8}{6} \left( \frac{1}{6} \frac{(ah-3cl+cm^2+6hl+6h)}{(hl-3cl+cm^2)} - \frac{2}{3} \left( \frac{8}{6} \frac{(ah-3cl+cm^2)}{(hl-3cl+cm^2)} \right)^2 \right) + \right. \\
& \left. \frac{3}{4} \left( \frac{4}{25} (ah-3cl+cm^2-16hl-16cl+ \left( \frac{3}{2} \frac{(ah-3cl+cm^2)}{(hl-3cl+cm^2)} \right)^2 + \left( \frac{3}{2} \frac{(ah-3cl+cm^2)}{(hl-3cl+cm^2)} \right)^3 \right) \right) \geq 0
\end{align*}
\]

< Figure 1 > The impacts of country asymmetry on the preference of greenfield investment over M&A in inter-bloc FDI

The above results are summarized in proposition 2.

**Proposition 2:** When the host country’s market size is larger and the host country’s marginal cost advantage is larger, horizontal greenfield investment in country \( l \) is a dominant FDI strategy compared to the horizontal cross-border M&A strategy.

Economic intuition behind this result lies in the fact that as the market size of the host country is larger, greenfield investment, which involves a higher technology investment, provides a higher profit than the cross-border M&A, which induces relatively lower technology transfer compared to the greenfield investment. Moreover, when the marginal cost advantage of the host country is larger, greenfield investment becomes a dominant strategy compared to cross-border M&A.
Now, we examine the impact of the plant specific fixed cost and the MNC’s technology transfer cost on the multinational firm’s choice of FDI strategy into the integrated market. Through the comparative static analysis, it is shown that when the plant specific cost and the technology transfer cost is relatively high, horizontal cross-border M&A strategy is a welfare-dominant strategy against horizontal greenfield investment. On the other hand, when host country’s cost to learn a new technology is relatively high, and the host country’s plant specific cost is high, horizontal cross-border M&A is a dominant investment strategy as shown in figure 2.

< Figure 2 > The impacts of host country’s plant specific fixed cost and the technology transfer cost on the preference of greenfield investment over M&A in inter-bloc FDI

\[
\Pi_h^{TFA}(HGI_h^h) - \Pi_h^{TFA}(HMA_h^h)
\]

\(G_i^h\): host country’s plant specific cost

The above results are summarized in Proposition 3.

**Proposition 3.** The cross-border M&A is a welfare dominant strategy when the host country’s plant specific cost is relatively large and the technology transfer cost is relatively high.

The intuition behind this result is that when the cost of technology transfer is relatively high, the choice of cross-border M&A involves relatively lower costs compared to the choice of greenfield FDI because M&A involves lower technology transfer and does not incur plant specific fixed costs.
4. Equilibrium and welfare impacts of two types of Greenfield FDI after FTA

The second condition for the equilibrium dominance of the inter-bloc horizontal greenfield investment strategy is satisfied when firm $h$ has no incentive to deviate to the vertical greenfield investment as follows:

$$\prod_{h}^{FTA} (HGI^h) - \prod_{h}^{FTA} (VGI^h) \geq 0$$

To check the above equilibrium dominance condition, the equilibrium of the inter-bloc vertical green-field investment should be determined. Vertical green-field FDI involves the production of final products only at the affiliate plants in the host country and re-export to the home country. Therefore, the sales of the final products in the home market involve the import tariff imposed by the home government. Therefore, the profit functions of firm $h$, $l$, $m$ under inter-bloc vertical green-field FDI into country $l$ are defined as follows:

$$\prod_{h}^{FTA} (VGI^h) = (p_h - c_i + k - t_h)x_h + (p_m - c_i + k)x_{hm} + (p_l - c_i + k)x_{hl} - G_j - F_h - vk^2 / 2$$

$$\prod_{h}^{FTA} (VGI^l) = (p_j - c_i)x_l + (p_m - c_i)x_{lm} + (p_h - c_i - t_h)x_{hl} - G_j - F_j$$

$$\prod_{m}^{FTA} (VGI^m) = (p_m - c_m)x_m + (p_l - c_m)x_{ml} + (p_h - c_m - t_h)x_{mh} - G_m - F_m$$

