2005

Standardization, localization, and multinationals

Chul-Woo Kwon
Iowa State University

Standardization, localization, and multinationals

by

Chul-Woo Kwon

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Economics

Program of Study Committee:
Harvey E. Lapan, Major Professor
John R. Schroeter
Giancarlo Moschini
Rajesh Singh
Ananda Weerasinghe

Iowa State University

Ames, Iowa

2005

Graduate College
Iowa State University

This is to certify that the doctoral dissertation of

Chul-Woo Kwon

has met the dissertation requirements of Iowa State University

Signature was redacted for privacy.

Major Professor

Signature was redacted for privacy.

For the Major Program

TABLE OF CONTENTS

Chapter 1. General Introduction

For last three decades, many international economists have realized the increasing importance of multinationals in international trade and have tried to explain the motive and nature of multinational firms. Although a few researchers (Caves, 1996; Dunning, 1998; UNCTAD World Investment Report, 1998) realized that the cultural difference between countries may affect the strategy choice and the performance of the multinationals, the effect of cultural differences between countries has been neglected in most studies. The cultural difference affects the performance and the choice of the firm in two different ways. First, multinationals from one country (e.g., the US) have an intrinsic advantage over multinationals from another country (e.g., Japan) in foreign countries that are culturally similar to their own country. For example, US multinationals may be seen to have a cultural (not simply geographic) advantage over Japanese multinationals in Canada, Europe and Australia, whereas Japanese multinationals are perceived to have advantages in other Asian countries, such as Korea, Thailand, and so forth. Several empirical studies about the expansion of multinationals show that multinationals start with neighboring countries. Davidson (1980) showed that U.S. multinationals establish their subsidiary in Canada and then proceed to operate in the United Kingdom. Multinationals in other countries show a similar pattern of expansion; Japanese firms start in the Southeast Asia (Tsurumi, 1976; Yoshihara, 1978;), Australian multinationals go to New Zealand (Deane, 1970), and Italian firms start with neighboring southern European countries (Onida and Viesti, 1988). A survey conducted by the Bureau of Economics Analysis also suggests that the performance of the US multinationals in European countries, Canada, and Australia dominates performance of

US firms in Asian countries; Japan, Rep. of Korea, Taiwan (table 1 in Appendix). Second, the different cultures (including legal and political system) in different countries could make firms establish their affiliate because the multinational can access to the difference cultural framework and the cultural-specific consumer demands and preferences through their affiliates (Dunning, 1998).

Another neglected fact of the multinational is the type of products manufactured by the multinational and the strategy choice with respect to R&D used to develop those products. Previous researches on multinationals usually have assumed that multinational firms produce homogenous products in many countries. However we can observe that many multinational firms and exporters develop and produce localized products to serve specific areas. For example, all Japanese carmakers supply cars that have the driver seat on the left side to US consumers although they sell cars with the driver seat on the right side in Japan. Microsoft also supplies a different language version of the software in different countries. A survey on foreign-based multinationals in the manufacturing sector in South Korea conducted by the Korea Institute for Industrial Economics and Trade (KIET) and the Korea Ministry of Commerce, Industry, and Energy shows that 67% of the foreign-based firms in Korea produce the standardized and locally adjustable product, 25% of MNEs produce the product that is fully localized to fit the Korean market, and 8% of MNEs produce the standard product (Kang, et al, 2002, table 3). Most recent survey on Korea-base multinationals in the manufacturing sector (D. Y. Kang, et al, 2004) shows the similar results (table 2). Also the survey on Korea-based multinational firms in the manufacturing industry shows that 56% of the Korea-based firms produce the standardized and locally adjustable product in the host country, and 21% of them produce fully localized products, and 23% of them produce the standard product (Kang, et al, 2003) (table 2).

The above surveys suggest that most multinational firms produce localized or localizable products instead of standard products. Furthermore most multinationals prefer to develop a standard product and adjust it to fit local preference. Although these different types of products and technology were studied in the literature on the flexible technology (Eaton and Schmitt, 1994; Norman and Thisse, 1999; Norman, 2002), it is neglected in researches on the multinationals and exporters. This dissertation examines (1) the role of the culture-specific demand on the strategic behavior of the firms, (2) when and why multinationals and exporters introduce localized products instead of standard products facing cultural difference between countries, and (3) the influence of the cultural different between two countries and the strategic decision of firms on the welfare in the home and the host country. Multinationals in this dissertation are assumed to have an advantage in the information about local preference over exporters. Horstmann and Markusen (1996) examined the knowledge advantage of a local firm over an exporter. They assumed that local agents have superior information for the local market, a potential the MNE doesn't have. Therefore an MNE should face asymmetric information problem in contracting with an agent and pay additional rent to the agent when the MNE chooses the contract over FDI. They found that the asymmetric information problem could lead a potential MNE to choose FDI with the additional cost in order to obtain the market information. Multinationals in this paper are assumed to observe the true preference in the foreign country that is uncertain to exporters and utilize this superior information to develop and produce variety.

This dissertation is organized as follows. In the second chapter of the dissertation, I will develop the model to study the effect of the culture-specific demand in the host and home country on the firm's choice of the location and will expand it to include various types of products, assuming a monopolist. The developed model will explain when and why a monopolist decides to be a multinational or exporter facing the cultural difference and various types of production methods. Furthermore I will discuss why and when this firm chooses to produce a standard variety or two different localized varieties. In addition, the second chapter will study the welfare in the home and the host country in various situations.

The third chapter will extend the monopoly model used in the second chapter to study an effect of cultural similarity among countries on the strategic interaction of two multinationals. To illuminate this, I will consider two multinationals that are from two different home countries that have different cultures; therefore, one firm possesses an intrinsic advantage in adjustment cost over the others. The two multinationals are assumed to supply their home country and are considering entering the host market; that is, the multinationals can either develop a new localized variety (or platform) to serve the host market or adjust their current variety for their home markets to serve the host market. In this situation, the third chapter will study, using the technology developed in the second chapter, the optimal production strategy of the two multinationals from the two culturally different home countries. Also profits of the two firms in the host country, the effect of the cultural difference on the firms' optimal choice, and consumer welfare in the host country will be discussed.

In chapter three, it is assumed that, if a multinational(s) decides not to create a new localized variety, it can adjust only its current variety to serve the host country; define this variety as a platform. This assumption will be relaxed in the fourth chapter, and I will allow that the multinationals can choose their platform for the adjustment process. In detail, I will consider a situation that two multinationals in two different home countries have their production facilities in their home countries and are considering entering the home and the host markets simultaneously. Using this modified duopoly model, I will study equilibrium of the duopoly game and strategic behaviors of the two multinationals. Further, consumer welfare in the home and the host countries also will be discussed.

In fifth chapter, the model used in chapter four will be modified again to include asymmetric competitions in the two home countries; that is, the two multinationals face different level of home competition because the different number of local competitors exist in the two home countries. Using the modified duopoly model, I will revisit the pattern of equilibrium of the duopoly game and will study the effect of asymmetric home competition on multinationals' strategic decisions, consumer welfare in the countries, and profits of multinationals.

Chapter 2. A Firm's Choice of the Technology and the Location under the Cultural Difference: Simple Monopoly Model

Introduction

As Dunning (1998) mentioned, different culture in any country provides the firm an incentive to establish its affiliate in that country because the multinational can learn that different cultural framework and the cultural-specific consumer demands and preferences. This chapter of the dissertation develops a theoretic model of a monopolist to support his assertion using a Lancaster-type preference and the technology developed by Eaton and Schmitt (1994). With this structure, I will discuss the simple model of a firm to discuss a firm's choice of the optimal technology as well as location of its production. In addition, the impact of these choices on welfare in the home and the host countries will be studied.

This chapter is organized in following way. The first part of this chapter will study a firm that is considering entering the host country by exporting or establishing its affiliate. The firm is assumed to have already developed a platform for its home market and is considering whether to develop a new platform for the host market or to adjust its current platform. Under this situation, given the cultural differences between the home and the host countries, I will develop a monopoly model to examine the firm's choice of optimal technology and location. Further, the welfare in the host and the home country facing the firm's strategic choice will be studied. The second part of the chapter will extend the monopoly model to include the initial platform of the firm and study the firm's decision and welfare issue. The developed model and results will be summarized in the conclusion of this chapter.

Model

Assume that there are two countries: the potential host (or foreign country) country *K* and home country *U*. Assume that there is only one firm in this economy which produces product in its home country; a good with no close substitutes. Further, this firm is considering entering the host country either by exporting or by establishing its own affiliate. Finally, assume that each country has a specific preference for the product that the firm produces. Therefore, the cultural similarity between two countries is assumed to be measured by the similarity in taste for this product.

Turning to preferences in the countries, assume that all consumers in a country have identical preferences for the product and prefer to consume a specific type of variety θ^i, $i = K, U$. The preferred variety of a product may be different across countries. Assume that a consumer in country *i* has the sub-utility function[1]:

$$u_i(q) = \max\left[\left(a - \gamma d\left(\theta_i^P, \theta^i\right)\right)q - \frac{\lambda}{2}q^2, 0\right]$$

where θ_i^P is the variety that is supplied by the firm in country *i*, (a, γ, λ) are positive parameter, q represents total sales of products (including all varieties), and $d\left(\theta_i^P, \theta^i\right) \equiv \left|\theta_i^P - \theta^i\right|$ is the distance in the variety space between the actually supplied variety and the ideally preferred variety.

From the utility function, the demand of a consumer for a product of variety θ_i^P

---

[1] We assume overall preferences are separated quasilinear, so we can ignore income effects on the role of other prices.

is given by:

$$p_i = a - \gamma d\left(\theta_i^P, \theta^i\right) - \lambda q_i$$

Let N_i be the population of country *i*, and it measures the market size in country *i*. Then the aggregate demand for θ_i^P is:

$$p_i = a - \gamma d\left(\theta_i^P, \theta^i\right) - \frac{\lambda}{N_i} q_i$$

Thus, the demand increases as the firm supplies a closer variety to θ_i^P. Finally, assume that a local producer, including a multinational, can observe the true type of θ^i, but this taste parameter is unknown to the foreign exporter at the beginning. I will discuss the detailed sequence of revealing the information on the local preference to the foreign exporter.

For the technology, I use a framework that is similar to the framework developed by Eaton and Schmitt (1994)[2]. Suppose that the firm is considering entering the market in the host country by exporting the products or establishing its affiliate in the host country. Assume that there is no transportation cost for an exporter to ship the products to the host country, and establishing an affiliate requires the fixed cost E_K.

---

2 They developed the flexible technology that the firm can produce any final products from base products with adjustment costs to study firms' entry, preemption and merger in a market with evenly distributed consumer preferences. Norman and Thisse (1999) used the Eaton-Schmitt model to analyze the entry and preemption allowing 'designated (or specialized) technology'. Norman (2002) also adopted the Eaton-Schmitt model to discuss the firm's choice of level of the flexible technology and the location of the base products in many submarkets. This chapter of the dissertation is closely related with the Norman and Thisse paper (1999) because my model also allows the localization strategy that matches to their designated technology

Further, if the firm decides to enter the host market, it can supply the current product used in its home country, that may be different from θ^K, or it can develop a new platform θ_K^P for the host country. With the latter strategy, the firm incurs the fixed R&D cost V_i[3]. Finally, assume that the firm can transform one variety to another variety with additional marginal cost.

Definitions:[4]

1. The adjustment technology is the process that transforms one variety to a different variety with additional marginal cost, which depends on the similarity between two varieties.
2. The platform variety is the prototypes of the variety before the adjustment technology is applied.

The additional marginal cost due to the adjustment technology can be thought as the marginal costs that are required to change the characteristics of the product (e.g., from left-hand drive to right-hand drive) from the current platform without developing a new platform. The additional adjustment marginal cost to transform θ^i to θ^j is defined by $b\left|\theta^i - \theta^j\right|$ where b is a positive parameter. Therefore, the marginal cost of the firm to produce a variety θ^j by adjusting the platform θ^i is $c\left(\theta^i, \theta^j\right) \equiv c + b\left|\theta^i - \theta^j\right|$. Assuming $b < \gamma$, the firm always supplies the ideally

[3] This strategy is essentially the same to the 'designated technology' in Norman and Thisse (1999) and Norman (2002). Also it is similar with the 'dedicated ' production strategy in Chang (1993, 1998) or the 'inflexible' technology (e.g. Boyer and Moreaux, 1997). Notice that the multinational can achieve the mass production with this production strategy since it has the lower marginal cost than the alternative.

[4] The *adjustment technology* is technically the same to the flexible technology that was developed by Eaton and Schimitt (1994). The *platform variety* is also matched with the base variety in their model.

preferred variety to a country if the firm can observe ideally preferred variety.

The sequence of the firm's decision and the revelation of information concerning preferences are as follow:

1. The firm decides whether to enter the foreign market and, if it enters, whether to be an exporter or a multinational by establishing its affiliate. If the firm becomes a MNE, it learns the true preference. Further, the firm decides whether to develop a new platform or use the current platform to serve the foreign market.
2. The uncertainty regarding preference in the host country is resolved for the exporter, and the firm can adjust the platform to serve the host market[5]. Given the locational and platform decision of the firm in the first stage, the firm chooses its output.

At the first stage, local producers, including multinationals in host country *K*, can observe the true type of θ^K, but this parameter is unknown to the foreign exporter at the beginning of the period. The exporter only knows the distribution of the type of θ^K : $\tilde{\theta}^K$ follows a uniform distribution with mean 0 and $\tilde{\theta}^K \in \left[-\varepsilon\theta^U, \varepsilon\theta^U\right]$ where $0 < \varepsilon < 1$ is a parameter. Since the expected preferred variety in country *K* is zero, θ^U is the cultural distance measured by the distance in the preference between the home-preferred variety and the expected foreign-preferred variety, and the exporter faces higher demand uncertainty as the cultural similarity between the host and the home countries decreases.

---

[5] The idea behind this sequence is that developing a new platform is a long-run process but adjusting a platform is a short-run process.

Finally, assume that the firm can earn positive monopoly profits in host country K

Assumption 1:

1. The monopoly firm earns positive profits in the host country when it adjust any platform to serve the host country and $\theta^i \in \left[-(a-c)/2b,(a-c)/2b\right]$, $i=U,K$.
2. Developing a new platform to serve the host country is profitable for the monopoly.

Decision of Location and Incentive to be a Multinational

At the first stage, the firm chooses the optimal locational strategy and the R&D decision to maximize its expected profit. The decision of the firm can be analyzed by backward solution. Further, notice that the firm has four possible strategies: exporting by adjusting the current home-preferred platform (*SAE* strategy), exporting by developing a new localized platform (*LAE* strategy), local production by adjusting the current platform (*SA* strategy), and local producing by developing a new localized platform (*FL* strategy). In addition, note that since the exporter can adjust the platform after the true foreign-preferred variety is revealed and $b<\gamma$, supplying θ^K is more profitable for the exporter than losing demand by producing $\theta_K^P \neq \theta^K$[6]. Finally, assume $\theta^U \geq 0$ without loss of generality.

---

[6] The loss of demand due to producing non-preferred variety is redundant in this paper because $b<\gamma$. I included this assumption for the loss of the demand to achieve more completeness of the model.

Exporter

Suppose the firm decides to export the products by adjusting its current platform. The expected profit of firm *U* in the host country with the current platform θ^U (*SAE* strategy) is:

$$E\pi_K^{SAE} = \frac{N_K}{12\lambda}\left[3\left(a-c-b\theta^U\right)^2 + b^2\varepsilon^2\left(\theta^U\right)^2\right]$$

Notice that θ^U represents cultural (or preference) difference between the home and the foreign countries because the mean of the foreign-preferred variety is assumed to be 0. Moreover, $E\pi^{SAE}$ is decreasing as θ^U increases for $\theta^U \in \left[0,(a-c)/2b\right]$[7].

Suppose the firm decides to export by developing a new localized platform (*LAE* strategy). The exporter chooses the new platform θ_K^P to maximize the following expected profit in country *K*:

$$\underset{\theta_K^P}{Max}\ E\pi_K\left(\theta_K^P\right) = \int_{-\varepsilon\theta^U}^{\varepsilon\theta^U}\left[\frac{1}{2\varepsilon\theta^U}\frac{N_K}{4\lambda}\left(a-c-bd\left(\theta_K^P,\theta^K\right)\right)^2 - V_i\right]d\theta^K$$

Note that the exporter can adjust the platform θ_K^P after the true host-preferred variety is revealed if $\theta_K^P \neq \theta^K$. The optimal localized platform of the exporter is the expected host-preferred variety: $\theta_K^P = 0$. The expected profit of the exporter in host country *K*

---

7 $\frac{\partial E\pi_K^{SAE}}{\partial\theta^U} = \frac{N_K}{6\lambda}\left[-3b\left(a-c-2b\theta^U\right) - b^2\theta^U\left(3-2\varepsilon^2\right)\right] \leq 0$ because $a-c-2b\theta^U \geq 0$ for given range of θ^U and $3-2\varepsilon^2 > 0$ for $\varepsilon \in [0,1]$.

with $\theta_K^P = 0$ is:

$$E\pi_K^{LAE} = \frac{N_K}{12\lambda}\left[3(a-c)^2 - 3b\varepsilon\theta^U(a-c) + b^2\varepsilon^2(\theta^U)^2\right] - V_i$$

Also this profit is decreasing in θ^U [8]. The exporter chooses its strategy by comparing $E\pi_K^{SAE}$ and $E\pi_K^{LAE}$.

Proposition 2.1:

Suppose the monopoly profit of an exporter in host country *K* is profitable. Then:

1. If the R&D cost is considerably high, that is $V_i \geq \frac{N_K}{16\lambda}(a-c)^2(2-\varepsilon)^2$, then entering with the current platform without developing a new localized platform (*SAE*) is the optimal production strategy of the exporter.

Assuming $V_i \leq \frac{N_K}{16\lambda}(a-c)^2(2-\varepsilon)^2$,

2. The exporter enters with the home-preferred platform if $\theta^U \leq \theta_{lower}^U$ and the home and the host countries have high cultural similarity.

3. If $\theta^U \in \left[\theta_{lower}^U, (a-c)/2b\right]$, the exporter enters the host market developing a new localized platform.

where $\theta_{lower}^U = \frac{1}{2b}\left[(2-\varepsilon)(a-c) - \sqrt{(a-c)^2(2-\varepsilon)^2 - (16\lambda V_i / N_K)}\right]$.

---

8 $\frac{\partial E\pi_K^{LAE}}{\partial \theta^U} = \frac{N_K}{12\lambda}\left[-3b\varepsilon\left(a-c-2b\theta^U\right) - 2b^2\varepsilon\theta^U(3-\varepsilon)\right] \leq 0$ for $\theta^U \in \left[0, (a-c)/2b\right]$ and $\varepsilon \in [0,1]$.

Proof:

From the profits $E\pi_K^{SAE}$ and $E\pi_K^{LAE}$,

$E\pi_K^{SAE} - E\pi_K^{LAE} = V_i + \frac{bN_K\theta^U}{4\lambda}\left(b\theta^U - (a-c)(2-\varepsilon)\right)$, which is a quadratic function with a positive coefficient on the second order term. Notice that,

when $\theta^U = \frac{1}{2b}\left[(2-\varepsilon)(a-c) \pm \sqrt{(a-c)^2(2-\varepsilon)^2 - 16\lambda V_i / N_K}\right]$, $E\pi_K^{SAE} - E\pi_K^{LAE} = 0$.

