Economic Integration and FDI between Asymmetric Countries: A Welfare Analysis

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I. Motivation

Major driving force of the upsurge in FTAs arrangement in Asia, especially from the perspective of Korea is the expectation that FTA arrangement will increase FDI inflows.

FDI inflows have different impacts on the host countries depending on the types of FDI
- greenfield FDI or cross-border M&A
- horizontal FDI or vertical FDI

Traditional views 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.

The purpose of this paper is to examine the welfare effects of cross-border M&A in comparison with greenfield FDI affected by regional integration considering:
- the difference between horizontal FDI and vertical FDI
- oligopolistic industrial structures
- strategic effects of cross-border M&A and greenfield FDI
Literature Review:

Norback and Persson (2005) identifies an asset complementary effect, which imply 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.

O Neary (2005): Based on 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.
O 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.

O While earlier studies showed the optimal FDI modes reflecting different market conditions and policy shocks, they do not consider the impacts of preferential trade agreement on the choice of M&A and greenfield investment considering the types of FDI.
- This paper demonstrates how the country asymmetries in terms of technology levels and market sizes influences on the choice of cross-border M&A and greenfield FDI in the context of horizontal FDI and vertical FDI.

- Moreover, this paper examines the welfare effects of different FDI modes resulting from preferential trade agreements.
2. The Model

- Assumptions: 3 countries, $h$, $m$ and $l$, with asymmetric technologies and asymmetric market sizes.

  - $c_l < c_m < c_h$: marginal production factor cost is lowest in country $l$

  - $F_l > F_m > F_h$: Firm specific fixed cost of headquarter services, which mainly involves the R&D process and other technology intensive headquarter services of production, is assumed to be lowest in country $l$ (Country $h$ has the highest technology level)

  - $G_l < G_m < G_h$: 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
- \( a_m < a_f < a_h \): In terms of market sizes, country \( h \) is largest while country \( m \) is smallest:

- Each country has a representative firm and each firm produces products not only for domestic market, but also for two foreign markets.
- Each firm can enter into foreign markets by exporting or through foreign direct investment while competing in Cournot fashion.

- 2 motivations for Foreign Direct Investment in each type of FDI
  i) Foreign market access motivation: horizontal FDI (only local sales by affiliates)
  ii) Cost reduction motivation: vertical FDI (re-exports to the home country: Fragmentation)
2 modes of FDI:

i) Greenfield Investment: New Investment involving additional plant specific fixed cost (Gl: additional investment in building new plant)

ii) Cross-border M&A: Investment on already existing plants with the purchase the existing plant at the negotiated price.

When firm $h$ chooses to enter market $l$ with merging 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.

O When firm $h$ chooses to enter market $l$ by setting up its affiliate by greenfield investment, it will incur the plant 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 fixed cost, while production factor cost is reflected in the marginal cost.

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

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

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

ii) When firm $h$ chooses **horizontal M&A** in country $l$

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

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 \textbf{vertical greenfield investment} in country $l$:

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

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

iv) When firm $h$ chooses \textbf{vertical M&A} in country $l$

$$F_h + (c_i + t_h - k)x_h + (c_i - k)x_{hl} + (c_i + t_m - k_m)x_{hm} + v k^2 / 2 + \mu$$

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

i) 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.

ii) In next stage, each representative firm observes the government policies and make the decision on market entry mode such as FDI types and makes its decision on investment for innovation and output level competing in each market with 2 other countries’ firms in Cournot fashion.

After governments choose trade policies, firm $h$ has to choose its entry mode among cross-border M&A and greenfield 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.

Equilibrium is obtained through backward induction.

- The difference in the welfare effects of different modes of FDI resulting from regional integration stems from the different level of investment for technology innovation.
- By equilibrium dominance rule, the optimal FDI strategies and dominant policies are obtained.
3. The impacts of FTA formation on the inter-bloc FDI inflows

o When country $l$ and $m$ form FTA and firm $h$ from a non-member country enters the integrated market through FDI, firm $h$ has to decide in which country to invest and what types of FDI it has to choose.

