

Regional Economic Integration and the Impacts on Industrial Relocation

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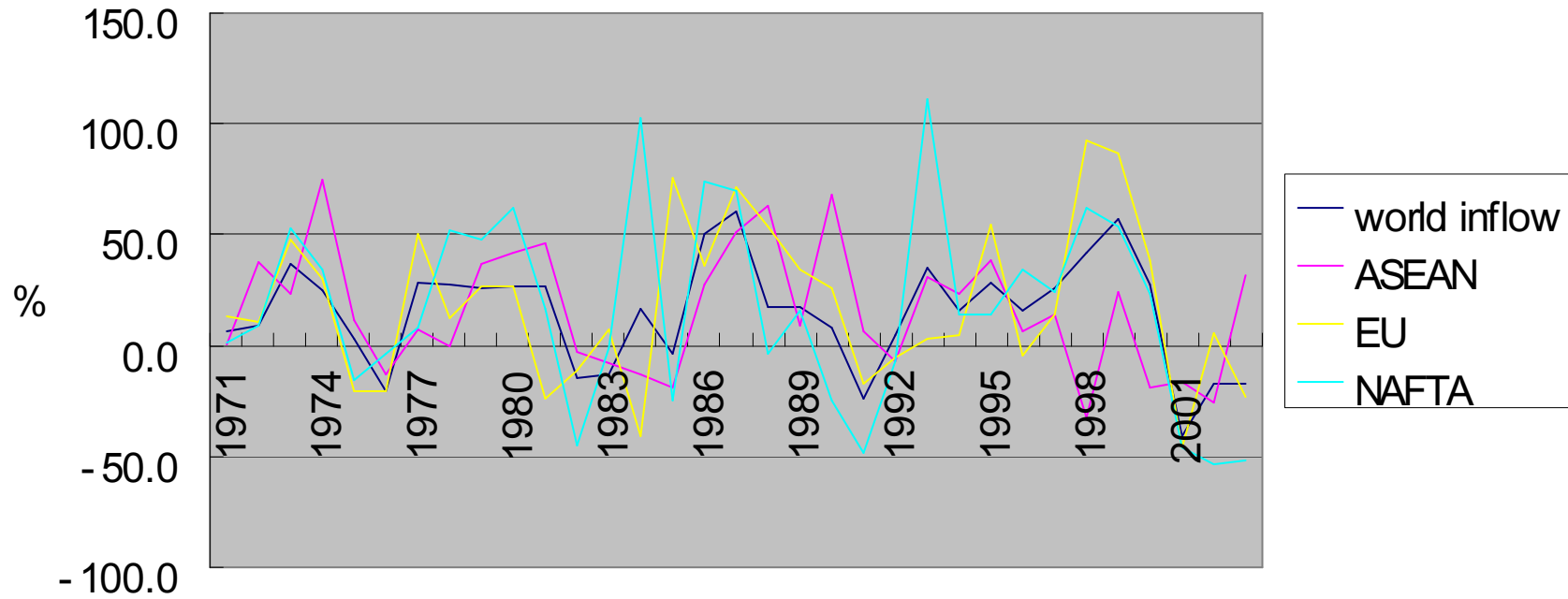
I. Motivation

- O The major driving force of the recent upsurge of regional economic integration in East Asia:
 - the preferential market access motivation
 - the expectation for the increased foreign capital inflows in terms of foreign direct investment

- O The backgrounds for this FDI inducing motivation is that FDI inflows will enhance the industrial efficiency and productivity in addition to the growth of domestic production.

- O Some mixed expectations on the impacts of Preferential Trade Agreement on FDI structure in East Asia
 - Ex: i) Korea-Japan FTA is expected to produce negative impacts to Korea in terms of trade balance and industrial production (negative static impacts)
 - However, large-scale FDI inflows due to FTA will enhance TFP → positive dynamic impacts (argued by supporters)
 - ii) Korea-China FTA is expected to produce increased hollowing out of Korean industries into China
 - Reduction in the number of jobs in Korea: Hollowing out or horizontal FDI?
 - Restructuring of Korean industrial structure: Vertical FDI with Korea specializing in a technology intensive sectors?
- O Some mixed empirical evidences:
 - Massive increase in FDI inflows into Mexico
 - Moderate impacts on Canada: the share of US FDI on Canada decreased

The rate of change in FDI Inflows



< Overseas Direct Investment of the U.S. Firms before and after NAFTA>*

Year		Canada		Mexico		NAFTA		ROW	
		Amt.	%	Amt.	%	Amt	%	Amt.	%
1987	326,253	59,145	18.1	5,434	1.7	64,579	19.8	261,674	80.2
1988	347,179	63,900	18.4	6,312	1.8	70,212	20.2	276,967	79.8
1989	381,781	63,948	16.7	8,264	2.2	72,212	18.9	309,569	81.1
1990	430,521	69,508	16.1	10,313	2.4	79,821	18.5	350,700	81.5
1991	467,844	70,711	15.1	12,501	2.7	83,212	17.8	384,632	82.2
1992	502,063	68,690	13.7	13,730	2.7	82,420	16.4	419,643	83.6
1993	564,283	69,922	12.4	15,221	2.7	85,143	15.1	479,140	84.9
1994	612,893	74,221	12.1	16,968	2.8	91,189	14.9	521,704	85.1
1995	699,015	83,498	11.9	16,873	2.4	100,371	14.4	598,644	85.6
1996	795,195	89,592	11.3	19,351	2.4	108,943	13.7	686,252	86.3
1997	871,316	96,626	11.1	24,050	2.8	120,676	13.8	750,640	86.2
1998	1,000,703	98,200	9.8	26,657	2.7	124,857	12.5	875,846	87.5
1999	1,215,960	119,590	9.8	37,151	3.1	156,741	12.9	1,059,219	87.1
2000	1,316,247	132,472	10.1	39,352	3	171,824	13.1	1,144,423	86.9
2001	1,460,352	152,601	10.4	52,544	3.6	205,145	14	1,255,207	86
2002	1,601,414	170,169	10.6	55,724	3.5	225,893	14.1	1,375,521	85.9
2003	1,788,911	192,409	10.8	61,526	3.4	253,935	14.2	1,534,976	85.8

American Overseas Direct Investment:

- O For example, after the formation of NAFTA, there has been sharp increases in the FDI inflows into Mexico, while the FDI inflows into Canada has shown quite stagnant trends comparing to the case of Mexico.
- O Moreover, the recent sharp decrease in the international transaction costs in terms of communication costs and transportation costs in addition to the removal institutional transaction costs such as tariff and non-tariff trade barriers has caused an upsurge of fragmentation, especially within the member countries of preferential trade agreements.
- O Asymmetric Impacts of PTA on FDI structures depending on production factor costs, technology level