From the assumption 1, $\theta_{lower}^U < \frac{a-c}{2b}$ and $\theta_{uper}^U > \frac{a-c}{2b}$ where θ_{lower}^U and θ_{upper}^U are the lower and the upper values of the critical θ^U such that $E\pi_K^{SAE} = E\pi_K^{LAE}$ at θ_{lower}^U and θ_{upper}^U respectively. Therefore, $E\pi_K^{SAE} \geq E\pi_K^{LAE}$ if $\theta^U \notin \left[\theta_{lower}^U, (a-c)/2b\right]$. Otherwise, $E\pi_K^{SAE} \leq E\pi_K^{LAE}$. Clearly, θ_{lower}^U and θ_{upper}^U exist only if

$V_i \leq \frac{N_K}{16\lambda}(a-c)^2(2-\varepsilon)^2$. If $V_i \geq \frac{N_K}{16\lambda}(a-c)^2(2-\varepsilon)^2$, $E\pi_K^{SAE} \geq E\pi_K^{LAE}$ for all θ^U.

QED

Proposition 2.1 suggests the following. When the R&D cost is too high, the exporter enters with the current platform and saves this high R&D cost. When the R&D cost is not too expensive, if the home and host countries have similar culture and tastes, the exporter also uses the current platform to supply the foreign market by adjusting it because the adjustment cost is considerably cheap. If the two countries have considerably different tastes and the R&D cost is not too high, the exporter chooses to develop a new localized platform because adjusting the current platform for the foreign market costs too much.

From the functional property of θ^U_{lower}, the following proposition for the comparative static property holds.

Proposition 2.2:

The smaller is the variance of the uncertain preference in the host country, the higher is the fixed R&D cost, or the smaller is the host market, the larger the range of θ^U for which the exporter will find it desirable to adopt the *SAE* strategy.

Proof:

To verify the first statement in Proposition 2.2, differentiate θ^U_{lower} with respect to ε.

$$\frac{\partial \theta^U_{lower}}{\partial \varepsilon} = -\frac{1}{2b}\left[a-c-\frac{(a-c)^2(2-\varepsilon)}{\sqrt{(a-c)^2(2-\varepsilon)^2-16\lambda V_i/N_K}}\right]<0$$

As the variance of the uncertain preference in the host country decreases, θ^U_{lower} increases, the range of θ^U for the multinational to adopt the *SAE* strategy becomes larger.

The second and the third statements can be verified in similar ways.

$$\frac{\partial \theta^U_{lower}}{\partial V_i} = \frac{4\lambda}{bN_K}\frac{1}{\sqrt{(a-c)^2(2-\varepsilon)^2-16\lambda V_i/N_K}}>0 \text{ and}$$

$$\frac{\partial \theta^U_{lower}}{\partial N_K} = -\frac{4\lambda V_i}{b(N_K)^2}\frac{1}{\sqrt{(a-c)^2(2-\varepsilon)^2-16\lambda V_i/N_K}}<0$$

Therefore, the higher is the fixed R&D cost, or the smaller is the host market, the larger range of θ^U will find the exporter to adopt the *SAE* strategy. QED

The first statement implies the following. If ε becomes smaller, the exporter faces less risk with respect to the host-preferred variety, and the expected profit of the exporter increases. Furthermore, since the adjustment process is applied after the true preference in the host country is revealed, the effect of the smaller ε on profit with the *SAE* strategy is relatively smaller than it is with the *LAE* strategy. The intuition behind the second statement is obvious. When the fixed R&D cost becomes high, the *LAE* strategy which requires the higher R&D cost than the *SAE* strategy becomes less profitable. The third statement in Proposition 2.2 implies that, as the host market becomes larger, the exporter prefers a strategy that has lower marginal cost in the host country (*LAE* strategy).

Multinational

Now consider the case which the firm decides to establish an affiliate in the host country and then becomes a multinational. Suppose the multinational uses its current platform for home country U to serve the foreign country K by adjusting it (*SA* strategy). Since the multinational can observe the true preferred variety in the host country, the profit with the *SA* strategy in the host country is:

$$\pi_K^{SA} = \frac{N_K}{4\lambda}\left(a - c - bd\left(\theta^U, \theta^K\right)\right)^2 - E_K$$

where θ^K is the observed host-preferred variety.

If the multinational decides to develop a new localized platform for the host country, the profit of the firm in the host country becomes:

$$\pi_K^{FL} = \frac{N_K}{4\lambda}(a-c)^2 - V_i - E_K$$

Notice that the multinational develops and serves θ^K without using the adjustment technology because the firm can observe the preference.

Given π_K^{SA} and π_K^{FL}, the multinational chooses the optimal strategy to maximize its profit.

Proposition 2.3:

Suppose the monopoly profit of the multinational in the host country is positive. Given the revealed θ^K,

1. The multinational uses the current platform to serve the host country if
   $d(\theta^U, \theta^K) \leq \hat{d}$.
2. The multinational develops a new localized platform to serve the host country if
   $d(\theta^U, \theta^K) \geq \hat{d}$.

where $\hat{d} \equiv \frac{1}{b}\left(a-c-\sqrt{(a-c)^2 - 4\lambda V_i / N_K}\right)$.

Proof:

From the profits of the multinational,

$\pi_K^{SA} - \pi_K^{FL} = \frac{N_K}{4\lambda}\left(a-c-bd(\theta^U, \theta^K)\right)^2 - \frac{N_K}{4\lambda}(a-c)^2 + V_i$, and $\pi_K^{SA} = \pi_K^{FL}$ at $d(\theta^U, \theta^K) = \hat{d}$, where $\hat{d} \equiv \frac{1}{b}\left(a-c-\sqrt{(a-c)^2 - 4\lambda V_i / N_K}\right)$. Further, $\pi_K^{SA} \geq \pi_K^{FL}$ if $d(\theta^U, \theta^K) \leq \hat{d}$, and $\pi_K^{SA} \leq \pi_K^{FL}$ if $d(\theta^U, \theta^K) \geq \hat{d}$. Notice that $\hat{d}$ always exists because the monopoly profit of the multinational is assumed to be positive and

$(a-c)^2 - 4\lambda V_i / N_K > 0$. QED

Similar to the exporter case, Proposition 2.3 implies the following. If the home and host countries have similar tastes, the multinational uses the current platform to supply the host market by adjusting it because the adjustment cost is relatively less expensive. If the two countries have considerably different tastes, the multinational chooses to develop a new localized platform because adjusting its current platform for the host market costs too much.

From the functional property of $\hat{d}$, we have the following comparative static result:

Proposition 2.4

As the size of the host market becomes larger, the multinational is more likely to develop a new localized platform to serve the host country.

Proof:

Take the derivative of $\hat{d}$ with respect to N_K:

$$\frac{\partial \hat{d}}{\partial N_K} = -\frac{4\lambda V_i}{b N_K^2 \sqrt{(a-c)^2 - 3\lambda V_i / N_K}} < 0$$

Therefore, as N_K increases, $\hat{d}$ decreases and the larger range of θ^U will find that the *FL* strategy is optimal for the multinational. QED

Proposition 2.4 means that, when the host market is large, the multinational can earn higher operating profits by choosing the strategy that has lower marginal cost (*FL* strategy)

Optimal Choice of Location and Platform

When the firm decides the locational choice between being an exporter and a multinational, the firm faces uncertain profits. The expected profits of the exporter are $E\pi_K^{SAE}$ or $E\pi_K^{LAE}$, depending on θ^U. The uncertain profits with the multinational strategy also depend on θ^U. If $-\varepsilon\theta^U \geq \varepsilon\theta^U - \hat{d}$, the multinational always adopts the *SA* strategy because the two countries have sufficiently similar taste. If $-\varepsilon\theta^U \leq \theta^U - \hat{d} \leq \varepsilon\theta^U$, the multinational may use the *SA* strategy or the *LA* strategy, depending on the revealed θ^K. Otherwise, the multinational always adopts the *LA* strategy for any revealed θ^K. The expected profit in each case is:

If $-\varepsilon\theta^U \geq \theta^U - \hat{d} \leftrightarrow \theta^U \leq \hat{d}/(1+\varepsilon)$,

$$E\pi_1^{MNE} = \frac{N_K}{12\lambda}\left[3\left(a-c-b\theta^U\right)^2 + b^2\varepsilon^2\left(\theta^U\right)^2\right] - E_K$$

If $-\varepsilon\theta^U \leq \theta^U - \hat{d} \leq \varepsilon\theta^U \leftrightarrow \hat{d}/(1+\varepsilon) \leq \theta^U \leq \hat{d}/(1-\varepsilon)$,

$$E\pi_2^{MNE} = \frac{1}{2\varepsilon\theta^U}[\left(\frac{N_K(a-c)^2}{4\lambda} - V_i\right)\left((1+\varepsilon)\theta^U - \hat{d}\right) + \frac{N_K}{12b\lambda}\left(\left(a-c-b(1-\varepsilon)\theta^U\right)^3 - \left(a-c-b\hat{d}\right)^3\right)] - E_K$$

If $\theta^U - \hat{d} \geq \varepsilon\theta^U \leftrightarrow \theta^U \geq \hat{d}/(1-\varepsilon)$,

$$E\pi_3^{MNE} = \frac{N_K}{4\lambda}(a-c)^2 - V_i - E_K$$

Ex ante, the firm compares $E\pi^{MNE}$ and $\max\left[E\pi_K^{SAE}, E\pi_K^{LAE}\right]$ to choose its best locational strategy.

Proposition2.5:

Suppose $E_K \le \frac{N_K}{48\lambda}(a-c)^2(6-\varepsilon)\varepsilon$.

1. There exists $\hat{\theta}^U_{lower} \in \left[\hat{d}/(1+\varepsilon),(a-c)/2b\right]$ such that the firm becomes an exporter if $\theta^U \le \hat{\theta}^U_{lower}$.
2. There exists $\hat{\theta}^U_{upper} \in \left[\hat{d}/(1+\varepsilon),(a-c)/2b\right]$ such that the firm becomes a multinational if $\theta^U \ge \hat{\theta}^U_{upper}$.

Proof:

First of all, the expected profits of an exporter and a multinational are maximum at $\theta^U = 0$[9]. When $\theta^U = 0$, $E\pi^{MNE} = \frac{N_K}{4\lambda}(a-c)^2 - E_K < \frac{N_K}{4\lambda}(a-c)^2 = E\pi_K^{SAE}$. Moreover, the expected profits are minimum at $\theta^U = (a-c)/2b$ that is the maximum of θ^U.

Assuming $E_K \le \frac{N_K}{48\lambda}(a-c)^2(6-\varepsilon)\varepsilon$, $E\pi^{MNE} \ge E\pi_K^{LEA}$ at $\theta^U = \frac{a-c}{2b}$:

$$E\pi^{MNE} = E\pi_3^{MNE} = \frac{N_K}{4\lambda}(a-c)^2 - V_i - E_K \ge \frac{N_K}{48\lambda}(a-c)^2\left(12-6\varepsilon+\varepsilon^2\right) - V_i = E\pi_K^{LAE}$$
$$\leftrightarrow E_K \le \frac{N_K}{48\lambda}(a-c)^2(6-\varepsilon)\varepsilon > 0$$

Now consider the slopes of the profits. The slopes of all profit functions are decreasing

---

[9] $\theta^U = 0$ eliminates both variance and cultural dissimilarity

in θ^U and have following properties;

$$\left|\frac{\partial E\pi^{SAE}}{\partial\theta^U}\right| > \left|\frac{\partial E\pi^{LAE}}{\partial\theta^U}\right| > \left|\frac{\partial E\pi_3^{MNE}}{\partial\theta^U}\right| = 0, \quad \left|\frac{\partial E\pi_1^{MNE}}{\partial\theta^U}\right| > \left|\frac{\partial E\pi_2^{MNE}}{\partial\theta^U}\right| > \left|\frac{\partial E\pi_3^{MNE}}{\partial\theta^U}\right| = 0, \text{ and}$$

$$\left|\frac{\partial E\pi^{SAE}}{\partial\theta^U}\right| = \left|\frac{\partial E\pi_1^{MNE}}{\partial\theta^U}\right|$$

Because $E\pi^{MNE} < E\pi_K^{SAE}$ at $\theta^U = 0$, $E\pi^{MNE} \geq E\pi_K^{LAE}$ at $\theta^U = (a-c)/2b$, and profit functions are continuous and decreasing in θ^U, there exists $\hat{\theta}_{lower}^U$ such that $E\pi^{MNE} \leq E\pi^{EXP}$ for $\theta^U \leq \hat{\theta}_{lower}^U$ from the mean-value theorem where $E\pi^{EXP}$ is the profit of the exporter. Likewise, there exists $\hat{\theta}_{upper}^U$ such that $E\pi^{MNE} \geq E\pi^{EXP}$ for $\theta^U \geq \hat{\theta}_{upper}^U$ from the mean-value theorem.

Further, we can show $\hat{d}/(1+\varepsilon) \leq \theta_{lower}^U$:

From the definitions of $\hat{d}$ and θ_{lower}^U,

$$\theta_{lower}^U - \hat{d}/(1+\varepsilon) = \frac{1}{2b}\left[(2-\varepsilon)(a-c) - \sqrt{(a-c)^2(2-\varepsilon) - 16\lambda V_i / N_K}\right] - \frac{\hat{d}}{1+\varepsilon}$$
$$\leftrightarrow \frac{1}{1+\varepsilon}\left[\frac{1+\varepsilon}{2b}\left((2-\varepsilon)(a-c) - \sqrt{(a-c)^2(2-\varepsilon)^2 - 16\lambda V_i / N_K}\right) - \hat{d}\right]$$

Notice that the expression in the bracket is an increasing function in ε and positive at $\varepsilon = 0$. Therefore, $\theta_{lower}^U - \hat{d}/(1+\varepsilon) \geq 0$ for all $\varepsilon \in (0,1)$.

Because $\left|\frac{\partial E\pi^{SAE}}{\partial\theta^U}\right| = \left|\frac{\partial E\pi_1^{MNE}}{\partial\theta^U}\right|$ and $\hat{d}/(1+\varepsilon) \leq \theta_{lower}^U$, it is clear that $E\pi^{MNE} < E\pi_K^{SAE}$ at $\theta^U = \hat{d}/(1+\varepsilon)$. Therefore, $\hat{\theta}_{lower}^U \geq \hat{d}/(1+\varepsilon)$ and $\hat{\theta}_{upper}^U \geq \hat{d}/(1+\varepsilon)$. QED

For certain a range of E_K, $\hat{\theta}_{lower}^U$ and $\hat{\theta}_{upper}^U$ are in the range of $\left[\hat{d}/(1+\varepsilon), \hat{d}/(1-\varepsilon)\right]$.

Corollary 2.5.1:

When $E_K \le \frac{N_K \varepsilon b\hat{d}}{12\lambda(1-\varepsilon)^2}\left[3(a-c)(1-\varepsilon)-\varepsilon b\hat{d}\right]$, there exist $\hat{\theta}^U_{lower}$ and $\hat{\theta}^U_{upper}$ such that $\hat{\theta}^U_{lower} \in \left[\hat{d}/(1+\varepsilon), \hat{d}/(1-\varepsilon)\right]$ and $\hat{\theta}^U_{upper} \in \left[\hat{d}/(1+\varepsilon), \hat{d}/(1-\varepsilon)\right]$.

Proof:

$E\pi^{MNE} \ge E\pi^{SAE}_K$ at $\theta^U = \hat{d}/(1-\varepsilon)$ when $E_K \le \frac{N_K \varepsilon b\hat{d}}{12\lambda(1-\varepsilon)^2}\left[3(a-c)(1-\varepsilon)-\varepsilon b\hat{d}\right]$.

From the continuity of the profits and the mean-value thermo, $\hat{\theta}^U_{lower} \le \hat{d}/(1-\varepsilon)$ and $\hat{\theta}^U_{upper} \le \hat{d}/(1-\varepsilon)$. QED

Proposition 2.5 implies that the firm becomes a multinational when the host country has a very different culture from the home country. In this case, the firm faces high preference uncertainty due to the cultural difference. However, the firm decides to be an exporter when the host and home countries have relatively similar culture. Notice that the *LAE* strategy of the exporter and the MNE strategy are the strategies to reduce the preference uncertainty. Therefore, the MNE strategy replaces the *LAE* strategy when the firm faces high cultural difference in the host country.

Welfare of the host country

Since the firm always serves the home country with the base marginal cost, the welfare of consumers is independent of the firm's decision on technology and location. However, the firm's strategic decision affects the welfare in the host country. The welfare in the host country is largest when the firm becomes a multinational and adopts the *FL* strategy because the firm serves the host market with the base marginal cost. The host country's welfare is lowest when the firm adopts the *SAE* or the *SA* strategy.

$$W_K^{FL} \geq W_K^{LAE} \geq W_K^{SAE} = W_K^{SA}$$

where W_K^i is the welfare in host country *K*. Note that the exporter with the *LAE* strategy is better for the host country than the multinational with the *SA* strategy.

Consider the situation that $E_K \leq \frac{N_K \varepsilon b\hat{d}}{12\lambda(1-\varepsilon)^2}\left[3(a-c)(1-\varepsilon)-\varepsilon b\hat{d}\right]$ and Corollary 2.5.1 holds. The order of welfare in the host country, Proposition 2.5 and Corollary 2.5.1 imply that the multinational may reduce the welfare of the host country for some ranges of θ^U and revealed θ^K.

Corollary 2.5.2:

Assume $E_K \leq \frac{N_K \varepsilon b\hat{d}}{12\lambda(1-\varepsilon)^2}\left[3(a-c)(1-\varepsilon)-\varepsilon b\hat{d}\right]$. Allowing a multinational reduces the welfare in host country if $\theta^U \in \left[\hat{\theta}^U_{upper}, \hat{d}/(1-\varepsilon)\right]$ and true $\theta^K \leq \hat{d}-\theta^U$.

As shown in Proposition 2.5, when $\theta^U \in \left[\hat{\theta}^U_{upper}, \hat{d}/(1-\varepsilon)\right]$, the firm decides to be a multinational. Further, if the true (but unobserved by the exporter) θ^K is $\theta^K \leq \hat{d}-\theta^U$, the multinational adopts the *SA* strategy after θ^K is revealed. Notice that the optimal strategy of the exporter for this ranges of θ^U and θ^K is the *LAE* strategy if the multinational is not allowed. Since $W_K^{LAE} \geq W_K^{SA}$, the host country becomes worse-off by allowing the multinational.

Since $W_K^{FL} \geq W_K^{SA}$ and $W_K^{LAE} \geq W_K^{SAE}$, the following corollary also holds.

Corollary 2.5.3

The host country will be better off if a culturally dissimilar exporter or multinational enters.

If the entrant has a similar cultural background to the host country, the firm is more likely to adopt the *SAE* or the *SA* strategy. Since it incurs higher marginal cost due to the adjustment process, the consumer welfare in the host country is reduced.

Choice of the Platform Variety

In the previous part of this chapter, I assumed the initial platform variety was given for the firm. Therefore, the firm only can adjust its current platform when it adopts the adjustment technology or creates a second platform. In remaining part, I will relax this assumption and allow the firm's choice of the platform. To do so, consider the situation in which demand for a new product emerges simultaneously in the home and host country. Suppose that a firm has its production facility in the home country and considers entering the home and host markets. As on the previous case, this firm can be either an exporter or a multinational. Assume the technology and the preference structure in the previous example hold here. Other assumptions made previously still hold in the remainder of this chapter. Without loss of generality, assume $\theta^U \geq \theta^K$. Finally, normalize the market size of the home country: $N_U = 1$.

Exporter

Suppose the firm decides to be an exporter and adopts the *SAE* strategy. Since the exporter can choose its platform variety, the expected profit depends on the choice of the platform variety. The expected joint profit in the two countries is:

$$E\hat{\pi}^{SAE}\left(\theta^{SP}\right)=\frac{1}{4\lambda}\left(a-c-bd\left(\theta^{SP},\theta^{U}\right)\right)^{2}+\frac{N_K}{12\lambda}\left[3\left(a-c-bd\left(\theta^{SP},\theta^{K}\right)\right)^{2}+b^{2}\varepsilon^{2}\left(\theta^{U}\right)^{2}\right]-V_i$$

where θ^{SP} is the standard platform. The first term is the profit in the home country and the second term is the expected profit in the host country. Note that the *SAE* strategy incurs V_i because the exporter develops a standard platform variety. From the convexity of the expected profit, the exporter's optimal choice of platform variety is θ^{U} or 0, which is the expected value of θ^{K}, depending on the relative market size in the host country.