O Eight types of possible equilibria:

i) When firm $h$ invests in country $l$ through horizontal FDI ($HFDI_l^h$), it has to decide between greenfield investment (GI) or M&A.

ii) firm $h$ invests in country $l$ through vertical FDI ($VFDI_l^h$) by GI or M&A,

iii) firm $h$ invests in country $m$ through horizontal FDI ($HFDI_m^h$) by GI or M&A,

iv) firm $h$ invests in country $m$ through vertical FDI ($VFDI_m^h$) by GI or M&A.

o The equilibrium FDI mode can be found through equilibrium dominance analysis.
First, we check the case of $HFDI_h^i$ both the case of GI and M&A. The equilibrium in case of $HFDI_h^i$ 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:

$$
\prod_{h}^{FTA} (HGI_h^l) = (p_h - c_h)x_h + (p_m - c_l - k)x_{hm} + (p_l - c_l - k)x_{hl} - G_h - G_l - F_h - vk^2 / 2
$$

$$
\prod_{l}^{FTA} (HGI_l^h) = (p_l - c_l)x_l + (p_m - c_l)x_{lm} + (p_h - c_l - t_h)x_{lh} - G_l - F_l
$$

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

The social welfare function is defined as summation of surplus of each sector, such as consumer surplus, producer surplus, and government surplus.
Each firm has three types of outputs, a product for domestic market, two types of products for two foreign markets.

The equilibrium in each market is derived from backward induction. The optimal output of each firm in each market is derived from the following first order conditions of profit maximization problem:

\[
\begin{align*}
SW_h (FDI_l) &= CS_h + PS_h + GS_h \\
&= \int_{x_h}^{x_h^*} p_h (x_h, x_{lh}, x_{mh}) \, dx - p_h^* (x_h^* + x_{lh}^* + x_{mh}^*) + \prod_{h}^{FTA} HGI_h + t_h (x_{lh} + x_{mh})
\end{align*}
\]  

(3)

\[
\begin{align*}
\frac{\partial \prod_{h}^{FTA} (HGI_h)}{\partial x_h} &= 0, & \frac{\partial \prod_{h}^{FTA} (HGI_h)}{\partial x_{hl}} &= 0, & \frac{\partial \prod_{h}^{FTA} (HGI_h)}{\partial x_{hm}} &= 0 \\
\frac{\partial \prod_{m} (HGI_m)}{\partial x_m} &= 0, & \frac{\partial \prod_{m} (HGI_m)}{\partial x_{ml}} &= 0, & \frac{\partial \prod_{m} (HGI_m)}{\partial x_{mh}} &= 0 \\
\frac{\partial \prod_{l} (HGI_l)}{\partial x_l} &= 0, & \frac{\partial \prod_{l} (HGI_l)}{\partial x_{lm}} &= 0, & \frac{\partial \prod_{l} (HGI_l)}{\partial x_{lh}} &= 0
\end{align*}
\]  

(4)
We derive the equilibrium values by 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:

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

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

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: $t_h^{FTA}(HGI_i^h)^* = \frac{3a_h - c_h - c_l - c_m}{10}$. 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:

$$x_h^{FTA}(HGI_i^h) = \frac{2a_h - 4c_h + c_l + c_m}{5}, \quad x_{lh}^{FTA}(HGI_i^h) = \frac{a_h + 3c_h - 7c_l + 3c_m}{10}, \quad x_{mh}^{FTA}(HGI_i^h) = \frac{a_h + 3c_h + 3c_l - 7c_m}{10}$$
In the same way, we can obtain the equilibrium outputs of each firm in each market. Then, based on these equilibrium values, we can obtain the equilibrium profits of firm $h$ as follows:

$$\prod_{h}^{FTA}(HGI_{i}^{h}) = \frac{1}{16}(-16F_{h}-16G_{h}-16L_{h}+(a_{l}-2c_{l}+c_{m}+3k)^2+(a_{m}-2c_{l}+c_{m}+3k)^2+(a_{h}-3c_{l}+c_{m}+2t_{h})^2-8k^2v)$$

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

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

f.o.c.: $$\frac{\partial \prod_{h}^{FTA}(HGI_{i}^{h})}{\partial k} = 0 \Rightarrow k^* (HGI_{i}^{h}) = \frac{3(a_{l} + a_{m} - 4c_{l} + 2c_{m})}{8v - 18}$$