- O The purpose of this paper is to examine the influences of preferential arrangements on the flows of foreign direct investment
- i) intra-bloc FDI: FDI among the member countries of preferential trade agreements, which are asymmetric in terms of technology and market sizes.
 - How those asymmetry in factor price and technology level influences on the FDI structure between PTA member countries
 - Whether there might be a hollowing out effects on a country with more expensive factor price
 - Which FDI mode will be chosen among PTA member countries
 - ii) inter-bloc FDI: FDI from non-member countries to integrated markets
 - Which country the third country firm will choose to invest in
 - What FDI mode it will choose among horizontal FDI & vertical FDI

O Literature Review:

- i) Fujita and Thisse (2003) examine two different aspects of globalization, such as the decreases in the trade costs of goods and the decline of communication costs between headquarters and production facilities within firms. They demonstrate that when the wage gap between two regions are significant, the process of integration eventually triggers the relocation of plants into the periphery. In particular, when the process of relocation is driven by falling communication costs, the welfare of all workers in the core goes down whereas the welfare of those who reside in the periphery rises.
- Fujita & Thisse (2003) differentiates the transaction cost into two types: first, trade costs, which include transportation costs and other trade barriers, and second, a communication cost between the headquarter of a firm and a

production site in a foreign country, which includes managerial costs of multinational corporation after foreign direct investment.

- To examine the agglomeration effect and the fragmentation effect, Fujita checks the different cases of two types of transaction costs. The intuition is that when trade cost is reduced, and at the same time, the communication cost is reduced, fragmentation is increased.

2. The Model

- o 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
 - $F_l > F_m > F_h$: 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)
 - $a_m < a_l < a_h$: In terms of market sizes, country h is largest while country m is smallest:

- o Each country has a representative firm and each firm produces products not only for 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.

O 5 types of foreign market entry mode:

- i) Exporting,
- ii) Horizontal FDI: headquarter service and plants located in foreign country (localization)
- iii) Partial horizontal FDI: headquarter service provided from home country while production plants located both in home and foreign country
- iv) Vertical FDI: production plants located only in foreign country while headquarter is located in home country
- v) Full-scale relocation: headquarter and production plants moving together to a foreign country (hollowing out)

o Cost structure of 5 modes of foreign market entry (Firm h 's cost structures when firm h tries to enter the foreign markets, l and m):

i) Exporting: $F_h + c_h x_h + (c_h + t_l)x_{hl} + x_{hm}(c_h + t_m)$

F_h : the fixed cost involved with the headquarter services provided at country h ,

c_h : the marginal cost country h ,

t_l : the import tariff of country l .¹

ii) Horizontal FDI: $F_h + c_h x_h + F_l + c_l x_{hl} + (c_l + t_m)x_{hm}$

iii) Partial horizontal FDI in country l : $F_h + c_h x_h + (c_l + m_l)x_{hl} + (c_l + m_l + t_m)x_{hm}$

where m_l : the management costs operating a foreign plant located country l

¹ We assume that t_l represents various trade barriers that might be removed by free trade agreements. Moreover, import tariffs might be assumed to be ad valorem tariffs, and in that case, the cost structure of exporting will be: $G_h + c_h(x_h + x_{hl}(1+t_l) + x_{hm}(1+t_m))$. However, the specific tariff form is assumed in this paper because it can provide the same economic intuition with more simplified expositions and notations.

with headquarter services provided from country h .

iv) Vertical FDI: $F_h + (c_l + m_l + t_h)x_h + (c_l + m_l)x_{hl} + (c_l + m_l + t_m)x_{hm}$

x_h : the quantity of outputs provided by firm h to country h . The final products are imported from the country where the production plant is located to the home country.

v) Full relocating FDI: $F_l + (c_l + t_h)x_h + c_l x_{hl} + (c_l + t_m)x_{hm}$

Full relocating FDI is the case where a firm moves the headquarter and production plant altogether to a foreign country, leaving home country. ²

² One example of the full relocating FDI is the case of Korean small and medium-size firms mainly in the less technology intensive sectors moving the whole process of business to China.

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

O 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 policy decision and makes its output decision competing in each market with 2 other countries' firms in Cournot fashion.

O Country m and l form FTA leaving out country h as an outsider.

- When the firm in country h enters the integrated markets through exporting, the profit functions of firm m , l , and h are defined as follows:

$$\prod_m^{FTA} (EXP) = (p_m - c_m)x_m + (p_l - c_m)x_{ml} + (p_h - c_m - t_h)x_{mh} - F_m$$

$$\prod_l^{FTA} (EXP) = (p_m - c_l)x_{lm} + (p_l - c_l)x_l + (p_h - c_l - t_h)x_{lh} - F_l$$

$$\prod_h^{FTA} (EXP) = (p_m - c_h - t_m)x_{hm} + (p_l - c_h - t_l)x_{hl} + (p_h - c_h)x_h - F_h$$

- o Two different paths through which PTA influences FDI structures:
 - i) inter-bloc FDI flows: the structure of FDI inflows from non-member countries into the member countries,
 - ii) intra-bloc FDI flows: the structure of FDI inflows between the member countries of preferential trade agreements.

- O When firm h , a firm in the non-member country, decides its FDI destination based on the comparison of expected profits from investing in country l and m .
 - Moreover, firm h has to decide the specific mode of FDI in addition.
 - The equilibrium foreign market entry mode under FTA can be determined through the analysis of equilibrium dominance among 5 regimes of foreign market entry.

O Among 4 types of FDI, we confine our discussion to 2 representative types of FDI, i.e., Vertical FDI and Horizontal FDI because Partial horizontal FDI is just a mixture of two types and relocating FDI is not that commonly observed mode.