Proposition 2.6:

Suppose an exporter adopts the *SAE* strategy.

1. If $N_K \geq 1$, the exporter uses the expected host-preferred variety as its platform.
2. If $N_K \leq 1$, the exporter uses its home-preferred variety as its platform.

Proof:

Given the monopoly profit with the *SAE* strategy, this follows from the comparison of $E\hat{\pi}^{SAE}\left(\theta^{U}\right)$ and $E\hat{\pi}^{SAE}\left(0\right)$, and the properties of the distance function $d\left(\theta^{U},\theta^{K}=0\right)$.

QED

Proposition 2.6 suggests that, when the exporter adopts the *SAE* strategy, the exporter uses the (expected) preferred variety in the larger market as its platform variety to reduce the marginal cost and earn higher profit in that market.

Now suppose that the exporter adopts the *LAE* strategy. The exporter's joint profit maximization problem is:

$$\underset{\theta_K^P}{Max}\ E\hat{\pi}^{LAE} = \int_{-\varepsilon\theta^U}^{\varepsilon\theta^U} \frac{1}{2\varepsilon\theta^U}\left(\frac{1}{4\lambda}(a-c)^2 + \frac{N_K}{2\lambda}\left(a-c-bd\left(\theta_K^P,\theta^K\right)\right)^2 - 2V_i\right)d\theta^K$$

The first term in the round bracket is the profit in the home country and the second term in the round bracket is the profit in the host country. The optimal localized platform of the exporter is the expected host-preferred variety: $\theta_K^P = 0$. The expected joint profit of the exporter is:

$$E\hat{\pi}^{LAE} = \frac{1}{4\lambda}(a-c)^2 + \frac{N_K}{12\lambda}\left[3(a-c)^2 - b\varepsilon\theta^U(a-c) + b^2\varepsilon^2\left(\theta^U\right)^2\right] - 2V_i$$

Note that $E\hat{\pi}^{LAE}$ is decreasing in θ^U[10].

The optimal production method of the exporter is the strategy that provides the higher profit. When $N_K \le 1$, the optimal platform for the *SAE* strategy is the home-

---

10 $\frac{\partial E\pi^{LAE}}{\partial\theta^U} = \frac{N_K}{12\lambda}\left[-b\varepsilon\left(a-c-2b\theta^U\right) - 2b^2\varepsilon\theta^U(1-\varepsilon)\right] \le 0$ for $\theta^U \in \left[0,(a-c)/2b\right]$ and $\varepsilon \in [0,1]$

preferred variety, and this model is identical to the monopoly model given the platform that was discussed in the previous part. Therefore, Propositions 2.1 and 2.2 hold here. However, when $N_K \geq 1$, the exporter chooses the host-preferred variety as the platform when it adopts the *SAE* strategy and Propositions 2.1 and 2.2 should be modified slightly.

Proposition 2.1':

Assume $N_K \geq 1$. Suppose the monopoly profits of an exporter in the host and the host countries are profitable. Then:

1. If the R&D cost is sufficiently high, that is, $V_i \geq (a-c)^2(2-\varepsilon N_K)^2/16\lambda$, then the exporter adopts the *SAE* strategy and chooses the host-preferred variety as its platform.

If $V_i \leq (a-c)^2(2-\varepsilon N_K)^2/16\lambda$, then:

2. The exporter adopts the *SAE* strategy and chooses the host-preferred variety as its platform if $\theta^U \leq \hat{\theta}^U_{lower}$ and the home and the host countries have high cultural similarity.
3. If $\theta^U \in \left[\hat{\theta}^U_{lower}, (a-c)/2b\right]$, the exporter adopts the *LAE* strategy.

where $\hat{\theta}^U_{lower} = \frac{1}{2b}\left[(2-\varepsilon N_K)(a-c)-\sqrt{(a-c)^2(2-\varepsilon N_K)^2-16\lambda V_i}\right]$.

Proposition 2.1' is essentially identical to Proposition 2.1, and the proof is also the same to that for Proposition 2.1; only the critical values of $\hat{\theta}^U_{lower}$ and V_i are changed. Therefore, interpretation of Proposition 2.1' is the same as that of Proposition 2.1.

Proposition 2.2':

Assume $N_K \geq 1$. The smaller is the variance of the uncertain preference in the host country, the higher is the fixed R&D cost, or *the larger is the host market*, the larger the range of θ^U such that the exporter chooses to adopt the *SAE* strategy.

Proof:

Proposition 2.2' can be verified by differentiating $\hat{\theta}^U_{lower}$ with respect to ε, N_i, and N_K:

$$\frac{\partial \hat{\theta}^U_{lower}}{\partial \varepsilon} = -\frac{N_K}{2b}(a-c)\left[1-\frac{(a-c)(2-\varepsilon N_K)}{\sqrt{(a-c)^2(2-\varepsilon N_K)-16\lambda N_i}}\right] < 0$$

$$\frac{\partial \hat{\theta}^U_{lower}}{\partial V_i} = \frac{4\lambda}{b}\frac{1}{\sqrt{(a-c)^2(2-\varepsilon N_K)^2-16\lambda V_i}} > 0$$

$$\frac{\partial \hat{\theta}^U_{lower}}{\partial N_K} = -\frac{\varepsilon(a-c)}{2b}\left(1-\frac{(a-c)(2-\varepsilon N_K)}{\sqrt{(a-c)^2(2-\varepsilon N_K)-16\lambda V_i}}\right) > 0.$$ QED

Note that the first two arguments in Proposition 2.2 also hold here, but the third argument doesn't hold anymore. The intuitions behind the first two arguments in Proposition 2.2' are the same as that for Proposition 2.2. If ε becomes smaller, the exporter faces less risk about incorrectly guessing the host-preferred variety, and the exporter prefers the *SAE* strategy. If the fixed R&D cost becomes higher, the exporter is more likely to adopt the *SAE* strategy to reduce the R&D cost. To understand the third argument, notice that the marginal cost in the host country is always the base marginal cost. Since the larger size of the host market means that the home country becomes relatively smaller and less important for the exporter, the exporter is less likely to develop the variety tailored to the home country (*LAE* strategy).

Multinational

Suppose the firm becomes a multinational and adopts the *SA* strategy. Since the multinational can observe the true preferred variety in the host country, the joint profit of the firm is:

$$\hat{\pi}^{SA}\left(\theta^{SP}\right)=\frac{1}{4\lambda}\left(a-c-bd\left(\theta^{SP},\theta^{U}\right)\right)^{2}+\frac{N_K}{4\lambda}\left(a-c-bd\left(\theta^{SP},\theta^{K}\right)\right)^{2}-V_i-E_K$$

The first and second terms in the profit expression are the profits earned in the home and host countries, respectively. From the convexity of the profit structure, the optimal platform is θ^U or θ^K.

Proposition 2.7:

Suppose a multinational adopts the *SA* strategy.

1. If $N_K \geq 1$, the multinational chooses the host-preferred variety as its platform.
2. If $N_K \leq 1$, the multinational chooses its home-preferred variety as its platform.

Proof:

Given the monopoly profit with the *SA* strategy, this follows from the comparison of $\hat{\pi}^{SA}\left(\theta^{U}\right)$ and $\hat{\pi}^{SA}\left(\theta^{K}\right)$. QED

Like the *SAE* strategy, Proposition 2.7 suggests that, when the multinational adopts the *SA* strategy, the multinational uses the preferred variety in the larger market as its platform variety to reduce the marginal cost and earn higher profit in the larger market.

Now consider the case in which the multinational adopts the *FL* strategy. Since the multinational develops two platforms tailored to two markets, the firm earns the usual monopoly profits in each market.

$$\hat{\pi}^{FL} = \frac{1}{4\lambda}(a-c)^2 + \frac{N_K}{4\lambda}(a-c)^2 - 2V_i$$

Given $\hat{\pi}^{SA}$ and $\hat{\pi}^{FL}$, the multinational's optimal production method is the strategy that provides the higher profit. Note that, if $N_K \leq 1$, the optimal platform for the *SA* strategy is the home-preferred variety and the choice of the multinational is identical to that in the model with given platform. Therefore, Proposition 2.3 holds here. When $N_K \geq 1$, Proposition 2.3 needs to be modified.

Proposition 2.3':

Assume $N_K \geq 1$. Suppose the monopoly profits of the multinational in the home and the host countries are positive.

Given the revealed θ^K,

1. The multinational adopts the *SA* strategy and chooses the host-preferred variety as its platform if $d\left(\theta^U, \theta^K\right) \leq \tilde{d}$.

2. The multinational adopts the *FL* strategy if $d\left(\theta^{U},\theta^{K}\right)\geq\tilde{d}$.

Where $\tilde{d}\equiv\frac{1}{b}\left(a-c-\sqrt{(a-c)^{2}-4\lambda V_{i}}\right)$.

The proof and interpretation of this proposition is essentially the same as that of Proposition 2.3. If the home and the host countries have similar cultures, the multinational adopts the *SAE* strategy because the adjustment cost is relatively inexpensive. Otherwise, the *LAE* strategy is the more favorable choice for the multinational because developing the additional platform is relatively cheaper than adjusting a platform.

Since $\tilde{d}$ doesn't depend on N_K, Proposition 2.4 doesn't hold anymore. That is, when $N_K\geq 1$, the choice of the multinational between the *SA* and the LE strategies are the choice of the efficient technology in the home market, which is independent of the size of the host market.

Optimal Choice of Location and Platform

When $N_K\leq 1$, the expected profits of the exporter and the multinational are the same as those in the model with a given platform; therefore, Proposition 2.5 holds. However, when $N_K\geq 1$, the choice of the firm is slightly changed since the profits with the *SAE* and the *SA* strategies are different in this model with the endogenous platform. When $N_K\geq 1$, the expected profit is:

If $\theta^{U}\leq\tilde{d}/(1+\varepsilon)$,

$$E\hat{\pi}_1^{MNE} = \frac{1}{12\lambda}\left[3\left(a-c-bd^U\right)^2 + b^2\varepsilon^2\left(\theta^U\right)^2\right] - \frac{N_K}{4\lambda}(a-c)^2 - V_i - E_K$$

If $\tilde{d}/(1+\varepsilon) \le \theta^U \le \tilde{d}/(1-\varepsilon)$,

$$E\hat{\pi}_2^{MNE} = \frac{1}{2\varepsilon\theta^U}[\left(\frac{(a-c)^2}{4\lambda} - V_i\right)\left((1+\varepsilon) - \tilde{d}\right) +$$

$$\frac{1}{12b\lambda}\left(\left(a-c-b(1-\varepsilon)\theta^U\right)^3 - \left(a-c-b\tilde{d}\right)^3\right)] + \frac{N_K}{4\lambda}(a-c)^2 - V_i - E_K$$

If $\theta^U \ge \tilde{d}/(1-\varepsilon)$,

$$E\hat{\pi}_3^{MNE} = \frac{1+N_K}{4\lambda}(a-c)^2 - 2V_i - E_K$$

Given $E\hat{\pi}^{MNE}$, $E\hat{\pi}^{EXP} \equiv \max\left[E\hat{\pi}^{SAE}, E\hat{\pi}^{LAE}\right]$, the firm chooses its best locational strategy.

Proposition 2.5':

Assume $N_K \ge 1$. Suppose $E_K \le \frac{N_K}{48\lambda}(a-c)^2(6-\varepsilon)\varepsilon$.

1. There exist $\tilde{\theta}_{lower}^U \in \left[\tilde{d}/(1+\varepsilon), (a-c)/2b\right]$ such that the firm becomes an exporter if $\theta^U \le \tilde{\theta}_{lower}^U$.
2. There exist $\tilde{\theta}_{upper}^U \in \left[\tilde{d}/(1+\varepsilon), (a-c)/2b\right]$ such that the firm becomes a multinational if $\theta^U \ge \tilde{\theta}_{upper}^U$.

Corollary 2.5.1':

Assume $N_K \geq 1$. When $E_K \leq \frac{N_K \varepsilon b\hat{d}}{12\lambda(1-\varepsilon)^2}\left[3(a-c)(1-\varepsilon)-\varepsilon b\hat{d}\right]$, there exist $\tilde{\theta}^U_{lower}$ and $\tilde{\theta}^U_{upper}$ such that $\tilde{\theta}^U_{lower} \in \left[\tilde{d}/(1+\varepsilon), \tilde{d}/(1-\varepsilon)\right]$ and $\tilde{\theta}^U_{upper} \in \left[\tilde{d}/(1+\varepsilon), \tilde{d}/(1-\varepsilon)\right]$.

The proofs of Proposition 2.5' and Corollary 2.5.1' are the same as those of Proposition 2.5 and Corollary 2.5.1. Like Proposition 2.5, this proposition suggests that the firm becomes a multinational if the host and the home countries have considerably different culture. When two countries have high cultural similarity, the firm is more likely to become an exporter. Moreover, if the host country has very similar culture with the home country, the *SAE* strategy is more favorable for the exporter. Assuming $N_K \geq 1$, the platform for the *SAE* strategy is the host-preferred variety.

Welfare of the home country

Assuming $N_K \geq 1$, the firm always serves the host country with the base marginal cost and the firm's decision on the technology and location doesn't affect the consumer welfare in the host country. However, consumer welfare in the home country depends on the firm's decision. The order of consumer welfare in the home country is:

$$W_U^{FL} \geq W_U^{LAE} \geq W_U^{SAE} = W_U^{SA}$$

where W_U^i is consumer welfare in home country *U*. Similar with consumer welfare analysis in the model with given platform, the multinational strategy could harm consumer welfare in the home country and Corollary 2.5.2' follows.

Corollary 2.5.2':

Assume $N_K \geq 1$ and $E_K \leq \frac{N_K \varepsilon b\tilde{d}}{12\lambda(1-\varepsilon)^2}\left[3(a-c)(1-\varepsilon)-\varepsilon b\tilde{d}\right]$. Allowing a multinational reduces consumer welfare in home country if $\theta^U \in \left[\tilde{\theta}^U_{upper}, \hat{d}/(1-\varepsilon)\right]$ and true $\theta^K \leq \tilde{d}-\theta^U$.

Clearly, when $N_K \leq 1$, Corollary 2.5.2 holds. The comparison of Corollaries 2.5.2 and 2.5.2' suggests that the country with the smaller market could be worse-off from the cultural dissimilarity and allowing a multinational strategy for some ranges of θ^U and θ^K. Furthermore, Corollary 2.5.2' shows that even the home country could be worse-off if it has a smaller market than the host country; that is, cultural dissimilarity harms the (smaller) home country but helps the (larger) host country.

Corollary 2.5.3'

Assuming $N_K \geq 1$. The home country will be better off if the home and the host country have sufficiently dissimilar culture.

When two countries have similar culture, the exporter or the multinational is more likely to adopt the *SA* or *SAE* strategy. Furthermore, if $N_K \geq 1$, the platform of a firm is the host-preferred variety because the host market is larger and hence more important for the firm. Therefore, the additional adjustment cost is imposed on the consumers in the home country.

Conclusion

As Dunning (1998) mentioned, different culture in any country provides the firm an incentive to establish its affiliate in that country because the multinational can access this different cultural framework and the cultural-specific consumer demands and preferences. This chapter of the dissertation develops a theoretic model of a monopolist to support his assertion using Lancaster-type preference. In addition, several surveys show that the dominant production strategy of multinationals is that they develop standardized and locally adjustable product (Kang, et al, 2002; Kang, et al, 2003; Kang, et al, 2004). This production strategy was discussed in the literature on the flexible technology (Eaton and Schmitt, 1994; Norman and Thisse, 1999; Norman, 2002) but was neglected in the literature on multinationals. The model introduced this strategy to allow the firm to reduce R&D cost by developing fewer varieties to serve different tastes in different countries. In the model with two countries, this strategy can be considered as a standardization strategy because the firm develops a standardized platform for adjustment. The alternative production strategy in the model is a localization strategy under which the firm develops a fully localized variety to satisfy a specific preference in the host country.

This chapter shows that the exporter or the multinational adopts the standardization strategy if the home and the host countries have similar culture. The similar culture in both countries means the firm will have low adjustment cost. If the cultural difference between two countries is considerably larger, the localization strategy is the optimal production strategy for the exporter or the multinational. The model also shows that the firm becomes a multinational when the host country has dissimilar culture, thereby supporting the assertion by Dunning. Assuming the platform for the standardization strategy is given by the home-preferred variety (or, equivalently, the home market is larger than the host market), the model shows that the multinational strategy may harm the welfare in the host country because the localization strategy of the exporter provides higher consumer welfare in the host country than the standardization strategy of the multinational. However, assuming the firm enters the home and the host markets simultaneously and the home market is smaller than the host market, the multinational strategy of the firm could reduce welfare in the home country rather than the host country. In this case, the cultural difference harms the home country.

Chapter 3. Competition of Two Multinationals under Different Cultural Backgrounds

Introduction

The second chapter showed that the different culture in any country provides the firm an incentive to establish its affiliate in that country because the multinational can access the different cultural framework and the cultural-specific consumer demands and preference. The third chapter of this dissertation will discuss another common argument for the influence of cultural differences on firms; that is, multinationals from one country may have an intrinsic advantage over multinationals from another country in foreign countries that are culturally similar to their own country (Caves, 1996; UNCTAD World Investment Report, 1998). For this purpose, the monopoly model used in the second chapter will be extended to a duopoly model. I consider two multinationals that are from two different home countries that have different cultures; therefore, one firm possesses an intrinsic advantage in adjustment costs over the other. They are assumed to supply their home country and are considering entering the host market; that is, the platform for the *SA* strategy is given as the firms' home-preferred variety.[11] In this situation, this chapter studies, using the technology developed in the second chapter, the optimal production strategy of two multinationals from two countries that have different cultures. Also, the profits of the two firms in the host country, the effect of the cultural difference on the firms' optimal choice, and the welfare in the host country are discussed.

---

[11] This assumption will be relaxed in the fourth chapter.

Model

Assume that there are two multinationals, one (labeled *U*) from home country *U* and another (labeled *J*) from home country *J*. Assume host country *K* is more culturally similar to home country *J*. Finally, consider the situation that these two multinationals are considering entering the host country.

Consider the same preference structure as was used with the monopoly model in the second chapter. Assume a representative consumer in country *i* has the following demand for a product of variety θ_i^j that is supplied by firm *j*:

$$p_i^j = a - \gamma d\left(\theta_i^j, \theta^i\right) - \lambda q_i^j$$

where (a, γ, λ) are positive parameters and θ^i is the ideally preferred variety in country i. p_i^j and q_i^j are the price and the quantity demanded for the variety θ_i^j respectively. Then the aggregate demand for θ_i^j is given by[12]:

$$p_i = a - \gamma d\left(\theta_i^j, \theta^i\right) - \frac{\lambda}{N_i} Q_i$$

where Q_i represent total sales of all varieties and N_i represents the number of consumers in country *i*.

Turning to the firms, assume there are two multinationals, *J* and *U*, which are

---

[12] At equilibrium a demand of a representative consumer satisfies the following condition:

$$\min\left[p_i^J + \gamma d\left(\theta_i^J, \theta^i\right), p_i^U + \gamma d\left(\theta_i^U, \theta^i\right)\right] = a - \lambda q_i$$

From this condition, the aggregate demand can be derived.

considering entering the host market. Each is currently a monopolist in its home market and produces a home-preferred variety, θ^U for the firm in home country *U* and θ^J for the firm in home country *J*. Assume that the preferred variety θ^K in the host country is common knowledge for both multinationals and there is no demand uncertainty. The technology of firms follows that in the second chapter. If multinational *i* decides to enter the host country, it incurs a fixed entry cost E_i and has two production strategies, *SA* and *FL*. Assuming $b < \gamma$, using the *SA* strategy, a multinational can produce θ^K by adjusting its current home-preferred variety with additional marginal cost[13]. Alternatively, with the *FL* strategy, a multinational can develop a new platform θ^K directly at a fixed R&D cost V_i without additional marginal cost. The total cost structure of a multinational h to produce θ^K is:

$$SA\text{ strategy: } TC_h^{SA} = \left(c_h + b\left|\theta^h - \theta^K\right|\right)Q_K^h + E_h$$

$$FL\text{ strategy: } TC_h^{FL} = c_h Q_K^h + E_h + V_h$$

where Q_K^h is total sales of a variety θ^K produced by the multinational h. Assume the two multinationals have the same base marginal cost. Finally, to focus the strategic interaction between the two multinationals, assume that the duopoly profit of multinationals is always positive.