- When $v < 9/4$, (when the technology innovation cost is relatively low, i.e., when the host country’s technology receptive capacity is relatively high), the technology innovation investment is always positive.
When we substitute the optimal level of technology transfer into the profit function, we obtain the following equilibrium profit function:

\[
\Pi_{fta}^{HGI_h} = \frac{1}{16} \left( \frac{1}{25} (2ah + 4ch + cl + cm)^2 - 16Fh - 16Gh - 16Gl - 18Hgl + am + 4cl + 2cm \right)^2 - \frac{1}{16} \left( \frac{9}{25} (al + am - 4cl + 2cm)^2 - 18Fm - 18Gm - 18Gl + 9Hm + al + 4cl + 2cm \right)^2 + \frac{1}{16} \left( \frac{1}{25} (al + am - 4cl + 2cm)^2 - 18Fm - 18Gm - 18Gl + 9Hm + al + 4cl + 2cm \right)^2
\]

\[
\Pi_{fta}^{HGI_i} = \frac{1}{16} \left( \frac{4}{25} (ah + 3ch + 7cl + 3cm)^2 - 16Fh - 16Gh - 16Gl + 18Hgl + am + 2cl + cm \right)^2 + \frac{1}{16} \left( \frac{1}{25} (ah + 3ch + 7cl + 3cm)^2 - 18Fm - 18Gm - 18Gl + 9Hm + al + 4cl + 2cm \right)^2 + \frac{1}{16} \left( \frac{1}{25} (ah + 3ch + 7cl + 3cm)^2 - 18Fm - 18Gm - 18Gl + 9Hm + al + 4cl + 2cm \right)^2
\]
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) $\prod_{h}^{FTA}(HGI_{i}^{h}) \geq \prod_{h}^{FTA}(HMA_{i}^{h})$: Condition for firm $h$ has no incentive to deviate from horizontal greenfield investment to horizontal M&A in country $l$.

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

$$\Pi^F_{h} (HMA^h_l) = (p_h - c_h)x_h + (p_m - c_l - k)x_{hm} + (p_l - c_l - k)x_{hl} - G_h - F_h - \mu^h_l - \frac{vk^2}{2}$$

$\mu^h_l$ is the payment to merge firm $l$, that is equivalent to the profit level of firm $l$ when firm $h$ enters with greenfield investment and $\frac{vk^2}{2}$ 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 to be firm $h$.

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

$$\Pi^F_{m} (HM & A^h_l) = (p_m - c_m)x_m + (p_l - c_m)x_{ml} + (p_h - c_m - t_h)x_{mh} - G_m - F_m$$
The inverse demand function in each market when $h$ merges $l$ is as follows:

$$P_h = a_h - b_h(x_h + x_{mh})$$
$$P_m = a_m - b_m(x_m + x_{hm})$$
$$P_l = a_l - b_l(x_l + x_{hl})$$

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

$$x^{FTA}_{h}(HMA^h_i) = \frac{a_h - 2c_h + c_m + t_h}{3}, \quad x^{FTA}_{mh}(HMA^h_i) = \frac{a_h + c_h - 2c_m - 2t_h}{3}$$

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:

$$t^{FTA}_{h}(HMA^h_i)^* = \frac{a_h - c_m}{3}.$$
- 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:

$$x_{h}^{FTA} (HMA_{i}^{h}) = \frac{2(2a_{h} - 3c_{h} + c_{m})}{9}, \quad x_{mh}^{FTA} (HMA_{i}^{h}) = \frac{a_{h} + 3c_{h} - 4c_{m}}{9} \quad (5)$$

- The equilibrium profits of firm $h$:

$$\prod_{h}^{FTA} (HMA_{i}^{h}) = \frac{1}{6} \left(-6F_{h} - 6G_{h} + \frac{2}{3} (a_{l} - 2c_{l} + c_{m} + 2k)^2 + \frac{2}{3} (a_{m} - 2c_{l} + c_{m} + 2k)^2 + \frac{2}{3} (ah - 2ch + cm + th)^2 - 6u - 3k^2 v \right)$$

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

$$Max \prod_{h}^{FTA} (HMA_{i}^{h})$$

f.o.c.: $\frac{\partial \prod_{h}^{FTA} (HMA_{i}^{h})}{\partial k} = 0 \quad k^{*} (HMA_{i}^{h}) = \frac{4(a_{l} + a_{m} - 4c_{l} + 2c_{m})}{9v - 16} \quad (v < 16/9)$
When we compare the level of technology transfer under the greenfield investment and the cross-border M&A, it turns out that the level of technology transfer under greenfield investment is always higher than the cross-border M&A case as follows:

\[ k^*(HMA^h_i) - k^*(HGI^h_i) = \frac{(a_1 + a_m - 4 c_1 + 2 c_m) (-24 + 5 v)}{288 - 290 v + 72 v^2} < 0 \text{ when } v < 4.8 \]

The non-negativity condition for \( k \) requires ‘\( v < 16/9 \).’ Therefore, the above inequality always holds. Above results can be summarized as follows:

**Proposition 1.** When an inter-bloc FDI takes the form of cross-border M&A rather than greenfield investment, it is more likely that the technology transfer from the multinational corporation which chose M&A is lower than the case that chose greenfield investment when the technology receptive capacity of the host country is higher than the critical value.
- Economic intuition: Cross-border M&A in oligopoly industries reduces market competition, and therefore, it is not required for a multinational firm to exert expensive efforts in technology transfer.