3. The impacts of FTA formation on inter-bloc FDI inflows from third countries into integrated markets

- o When country h enters the integrated market through FDI, there are four types of possible equilibria, and the equilibrium FDI mode can be determined through equilibrium dominance analysis.
 - i) firm h invests in country l through horizontal FDI ($HFDI_l^h$),
 - ii) firm h invests in country l through vertical FDI ($VFDI_l^h$),
 - iii) firm h invests in country m through horizontal FDI ($HFDI_m^h$),
 - iv) firm h invests in country m through vertical FDI ($VFDI_m^h$).
- o The equilibrium FDI mode can be found through equilibrium dominance analysis. First, we check the case of $HFDI_l^h$. The equilibrium in case of $HFDI_l^h$ can be determined by backward induction. When firm h invests in

country l through horizontal FDI mode under FTA regime, the profit function of firm h , l , and m are defined respectively as follows:³

:

$$\begin{aligned}\prod_h^{FTA} (HFDI_l^h) &= (p_h - c_h)x_h + (p_m - c_l)x_{hm} + (p_l - c_l)x_{hl} - F_h - F_l \\ \prod_l^{FTA} (HFDI_l^h) &= (p_l - c_l)x_l + (p_m - c_l)x_{lm} + (p_h - c_l - t_h)x_{lh} - F_l \\ \prod_m^{FTA} (HFDI_l^h) &= (p_m - c_m)x_m + (p_l - c_m)x_{ml} + (p_h - c_m - t_h)x_{mh} - F_m\end{aligned}$$

o $SW_h(FDI_l) = CS_h + PS_h + GS_h$

³ The definition of profit function in each case is defined as follows:

- $\prod_h^{FTA} (FDI_l^h)$: the profit of firm h when firm h invests in country l after the FTA between country l and m is formed.
- $\prod_h^{FTA} (EXP)$: the profit of firm h when firm h enters the integrated markets by exporting after the FTA between country l and m is formed.
- $\prod_h^{FTA} (FDI_m^h)$: the profit of firm h when firm h invests in country m after the FTA between country l and m is formed.
- $\prod_h^{MFN} (FDI_l^h)$: the profit of firm h when firm h invests in country l under the MFN(Most Favored Nation) regime, i.e., without any FTA
- $\prod_h^{MFN} (EXP)$: the profit of firm h when firm h enters the foreign markets by exporting under the MFN(Most Favored Nation) regime, i.e., without any FTA
- $\prod_h^{MFN} (FDI_m^h)$: the profit of firm h when firm h invests in country m under the MFN(Most Favored Nation) regime, i.e., without any FTA

$$= \int_0^{x_h^* + x_{mh}^* + x_{lh}^*} p_h(x_h, x_{lh}, x_{mh}) dx - p_h^*(x_h^* + x_{lh}^* + x_{mh}^*) + \prod_h^{FTA} HFDI_l^h + t_h(x_{lh} + x_{mh})$$
 : The social welfare function is defined as summation of consumer surplus, producer surplus, and government surplus. ⁴

- o 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:

$$\begin{aligned}
 \frac{\partial \prod_h^{FTA}(HFDI_l^h)}{\partial x_h} = 0, & \quad \frac{\partial \prod_h^{FTA}(HFDI_l^h)}{\partial x_{hl}} = 0, & \quad \frac{\partial \prod_h^{FTA}(HFDI_l^h)}{\partial x_{hm}} = 0 \\
 \frac{\partial \prod_m(HFDI_l^h)}{\partial x_m} = 0, & \quad \frac{\partial \prod_m(HFDI_l^h)}{\partial x_{ml}} = 0, & \quad \frac{\partial \prod_m(HFDI_l^h)}{\partial x_{mh}} = 0 \\
 \frac{\partial \prod_l(HFDI_l^h)}{\partial x_l} = 0, & \quad \frac{\partial \prod_l(HFDI_l^h)}{\partial x_{lm}} = 0, & \quad \frac{\partial \prod_l(HFDI_l^h)}{\partial x_{lh}} = 0
 \end{aligned}$$

⁴ It is assumed that the profits of FDI affiliates are repatriated to the home country of each FDI.

o 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:

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

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

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

$$x_h^{FTA}(HFDI_l^h) = \frac{2a_h - 4c_h + c_l + c_m}{5}, \quad x_{lh}^{FTA}(HFDI_l^h) = \frac{a_h + 3c_h - 7c_l + 3c_m}{10}$$

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

- o 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 each firm as follows:

$$\prod_h^{FTA} (HFDI_l^h) = \frac{(a_l - 2c_l + c_m)^2 + (a_m - 2c_l + c_m)^2}{16} + \frac{(2a_h + c_l + c_m - 4c_h)^2}{25} - F_h - F_l$$

$$\prod_l^{FTA} (HFDI_l^h) = \frac{(a_l - 2c_l + c_m)^2 + (a_m - 2c_l + c_m)^2}{16} + \frac{(a_h - 7c_l + 3c_m + 3c_h)^2}{100} - F_l$$

$$\prod_m^{FTA} (HFDI_l^h) = \frac{(a_l + 2c_l - 3c_m)^2 + (a_m + 2c_l - 3c_m)^2}{16} + \frac{(a_h + 3c_l - 7c_m + 3c_h)^2}{100} - F_m$$

o Firm h 's strategy to invest in country l through horizontal FDI under FTA between country l and m is an equilibrium strategy when the following conditions are held:

- i) $\prod_h^{FTA}(HFDI_l^h) \geq \prod_h^{FTA}(VFDI_l^h)$: Condition for firm h has no incentive to deviate from horizontal FDI to vertical FDI in country l .
- ii) $\prod_h^{FTA}(HFDI_l^h) \geq \prod_h^{FTA}(HFDI_m^h)$: Condition for firm h has no incentive to deviate from horizontal FDI in country l to horizontal FDI in country m .
- iii) $\prod_h^{FTA}(HFDI_l^h) \geq \prod_h^{FTA}(VFDI_m^h)$: Condition for firm h has no incentive to deviate from horizontal FDI in h to vertical FDI in country m .

$$\prod_h^{FTA}(VFDI_l^h) = (p_h - c_l - t_h - m_l)x_h + (p_m - c_l - m_l)x_{hm} + (p_l - c_l - m_l)x_{hl} - F_h$$

$$\prod_l^{FTA}(VFDI_l^h) = (p_l - c_l)x_l + (p_m - c_l)x_{lm} + (p_h - c_l - t_h)x_{lh} - F_l$$

$$\prod_m^{FTA}(VFDI_l^h) = (p_m - c_m)x_m + (p_l - c_m)x_{ml} + (p_h - c_m - t_h)x_{mh} - F_m$$