Assumption 1: $c_J = c_U = c$, $d^J \le d^U$, $E_J \le E_U$, and $V_J \le V_U$ where $d^h \equiv \left|\theta^h - \theta^K\right|$,

---

[13] Following the technology in the second chapter, adjusting a platform θ^P to another variety requires additional marginal cost: $b\left|\theta^P - \theta^j\right|$

$h = J, U$

Assumption 2: Duopoly profit of a multinational is always positive, and multinationals *U* and *J* enter the host market.

Strategic Interaction

Assuming the entry of both firms, the two multinationals play the game with the following sequence in host country *K*:

1. Given the entry of both firms, each firm decides its optimal production strategy; whether to adjust its current home-preferred platform θ^h or to develop a new platform θ^K tailored to the host market at a fixed R&D cost V_h, $h = J, U$.
2. Given the prior stage decision, each firm simultaneously chooses its output.

The duopoly profit matrix for this game is:

Firm *J*/Firm *U*	*SA*	*FL*
SA	$\left(\pi^J_{SA,SA} - E_J, \pi^U_{SA,SA} - E_U\right)$	$\left(\pi^J_{SA,FL} - E_J, \pi^U_{SA,FL} - E_U\right)$
FL	$\left(\pi^J_{FL,SA} - E_J, \pi^U_{FL,SA} - E_U\right)$	$\left(\pi^J_{FL,FL} - E_J, \pi^U_{FL,FL} - E_U\right)$

where $\pi^h_{x,y}$ represent the profit of firm h – exclusive of entry cost - if firm *J* and firm *U* adopt the strategies x and y respectively, $h = J, U$, x and $y = SA, FL$. The profit structures of the firms in each equilibrium are shown in table 4 in the appendix.

Given the profit structure, the firm's optimal choice of strategy depends on its fixed R&D cost. Hence:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \quad \textit{iff} \quad V_U < V_1 \equiv \left(\frac{4bd^U N_K}{9\lambda}\right)\left(a-c-b\left(d^U - d^J\right)\right)$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \quad \textit{iff} \quad V_U < V_2 \equiv \left(\frac{4bd^U N_K}{9\lambda}\right)\left(a-c-bd^U\right);$$

$$\text{and} \quad V_1 - V_2 = \left(\frac{4b^2 d^U d^J N_K}{9\lambda}\right) > 0$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \quad \textit{iff} \quad V_J < V_3 \equiv \left(\frac{4bd^J N_K}{9\lambda}\right)\left(a-c-b\left(d^J - d^U\right)\right)$$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \quad \textit{iff} \quad V_J < V_4 \equiv \left(\frac{4bd^J N_K}{9\lambda}\right)\left(a-c-bd^J\right);$$

$$\text{and} \quad V_3 - V_4 = \left(\frac{4b^2 d^U d^J N_K}{9\lambda}\right) > 0$$

Given the cost structure, $V_1 > V_2$ and $V_3 > V_4$. Also, given $d^J > d^U$, $V_3 < V_1$ and $V_4 < V_2$. However, the ordering of V_2 and V_3 is ambiguous. Figure 1[14] shows the pattern of the equilibrium, assuming zero entry cost.

When $V_U > V_1$, the *SA* strategy is a dominant strategy for firm *U*. When $V_U < V_2$, the dominant strategy of firm *U* is the *FL* strategy. Otherwise, for $V_U \in (V_2, V_1)$, firm *U* can chooses either the *SA* or the *FL* strategy depending on firm *J*'s choice of the strategy; if firm *J* adopts the *SA* strategy, then firm *U* responds to firm *J* by using the *FL* strategy.

[14] All figures are in the appendix.

Vice versa, if firm *J* uses the *FL* strategy, firm *U* responds by adopting the *SA* strategy. In general, when the fixed R&D cost is sufficiently low, firm *U* is more likely to adopt the *FL* strategy since developing a new localized platform costs less; when the fixed R&D cost is high, the *SA* strategy is more favorable strategy for firm *U*. The strategy choice of firm *J* is similar. Note that there exist multiple equilibria if $V_U \in (V_2, V_1)$ and $V_J \in (V_4, V_3)$.

Equilibrium of the duopoly game and the cultural similarity of three countries

Simple comparative statics of V_i, $i = 1,2,3,4$ show the effect of the culture on the strategic choice of firms and the equilibrium of duopoly game.

Proposition 3.1:

Let assumption 2 hold. Given d^k ($k = J,U$),

As d^h ($h = J,U$, $h \neq k$) increases (or decreases):

1. The range of V_h in which the *FL* strategy is the dominant strategy of firm *h* becomes larger (smaller).
2. The ranges of V_h and V_k in which the *SA* strategy is the dominant strategy of firm *h* and *k* become smaller (or larger).
3. The range of V_h and V_k for which there exist multiple equilibria also becomes larger (or smaller).

Proof:

The first and third statements follow from assumption 2 and the functional property of

V_i, $i = 1,2,3,4$:

$$\frac{\partial V_1}{\partial d^U} = \frac{4bN_K}{9\lambda}\left(a - c + bd^J - 2bd^U\right) > 0,\ \frac{\partial V_2}{\partial d^U} = \frac{4bN_K}{9\lambda}\left(a - c + 2bd^U\right) > 0,$$

$$\frac{\partial V_3}{\partial d^U} = \frac{4b^2 d^J N_K}{9\lambda} > 0, \text{ and } \frac{\partial V_4}{\partial d^U} = 0;$$

$$\frac{\partial V_1}{\partial d^J} = \frac{4b^2 d^U N_K}{9\lambda} > 0,\ \frac{\partial V_2}{\partial d^J} = 0,\ \frac{\partial V_3}{\partial d^J} = \frac{4bN_K}{9\lambda}\left(a - c + bd^U - 2bd^J\right) > 0,$$

$$\text{and } \frac{\partial V_4}{\partial d^J} = \frac{4bN_K}{9\lambda}\left(a - c + 2bd^J\right) > 0$$

Note that the area for the multiple eqilibria is:

$$Area(D) = \left(\frac{4b^2 d^J d^U N_K}{9\lambda}\right)^2 \text{ and } \frac{\partial}{\partial d^i} Area(D) > 0,\ i = J,U.$$

Therefore, the second and the third statements also hold. QED

Proposition 3.1 suggests that, when a multinational *h* has the cultural unfamiliarity in the host country, developing a new localized platform is more likely to be a dominant strategy of that firm; the R&D cost to develop an additional platform is relatively cheaper for the multinational *h* than the adjustment marginal cost for the *SA* strategy. Since the *FL* strategy chosen by firm *h* reduces its marginal cost in the host country, firm *k*, $k \neq h$, also is more likely adopt the *FL* strategy to prevent the loss of the market share in the host country; that is, the *SA* strategy is less likely to be a dominant strategy of firm *k*. Overall, if the two firms have more asymmetric cultural backgrounds, the firm from the culturally similar country is more likely to adopt the *SA* strategy while the *FL* strategy is more likely to be adopted by the firm from the culturally dissimilar country; the former firm has more advantage using the adjustment technology than the latter firm. In addition, the optimal strategy of firm *k* depends more on the strategic choice of firm *h*, and the area for multiple equilibria becomes larger.

Assuming $V_J = V_U = V$, the equilibrium lines on the 45 degree line. Figure 1 shows that, when the R&D cost is low, the equilibrium of the game is (*FL*, *FL*): as the R&D cost increases, an asymmetric equilibrium occurs; when the R&D cost is very high, both firms adopt the *SA* strategy, and the equilibrium (*SA*, *SA*) is achieved. Further, Proposition 3.1 implies the following corollary.

Corollary 3.1.1:

Assume $V_J = V_U = V$.

Given d^J, as d^U increases (or decreases),

1. The region of *V* for (*FL*, *FL*) is unchanged.
2. The region of *V* for (*FL*, *SA*) becomes larger (or is reduced).
3. The region of *V* for multiple equilibria and (*SA*, *SA*) are reduced (or become larger).

Given d^U, as d^J increases (or decreases)

4. The region of *V* for (*FL*, *FL*) and multiple equilibria become larger (or are reduced).
5. The region of *V* for (*FL*, *SA*) and (*SA*, *SA*) is reduced (or becomes larger).

Proof:

Corollary 3.1.1 follows directly from Proposition 3.1 and the assumption of $V_J = V_U = V$. QED

Corollary 3.1.1 is summarized in table 5. Given the cultural similarity of home country *J*, as the home country becomes more culturally dissimilar with the host country, (*FL*, *SA*) becomes the more likely outcome of the game; multinational *U* prefers to adopt the *FL* strategy because the *SA* strategy requires higher adjustment costs. For the same reason, the equilibrium (*SA*, *SA*) is less likely to be achieved. Since firm *J* has more advantage using the adjustment cost, the possibility of multiple equilibira decreases. Similarly, given d^U, as firm *J* becomes less culturally familiar to the host market, firm *J* has more incentive to choose the *FL* strategy, and equilibrium (*FL*, *FL*) is more likely to emerge. Because the two firms have more similar cultural backgrounds, the possibility of the asymmetric outcome (*FL*, *SA*) is reduced, but multiple equilibria emerge with more possibility. Further, (*SA*, *SA*) is less likely to be achieved because firm *J* also has greater likelihood. In addition, from Corollary 3.1.1, Corollary 3.1.2 is derived.

Corollary 3.1.2:

Assuming $d^J < d^U$,

1. As d^J and d^U increases, the region for the equilibrium (*FL*, *FL*) becomes larger, but that for (*SA*, *SA*) is reduced.
2. As d^J and d^U decreases, the region for the equilibrium (*FL*, *FL*) becomes smaller, but that for (*SA*, *SA*) becomes larger.
3. As d^J increases and d^U decreases, that is, they become closer, the region for (*FL*, *FL*) and multiple equiliria become larger; however, the region for (*SA*, *FL*) is reduced.
4. As d^J decreases and d^U increases, that is, they become further, the region for (*FL*, *FL*) and multiple equilibria are reduced; however, the region for (*SA*, *FL*) becomes larger.

The proof for this corollary follows from Corollary 3.1.1. The intuition behind Corollary 3.1.2 is the same as that for Corollary 3.1.1. Moreover, Proposition 3.1.2 suggests that, when the two home countries have similar culturals, the game has multiple equilibria with higher probability. That is, the strategy of one firm becomes more dependent on the other firm's strategy, but less on the marginal cost advantage. More cultural dissimilarity between the two home countries reduces the probability of multiple equilibira because firm *J* has considerably more advantage in the adjustment cost over its competitor and is less likely to adopt the *FL* strategy. Corollary 3.1.2 is summarized in table 6.

Profit of firms under the different cultural backgrounds

Using the cost assumption and the symmetry of the profit functions, the following relations hold for profits:

$$\pi^J_{SA,FL} > \pi^U_{FL,SA} \text{ and } \pi^J_{SA,SA} > \pi^U_{SA,SA} \text{ for } |d^U| > |d^J|,\ V_U \geq V_J$$

$$\pi^J_{FL,FL} \geq \pi^U_{FL,FL} \text{ and } \pi^J_{FL,SA} > \pi^U_{SA,FL} \text{ for } |d^U| > |d^J|,\ V_U \geq V_J$$

The equality in (FL, FL) holds if R&D costs are the same for the two firms ($V_U = V_J$). Therefore, when both firms adopt the *SA* or *FL* strategy, that is, in a symmetric equilibrium, (SA, SA) or (FL, FL), firm *J* earns higher (no lower) profits than firm *U*, given $V_U \geq V_J$. Moreover, if (FL, SA) is the equilibrium, then the profit of firm *J* is higher than that of firm *U*: $\pi^J_{FL,SA} > \pi^J_{SA,SA} > \pi^{UU}_{SA,SA} > \pi_{FL,SA}$. The first and third inequalities follow from the best response of firm *J* and firm *U* respectively, while the second inequality is due to the cost advantage of firm *J*.

However, when firm *J* adopts the *SA* strategy but firm *U* adopts the *FL* strategy, that is, the equilibrium (SA, FL), either firm can earn higher profit depending on d^h and V_h, for $h = J, U$.

Proposition 3.2:

Assuming two firms *J* and *U* have identical base marginal costs, then firm *U* earns higher profit than firm *J* in equilibrium if $V_U \leq \min\left[\hat{V}_U, V_1\right]$, $\hat{V}_U \geq V_4$, and $V_4 \leq V_J$ where $\hat{V}_U \equiv \left(bd^J N_K / 3\lambda\right)\left(2a - 2c - bd^J\right)$.

Proof:

Assume the two firms have the same base marginal and zero entry costs: $E_J = E_U = 0$. The profit of firm *U* can be higher than firm *J* only if the equilibrium is (SA, FL). Suppose the equilibrium is (SA, FL) and the profit of firm *U* is higher than that of firm *J*, $\pi^J_{SA,FL} \leq \pi^U_{SA,FL}$. This is true only if $V_U \leq \hat{V}_U \equiv \left(bd^J N_K / 3\lambda\right)\left(2a - 2c - bd^J\right)$ where $\hat{V}_U$ is the fixed cost of firm *U* that makes $\pi^J_{SA,FL} = \pi^U_{SA,FL}$. Further, the equilibrium (SA, FL) is achieved only when $V_U \leq V_1$ and $V_4 \leq V_J$. Since $V_1 > V_4$ and $V_U \geq V_J$, V_U such that $V_U \leq \hat{V}_U$ exists only if $\hat{V}_U \geq V_4$. Notice that $\hat{V}_U$ exists for all d^i, $i = J, U$, such that $d^J \leq d^U$. QED

Proposition 3.2 suggest following. When the fixed R&D costs are not too high for firm *U* but high enough for firm *J*, the high adjustment costs for firm *U* may lead it to develop a new platform with the fixed R&D cost, regardless of the choice by firm *J*. This decision makes firm *J* face the lower marginal cost of the competitor *U* and hence lowers the profits of firm *J*.

Size of the foreign market and the equilibrium of the duopoly game

Assume $E_J = E_U$ and $V_J = V_U = V$; the equilibrium lies on the 45 degree line in figure 1. As the market size N_K in the host country increases, critical values of V_i increases, $i = 1, 2, 3, 4$. That is, the increase in N_K has the same effect as shrinking the fixed cost V. If the host market is small, neither firm will develop the local platform. As the host market becomes larger, the more dissimilar multinational adopts the *FL* strategy first; that is, develops the local platform. When the host market becomes large enough, both firms adopt the *SA* strategy and adjust their current platform with additional adjustment costs.

Assume the duopoly profit of a firm is positive. If the market size N_K is very small, neither firm adopts the local platform: (SA, SA). Clearly firm *J* earns higher profit than the competitor. As the market size grows, the equilibrium moves to G; (SA, FL), then more dissimilar multinational *U* adopts the *FL* strategy first; that is, develops the local platform. Moreover, if $V_4 \leq V \leq \min\left[\hat{V}_U, V_1\right]$ is satisfied, firm *U* even earns higher profit than firm *J*. As the market size grows more, D becomes the equilibrium, and multiple equilibria, (SA, FL) and (FL, SA), emerges. In this situation, either firm can earn higher profits than its competitor. As N_K grows even more, the equilibrium moves to C and the unique equilibrium (SA, FL) is achieved again. Firm U can earn higher profit than firm J if Proposition 3.2 holds. Finally, if the market size in the host country is very large, both firms adopt the local variety to serve the host country, and firm J's profit is higher (no lower) than firm U's profit.

Welfare of the host country

The welfare in the host country is largest when both firms adopt the local variety and lowest in the equilibrium (SA, SA). The size of welfare in the host country is ordered as:

$$W(FL, FL) \geq W(SA, FL) \geq W(FL, SA) \geq W(SA, SA)$$

where $W(i, j)$ is the welfare in the equilibrium (i, j), $i, j = SA, FL$.

From Proposition 3.1, the order of the welfare in the host country suggests that, when both home countries have considerably different culture from the host country, both firms adopt the FL strategy and the welfare in the host country is highest. This occurs since both firms develop the local platform and reduce the marginal cost, and hence price, in the host market. However, if both multinationals come from the home countries that are culturally similar with the host country, the equilibrium (SA, SA) is achieved, and the welfare of host country is lowest. From the perspective of the host country, entry of the unfamiliar firms can be better because these firms choose the localization strategy.[15]

---

[15] Notice that, as d^U increases, welfare in host country will go down if firm U adopts the SA strategy.

Assume $E_J = E_U$ and $V_J = V_U$; then equilibrium lies on the 45 degree line in figure 1. The welfare structure in the host country suggests the following. As the fixed R&D cost V increases or the N_K decreases, the equilibrium moves toward the area I, and the welfare in the host country is reduced. From the perspective of the host country, a policy that reduces the firms' fixed R&D cost V can encourage the multinational to develop the local variety, and this may increase the welfare.

Conclusion

In this chapter I discussed one common belief for the effect of culture on multinationals; multinationals from the country that is culturally similar to the host country may have an intrinsic advantage over multinationals from another country (Caves, 1996; UNCTAD World Investment Report, 1998). For this purpose, the model of a monopolist in the second chapter is expended to a duopoly situation where there are two multinationals from two different home countries. Multinationals in this chapter are assumed to supply their home country and consider entering the host market; the platform for the *SA* strategy is given the firms' home-preferred variety. Under these assumptions and using the technology developed in the second chapter, this chapter studies the optimal production strategy of the two multinationals. Profits of the two firms, the effect of the cultural difference on the firms' optimal choice, and the welfare in the host country are also discussed.

The duopoly model assumes that the multinational, call it *J*, from the home country that is culturally similar to the host country has an advantage in the adjustment cost; firm *J* can adjust its home-preferred variety with lower marginal adjustment cost

---

Welfare will decreases until firm *U* will adopt the FL strategy and will be recovered in the new equilibrium.

than firm *U*. When both home countries have considerably different cultures (or preferences) from the host country, both multinationals are more likely to adopt the *FL* strategy. If two home countries have similar cultures with the host country, both firms adjust their home-preferred variety to serve host market. Furthermore, when cultural backgrounds of two multinationals are considerably different from each other, the asymmetric equilibrium is more likely to appear; firm *J*, which has an advantage in the adjustment cost, may adopt the *SA* strategy, but the *FL* strategy becomes the more favorable choice of firm *U*. If both home countries have similar cultural backgrounds, the symmetric equilibrium becomes the more possible outcome; the possibility of multiple equilibria also increases.

Another suggestion of duopoly game is that, although firm *J* has an intrinsic cost advantage over firm *U*, the strategic interaction of the two multinationals could allow firm *U*, from the culturally dissimilar country, to earn higher profit in the host country. Thus, cultural similarity of firm *J* may turn out to be a strategy disadvantage. In detail, when the fixed R&D costs are not too high for firm *U* but high enough for firm *J*, firm *U* may adopt the *FL* strategy because of the high adjustment costs, but firm *J* adjusts its home-preferred variety to serve the host country. In this situation, the marginal cost of firm *J* is higher than that of firm *U*, and firm *U* can earn higher profit than firm *J*.

The size of the host market affects the decision of multinationals; as the host market becomes larger, multinationals are more likely to develop a localized platform to earn higher profit in host market. In terms of consumer welfare in the host country, the *SA* strategy reduces the welfare (compared to the *FL* strategy) because the marginal cost in the host country increases. As R&D cost of both firms increases, the equilibrium of the duopoly game moves from (*FL*, *FL*) to (*SA*, *SA*) via the asymmetric equilibrium (*SA*, *FL*) or (*FL*, *SA*), reducing the consumer welfare in the host country.