Equilibrium is derived through backward induction as in the earlier case. By solving the profit maximization problem of each firm in each market, we obtain the following equilibrium outputs in market $h$:

$$x_{h}^{FTA} (VGI^h) = \frac{a_h - 2c_i + c_m + 3k - t_h}{4}$$

$$x_{lh}^{FTA} (VGI^h) = \frac{a_h - 2c_i + c_m - k - t_h}{4}$$

Firm $h$ decides its optimal level of technology transfer with the greenfield investment to maximize its profit as follows:

$$\text{Max}_{k} \prod_{h}^{FTA} (VGI^h)$$

f.o.c.: $$\frac{\partial}{\partial k} \prod_{h}^{FTA} (VGI^h) = k \ast (VGI^h) = \frac{3(a_h + a_l + a_m - 6c_i + 3c_m - t_h)}{8y - 27}$$

Government $h$ decides the optimal trade policies to maximize the social welfare expecting the firms’ investment level and the output level. The optimal trade policy is derived from the first order condition of social welfare maximization problem as follows:
When the optimal tariff level of home country under vertical greenfield FDI is compared with that under horizontal greenfield FDI, it is found that the import tariff is lower under vertical greenfield FDI as shown in figure 3:

\[
t_h^*(VGI) = \frac{42ah + 15al + 15am - 36cl - 36cm - 8ahv - 16clv + 24cmv}{366 - 104v}
\]

Proposition 4. Under the vertical greenfield investment, country \( h \) has an incentive to impose lower tariffs because the lower import tariff improves the social welfare with the increase in producer surplus of country \( h \) under the fragmented production process dominating the loss in the government surplus.

The intuition behind this result is that when country \( h \) lowers her import tariffs on the commodity imported from the affiliate plants in the host country, not only the consumer surplus of country \( h \) improves with the lowered imported price, but also the producer surplus of headquarter company in country \( h \) improves with the sales increase of its affiliate firm. The increase in the consumer surplus and producer surplus through the tariff reduction is dominant to the loss in the government tariff revenue. In other words, fragmentation of the production process facilitates the further reduction of tariff barriers.
When we substitute the equilibrium tariff rate, we obtain the following equilibrium value of technology transfer under vertical greenfield FDI:

\[ k^*(VGI) = \frac{3(12ah + 13al + 13am - 80cl + 42cm)}{-366 + 104v} \]

By comparing the level of optimal technology transfer under horizontal greenfield FDI and vertical greenfield FDI, it is found that vertical greenfield FDI provides a higher level of technology transfer regardless of marginal cost difference between the integrating countries and the market size asymmetry between the home and host markets as shown in the follows:

\[ k^*(HGI) - k^*(VGI) = \frac{3(12ah + 13al + 13am - 80cl + 42cm)}{366 - 104v} + \frac{3(al + am - 4cl + 2cm)}{-18 + 8v} < 0 \]

Comparative static analysis of the difference in the technology transfer level with respect to production factor cost difference and technology transfer cost shows that vertical greenfield FDI provides a higher level of technology investment as shown in figure 4.

< Figure 4 > The impacts of marginal cost difference and technology transfer cost on the technology transfer under vertical and horizontal greenfield investment

When we check the impacts of the market size asymmetry between the host country and the home market on the level of technology transfer under horizontal greenfield FDI and vertical greenfield FDI, it is shown that vertical greenfield FDI
provides a higher level of technology transfer in the whole range of market size differences as shown in figure 5.

<Figure 5> The impacts of market size asymmetry and $v$ on innovation investment

Above results are summarized in proposition 5.

**Proposition 5.** The investment for technology innovation is higher under vertical greenfield FDI than the case under horizontal greenfield FDI regardless of the cost differences among the integrated countries, and market size asymmetry between the host country and the home country.

Under vertical greenfield FDI, the productions level by the affiliate plant in the host country is higher than that under horizontal greenfield FDI because the affiliate’s output is re-exported to the home market. Therefore, there is more incentive for technology transfer and innovation investment for affiliate plant under vertical greenfield FDI.