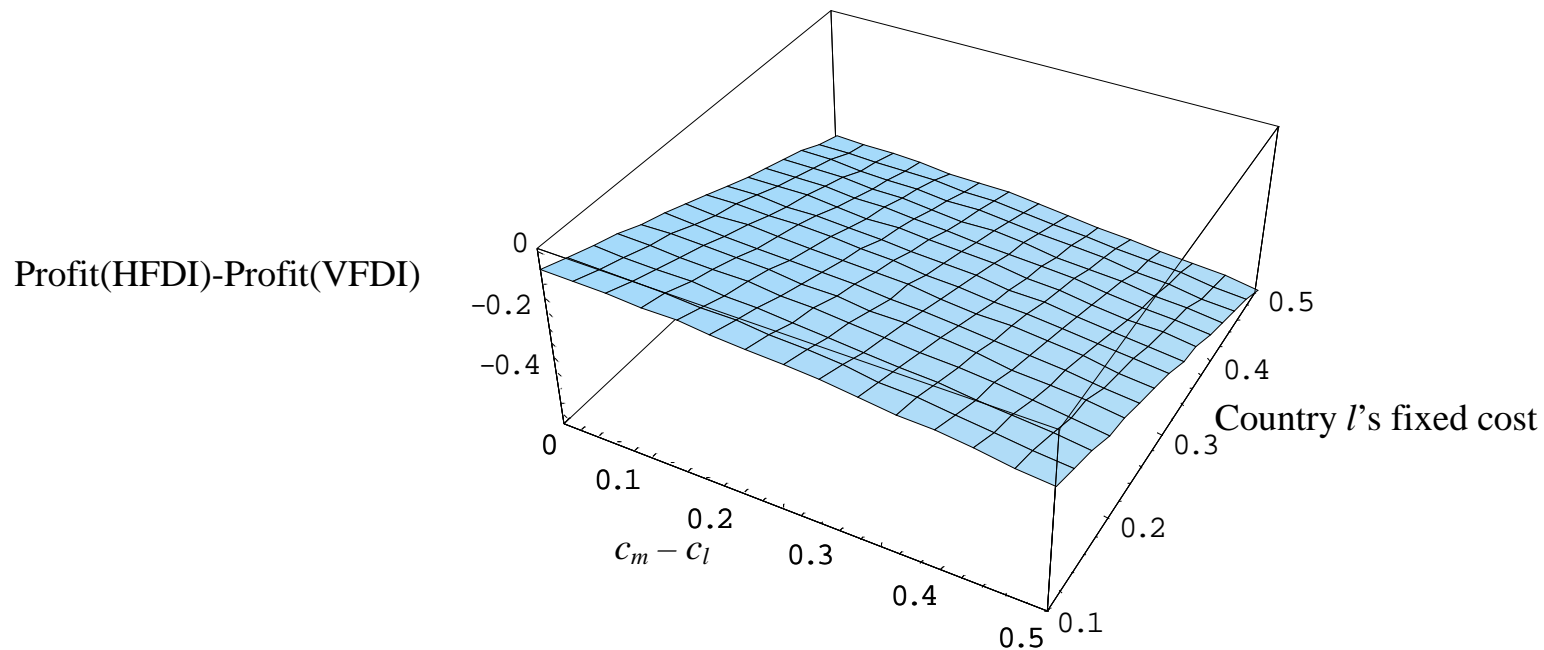
o The equilibrium profit is derived by backward induction as follows:

$$\prod_h^{FTA} (VFDI_l^h) = \frac{1}{400} [64ah^2 + 25a_l^2 + 25a_m^2 - 100amc_l + 600c_l^2 + 50amc_m - 680c_l c_m + 194c_m^2 - 400F_h - 150amml + 1880c_l ml - 1068cmml + 1474ml^2 - 50al(2c_l - c_m + 3ml) - 64ah(5c_l - 3cm + 8ml)]$$

i) $\prod_h^{FTA} (HFDI_l^h) - \prod_h^{FTA} (VFDI_l^h) > 0 :$

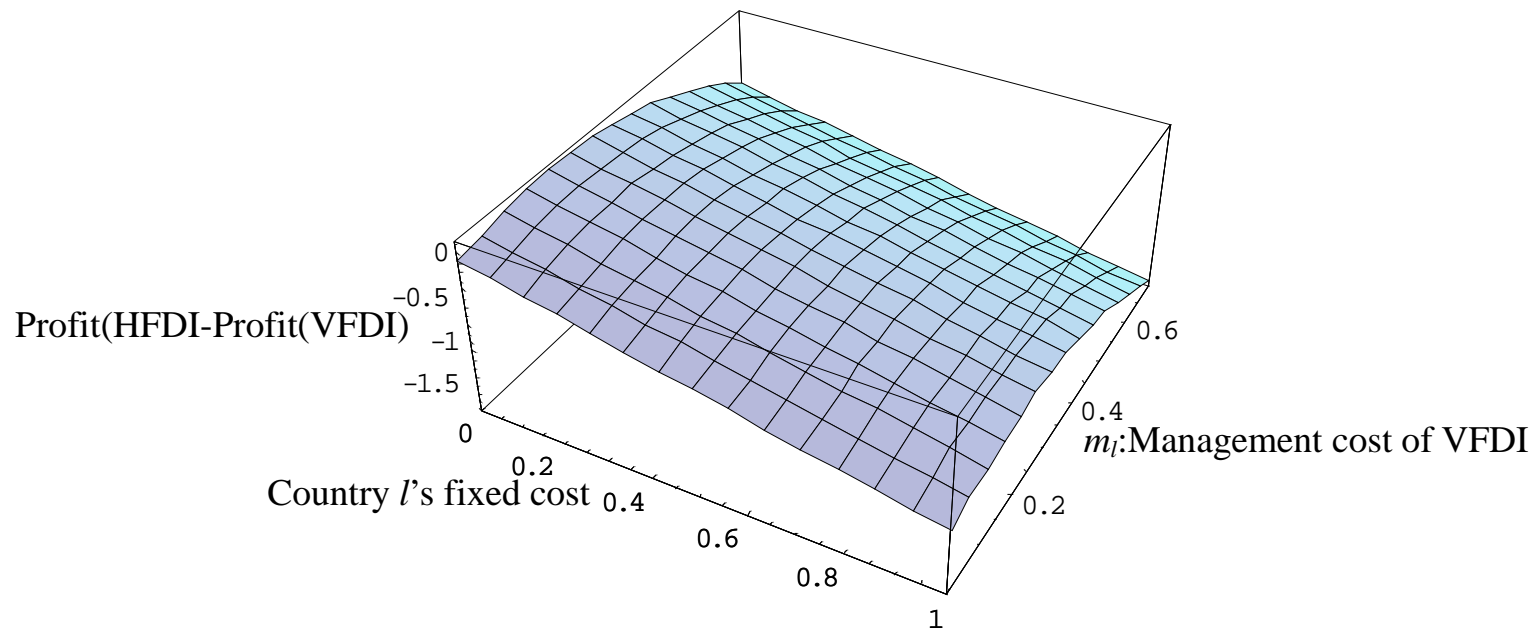
$$\rightarrow \frac{(a_l - 2c_l + c_m)^2 + (a_m - 2c_l + c_m)^2 + (2a_h + c_l + c_m - 4c_h)^2}{16} - F_h - F_l - \frac{1}{400} [64ah^2 + 25a_l^2 + 25a_m^2 - 100amc_l + 600c_l^2 + 50amc_m - 680c_l c_m + 194c_m^2 - 400F_h - 150amml + 1880c_l ml - 1068cmml + 1474ml^2 - 50al(2c_l - c_m + 3ml) - 64ah(5c_l - 3cm + 8ml)] > 0$$

- The impact of marginal cost asymmetry and market size asymmetry on the firm's choice of FDI mode.