Chapter 4. Duopoly Model with Endogenous Choice of the Platform Variety: Role of the Size of Markets

Introduction

The third chapter assumed the initial platform varieties of the two multinationals for the *SA* strategy was given. In this chapter, I will relax that assumption and allow the firm to choose its platform if it uses the *SA* strategy.

In this chapter, I consider a situation in which demand for a new product emerges in the home and the host countries. Further, two multinationals in two different home countries have their production facility in their home countries and consider entering the home and host market simultaneously. In this situation, the size of the home markets plays a major role in the firms' choice of platform for the *SA* strategy. Briefly speaking, if a firm has a (relatively) large home market, the firm is more likely to use its home-preferred variety as its platform for the *SA* strategy. This enables the firm to earn higher profit from the larger home market, even though the profit in the smaller host country is reduced. Conversely, when the host market is large, the firm's platform for the *SA* strategy is likely to be the host-preferred variety. Thus, the relative size of the two home markets affects the firms' choices of platform. A firm from a relatively large country may adopt the *FL* strategy or uses its home-preferred variety as its platform for the *SA* strategy, while a firm from a relatively small country is more likely to adopt the *SA* strategy using the host-preferred platform. If all three countries are of similar size, the firm's choice of platform depends more on the competitor's strategy, and there is a possibility for multiple equilibria to exist. Furthermore, it is possible that a less efficient outcome emerges. In addition, this chapter studies the welfare of each country at the equilibrium, as dependent on the sizes of the three countries.

Model

Assume that two multinationals have the same technology as in the third chapter. Assume that each firm is the sole supplier in its home country, and that monopoly profit is always positive. Further, assume that the duopoly profit in the host country is also positive, and both firms always enter the host market. Each firm can have two production strategies: the *SA* strategy or the *FL* strategy as in the duopoly model in the third chapter. However, when it adopts the *SA* strategy, the firm can choose which platform to utilize.

Turing to demand, I assume that the multinational faces the following inverse demand for the variety θ_i^j in country *i* supplied by firm *j*, which was discussed before.

$$p_j^i = a - \gamma d\left(\theta_i^j, \theta^i\right) - \frac{\lambda}{N_i} Q^i$$

where θ^i is the ideally preferred variety in country *i* and N_i is the market size in country *j*. Other assumptions of the duopoly model in the third chapter still hold in this chapter.

Both multinational *U* and *J* have the strategy set $S^i = \left\{FL, SA\left(\theta_i^P\right)\right\}$, $i = J, U$, where θ_i^P is the platform variety that firm *i* chooses. Given entry of both firms, the game is played in the following sequence:

1. The two multinationals choose their optimal production strategy $s^i \in S^i$,

$j = J, U$.

2. Given the optimal production strategy that was chosen in the first stage, if a multinational *i* adopts $SA\left(\theta_i^P\right)$ strategy, then firm *i* chooses the optimal platform variety θ_i^P.
3. Given the prior stage decision, each firm chooses its output.

Thus, a multinational chooses the number of platforms to develop in the first stage. In the second stage, the firm develops this (these) platform(s) using the firm's information on markets and the competitor's strategy. The idea behind this sequence is that, even if the firm chooses the number of platforms and the prototype of the platform simultaneously, the platform can be changed during the R&D process, responding to the competitor's strategy or additional market information. However, irreversible investment to construct the production facility to produce multi-platforms cannot be changed once the investment decision is made. Assuming $b < \gamma$, firm *j* supplies only the ideally preferred variety to country *I*: $\theta_i^j = \theta^i$. Finally, assume that the assumptions 1 and 2 in chapter three hold here.

Strategic Interaction

From the given sequence of decisions, the two multinationals play a two-stage. The equilibrium output in this duopoly game can be studied by backward solution. Assuming the entry of both multinationals, the profit matrix in the first stage game is as follows. Notice that profits with the *SA* strategy depends on the choice of platform in the second stage.

Firm *J*/firm *U*	*FL*	*SA*
FL	$\left(\pi^{J}_{FL,FL}-E_J,\pi^{U}_{FL,FL}-E_U\right)$	$\left(\pi^{J}_{FL,SA}-E_J,\pi^{U}_{FL,SA}-E_U\right)$
SA	$\left(\pi^{J}_{SA,FL}-E_J,\pi^{U}_{SA,FL}-E_U\right)$	$\left(\pi^{J}_{SA,SA}-E_J,\pi^{U}_{SA,SA}-E_U\right)$

where $\pi^{h}_{x,y}$ represents the profits of firm *h* – exclusive of entry cost – if firms *J* and *U* adopt the strategies *x* and *y* respectively, $h=J,U$, x and $y=SA,FL$. If either firm chooses the *SA* strategy, the two firms play the subgame to choose platform in the second stage. Therefore, except for the equilibrium (*FL, FL*), the profits of the two multinationals are a function of the platforms that are chosen in the next stage[16].

Suppose both multinationals enter the markets by developing two localized varieties (the *FL* strategy). The joint profits of multinational *i*, $i=J,U$ - exclusive of entry cost - is:

$$\pi^{i}_{FL,FL}=\frac{N_i}{4\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c\right)^2-2V_i;\ \ j=J,U\ ,\ \ i\neq j$$

If multinational *J* enters by developing only one platform variety (the *SA* strategy), but multinational *U* adopts the *FL* strategy, the joint profits of firms *J* and *U* – exclusive of entry cost - are:

$$\pi^{J}_{SA,FL}\left(\theta^{P}_{J}\right)=\frac{N_J}{4\lambda}\left(a-c-bd^{PJ,J}\right)^2+\frac{N_K}{9\lambda}\left(a-2\left(c+bd^{PJ,K}\right)+c\right)^2-V_J$$

[16] Even in the FL strategy, platforms are chosen in second stage. However, the optimal strategy is always to choose the ideal variety for each country, so there is no strategic aspect to these choices.

$$\pi^{U}_{SA,FL}\left(\theta^{P}_{J}\right)=\frac{N_U}{4\lambda}(a-c)^2+\frac{N_K}{9\lambda}\left(a-2c+\left(c+bd^{PJ,K}\right)\right)^2-2V_U$$

where $d^{PJ,i}\equiv\left|\theta^{P}_{J}-\theta^{i}\right|,\ i=J,K$. Firm J's optimal choice of platform variety is θ^{J} or θ^{J}, depending on the relative market size of the home country. The choice of platform strategy and the joint profits of the two multinationals – exclusive of entry cost - are:

If $N_J\geq\Theta^{J,U}N_K$, then $\theta^{P}_{J}=\theta^{J}$ and

$$\pi^{J}_{SA,FL}\left(\theta^{J}\right)=\frac{N_J}{4\lambda}(a-c)^2+\frac{N_K}{9\lambda}\left(a-c-2bd^{J}\right)^2-V_J$$

$$\pi^{U}_{SA,FL}\left(\theta^{J}\right)=\frac{N_U}{4\lambda}(a-c)^2+\frac{N_K}{9\lambda}\left(a-c+bd^{J}\right)^2-2V_U$$

If $N_J\leq\Theta^{J,U}N_K$, then $\theta^{P}_{J}=\theta^{K}$ and

$$\pi^{J}_{SA,FL}\left(\theta^{K}\right)=\frac{N_J}{4\lambda}\left(a-c-bd^{J}\right)^2+\frac{N_K}{9\lambda}(a-c)^2-V_J$$

$$\pi^{U}_{SA,FL}\left(\theta^{K}\right)=\frac{N_U}{4\lambda}(a-c)^2+\frac{N_K}{9\lambda}(a-c)^2-2V_U$$

where $\Theta^{i,j}\equiv\frac{16}{9}\left(\frac{a-2c^{i}+c^{j}-bd^{i}}{2\left(a-c^{i}\right)-bd^{i}}\right)=\frac{16}{9}\left(\frac{a-c-bd^{i}}{2(a-c)-bd^{i}}\right),\ i,j=J,U$.

Similarly, the optimal platform variety and the joint profits of the two multinationals in (*FL, SA*) – exclusive of entry cost - are:

If $N_U\geq\Theta^{U,J}N_K$, then $\theta^{P}_{U}=\theta^{U}$ and

$$\pi^{J}_{FL,SA}\left(\theta^{U}\right)=\frac{N_J}{4\lambda}(a-c)^2+\frac{N_K}{9\lambda}\left(a-c+bd^{U}\right)^2-2V_J$$

$$\pi^{U}_{FL,SA}\left(\theta^{U}\right)=\frac{N_U}{4\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c-2bd^{U}\right)^2-V_U$$

If $N_U \leq \Theta^{U,J} N_K$, then $\theta^{P}_{U}=\theta^{K}$ and

$$\pi^{J}_{FL,SA}\left(\theta^{K}\right)=\frac{N_J}{4\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c\right)^2-2V_J$$
$$\pi^{U}_{FL,SA}\left(\theta^{K}\right)=\frac{N_U}{4\lambda}\left(a-c-bd^{U}\right)^2+\frac{N_K}{9\lambda}\left(a-c\right)^2-V_U$$

If (*FL, SA*) or (*SA, FL*) is the choice in the first stage, a multinational that adopts the *SA* strategy plays a sub-game to choose its optimal platform in the second stage. The multinational *i* chooses the home-preferred platform θ^{i} as the platform variety if the home market is large enough. The optimal platform variety of multinational *i* is θ^{i} if $N_i \geq \Theta^{i,j} N_K$, $i,j=J,U$, $i \neq j$; otherwise, θ^{K} is the optimal platform variety of firm *i*.

Finally, suppose (*SA, SA*) is chosen in the first stage. In this case, the two multinationals play a sub-game to choose their optimal platform variety. Profits of multinational *i* in (*SA, SA*) – exclusive of entry cost - are:

$$\pi^{i}_{SA,SA}\left(\theta^{P}_{J},\theta^{P}_{U}\right)=\frac{N_i}{4\lambda}\left(a-c-bd^{Pi,i}\right)^2+\frac{N_K}{9\lambda}\left(a-2\left(c+bd^{Pi,K}\right)+\left(c+bd^{Pj,K}\right)\right)^2-V_i$$

where $i=J,U$, $j=J,U$, and $i \neq j$. Due to the convexity of the profit function in marginal cost, the profit-maximizing platform variety of firm *i* is θ^{i} or θ^{K}.

Therefore, assuming entry into the host country is profitable for both firms, the profit matrix for the platform variety game in the second stage becomes:

Firm J / firm U	θ^U	θ^K
θ^J	$\left(\pi^J_{SA,SA}\left(\theta^J,\theta^U\right),\pi^U_{SA,SA}\left(\theta^J,\theta^U\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^J,\theta^K\right),\pi^U_{SA,SA}\left(\theta^J,\theta^K\right)\right)$
θ^K	$\left(\pi^J_{SA,SA}\left(\theta^K,\theta^U\right),\pi^U_{SA,SA}\left(\theta^K,\theta^U\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^K,\theta^K\right),\pi^U_{SA,SA}\left(\theta^K,\theta^K\right)\right)$

The profits of the firms in each equilibrium are shown in table 7.

Given the profit structure, the firm's choice of platform variety depends on the market size of the home country, and we obtain the following relations:

$$\pi^U_{SA,SA}\left(\theta^J,\theta^K\right)\geq\pi^U_{SA,SA}\left(\theta^J,\theta^U\right)\leftrightarrow N_U\leq N_1\equiv\Omega^{U,J}N_K$$

$$\pi^U_{SA,SA}\left(\theta^K,\theta^K\right)\geq\pi^U_{SA,SA}\left(\theta^K,\theta^U\right)\leftrightarrow N_U\leq N_2\equiv\Theta^{U,J}N_K$$

$$\pi^J_{SA,SA}\left(\theta^K,\theta^U\right)\geq\pi^J_{SA,SA}\left(\theta^J,\theta^U\right)\leftrightarrow N_J\leq N_3\equiv\Omega^{J,U}N_K$$

$$\pi^J_{SA,SA}\left(\theta^K,\theta^K\right)\geq\pi^J_{SA,SA}\left(\theta^J,\theta^K\right)\leftrightarrow N_J\leq N_4\equiv\Theta^{J,U}N_K$$

where $\Omega^{i,j}\equiv\dfrac{16\left(a-c+bd^j-bd^i\right)}{9\left(2\left(a-c\right)-bd^i\right)}$, $i,j=J,U$. Notice that $N_1\geq N_2$ and $N_3\geq N_4$[17].

Also, given $d^U>d^J$, then $N_3>N_1$ and $N_4>N_2$. Whenever $N_U\leq N_2$, the choice of θ^K is a dominant strategy (in this sub-game) for multinational *U*. Whenever $N_U\geq N_1$, θ^U is *U*'s dominant strategy. For $N_U\in\left(N_2,N_1\right)$, either θ^U or θ^K can be the platform variety chosen by firm *U*, depending on (its beliefs concerning) firm *J*'s

---

[17] $N_1-N_2=\left(16/9\right)\cdot\left(bd^JN_K/\left(2\left(a-c\right)-bd^U\right)\right)\geq0$ and $N_3-N_4=\left(16/9\right)\cdot\left(bd^UN_K/\left(2\left(a-c\right)-bd^J\right)\right)\geq0$

choice of platform variety. The strategic decision of firm *J* is similar. Figure 2 shows the pattern of the equilibrium of this sub-game. Notice that $N_2 < N_4 < N_K$ but the comparison of N_1 and N_3 to N^K is ambiguous[18].

If both home countries' markets are considerably larger than the host country, the equilibrium of the sub-game to choose the optimal platforms is I: $\left(\theta^J, \theta^U\right)$. If the market size in the two home countries are similar to each other and "comparable" in size to the host country, the equilibrium of the sub-game is D and multiple equilibria exist; $\left(\theta^J, \theta^K\right)$ and $\left(\theta^K, \theta^U\right)$. If the markets of the two home countries are both considerably smaller than that of the host country, the equilibrium is in area A where both multinationals choose θ^K as their platform variety. If one home country's market *i* is considerably larger than that of the host country, then a decrease in size of the other home market will lead to an equilibrium in which the multinational from the small home market chooses θ^K as its optimal platform variety, while the other multinational chooses its home variety as its platform.[19]

Equilibrium of the Game and the Size of Markets

As shown before, the equilibrium choice of platforms, when firms adopt the *SA* strategy, depends on the size of their home countries. In this section, I will examine all possible cases.

Since both multinationals enter the home and host markets simultaneously, a

---

[18] We know $N_1 < N_3$. $N_1 < N_K$ if $\left\{2\left(a-c-2bd^J\right)+b\left(7d^U-12d^J\right)\right\}>0$. The first term must be positive; thus, if d^U is sufficiently larger than d^J, $N_1 < N_K$.

[19] Clearly, similar results would hold if each firm faced a competitor in its home market. This will be discussed in chapter 5.

comparison of the total profits of the two firms in the host and home countries has more meaning than the profit of the two firms in the host country. However, total profit of a firm depends on more the size of the home market than on the strategic interaction between the two firms. Therefore, I will focus analysis on the pattern of the duopoly equilibrium and the welfare issue rather than the profits of both firms.

i. $N_U \geq N_1$ and $N_J \geq N_3$: Area I

First, consider the situation in which the two home countries have considerably larger markets than the host country, that is, $N_U \geq N_1$ and $N_J \geq N_3$. This is area I in the figure 2. A multinational chooses its home-preferred platform θ^i, $i = J, U$, when it adopts the *SA* strategy. The profit – exclusive of entry cost - matrix in the first stage becomes:

Firm *J* / firm *U*	*FL*	$SA(\theta^U)$
FL	$(\pi^J_{FL,FL}, \pi^U_{FL,FL})$	$(\pi^J_{FL,SA}(\theta^U), \pi^U_{FL,SA}(\theta^U))$
$SA(\theta^J)$	$(\pi^J_{SA,FL}(\theta^J), \pi^U_{SA,FL}(\theta^J))$	$(\pi^J_{SA,SA}(\theta^J, \theta^U), \pi^U_{SA,SA}(\theta^J, \theta^U))$

Notice that the duopoly game with the endogenous choice of platform variety here is the same as that in the third chapter that assumed the given initial platform of each multinational. Since the multinationals come from large home markets, they will adjust their home-preferred variety when they adopt the *SA* strategy. By doing so, they can earn high profit in their home countries which have large markets. The results of the analysis and the propositions/corollaries from the third chapter hold here.

The size of the consumer welfare in each country is ordered as:

$$W^K(FL,FL) > W^K(SA^J,FL) > W^K(FL,SA^U) > W^K(SA^J,SA^U)$$

$$W^J(FL,FL) = W^J(SA^J,FL) = W^J(FL,SA^U) = W^J(SA^J,SA^U)$$

$$W^U(FL,FL) = W^U(SA^J,FL) = W^U(FL,SA^U) = W^U(SA^J,SA^U)$$

where $W^h(i,j)$ is the welfare at equilibrium (i,j) in country h, and the superscript of *SA* refers the firm's platform. Note that the *SA* strategy of multinationals does not change the welfare in their home country; their home markets are large enough, and they use their home-preferred variety as platforms. However, the *SA* strategy makes the host country worse-off because the host market is small.

ii. $N_U \le N_2$ and $N_J \le N_4$: Area A

If both home countries are relatively small, that is, if $N_U \le N_2$ and $N_J \le N_4$, any firm that adopts the *SA* strategy uses the host-preferred variety as its platform. The firm can earn more profit from the larger market – host market – by using the host-preferred variety as its platform. The profit – exclusive of entry cost – matrix in the first stage is:

Firm *J* / firm *U*	*FL*	*SA*
FL	$\left(\pi^J_{FL,FL}, \pi^U_{FL,FL}\right)$	$\left(\pi^J_{FL,SA}(\theta^K), \pi^U_{FL,SA}(\theta^K)\right)$
SA	$\left(\pi^J_{SA,FL}(\theta^K), \pi^U_{SA,FL}(\theta^K)\right)$	$\left(\pi^J_{SA,SA}(\theta^K,\theta^K), \pi^U_{SA,SA}(\theta^K,\theta^K)\right)$

As in the previous case, given the profit structure, the firm's optimal choice of the strategy depends on its fixed R&D cost:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ iff } V_U < V_1^A \equiv \left(\frac{bd^U N_U}{4\lambda}\right)\left(2a - 2c - bd^U\right)$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < V_2^A = V_1^A$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \text{ iff } V_J < V_3^A = \left(\frac{bd^J N_J}{4\lambda}\right)\left(2a - 2c - bd^J\right)$$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < V_4^A = V_3^A;$$

Note that the order of V_1^A and V_3^A is undetermined[20]. Figure 3 shows the pattern of the equilibrium, assuming zero entry cost.

The pattern of the equilibrium is similar with case (i). When $V_U \le V_1^A$ and $V_J \le V_3^A$, equilibrium (FL, FL) is achieved because both firms have low R&D costs. When $V_U \ge V_1^A$ and $V_J \ge V_3^A$, both firms adopt the *SA* strategy with platform θ^K. Otherwise, the firm that has relatively low R&D cost uses the *FL* strategy. Further, the figure 3 shows that multiple equilibria never occur. Notice that both firms earn the constant operating profits in the host country in this case. Therefore, the choice of a firm's strategy depends on the profit in its home country, but doesn't depend on the

---

[20] From $N_U \le N_2$, $V_1^A \le V_2$ where V_2 is defined by $\left(4bd^U N_K / 9\lambda\right)\left(a - c - bd^U\right)$ in the third chapter. Also $V_3^A \le V_4$ from $N_J \le N_4$ where $V_4 = \left(4bd^J N_K / 9\lambda\right)\left(a - c - bd^J\right)$. Therefore, if $N_J = N_U$, $V_1^A > V_3^A$ since $d^J < d^U$.

competitor's strategy since the competitor only chooses θ^K for one platform.

Remark:

Proposition 3.1 and Corollaries 3.1.1/3.1.2 hold except concerning the cases of multiple equilibria.