The choice of horizontal greenfield FDI is the equilibrium strategy when the second condition for the equilibrium dominance holds as follows:

$$
\prod_{h}^{FTA} (HGL^h) - \prod_{h}^{FTA} (VGL^h) \geq 0
$$

When we substitute the equilibrium values of outputs, technology transfer level, and the optimal tariffs into the equilibrium dominance condition, we obtain the following:
When we check the impacts of marginal cost difference and plant specific fixed cost on the FDI strategy, it is shown that vertical shown that vertical greenfield investment is a dominant strategy compared to horizontal greenfield investment when the host country has the advantage in the production factor cost and plant specific fixed cost as shown in figure 6.

< Figure 6 > The equilibrium FDI strategy when MNC chooses greenfield investment

The above results are summarized in proposition 6.

**Proposition 6.** When a MNC chooses greenfield investment, fragmentation strategy through the vertical greenfield FDI is the dominant strategy compared to the horizontal greenfield investment when the host country has advantage in marginal costs and plant specific costs compared to those of the home country.
When the host country has the advantage in the marginal production cost and the plan specific fixed cost, vertical greenfield investment is a dominant strategy because the total production cost is reduced further by choosing vertical greenfield investment through the increased production in the foreign plants with the lower production factor cost in addition to the lower plant specific cost.

**Summary of the Equilibrium FDI strategy**

When the host country has a comparative advantage in marginal production cost and market size is relatively large, vertical greenfield investment is the first best strategy, followed by the horizontal greenfield FDI, while the horizontal M&A is the worst case. The rationale behind this result is that when the host country’s market size is relatively large with the cost advantage, a MNC can increase its profit by choosing vertical greenfield investment because the vertical greenfield investment involves the highest investment in technology innovation with the higher returns from the investment.

When the market size of the host country is relatively large with a cost advantage, horizontal M&A is the FDI mode for MNC which provides the lowest profit because it involves the least investment for technology innovation resulting in the least returns even with the reduced competition after M&A. However, when the host country’s market size is relatively small, and the marginal cost advantage is lower, horizontal M&A is welfare dominant strategy for a MNC.

**The welfare effects of different FDI inflows**

Finally, the impact of the multinational firm’s FDI strategy on the social welfare of host country is examined. By checking the equilibrium dominance condition between the social welfare under horizontal greenfield FDI, vertical greenfield FDI, and horizontal cross-border M&A, we can determine the equilibrium dominant FDI regime from the perspective of the host country. When we substitute the equilibrium values of each strategic variable into the equilibrium dominance condition, it is found that social welfare under vertical greenfield investment is dominant to that under horizontal vertical greenfield investment as shown in figure 7.
The above result is summarized in the following proposition.

**Proposition 7.** The equilibrium with vertical greenfield FDI is the welfare dominant to that with the horizontal greenfield FDI, while the horizontal M&A provides the lowest welfare level for the host country.

The intuition behind this result is that vertical greenfield investment involves the higher investment for the technology innovation in the host country. Consequently, the social welfare level of host country is highest with the vertical greenfield investment while lowest with the horizontal M&A, which induces the lowest investment for technology innovation.
5. Policy implications and concluding remarks

We examined the optimal foreign direct investment strategy and the resulting social welfare effects considering the asymmetry in technologies and market sizes of integrating countries and non-member countries, which characterizes the regional integration in East Asia. Through the oligopoly model analysis, it is found that when the host country has the comparative advantage in marginal production cost and market size, vertical greenfield investment is the optimal strategy for a multinational corporation in non-member countries, while horizontal cross-border M&A provides the lowest profit level. When host country shows comparative disadvantage in the marginal production cost and market size, horizontal cross-border M&A might be a dominant strategy. This latter result provides a theoretical clue to understand the recent trends of FDI in Korea and China.

The investment level for technology innovation to reduce the production cost is larger in greenfield investment compared to cross-border M&A due to the increased competitive pressure under greenfield investment compared to the case of cross-border M&A. Consequently, the host country’s welfare level with the greenfield investment is higher to that with the cross-border M&A mainly due to the differentiated innovation investment level. The above results imply that it is optimal for the host country to provide policy incentives for the multinational firms to choose greenfield investment. In other words, policy incentives by host countries should support the individual rationality condition and the incentive compatibility condition for the greenfield investment by the multinational firms. The detailed studies on the policy measures and the level of the policy incentives would be the future research topics.
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