- However, when a multinational firm enters an integrated market by choosing greenfield investment, it is required for the MNC to make further efforts to for technology transfer 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 function:

\[
\prod_{h}^{FTA} (HMA_{i}^{h}) = \frac{1}{6} \left( \frac{8}{27} (2a_{h}-3c_{h}+\alpha)^2 -6b_{h}-6c_{h} - \frac{48 (a_{i}+\alpha\cdot 4c_{i}+2\alpha^{2}v )}{(16-9v)^2} + \frac{2}{3} \left( \frac{\alpha-2c_{i}+\alpha^{2}}{16+9v} \right)^2 \right) + \frac{2}{3} \left( \frac{\alpha-2c_{i}+\alpha^{2}}{16+9v} \right)^2 - \frac{3}{8} \left( \frac{4}{25} (2\alpha+3c_{i}-7c_{i}+3\alpha)^2 -16f_{i}-16c_{i} - \frac{3 (a_{i}+\alpha\cdot 4c_{i}+2\alpha^{2}v )}{-18+8v} + \frac{3 (a_{i}+\alpha\cdot 4c_{i}+2\alpha^{2}v )}{-18+8v} \right)^2 \right)
\]
If the following condition holds, greenfield investment is an equilibrium dominant strategy for a multinational firm to enter an integrated markets:

$$\prod_{h}^{FTA} (HGI_{i}^{h}) - \prod_{h}^{FTA} (HMA_{i}^{h}) \geq 0$$

$$\leq \frac{1}{16} \left[ \frac{16}{25} (2ah - 4ch + cl + cm)^2 - 16Ph - 16ch - 16Gl - 18(al + am + 4cl + 2cm)^2 \left( \frac{9(al + am + 4cl + 2cm)}{-18 + 8v} \right)^2 \right] +$$

$$+ \frac{1}{6} \left[ -\frac{8}{27} (2ah - 3ch + cm)^2 + 6Ph + 6ch + \frac{48(al + am + 4cl + 2cm)^2}{(16 - 9v)^2} - \frac{2}{3} (al - 2cl + cm + \frac{8(al + am + 4cl + 2cm)}{-16 + 9v})^2 \right] +$$

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

$$+ \frac{3}{8} \left[ \frac{4}{25} (3ah + 3ch - 7cl + 3cm)^2 - 16Fl - 16Gl + \left( al - 2cl + cm + \frac{3(al + am + 4cl + 2cm)}{-18 + 8v} \right)^2 \right] \geq 0$$
The impacts of country asymmetry on the preference of greenfield investment over M&A in inter-bloc FDI

\[ \prod_h^{FTA}(HGI_h) - \prod_h^{FTA}(HMA_h) \]

host country’s market size

host country’s marginal cost advantage \((c)\)

The above results can be summarized as follows:
Proposition 2: When the host country’s market size is larger and the host country’s marginal cost advantage is larger, greenfield investment in country $l$ is a dominant FDI strategy compared to 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 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.
< 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

\[ \prod_{h}^{FTA} (HGI_{i}^{h}) - \prod_{h}^{FTA} (HMA_{i}^{h}) \]

\( G_{i} \): host country’s plant specific cost

\( v \): MNC’s technology transfer cost

The above results are summarized as follows:
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 with the higher cost of technology transfer, cross-border M&A is preferred because M&A tends to induce less technology transfer and the plant specific cost of the host government occurs only with the greenfield investment.
4. Policy implications and concluding remarks

With the market size asymmetry and the technology asymmetries, horizontal FDI inflows via Greenfield investment are more likely when the host country’s market size is relatively large and the technology receptive capacity is relatively high.

- In opposite case, cross-border M&A will be preferred especially when the plant specific cost of the host country is relatively high.

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 with the greenfield investment is dominant to that with the cross-border M&A mainly due to the differentiated innovation investment.

- The above results imply that when the host country’s economic structure does not satisfy the incentive compatible condition for the multinational firms to choose greenfield investment, additional policy incentives are required.

- Policy incentives should support the individual rationality condition and the incentive compatibility condition for the greenfield investment by the multinational firms.

- The optimal types and level of the policy incentives would be the future research topics