The remark follows from the functional properties of V_1^A and V_3^A:

$$\frac{\partial V_1^A}{\partial d^U} > 0 ; \ \frac{\partial V_3^A}{\partial d^U} = 0 ; \ \frac{\partial V_1^A}{\partial d^J} = 0 ; \ \frac{\partial V_3^A}{\partial d^J} > 0$$

Turning to the welfare issue, the size of consumer welfare in each country is ordered as:

$$W^K(FL,FL) = W^K(SA^K,FL) = W^K(FL,SA^K) = W^K(SA^K,SA^K)$$

$$W^J(FL,FL) = W^J(FL,SA^K) > W^J(SA^K,FL) = W^J(SA^K,SA^K)$$

$$W^U(FL,FL) = W^U(SA^K,FL) > W^U(FL,SA^K) = W^U(SA^K,SA^K)$$

The welfare in the *relatively large* host country is constant and high regardless of the equilibrium of the duopoly game since both firms always develop the host-preferred platform. However, each home country *h*, $h = J,U$, loses consumer welfare if multinational *h* adopts the *SA* strategy. The multinational(s) can increase its cost efficiency by adopting the *SA* strategy, but this choice results in a loss of consumer welfare in its home market, which is relatively small.

iii. $N_U \geq N_2$ and $N_J \leq N_4$: Areas B and E

Suppose firm *J* has a relatively small home market, but the home market of *U* is not too small; $N_U \geq N_2$ and $N_J \leq N_4$. Then firm *J* uses the host-preferred variety as its platform when it adopts the *SA* strategy to earn higher profit from the host market. However, firm *U*'s platform for the *SA* strategy is the home-preferred variety because home market *U* is large enough. The profit – exclusive of entry cost – matrix in the first stage becomes:

Firm *J* / firm *U*	*FL*	*SA*
FL	$\left(\pi^J_{FL,FL}, \pi^U_{FL,FL}\right)$	$\left(\pi^J_{FL,SA}\left(\theta^U\right), \pi^U_{FL,SA}\left(\theta^U\right)\right)$
SA	$\left(\pi^J_{SA,FL}\left(\theta^K\right), \pi^U_{SA,FL}\left(\theta^K\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^K,\theta^U\right), \pi^U_{SA,SA}\left(\theta^K,\theta^U\right)\right)$

As in previous cases, the firms' choice of strategy follows the following rules:

$\pi^U_{SA,FL} > \pi^U_{SA,SA}$ iff $V_U < V_1^{BE} = V_2$

$\pi^U_{FL,FL} > \pi^U_{FL,SA}$ iff $V_U < V_2^{BE} = V_1^A$; $V_2^{BE} \geq V_1^{BE}$[21]

$\pi^J_{FL,SA} > \pi^J_{SA,SA}$ and $\pi^J_{FL,FL} > \pi^J_{SA,FL}$ iff $V_J < V_3^{BE} = V_4^{BE} = V_3^A$

Notice that $V_2^{BE} \geq V_1^{BE} = V_2 > V_4 \geq V_3^{BE}$.[22] Figure 4 shows the pattern of the equilibrium,

[21] $V_2^{BE} \geq V_1^{BE}$ because $N_U \geq N_2$.

[22] $V_4 \geq V_3^{BE}$ comes from $N_J \leq N_4$.

assuming zero entry cost.

The equilibrium pattern is similar with case (ii). Since the two multinationals have a more asymmetric structure, that is, more asymmetric home markets, the symmetric equilibrium becomes less likely as the outcome of the game. As in the case (ii), multiple equilibria do not exist in this range of N_i, $i = J, U$. Further, assuming $V_J = V_U$, (FL, SA^U) never shows up. Notice that the critical values of the R&D costs have the following properties:

$$\frac{\partial V_1^{BE}}{\partial d^U} > 0; \ \frac{\partial V_2^{BE}}{\partial d^U} > 0; \ \frac{\partial V_3^{BE}}{\partial d^U} = 0; \ \frac{\partial V_1^{BE}}{\partial d^U} > 0; \ \frac{\partial V_2^{BE}}{\partial d^J} = 0; \ \frac{\partial V_3^{BE}}{\partial d^J} > 0$$

Therefore, Proposition 3.1 and Corollaries 3.1.1/3.1.2 hold except the arguments for multiple equilibria.

Now consider the size of consumer welfare in each country. They are ordered as:

$$W^K(FL, FL) = W^K(SA^K, FL) > W^K(FL, SA^U) = W^K(SA^K, SA^U)$$

$$W^J(FL, FL) = W^J(FL, SA^U) > W^J(SA^K, FL) = W^J(SA^K, SA^U)$$

$$W^U(FL, FL) = W^U(SA^K, FL) = W^U(FL, SA^U) = W^U(SA^K, SA^U)$$

Notice that home country *U*, which has a *large* market, has constant and maximum consumer welfare level for any equilibrium outcome. The host country, which is smaller than home country *U*, loses some welfare due to the *SA* strategy of firm *U*. However, the

SA strategy of firm *J*, which comes from a relatively small country, harms its home country but benefits the host country.

iv. $N_U \le N_2$ and $N_J \ge N_4$: Areas C and F

When firm *U* has a small home market, but the home market of firm *J* is not too small, firm *J* uses its home-preferred variety as the platform for the *SA* strategy while firm *U*'s platform for the *SA* strategy is the host-preferred variety. This is just the reverse of the previous case. The profit – exclusive of entry cost – matrix is:

Firm *J* / firm *U*	*FL*	*SA*
FL	$\left(\pi^J_{FL,FL}, \pi^U_{FL,FL}\right)$	$\left(\pi^J_{FL,SA}\left(\theta^K\right), \pi^U_{FL,SA}\left(\theta^K\right)\right)$
SA	$\left(\pi^J_{SA,FL}\left(\theta^J\right), \pi^U_{SA,FL}\left(\theta^J\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^J,\theta^K\right), \pi^U_{SA,SA}\left(\theta^J,\theta^K\right)\right)$

As usual, the firms' choice of strategy follows the following rule:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ and } \pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < V_1^{CF} = V_2^{CF} = V_1^A$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \text{ and } \pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < V_3^{CF} = V_4^{CF} = V_4$$

The order of V_1^{CF} and V_3^{CF} is undetermined[23]. The equilibrium pattern is same as that in case (ii) except for the critical values of V_i, $i = J,U$, and looks like figure 3. Like (ii), there do not exist multiple equilibria in this game. Since V_i^{CF}, $i = 1,3$, is non-

---

[23] Since $N_U \le N_2$, $V_1^{CF} \le V_2$. However, the order of V_1^{CF} and V_3^{CF} is ambiguous.

decreasing in d^h, $h = J, U$, Proposition 3.1 and Corollaries 3.1.1/3.1.2 also hold here, except the arguments for multiple equilibria.

Now consider the size of consumer welfare in each country. They are ordered as:

$$W^K(FL,FL) = W^K(FL,SA^K) > W^K(SA^J,FL) = W^K(SA^J,SA^K)$$

$$W^J(FL,FL) = W^J(SA^J,FL) = W^J(FL,SA^K) = W^J(SA^J,SA^K)$$

$$W^U(FL,FL) = W^U(SA^J,FL) > W^U(FL,SA^K) = W^U(SA^J,SA^K)$$

Since home country *J* is large enough, the *SA* strategy of firm *J* doesn't reduce the welfare in its home country but decreases that in the host country. However, the *SA* strategy of firm *U*, which comes from a small country, harms its home country, but not the host country.

v. $N_U \geq N_1$ and $N_4 \leq N_J \leq N_3$: Area H

The fifth case is that home country *U* has large market and home country *J* has a moderate size home market. In the asymmetric equilibrium, that is, (FL,SA) or (SA,FL), a firm that adopts the *SA* strategy uses its home-preferred variety as its platform. This is because the home market of the firm is not too small. However, when both firms adopt the *SA* strategy, firm *J* uses the host-preferred variety, but firm *U* uses its home-preferred variety as its platform since home market *U* is relatively larger than home market *J*. The profit – exclusive of entry cost – matrix in the first stage is:

Firm J / firm U	FL	SA
FL	$\left(\pi^J_{FL,FL}, \pi^U_{FL,FL}\right)$	$\left(\pi^J_{FL,SA}\left(\theta^U\right), \pi^U_{FL,SA}\left(\theta^U\right)\right)$
SA	$\left(\pi^J_{SA,FL}\left(\theta^J\right), \pi^U_{SA,FL}\left(\theta^J\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^K, \theta^U\right), \pi^U_{SA,SA}\left(\theta^K, \theta^U\right)\right)$

The firms' choice of strategy depends on the fixed R&D cost:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ iff } V_U < V_1^H = \left(\frac{b\left(d^J + 2d^U\right)N_K}{9\lambda}\right)\left(2a - 2c + b\left(d^J - 2d^U\right)\right)$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < V_2^H = V_2;\ V_1^H \ge V_2^H$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \text{ iff } V_J < V_3^H = V_3^A$$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < V_4^H = V_4;\ V_3^H \ge V_4^H$$

Notice that $V_2^H < V_4^H$ and $V_1^H > V_1 > V_3 \ge V_3^H$ for $N_U \ge N_1$ and $N_4 \le N_J \le N_3$[24]. The pattern of equilibrium is similar with case (i), and looks like the figure 3.1 except critical values of V_i, $i = J, U$. Like case (i), multiple equilibria can occur in area D (see figure 3.1). Further, Proposition 3.1 and Corollaries 3.1.1/3.1.2 hold because V_i^H, $i = 1,2,3,4$, is non-decreasing in d^h, $h = J, U$.

The consumers' welfare in each countriy are ordered as:

$$W^K\left(FL, FL\right) > W^K\left(SA^J, FL\right) > W^K\left(FL, SA^U\right) = W^K\left(SA^K, SA^U\right)$$

---

[24] $V_1 = \left(4bd^U N_K / 9\lambda\right)\left(a - c - b\left(d^U - d^J\right)\right)$ and $V_3 = \left(4bd^J N_K / 9\lambda\right)\left(a - c - b\left(d^J - d^U\right)\right)$ from the chapter three.

$$W^J(FL,FL)=W^J(FL,SA^U)=W^J(SA^J,FL)>W^J(SA^K,SA^U)$$

$$W^U(FL,FL)=W^U(SA^J,FL)=W^U(FL,SA^U)=W^U(SA^K,SA^U)$$

Because home country *U* is large, firm *U* chooses its home-preferred variety as its platform, and this choice reduces the welfare in the host country but not home country *U*. Since the size of home country *J* is moderate, the optimal platform of firm *J* depends on the strategy of firm *U*. If firm *U* adopts the *FL* strategy, θ^J is the optimal platform for firm *J* because home market *J* is not too small. However, if firm *U* adopts the *SA* strategy, firm *J* can earn higher duopoly profit in the host country by using the host-preferred variety as its platform because the marginal cost of firm *U* is relatively high. This additional profit in the host market overcomes the loss of firm *J*'s profit in its home market *J*. Therefore (SA^K,SA^U) reduces the welfare in home country *J*.

vi. $N_2 \le N_U \le N_1$ and $N_J \ge N_3$: Area G

Consider the case in which country *J* has a large market, but country *U* has a moderate size home market. Like case (v), in asymmetric equilibrium (FL,SA) or (SA,FL), a firm that adopts the *SA* strategy uses its home-preferred variety as its platform. However, in equilibrium (SA,SA), firm *J* uses its home-preferred variety, but firm *U* uses the host-preferred variety as their platforms because home country *J* is relatively larger than home country *U*. The profit – exclusive of entry cost – matrix in the first stage is:

Firm J / firm U	FL	SA
FL	$\left(\pi^J_{FL,FL}, \pi^U_{FL,FL}\right)$	$\left(\pi^J_{FL,SA}\left(\theta^U\right), \pi^U_{FL,SA}\left(\theta^U\right)\right)$
SA	$\left(\pi^J_{SA,FL}\left(\theta^J\right), \pi^U_{SA,FL}\left(\theta^J\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^J,\theta^K\right), \pi^U_{SA,SA}\left(\theta^J,\theta^K\right)\right)$

As before, given the profit structure, the firms' choice of strategy depends on their fixed R&D costs:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ iff } V_U < V_1^G = V_1^A$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < V_2^G = V_2;\ V_1^G \geq V_2^G$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \text{ iff } V_J < V_3^G = \left(\frac{b\left(2d^J + d^U\right)N_K}{9\lambda}\right)\left(2a - 2c - b\left(2d^J - d^U\right)\right)$$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < V_4^G = V_4;\ V_3^G \geq V_4^G$$

From $V_2 > V_4$, $V_2^G > V_4^G$. However, the order of V_1^G and V_3^G is undetermined. The equilibrium pattern is similar to case (i) or (v). Figure 3.1 shows the pattern of the equilibrium except for the critical values of V_i, $i = J,U$. The firms' decision rules suggest that multiple equilibria exist here. Moreover, V_j^G, $j = 1,2,3,4$ is non-decreasing in d^h, $h = J,U$. Therefore, Proposition 3.1 and Corollaries 3.1.1/3.1.2 still hold.

Turning to the consumer welfare in three countries, the size of the welfare in each country is ordered as:

$$W^K(FL,FL) > W^K(SA^J,FL) = W^K(SA^J,SA^K) > W^K(FL,SA^U)$$

$$W^J(FL,FL) = W^J(FL,SA^U) = W^J(SA^J,FL) = W^J(SA^J,SA^K)$$

$$W^U(FL,FL) = W^U(SA^J,FL) = W^U(FL,SA^U) > W^U(SA^J,SA^K)$$

The large home market of J induces firm J to use its home-preferred variety as the platform; the welfare in home country J is constant and high, but host country loses some welfare. Since the size of home market U is moderate, the platform of firm U for the SA strategy is θ^U if firm J adopts the FL strategy or θ^K if firm J adopts the SA strategy. Therefore, the equilibrium (FL,SA^U) harms the host country, but doesn't affect on the consumer welfare in home country U. When the equilibrium is (SA^J,SA^K), the SA strategy of firm J reduces the welfare of the host country, but the SA strategy of firm U doesn't influence consumers' welfare in the host country.

vii. $N_2 \le N_U \le N_1$ and $N_4 \le N_J \le N_3$: Area D

The last possible situation is that both home countries have moderate size of their home market. The two multinationals are highly symmetric, except for the cultural similarity. When one firm adopts the SA strategy, the firm uses its home-preferred variety as the platform because its home market is large enough. However, when both firms use the SA strategy, firms can choose either home-preferred variety or host-preferred variety for their platform. The profit – exclusive of entry cost – matrix in the first stage can be expressed as:

FirmJ/firmU	*FL*	*SA*
FL	$\left(\pi^J_{FL,FL}, \pi^U_{FL,FL}\right)$	$\left(\pi^J_{FL,SA}\left(\theta^U\right), \pi^U_{FL,SA}\left(\theta^U\right)\right)$
SA	$\left(\pi^J_{SA,FL}\left(\theta^J\right), \pi^U_{SA,FL}\left(\theta^J\right)\right)$	$\left(\pi^J_{SA,SA}\left(\theta^i, \theta^j\right), \pi^U_{SA,SA}\left(\theta^i, \theta^j\right)\right)$

where $i = J, K$ and $j = U, K \ \ , i \neq j$. Notice that the game is a mixture of cases (v) and (vi).

Given the profit structure and analysis in (v) and (vi), the firm's rule for the optimal strategy is:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ if } V_U < V_1^D \equiv \min\left[V_1^H, V_1^G\right] = V_1^G$$

$$\pi^U_{SA,FL} < \pi^U_{SA,SA} \text{ if } V_U > \tilde{V}_1^D \equiv \max\left[V_1^H, V_1^G\right] = V_1^H$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < V_2^D = V_2^H = V_2^G = V_2; \ V_2^D < V_1^D$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \text{ if } V_J < V_3^D \equiv \min\left[V_3^H, V_3^G\right] = V_3^H$$

$$\pi^J_{FL,SA} < \pi^J_{SA,SA} \text{ if } V_J > \tilde{V}_3^D \equiv \max\left[V_3^H, V_3^G\right] = V_3^G$$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < V_4^D = V_4^H = V_4^G = V_4$$

Note that $V_1^H > V_1^G$ and $V_3^G > V_3^H$ hold for $N_2 \leq N_U \leq N_1$ and $N_4 \leq N_J \leq N_3$. Clearly, $V_2^D > V_4^D$ holds. However, the order of $\tilde{V}_1^D$ and $\tilde{V}_3^D$ is ambiguous. The order of V_1^D and V_3^D is also ambiguous. Figure 5 shows the pattern of equilibrium, assuming zero entry cost.

The general pattern of equilibrium in figure 5 is similar to previous cases. When

$V_U > \tilde{V}_1^D$, the *SA* strategy is a dominant strategy for firm *U* regardless of the firms' choice of platforms. When $V_U < V_2^D$, the dominant strategy of firm *U* is the *FL* strategy. In other cases, the strategy of firm *U* can be either the *SA* or *FL* strategy, depending on the competitor's strategy. Likewise, when $V_J > \tilde{V}_3^D$, the *SA* strategy is the optimal choice of firm *J* regardless of the other firm's choice of platforms. If $V_J < V_4^D$, firm *J* always uses the *FL* strategy. Therefore, for $V_U < V_2^D$ and $V_J < V_4^D$ (Area A), (FL, FL) is the equilibrium of the duopoly game. For $V_U > \tilde{V}_1^D$ and $V_J > \tilde{V}_3^D$ (Area P), the equilibrium becomes (SA^J, SA^K) or (SA^K, SA^U). When the R&D cost is relatively high for firm *J* but relatively low for firm *U*, that is, in area E, I, J, M, and N[25], (SA^J, FL) is the unique equilibrium; firm *J* utilizes its advantage in the adjustment cost, but firm *U* develops a new platform for the host country. Similarly when the R&D cost is relatively low for firm *J* but relatively high for firm *U* (area B, C, D, G and H[26]), firm *U* adjusts its home-preferred variety, but firm *J* develops a new localized platform: (FL, SA^U).

In the remaining region in figure 5, multiple equilibria exist. First, consider area F. Multiple equilibria in area F is the outcome that was discussed in other cases. However, in areas K, L, and O, it is possible that an outcome of the duopoly game is strictly worse for a multinational(s) than other possible outcomes from an ex post perspective; I define this outcome as *ex post inefficient* outcome.

---

[25] The Area J has unique equilibrium also because firm *J* never uses the host-preferred variety as its platform for equilibrium (SA, FL)

[26] Also firm *U* always uses its home-preferred variety as its platform for (FL, SA), and the area G has unique equilibrium.