- ➔ When firm h , which is a firm from non-member country of FTA, chooses its FDI entry mode into country l , it is mainly influenced by the fixed costs of country, that is the technology level of country.

→ With the formation of FTA, when a firm from an outsider country invests into a country with a lower technology, it will mainly choose VFDI, i.e., mainly in a production plant of less-value adding sectors.



- o The above result shows that when country l ' fixed cost is higher, i.e., when the technology level of country l is lower, firm h chooses vertical FDI rather than horizontal FDI.

ii) $\prod_h^{FTA}(HFDI_l^h) \geq \prod_h^{FTA}(HFDI_m^h)$: Condition for firm h has no incentive to deviate from horizontal FDI in country l to horizontal FDI in country m .

$$\prod_h^{FTA}(HFDI_l^h) = \frac{(a_l - 2c_l + c_m)^2 + (a_m - 2c_l + c_m)^2}{16} + \frac{(2a_h + c_l + c_m - 4c_h)^2}{25} - F_h - F_l$$

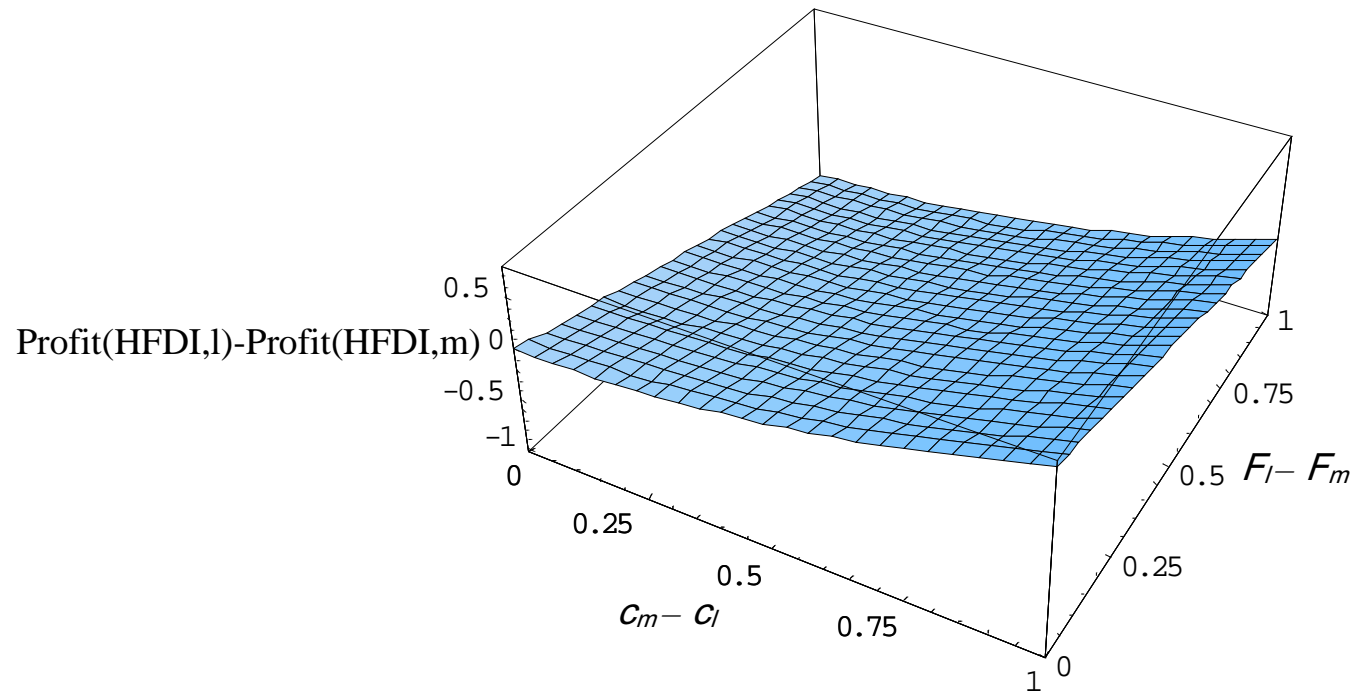
$$\prod_h^{FTA}(HFDI_m^h) = \frac{(a_l + c_l - 2c_m)^2 + (a_m + c_l - 2c_m)^2}{16} + \frac{(2a_h + c_l + c_m - 4c_h)^2}{25} - F_h - F_m$$

o The condition for firm h to horizontally invest into country l rather than country

$$m: \quad \prod_h^{FTA}(HFDI_l^h) - \prod_h^{FTA}(HFDI_m^h) = \frac{3}{8}c(a_l + a_m - 2c_m + c) - F \geq 0$$

where $c = c_m - c_l$ and $F = F_l - F_m$.

< The impact of technology and factor cost on the HFDI country selection >



➔ When the technology gap between country l and m is larger than a critical value, firm h will horizontally invest into country m even though the marginal production factor cost is higher in country m compared to country l .

iii) $\prod_h^{FTA} (VFDI_l^h) - \prod_h^{FTA} (VFDI_m^h) \geq 0$: The condition for country h to invest in country l when it vertically invests into the integrated market