Proposition 4.1:

Suppose $N_U \in [N_2, N_1]$ and $N_J \in [N_4, N_3]$. An *ex post inefficient* outcome can occur in following cases:

(1) $V_U \in \left[V_1^D, \tilde{V}_1^D\right]$ and $V_J \geq \tilde{V}_3^D$: Area O

(2) $V_U \geq \tilde{V}_1^D$ and $V_J \in \left[V_3^D, \tilde{V}_3^D\right]$: Area L

(3) $V_U \in \left[V_1^D, \tilde{V}_1^D\right]$ and $V_J \in \left[V_3^D, \tilde{V}_3^D\right]$: Area K

Proof:

If V_i, $i = J, U$, are in the area L, three equilibria exist: $\left(SA^J, SA^K\right)$, $\left(SA^K, SA^U\right)$, and $\left(FL, SA^U\right)$. Since $\tilde{V}_3^D = V_3^G > V_J > V_3^D = V_3^H$, the order of the profits of firm J becomes $\pi^J\left(SA^K, SA^U\right) > \pi^J\left(FL, SA^U\right) > \pi^J\left(SA^J, SA^K\right)$, and firm *J* can earn higher profit at $\left(SA^K, SA^U\right)$ that at $\left(FL, SA^U\right)$ without harming firm *U* (see case (v)); $\left(FL, SA^U\right)$ is *ex post inefficient*. Similarly, in area O, possible equilibria are $\left(SA^J, SA^K\right)$, $\left(SA^K, SA^U\right)$, and $\left(SA^J, FL\right)$. $\left(SA^J, FL\right)$ is *ex post inefficient* because $\tilde{V}_1^D = V_1^H > V_U > V_1^D = V_1^G$ and $\pi^U\left(SA^J, SA^K\right) > \pi^U\left(SA^J, FL\right) > \pi^J\left(SA^K, SA^U\right)$ (see case (vi)). Finally, consider the area K that has four equilbria: $\left(SA^J, SA^K\right)$, $\left(SA^K, SA^U\right)$, $\left(SA^J, FL\right)$, and $\left(FL, SA^U\right)$. Firm *U* can earn higher profit at $\left(SA^J, SA^K\right)$ than at $\left(SA^J, FL\right)$ without changing the profit of firm *J* because $\tilde{V}_1^D > V_U > V_1^D$. Also, firm *J* can earn higher profit at $\left(SA^K, SA^U\right)$ than at $\left(FL, SA^U\right)$ because $\tilde{V}_3^D > V_J > V_3^D$. Therefore, $\left(FL, SA^U\right)$ and $\left(SA^J, FL\right)$ are *ex post inefficient* outcomes. QED

Notice that the *ex post inefficient* outcome emerges due to the unknown equilibrium in the subgame. That is, in areas K, L, and O, either the *FL* strategy or the *SA* strategy is not a dominant strategy for a multinational(s), and the equilibrium of the game depend on the multinationals' choice of platforms in the second stage which is unknown in the first stage. This leads to the possibility of an *ex post inefficient* outcome. Moreover, Note that both firms have highly similar cost structures in area K, and this makes for a larger chance for *ex post inefficient* outcome.

From cases (v) and (vi), we know that V_i^D, $i = 1,2,3,4$, and $\tilde{V}_j^D$, $j = 1,3$, are non-decreasing in d^h, $h = J,U$. Therefore, Proposition 3.1 and Corollaries 3.1.1/3.1.2 hold here. Notice that the arguments for multiple equilibria in these propositions and corollaries hold for the area K only.

Lastly, consider the consumer welfare of the three countries. Since the outcome of the game is a mixture of cases (vi) and (vii), the analysis of welfare in three countries is also a mixture of them. Moreover, due to the multiple equilibria in areas F, G, J, K, L, O, and P, the welfare in each country is highly ambiguous and unpredictable. That is, for given sizes of the two home countries, neither home country has a dominantly large market, and the firms' platform choices depend on the strategic interaction with its competitor rather than on the size of the home markets; any country can be either worse-off or better-off, depending on which of the multiple equilibria is achieved.

The welfare analysis for all cases is summarized in the following remark.

Remark:

1. When a country has a considerably larger market than others, the consumer

welfare in this country is not affected by the strategic choice of multinationals.

2. When a country has a considerably smaller market than the others, the *SA* strategy by a multinational(s) reduces consumer welfare in that country.
3. When a home country *h* has a moderately sized home market, consumer welfare in home country *h* and the host country is more likely to depend on the strategic interaction of the multinationals rather than on the size of home country *h*.
4. When the two home countries have moderately sized home markets, the welfare in the three countries is highly ambiguous because it depends more on the strategic interaction of two multinationals in the second stage, as well as choices in the first stage.

Conclusion

The third chapter discussed two multinationals' choice of production strategy in a culturally different host country assuming the given initial platform varieties of two firms for the *SA* strategy. This chapter relaxes the assumption of given platforms and allows each firm to choose its platform for the *SA* strategy. To illustrate this, I consider a situation in which demands for a new product emerges in the home and host countries simultaneously. Two multinationals are assumed to have their production facility in their home countries and to consider entering the home and host market simultaneously. The demand and technology structures in the third chapter hold here. The duopoly game in this chapter is assumed to be a two-stage game. In the first stage, two firms adopt their optimal production strategy between the *FL* and *SA* strategies; in the second stage, each firm chooses the optimal platform if it adopted the *SA* strategy in the first stage.

In this situation, the size of home markets plays a major role in firms' decision about their platform for the *SA* strategy in the second stage. Generally speaking, when a firm's home market is relatively large (or larger than other countries), the firm is more likely to use its home-preferred variety as its platform for the *SA* strategy. Then the firm can earn higher profit from the larger market, that is, its home market, but the profit in the host country is reduced. In terms of the consumer welfare, the host country loses welfare, but the home country which has the large market doesn't lose consumer welfare. Conversely, when the host market is large, the firm's platform for the *SA* strategy is the host-preferred variety, and the home country is the one that loses consumer welfare due to the *SA* strategy. The relative size of two home countries affects the firms' choice of platform and production strategy. A firm from a relative large country may adopt the *FL* strategy or uses its home-preferred variety as its platform for the *SA* strategy; another firm from a relatively small country is more likely to adopt the *SA* strategy using its host-preferred platform. The smaller home country and the host country lose welfare due to the *SA* strategy. If all three countries have relatively similar sized markets, the firms' choice of platform depends more on the competitor's strategy, and there is more possibility for multiple equilibria to exist. Furthermore, it is possible that an outcome of the duopoly game is strictly worse for a multinational(s) than other possible outcomes from an ex post perspective.

Chapter 5. Extension of the Duopoly Model: Strategic Interaction under Asymmetric Home Competition

Introduction

The third and the fourth chapters developed a model of the strategic interaction of two multinationals in a host country that is culturally different from their home countries. Although the two home countries in the previous chapters are assumed to have different cultural backgrounds and different size markets, the market structures in the two home countries are assumed to be symmetric; two multinationals earn monopoly profits in their home markets. However, it is sometimes argued that some countries have relatively more competitive markets, but some countries have less competitive markets. Therefore, this chapter will modify the model in the fourth chapter to study the effect of asymmetric home competition on multinationals' strategic decisions and consumer welfare in countries.

In this chapter, I will consider a duopoly model that is essentially the same as that used in the fourth chapter, except for the number of firms in the two home countries. If a home country allows more entrants into the market, given other parameters, the multinational from this country is less likely to adopt the *FL* strategy because the return from the additional R&D cost to develop a platform for the home country is reduced. Therefore, the *SA* strategy becomes a more favorable strategy for this multinational. When the multinational chooses the *SA* strategy, a more competitive home market makes the host-preferred variety a more favorable platform for the multinational. Furthermore, it is possible that the entry of new local firms in a home country can change the strategic decision of the multinational from the other home country and can increase consumer welfare in that other home country. Also it is possible that the entry of new local firms in the home country increases the profit of the multinational if the size of the host market is large enough.

Model

Assume that two multinationals *J* and *U*, located in two different home countries, *J* and *U*, respectively, have the technology used in the third and fourth chapters. Further, they already have their production facility in their home countries and consider entering the emerging market for a product in the home and host market simultaneously. Unlike the fourth chapter, multinationals may or may not be the sole supplier in their home country, as new local entrants in each home country may enter this emerging market. Like multinationals, assume that potential local entrants already have a production facility and currently produce other products. Once a local firm in a home country i decides to enter this new product market, it develops a new product with fixed cost V_i, $i = J, U$.

Turning to the demand structure, consider the same demand as in the previous chapters; the inverse demand for a variety θ^i in a country *j* is given by:

$$p_i^j = a - \gamma d\left(\theta_j^i, \theta^j\right) - \frac{\lambda}{N_j}\left(q^i + \sum_{h \neq i} q^h\right)$$

where (a, γ, λ) are positive parameters, θ^j is the preferred variety in country *j*, and θ^i is the supplied variety by firm i. q^i represents the total sales of the variety produced by firm i. As discussed in the previous chapters, if $b < \gamma$[27], firms supply only the preferred variety in a country *j*: $\theta_j^i = \theta^i$.

Multinationals have the strategy set $S^i = \{FL, SA(\theta_i^P)\}$, $i = J, U$, where θ_i^P is the platform variety that multinational *i* chooses. However, local firms produce only the home-preferred variety without using the adjustment technology. Other assumptions about the cost structure used in the third and fourth chapters also hold here. Given technology, the two multinationals play the duopoly game in the following sequences:

1. The policy makers in home countries decide the policy of entry in home markets.
2. Given entry policy, local firms enter the home market by developing a home-preferred variety. Simultaneously, the two multinationals choose their optimal production strategy $s^i \in S^i$, $i = J, U$.
3. Given the optimal production strategy that was chosen in the second stage, if multinational *i* adopts $SA(\theta_i^P)$ strategy, then multinational *i* chooses the optimal platform variety θ_i^P.
4. Given the prior stage decision, firms (multinationals and local entrants) choose their output.

The intuition behind the sequence of actions in the game is the same as that in the fourth chapter, except the entry of local firms which occurs in the first and second stages. Notice that, in the second stage, local firms also immediately choose their optimal strategy, which is unique: *FL* strategy. Therefore, local firms skip the third stage.

---

[27] From the previous chapters, b is the additional marginal cost to adjust a platform.

First, consider the market structure in home market *j*, $j = J, U$. Suppose that there are ω_j firms in home country *j*: one multinational and $\omega_j - 1$ identical local entrants. Under the given technology and market structure, the profit maximization problem of multinational *j* is:

$$\max\ q_j^m \left[a - \frac{\lambda}{N_j} \left(q_j^m + \sum_{l \neq j} q_j^l \right) - c_j^m \right]$$

where q_j^m and q_j^l are total sales of the product produced by multinational *j* and by local entrants, respectively, and c_j^m is the total marginal cost of multinational *j*, which is:

SA strategy: $c_j^m = c_j + b\left|\theta_j^P - \theta^j\right|$

FL strategy: $c_j^m = c_j$

where c_j is the base marginal cost to produce a platform. The optimal output level and profit of multinational *j* are:

$$q_j^m = \frac{N_j}{(\omega_j + 1)\lambda}\left[a + (\omega_j - 1)c_j - \omega_j c_j^m \right]$$

$$\pi_j^m = \frac{N_j}{(\omega_j + 1)^2 \lambda}\left[a + (\omega_j - 1)c_j - \omega_j c_j^m \right]^2$$

Similarly, the output and profit of a local firm are:

$$q_j^l = \frac{N_j}{(\omega_j + 1)\lambda}\left(a + c_j^m - 2c_j\right)$$

$$\pi_j^l = \frac{N_j}{(\omega_j + 1)^2 \lambda}\left(a + c_j^m - 2c_j\right)^2$$

Notice that a local firm develops and produces only the home-preferred variety, and its marginal cost is always c_j.

Strategic Interaction

Given the profit structure in home markets, the two multinationals play a two-stage duopoly game, and there are four possible outcomes: (*FL*, *FL*), (*SA*, *FL*), (*FL*, *SA*), (*SA*, *SA*). As discussed in the fourth chapter, when any multinational adopts the *SA* strategy, the profits of the two multinationals depend on the choice of platform in the second stage.[28]

Suppose both multinationals adopts the *FL* strategy in the first stage: (*FL*, *FL*). The joint profits of multinational *i*, $i = J, U$ - exclusive of entry cost – are:

$$\pi_{FL,FL}^i = \frac{N_i}{(\omega_i + 1)^2 \lambda}(a - c)^2 + \frac{N_K}{9\lambda}(a - c)^2 - 2V_i;\ i = J, U,\ i \neq j$$

When multinational *J* adopts the *SA* strategy, but multinational *U* uses the *FL*

[28] The detailed analysis for the game is the same as that in the fourth chapter.

strategy, the joint profits of the two multinationals – exclusive of entry costs – are:

$$\pi^{J}_{SA,FL}\left(\theta^{P}_{J}\right)=\frac{N_J}{\left(\omega_J+1\right)^2\lambda}\left(a-c-\omega_J bd^{PJ,J}\right)^2+\frac{N_K}{9\lambda}\left(a-c-2bd^{PJ,K}\right)^2-V_J$$

$$\pi^{U}_{SA,FL}\left(\theta^{P}_{J}\right)=\frac{N_U}{\left(\omega_U+1\right)^2\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c+bd^{PJ,K}\right)^2-2V_U$$

Multinational *J* chooses θ^J or θ^K as its platform depending on the relative market size and number of firms in its home country:

If $N_J \geq \hat{\Theta}^{J,U} N_K$, then $\theta^P_J = \theta^J$ and:

$$\pi^{J}_{SA,FL}\left(\theta^{J}\right)=\frac{N_J}{\left(\omega_J+1\right)^2\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c-2bd^{J}\right)^2-V_J$$

$$\pi^{U}_{SA,FL}=\frac{N_U}{\left(\omega_U+1\right)^2\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c+bd^{J}\right)^2-2V_U$$

If $N_J \geq \hat{\Theta}^{J,U} N_K$, then $\theta^P_J = \theta^K$ and:

$$\pi^{J}_{SA,FL}\left(\theta^{K}\right)=\frac{N_J}{\left(\omega_J+1\right)^2\lambda}\left(a-c-\omega_J bd^{J}\right)^2+\frac{N_K}{9\lambda}\left(a-c\right)^2-V_J$$

$$\pi^{U}_{SA,FL}\left(\theta^{K}\right)=\frac{N_U}{\left(\omega_U+1\right)^2\lambda}\left(a-c\right)^2+\frac{N_K}{9\lambda}\left(a-c\right)^2-2V_U$$

where $\hat{\Theta}^{i,j} \equiv \frac{4\left(\omega_i+1\right)^2}{9\omega_i}\left(\frac{a-c-bd^i}{2\left(a-c\right)-\omega_i bd^i}\right)$, $i,j=J,U$. Notice that $\hat{\Theta}^{J,U}$ is increasing in ω_J: the more competition there is in home country *J*, the larger the region of N_J for which θ^K is the optimal platform choice for multinational J[29].

Similarly, in equilibrium (*FL*, *SA*), the optimal platform variety of multinational *U* and the joint profit – exclusive of entry cost – of the two multinationals are:

If $N_U \geq \hat{\Theta}^{U,J} N_K$, then $\theta_U^P = \theta^U$ and:

$$\pi_{FL,SA}^J\left(\theta^U\right) = \frac{N_J}{\left(\omega_J+1\right)^2 \lambda}\left(a-c\right)^2 + \frac{N_K}{9\lambda}\left(a-c+bd^U\right)^2 - 2V_J$$

$$\pi_{FL,SA}^U\left(\theta^U\right) = \frac{N_U}{\left(\omega_U+1\right)^2 \lambda}\left(a-c\right)^2 + \frac{N_K}{9\lambda}\left(a-c-2bd^U\right)^2 - V_U$$

If $N_U \leq \hat{\Theta}^{U,J} N_K$, then $\theta_U^P = \theta^K$ and:

$$\pi_{FL,SA}^J\left(\theta^K\right) = \frac{N_J}{\left(\omega_J+1\right)^2 \lambda}\left(a-c\right)^2 + \frac{N_K}{9\lambda}\left(a-c\right)^2 - 2V_J$$

$$\pi_{FL,SA}^U\left(\theta^K\right) = \frac{N_U}{\left(\omega_U+1\right)^2 \lambda}\left(a-c-\omega_U bd^U\right)^2 + \frac{N_K}{9\lambda}\left(a-c\right)^2 - V_U$$

Like (*SA*, *FL*), $\hat{\Theta}^{U,J}$ is increasing in ω_U: higher competition in home country *U* is more likely to make multinational *U* choose θ^K for its platform.

Turning to (*SA*, *SA*), the two multinationals play a sub-game to choose their platforms. Profits of multinational *i* in (*SA*, *SA*) is:

$$\pi_{SA,SA}^i\left(\theta_J^P,\theta_U^P\right) = \frac{N_i}{\left(\omega_i+1\right)^2 \lambda}\left(a-c-\omega_i bd^{Pi,i}\right)^2 + \frac{N_K}{9\lambda}\left(a-2\left(c+bd^{Pi,K}\right)+\left(c+bd^{Pj,K}\right)\right)^2 - V_i$$

---

29 $$\frac{\partial\hat{\Theta}^{J,U}}{\partial\omega_J} = \left(\frac{8\left(\omega_J+1\right)N_K}{9\omega_J^2}\right)\left(\frac{\left(a-c-bd^J\right)\left(\omega_J\left(a-c+bd^J\right)-a+c\right)}{2\left(a-c\right)+\omega_J bd^J}\right) > 0 \text{ for } \omega_J \geq 1$$

where $i = J,U$, $j = J,U$, and $i \neq j$. As analyzed in the fourth chapter, the optimal platform of multinational *i* is either θ^i or θ^j due to the convexity of the profit function[30]. The profits of the two multinationals in the four possible equilibria are shown in table 8. As in chapter four, from the profit structure, the following relations are obtained.

$$\pi^U_{SA,SA}\left(\theta^J,\theta^K\right) \geq \pi^U_{SA,SA}\left(\theta^J,\theta^U\right) \leftrightarrow N_U \leq \hat{N}_1 \equiv \hat{\Omega}^{U,J} N_K$$

$$\pi^U_{SA,SA}\left(\theta^K,\theta^K\right) \geq \pi^U_{SA,SA}\left(\theta^K,\theta^U\right) \leftrightarrow N_U \leq \hat{N}_2 \equiv \hat{\Theta}^{U,J} N_K$$

$$\pi^J_{SA,SA}\left(\theta^K,\theta^U\right) \geq \pi^J_{SA,SA}\left(\theta^J,\theta^U\right) \leftrightarrow N_J \leq \hat{N}_3 \equiv \hat{\Omega}^{J,U} N_K$$

$$\pi^J_{SA,SA}\left(\theta^K,\theta^K\right) \geq \pi^J_{SA,SA}\left(\theta^J,\theta^K\right) \leftrightarrow N_J \leq \hat{N}_4 \equiv \hat{\Theta}^{J,U} N_K$$

where $\hat{\Omega}^{i,j} \equiv \dfrac{4\left(\omega_i+1\right)^2}{9\omega_i}\left(\dfrac{a-c+bd^j-bd^i}{2\left(a-c\right)-\omega_i bd^i}\right)$. Notice that $\hat{N}_1 \geq \hat{N}_2$ and $\hat{N}_3 \geq \hat{N}_4$[31]. Also, assuming $d^U > d^J$, $\hat{N}_3 > \hat{N}_1$ and $\hat{N}_4 > \hat{N}_2$. The interpretation of the above relations is the same as that in the fourth chapter. When $N_U \leq \hat{N}_2$, a dominant strategy for multinational *U* in this sub-game is the choice of θ^K. When $N_U \geq \hat{N}_1$, θ^U is a dominant strategy of multinational *U*. Otherwise, multinational *U* will choose either θ^U or θ^K for its platform, depending on its beliefs about multinational *J*'s choice of

---

[30] For detail analysis, refer to chapter four.

[31] $\hat{N}_1 - \hat{N}_2 = \left(4\left(\omega_U+1\right)^2/9\omega_U\right)\left(bd^J N_K/\left(2\left(a-c\right)-bd^U\right)\right) \geq 0$ and $\hat{N}_3 - \hat{N}_4 = \left(4\left(\omega_J+1\right)^2/9\omega_J\right)\left(bd^U N_K/\left(2\left(a-c\right)-bd^J\right)\right) \geq 0$.

platform. The strategic decision of multinational J is similar. Figure 6 shows the pattern of equilibrium of this sub-game. As shown before, $\hat{\Theta}^{i,j}$ is increasing in ω_i: the region of N_i that makes θ^K a dominant platform strategy of multinational i enlarges if multinational i faces more competition in its home country i. In addition, notice that $\hat{\Omega}^{i,j}$ (equivalently $\hat{N}_h$, $h=2,3$) is increasing in ω_i [32]: θ^i is less likely to be a dominant platform strategy of multinational i, as competition in home country i increases. Furthermore, the change in ω_i affects $\hat{\Omega}^{i,j}$ more than $\hat{\Theta}^{i,j}$ [33].