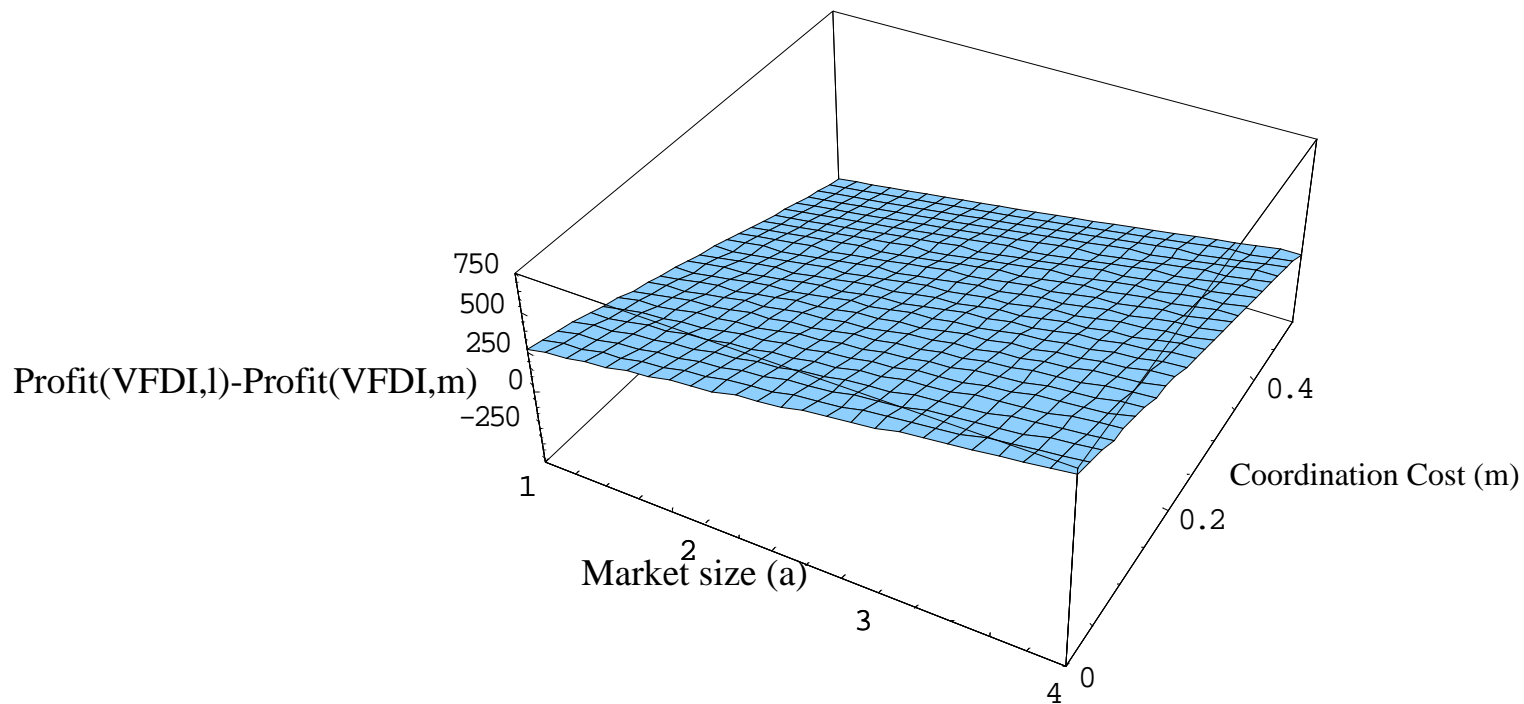
$$\prod_h^{FTA} (VFDI_l^h) = \frac{1}{400} [54a_h^2 + 25a_l^2 + 25a_m^2 - 100amc_l + 600c_l^2 + 50amc_m - 680c_l c_m - 194c_m^2 - 400F_h - 150amml + 1880c_l ml - 1068cmml + 1474ml^2 - 50a_l [2c_l - c_m + 3ml] - 64ah [5c_l - 3c_m + 8ml]]$$

$$\prod_h^{FTA} (VFDI_m^h) = \frac{1}{400} [54a_h^2 + 25a_l^2 + 25a_m^2 + 50amc_l + 194c_l^2 - 100amc_m - 680c_l c_m + 600c_m^2 - 400F_h + 64ah [3c_l - 5c_m - 8ml] - 50a_l [c_l - 2c_m - 3ml] - 150ammm - 1068c_l mm + 1880c_m mm + 1474mm^2]$$

$$\prod_h^{FTA} (VFDI_l^h) - \prod_h^{FTA} (VFDI_m^h) = \frac{1}{200} (256a_h + 75(a_l + a_m) - 203(c_m + c_l) - 1474m)(c_m - c_l) \geq 0$$

- o When the market sizes of trading countries are relatively large compared to the management cost of running the foreign plant, firm h chooses to vertically invest in country l .

< The impact of lower coordination costs on inter-bloc VFDI flows >



o With the development of information technology, the communication and coordination cost of managing foreign plants is getting lower, leading to firm h to vertically invests in country l with a lower marginal production cost.

(The critical value of m , below which, firm h chooses to vertically invest in

country l is:
$$\hat{m} = \frac{1}{1474} (256a_h + 75(a_l + a_m) - 203(c_m + c_l))$$

Proposition 1: Firm h , a firm from non-member countries trying to serve markets integrated by PTA, chooses to vertically invest (VFDI) into a country with a lower production cost. When the technology gap is large with the significant management cost of foreign plants, firm h chooses to horizontally invest (HFDI) into country m even though the production factor cost is higher in country m .

4. The impact of FTA formation on the intra-bloc FDI structure

o The formation of FTA influences the FDI structures between the FTA member countries mainly through the reduction of transaction costs between the FTA member countries while keeping the trade barrier towards non-member countries.

Ex: The formation of Korea-China FTA is supposed to boost up massive FDI outflows from Korea to China.

O How the FTA formation between country m and l will influence firm m 's decision on FDI into country $l \rightarrow$ Firm m will choose to vertically invest into country l rather than choosing horizontal FDI if the following condition holds: $\prod_m^{FTA} (VFDI_l^m) \geq \prod_m^{FTA} (HFDI_l^m)$.

Firm m 's profit from vertical FDI into country l :

$$\prod_m^{FTA} (VFDI_l^m) = (p_m - c_l - m_l)x_m + (p_l - c_l - m_l)x_{ml} + (p_h - c_l - m_l - t_h)x_{mh} - F_m$$

The profit functions of firm l and h are:

$$\prod_l^{FTA} (VFDI_l^m) = (p_l - c_l)x_l + (p_m - c_l)x_{lm} + (p_h - c_l - t_h)x_{lh} - F_l$$

$$\prod_h^{FTA} (VFDI_l^m) = (p_h - c_h)x_h + (p_m - c_h - t_m)x_{hm} + (p_l - c_h - t_l)x_{hl} - F_h$$

The equilibrium profit of each firm is derived by backward induction;

$$\prod_m^{FTA} (VFDI_l^m) = \frac{1}{441} [5a_m - 3c_h + 7c_l - 16c_m] F_m + \frac{1}{841} [7a_l + 3c_h - 10c_l - 21m_l] F_l - \frac{1}{100} [a_h + c_h - 4c_l - 7m_l] F_h$$

Firm m 's profit from horizontal FDI into country l under FTA:

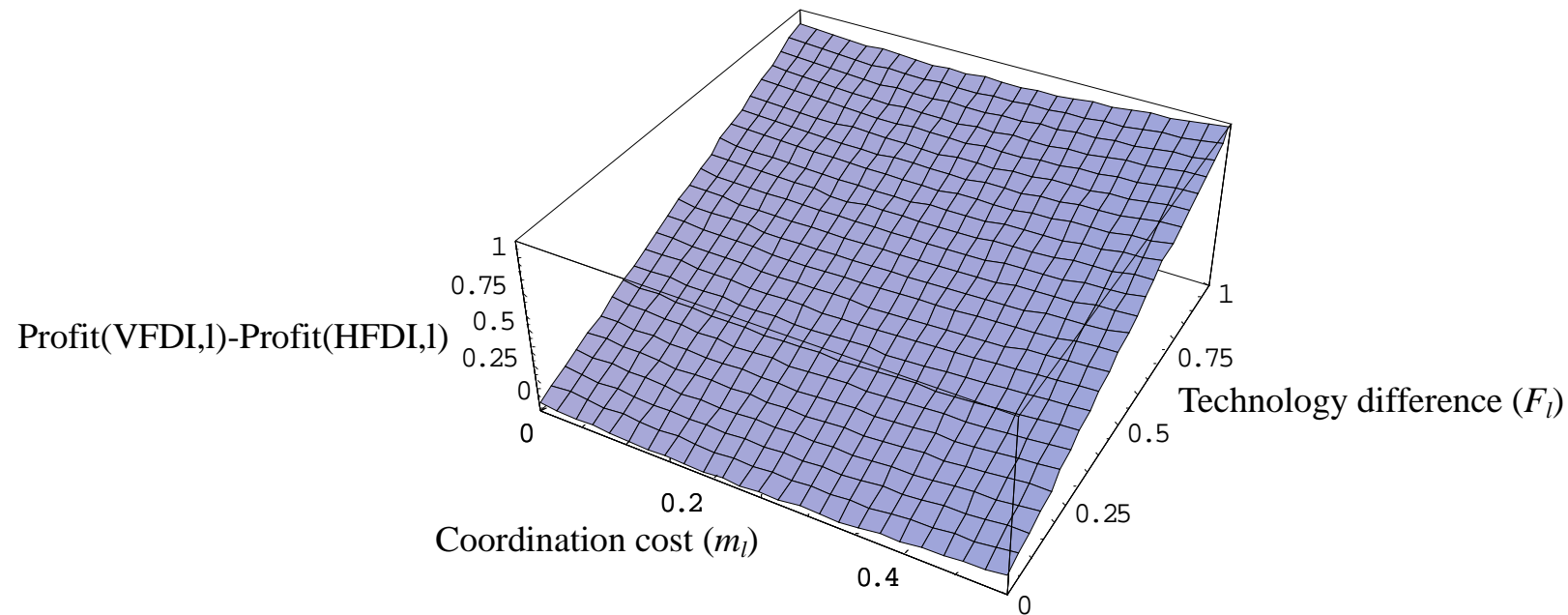
$$\prod_m^{FTA} (HFDI_l^m) = \frac{1}{100} [a_h + c_h - 4c_l] F_l - \frac{1}{49} [2a_l + c_h - 3c_l] F_l - \frac{1}{441} [5a_m + 3c_h + 7c_l - 16c_m] F_l - F_m$$

o The condition for firm m to choose VFDI after FTA:

$$\prod_m^{FTA} (VFDI_l^m) - \prod_m^{FTA} (HFVDI_l^m) > 0.$$

$$\begin{aligned} & \prod_m^{FTA} (VFDI_l^m) - \prod_m^{FTA} (HFVDI_l^m) = \\ = & -\frac{1}{100} \frac{(h+3c_h-4c_l)}{49} \frac{1}{49} \frac{(a_l+c_h-3c_l)}{81} + \frac{1}{841} \frac{(a_l+c_h-10c_l-21m_l)}{100} \frac{1}{100} \frac{(h+3c_h-4c_l-7m_l)}{100} \end{aligned}$$

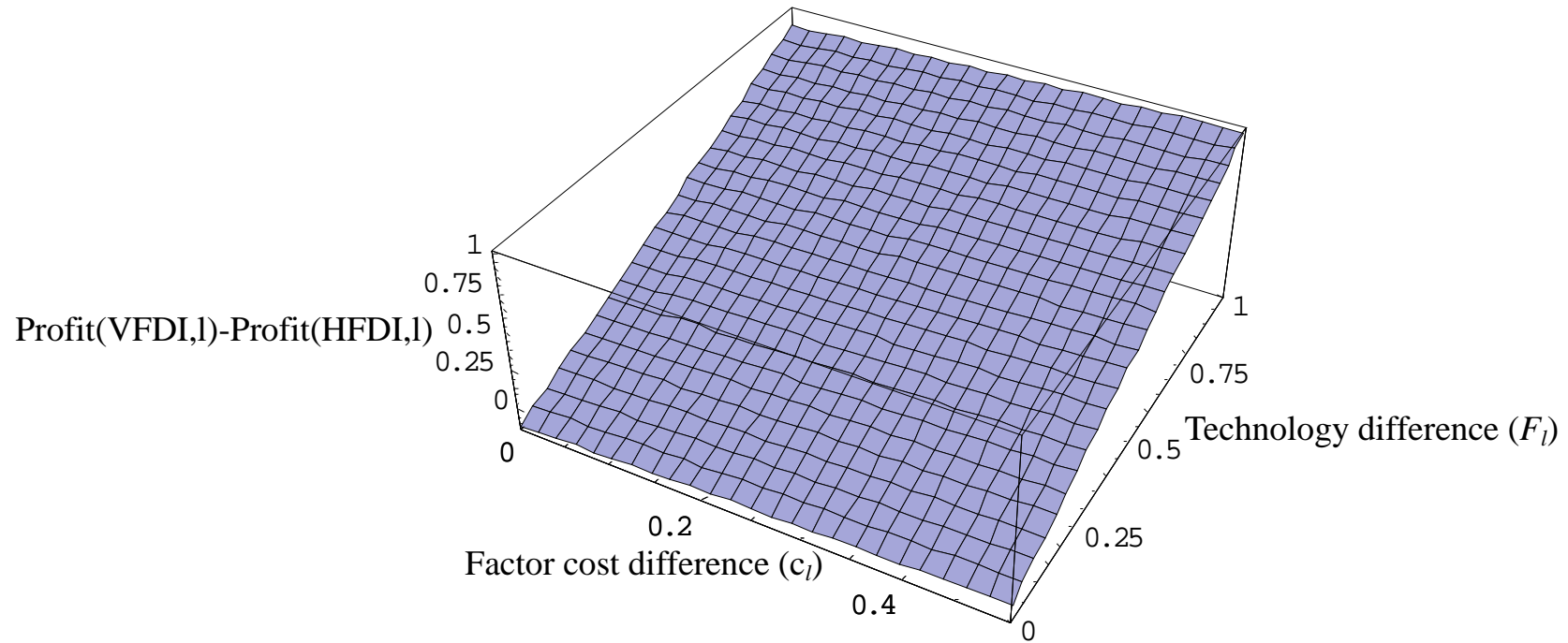
< The impacts of technology and coordination cost on intra-bloc FDI mode >



- o Intra-bloc FDI structure among FTA member countries is characterized by the vertical FDI rather than horizontal FDI throughout the parameter values which satisfy the model assumptions.
- As the technology level of the country with a lower factor price (country l) is lower, the vertical FDI becomes much more dominant strategy than a horizontal FDI for firm m .

- o However, if the technology gap between country m and l is relatively small, and the marginal cost difference is big, it is likely that horizontal FDI of firm m is a dominant strategy to invest into country l .

< The impacts of technology and factor cost on intra-bloc FDI mode choice >



o The condition for industrial relocation from country m to country l :

$$\prod_m^{FTA} (HFDI_l^m) - \prod_m^{MFN} (HFDI_l^m) > 0$$

$$\prod_m^{FTA} (HFDI_l^m) * =$$

$$\frac{1}{100} (ah + ch - 4cl) \left(\frac{1}{49} (2al + ch - 3cl) \left(\frac{1}{441} (5am + 3ch + 7cl - 16cm) (2fl - fm) \right) \right)$$

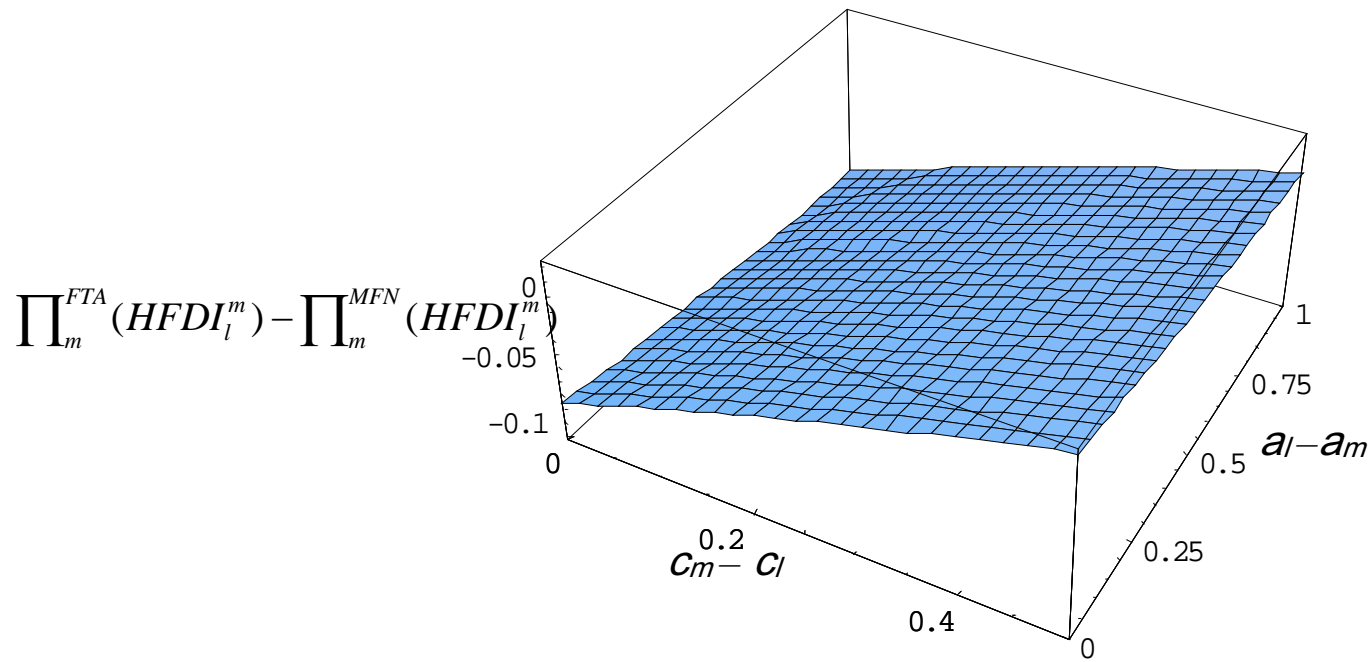
$$\prod_m^{MFN} (HFDI_l^m) * =$$

$$\frac{(3ah + 6al + 52ch - 151cl) (21ah - 6al + 25ch - 40cl) (21ch - 120al - 65ch + 104cl) \left(\frac{1}{25} (2am + ch + cl - 4cm) (fl - fm) \right)}{114921 \cdot 76614}$$

$$\prod_m^{FTA} (HFDI_l^m) - \prod_m^{MFN} (HFDI_l^m) =$$

$$\frac{(3ah + 6al + 52ch - 151cl) \left(\frac{1}{100} (ah + ch - 4cl) \left(\frac{1}{49} (2al + ch - 3cl) \left(\frac{1}{441} (5am + 3ch + 7cl - 16cm) (2fl - fm) \right) \right) \right)}{114921} - \frac{(3ah + 6al + 52ch - 151cl) (21ah - 6al + 25ch - 40cl) (21ch - 120al - 65ch + 104cl) \left(\frac{1}{25} (2am + ch + cl - 4cm) (fl - fm) \right)}{76614}$$

- o Firm h 's HFDI into country l is to be reduced after the formation of FTA between country m and l ;
- ➔ Hollowing out is not a serious threat of FTA with a country with a lower factor costs:



Proposition 2: After the formation of PTA, firm h will choose VFDI when the factor cost difference is relatively large. FTA formation between two countries are not going to increase the hollowing out due to the fact that tariff reduction decreases the motivation for HFDI.

4. Policy Implications of the concluding remarks

- o FTA formation between countries with asymmetric technology, factor prices, and market size, the following results derived:
 - i) inter-bloc FDI flows: firms from non-member country tend to choose
 - VFDI into a country with a lower factor costs
 - HFDI into a country with a higher technologies with higher factor prices (when technology gap is high between the member countries with high management costs)

 - ii) intra-bloc FDI flows: firms from a member countries tend to choose
 - VFDI into a member country with a lower factor costs
 - HFDI into a member country with a lower factor costs tends to decrease due to tariff reduction decreases HFDI motivation → Little threat for hollowing out