Equilibrium of the Game

Figure 6 shows that the multinationals' choice of platforms in the sub-game depends on the size of home countries, and there are seven possible cases. The two multinationals' choice of platforms in each case is summarized in table 8. If multiple equilibira do not occur in the equilibrium in the sub-game[34], we can obtain the following decision rule of the multinational:

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ iff } V_U < \hat{V}_1$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < \hat{V}_2$$

$$\pi^J_{FL,SA} > \pi^J_{SA,SA} \text{ iff } V_J < \hat{V}_3$$

---

32 $\dfrac{\partial \hat{\Omega}^{i,j}}{\partial \omega_i} = \left(\dfrac{8(\omega_i+1)N_K}{9\omega_i^2}\right)\left(\dfrac{(a-c+bd^j-bd^i)(\omega_i(a-c+bd^i)-a+c)}{2(a-c)+\omega_i bd^i}\right) > 0$, for $\omega_i \geq 1$

33 $\dfrac{\partial(\hat{\Omega}^{i,j}-\hat{\Theta}^{i,j})}{\partial \omega_i} = \left(\dfrac{8(\omega_i+1)bd^iN_K}{9\omega_i^2}\right)\left(\dfrac{\omega_i(a-c+bd^i)-a+c}{2(a-c)+\omega_i bd^i}\right) > 0$, for $\omega_i \geq 1$

34 Multiple equilibria in the sub-game appear if $\hat{N}_2 \leq N_U \leq \hat{N}_1$ and $\hat{N}_4 \leq N_J \leq \hat{N}_3$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < \hat{V}_4$$

where $\pi^h_{x,y}$ represents the profit of multinational h – exclusive of entry cost – if multinational J and multinational U adopt the strategies x and y respectively, $h = J,U$, x and $y = SA, FL$. Critical values of fixed R&D cost are different in each case. They are summarized in table 9. As shown in chapter four, the decision rule of multinationals is more complicated in the 'multiple equilibra' case: area G in figure 6.

$$\pi^U_{SA,FL} > \pi^U_{SA,SA} \text{ if } V_U < \hat{V}_1^D \equiv \min\left[\hat{V}_1^H, \hat{V}_1^G\right] = \hat{V}_1^G$$

$$\pi^U_{SA,FL} < \pi^U_{SA,SA} \text{ if } V_U > \bar{V}_1^D \equiv \max\left[\hat{V}_1^H, \hat{V}_1^G\right] = \hat{V}_1^H$$

$$\pi^U_{FL,FL} > \pi^U_{FL,SA} \text{ iff } V_U < \hat{V}_2^D = \hat{V}_2^H = \hat{V}_2^G = V_2;\ \hat{V}_2^D < \hat{V}_1^D$$

$$\pi^J_{SA,FL} > \pi^J_{SA,SA} \text{ if } V_J < \hat{V}_3^D \equiv \min\left[\hat{V}_3^H, \hat{V}_3^G\right] = \hat{V}_3^H$$

$$\pi^J_{FL,SA} < \pi^J_{SA,SA} \text{ if } V_J > \bar{V}_3^D \equiv \max\left[\hat{V}_3^H, \hat{V}_3^G\right] = \hat{V}_3^G$$

$$\pi^J_{FL,FL} > \pi^J_{SA,FL} \text{ iff } V_J < \hat{V}_4^D = \hat{V}_4^H = \hat{V}_4^G = V_4$$

The general pattern of the equilibrium is the same as that in chapter four, the only change is that several critical values of the fixed R&D cost depend on the number of firms in the home countries. Therefore, I will focus on the effect of ω_i, $i = J,U$, on the critical values of the fixed R&D cost in each case. For a detailed discussion of the pattern of equilibrium, refer to chapter four. In addition, notice that $\hat{V}_1^A$ and $\hat{V}_3^A$ are decreasing in ω_U and ω_J respectively[35], and $\hat{V}_i$, $i=1,2,3,4$ is non-increasing in ω_J or ω_U[36]. Generally speaking, as competition in home country *h* increases, $h=J,U$, the *FL* strategy becomes a less favorable strategy for multinational *h* given the R&D cost: that is, the return on the additional R&D cost required to develop a platform for the home country is reduced, and multinational *h* is more likely to adopt the *SA* strategy.

Entry and Consumer Welfare in a Home Country

Suppose that a new local firm enters home market *U*. This entry of a new local firm in home country *U* affects the strategic choice of multinationals in the first and the second stages of the game. Since $\hat{V}_h$, $h=1,2$, is non-increasing in ω_U, it is possible that multinational *U* may change its production strategy from FL to SA in the first stage of game, given platforms in the second stage[37]. Also since $\hat{\Theta}^{U,J}$ and $\hat{\Omega}^{U,J}$ are increasing in ω_U, the optimal platform of multinational *U* can be switched from θ^U to θ^K in the second stage, if the equilibrium in the first stage is (SA,SA). Moreover, it is possible that the increase in ω_U affects the strategic choice of multinational *J*, and consumer welfare in home country *J* can be reduced.

---

[35] $\frac{\partial \hat{V}_1^A}{\partial \omega_U} = -\left(\frac{2bd^U N_U}{(\omega_U+1)^3\lambda}\right)\left(\omega_U\left(a-c+bd^U\right)-a+c\right)<0$ for $\omega_U \geq 1$ and

$\frac{\partial \hat{V}_4^A}{\partial \omega_J} = -\left(\frac{2bd^J N_J}{(\omega_J+1)^3\lambda}\right)\left(\omega_J\left(a-c+bd^J\right)-a+c\right)<0$ for $\omega_J \geq 1$

[36] Since $\hat{V}_2^A = \hat{V}_2^{BE} = \hat{V}_1^{CF} = \hat{V}_2^{CF} = \hat{V}_1^G = \hat{V}_1^A$ and $\hat{V}_4^A = \hat{V}_3^{BE} = \hat{V}_4^{BE} = \hat{V}_3^H = \hat{V}_3^A$, these critical values are decreasing in ω_U and ω_J, respectively. Other critical values are independent on ω_h, $h=J,U$.

[37] Multinational *U* could switch the production strategy from FL to SA^U in the third, the sixth, and the seventh cases in table 8 due to increase in ω_U; from FL to SA^K in the second, the fourth, the sixth, and the seventh cases.

For example, consider the following case. Assume V_J and V_U are sufficiently high: a sufficient condition is $V_J \geq V_1$ and $V_U \geq V_3$[38]. In this case, both multinationals always adopt the *SA* strategy, and the equilibrium in the first stage is always (SA, SA)[39]. Notice that, as shown in the previous section, the platforms of the two multinationals still depend on the size of the home markets and the level of home competition. Suppose that there are currently ω_U firms in home country *U*, and a policy maker in *U* is considering allowing the entry of a new local firm. The number of firms in home country *J* is fixed.

Turning to home market *U*, the price of the variety θ^U is:

$$p_U = \frac{1}{\omega_U + 1}\left(a + \omega_U c + bd^{PU,U}\right)$$

where $d^{PU,U} = \left|\theta_U^P - \theta^U\right|$. When multinational *U* chooses θ^U as its platform for the *SA* strategy, $d^{PU,U} = 0$: if θ^K is the optimal choice of multinational *U*, $d^{PU,U} = d^U$. At this price, the consumer welfare in home country *U* becomes:

$$W^U\left(\theta_U^P, \omega_U\right) = \frac{N_U}{2\left(\omega_U + 1\right)^2 \lambda}\left(\omega_U\left(a - c\right) - bd^{PU,U}\right)^2$$

where $W^U(i, j)$ represents the welfare in home country *U* given the platform θ_U^P of

---

[38] V_1 and V_3 are the highest critical values of $\hat{V}_1$ and $\hat{V}_3$ in every cases.

[39] The example here is only one possible specification, and the reduction of the consumer welfare can occur in different specifications. However, this example is easy to analyze because we can ignore the game in the first stage and can analyze only second stage.

multinational U and ω_U firms. Suppose that a new local firm enters home market U, and it makes multinational U switch its platform from θ^U to θ^K; figure 7 shows that this case can happen in areas A, B, C, and D. As ω_U increases due to the entry of a local firm, $\hat{N}_h$, $h=1,2$ shifts to the right, and multinational U changes its platform from θ^U to θ^K.

Now consider areas C and D in figure 7[40]. The entry of a new local firm in home country U will not decrease consumer welfare in that country. This can be proved in the following way. The FOC for firm i in home country U is:

$$p_U + q_i \frac{\partial p_U}{\partial q_i} - c_i = p_U - q_i \frac{\lambda}{N_U} - c_i = 0$$

Summing across ω_U firms in country U yields:

$$\omega_U p_U - \frac{Q_U \lambda}{N_U} - \sum_i c_i = 0$$

Call the price and output in the initial situation p_U^0, Q_U^0 and the price and output in the new situation p_U^1, Q_U^1. Then:

(5.1) $\quad \omega_U p_U^0 + Q_U^0 \lambda / N_U - \omega_U c = 0$

[40] Mathematical condition is $V_U \geq V_1$, $V_J \geq V_3$, $\hat{N}_1(\omega_U + 1) \leq N_U \leq \hat{N}_1(\omega_U)$, and $N_J \geq \hat{N}_3(\omega_J)$ for area D; $V_U \geq V_1$, $V_J \geq V_3$, $\hat{N}_2(\omega_U + 1) \leq N_U \leq \hat{N}_1(\omega_U)$, and $N_J \leq \hat{N}_4(\omega_J)$ for area C.

(5.2) $\left(\omega_U+1\right)p_U^1+Q_U^1\lambda/N_U-\omega_U-\left(c+bd^U\right)=0$

Subtract equation (5.1) from equation (5.1) to get:

$$\left(p_U^1-c-bd^U\right)+\omega_U\left(p_U^1-p_U^0\right)+\left(Q_U^1-Q_U^0\right)\left(\lambda/N_U\right)=0$$

Hence, if $p_U^1\geq c+bd^U$, $p_U^1\leq p_U^0$ and consumer welfare in home country U increases[41]. The new consumer welfare becomes:

$$W^U\left(\theta^K,\omega^U+1\right)=\frac{N_U}{2\left(\omega_U+2\right)^2\lambda}\left(\left(\omega_U+1\right)\left(a-c\right)-bd^U\right)^2>W^U\left(\theta^U,\omega_U\right)$$

The non-negative profit condition of the new entrant is $\pi_U^I(\omega_U+1)\geq V_U$. Since the platform of multinational J becomes θ^K after the entry occurs, this condition can be rewritten as:

$$N_U\geq V_U\frac{\left(\omega_U+2\right)^2}{\left(a-c+bd^U\right)^2}$$

However, if $p_U^1<c+bd^U$, then multinational U won't serve home country U, and

---

[41] The condition $p_U^1\geq c+bd^U$ is equivalent to $\omega_U\leq\dfrac{a-c-bd^U}{bd^U}$.

consumer welfare in U is unchanged; the new entrant replaces multinational U[42]. The non-negative profit condition of the new entrant is:

$$N_U \geq V_U \frac{(\omega_U + 1)^2}{(a-c)^2}$$

Note that, in either case, consumers in country U cannot be worse off. In addition, notice that the profit of firm J in the host country will be reduced. The above results are summarized in the following proposition.

Proposition 5.1:

Given V_U, ω_U, and ω_J, suppose $V_U \geq V_1$, $V_J \geq V_3$, $\hat{N}_1(\omega_U + 1) \leq N_U \leq \hat{N}_1(\omega_U)$, and $N_J \geq \hat{N}_3(\omega_J)$ or $N_J \leq \hat{N}_3(\omega_J)$. Then, allowing a new entrant in home country U has the following impact:

1. If $\omega_U \geq \hat{\omega}_U$ and $N_U \geq V_U(\omega_U + 1)^2/(a-c)^2$, the consumer welfare in home country U is unchanged.
2. If $\omega_U < \hat{\omega}_U$ and $N_U \geq V_U(\omega_U + 2)^2/(a-c+bd^U)^2$, consumer welfare in home country U increases.
3. In either case, the entry of a new local firm in home country U makes the platform of multinational U from θ^U to θ^K.
4. Otherwise, the entry doesn't occur.

---

[42] $p_U^1 \leq c + bd^U \leftrightarrow \omega^U \geq \dfrac{a-c-bd^U}{bd^U}$

where $\hat{\omega}_U \equiv (a-c-bd^U)/bd^U$.

Now consider the areas A and B in figure 7. In these areas, it is possible that the entry in home country U can make firm U change its platform from θ^U to θ^K, and proposition 5.1 can hold in these areas. Further, when that happens, firm J's choice of the platform may also be changed from θ^K to θ^J, and the profit of firm J in the host country becomes smaller[43], equilibrium could be changed from (θ^K,θ^U) to (θ^J,θ^K). Thus, the more competitive home market of firm U can make firm U choose θ^K, and then firm J uses its home-preferred variety for the platform due to the reduced profitability of the host markets. Consumer welfare in home country J is thus changed from $W^J(\theta^K,\omega_J)$ to $W^J(\theta^J,\omega_J)$ where $W^J(i,j)$ is consume welfare in home J with platform i of multinational J and j firms in home market. Further, consumer welfare in home country J increases:

$$W^J\left(\theta^J,\omega_J\right)-W^J\left(\theta^K,\omega_J\right)=\frac{N_J bd^J}{2\lambda\left(\omega_J+1\right)^2}\left(2\omega_J\left(a-c\right)-bd^J\right)>0$$

Moreover, in a special situation[44], it is possible that the entry of a new local firm in U doesn't increase consumer welfare in U but increases consumer welfare in J.

Proposition 5.2:

Suppose $V_U \geq V_1$, $V_J \geq V_3$, and $\hat{N}_4(\omega_J) \leq N_J \leq \hat{N}_3(\omega_J)$. Also suppose that N_U

---

[43] In area except A, B, C, and D, the profit of firm J in K is unchanged because the platform of firm U is unchanged. Overall, the profit of firm J in K is non-increasing when a new local firm enters in U.

[44] Multinational U doesn't serve home country U due to the entry of a new local competitor.

satisfies $\hat{N}_1(\omega_U+1) \le N_U \le \hat{N}_1(\omega_U)$ or $\hat{N}_2(\omega_U+1) \le N_U \le \hat{N}_2(\omega_U)$. Then, allowing entry in home country *U* can increase consumer welfare in home country *J* if one of the following conditions holds:

1. $\omega_U \ge \hat{\omega}_U$ and $N_U \ge V_U(\omega_U+1)^2/(a-c)^2$
2. $\omega_U < \hat{\omega}_U$ and $N_U \ge V_U(\omega_U+2)^2/(a-c+bd^U)^2$

Furthermore, if the condition 1 holds, the entry of a new local firm in home country *U* can raise consumer welfare in home country *J* instead of that in home country *U*.

Proof:

From the definitions, the condition for the area A is $\hat{N}_4(\omega_J) \le N_J \le \hat{N}_3(\omega_J)$ and $\hat{N}_2(\omega_U+1) \le N_U \le \hat{N}_2(\omega_U)$. Similarly, the condition for the area B is defined by $\hat{N}_4(\omega_J) \le N_J \le \hat{N}_3(\omega_J)$ and $\hat{N}_1(\omega_U+1) \le N_U \le \hat{N}_1(\omega_U)$. As shown in proposition 5.1, the non-negative profit of the new entrant in home country *U* is $\omega_U \ge \hat{\omega}_U$ and $N_U \ge V_U(\omega_U+1)^2/(a-c)^2$, if multinational *U* doesn't serve home country *U*; $\omega_U < \hat{\omega}_U$ and $N_U \ge V_U(\omega_U+2)^2/(a-c+bd^U)^2$ if multinational *U* continues to serve home country *U*. QED

In summary, as propositions 5.1 and 5.2 imply, a more competitive home market in country *U* can make multinational *U* value the host market above the home market. Then, multinational *J* may respond by changing its platform to the home-preferred variety since multinational *J* values the home market above the host market. This increases consumer welfare in home country *J*.

Entry and Profit of a Multinational

Now consider the change in the profit of multinational *U*. If the entry of a new local firm doesn't change the equilibrium of game, the profit of multinational *U* is reduced because $\pi^{U}_{SA,SA}(\theta^{P}_{J},\theta^{P}_{U})$ is decreasing in ω_U [45]. In cases C and D in figure 7, the equilibrium of the duopoly game is changed due to the entry, and multinational *U* earns less profit than before due to the entry in home country *U*. In detail, consider area C. $\hat{N}_2(\omega_U) \le N_U$ holds in area C, and it implies $\pi^U(\theta^K,\theta^U,\omega_U) \ge \pi^U(\theta^K,\theta^K,\omega_U)$ from the definition of $\hat{N}_2(\omega_U)$. Since $\pi^U(\theta^K,\theta^K,\omega_U)$ is decreasing in ω_U, the following relation holds, and the profit of multinational *U* decreases due to the entry in home country *U*:

$$\pi^U(\theta^K,\theta^K,\omega_U+1) \le \pi^U(\theta^K,\theta^K,\omega_U) \le \pi^U(\theta^K,\theta^U,\omega_U)$$

Similarly, from the definition of $\hat{N}_1(\omega_U)$ and the functional property of $\pi^U(.,\omega_U)$, the following relation of the profit function holds, and the profit of multinational *U* is reduced in area D:

$$\pi^U(\theta^J,\theta^K,\omega_U+1) \le \pi^U(\theta^J,\theta^K,\omega_U) \le \pi^U(\theta^J,\theta^U,\omega_U)$$

However, in areas A and B in figure 7, it is possible that the profit of multinational *U* can

---

45 $\dfrac{\partial \pi^{U}_{SA,SA}(\theta^{P}_{J},\theta^{P}_{U})}{\partial \omega_U} = -\dfrac{2N_U}{(\omega_U+1)^3\lambda}\left(a-c+bd^{PU,U}\right)\left(a-c-\omega_U bd^{PU,U}\right) < 0$ for given platforms θ^P_J and θ^P_U.

be increased by the entry of a new local firm in home country *U*. First, consider the area A and suppose that equilibrium is changed from $(\theta^K, \theta^U, \omega_U)$ to $(\theta^J, \theta^K, \omega_U + 1)$. From the definitions of $\hat{N}_2(\omega_U)$ and $\hat{N}_2(\omega_U + 1)$, $\hat{N}_2(\omega_U) \le N_U \le \hat{N}_2(\omega_U + 1)$ implies:

$$\pi^U(\theta^K, \theta^U, \omega_U) \ge \pi^U(\theta^K, \theta^K, \omega_U)$$

$$\pi^U(\theta^J, \theta^K, \omega_U) \ge \pi^U(\theta^J, \theta^U, \omega_U)$$

$$\pi^U(\theta^K, \theta^K, \omega_U + 1) \ge \pi^U(\theta^K, \theta^U, \omega_U + 1)$$

$$\pi^U(\theta^J, \theta^K, \omega_U + 1) \ge \pi^U(\theta^J, \theta^U, \omega_U + 1)$$

Since $\pi^U(\theta^J, .) \ge \pi^U(\theta^K, .)$ for given platform of multinational *U* and number of firms in home market *U*, the order of profits of multinational *U* becomes:

$$\pi^U(\theta^J, \theta^K, \omega_U) \ge \pi^U(\theta^J, \theta^U, \omega_U) \ge \pi^U(\theta^K, \theta^U, \omega_U) \ge \pi^U(\theta^K, \theta^K, \omega_U)$$

$$\pi^U(\theta^J, \theta^K, \omega_U + 1) \ge \pi^U(\theta^K, \theta^K, \omega_U + 1) \text{ and } \pi^U(\theta^J, \theta^U, \omega_U + 1) \ge \pi^U(\theta^K, \theta^U, \omega_U + 1)$$

Notice that the order of $\pi^U(\theta^K, \theta^K, \omega_U + 1)$ and $\pi^U(\theta^J, \theta^U, \omega_U + 1)$ is undetermined. Because $\pi^U(., \omega_U) \ge \pi^U(., \omega_U + 1)$ for given platforms of the multinationals, the above inequalities imply that the profit at the new equilibrium can be higher than the previous profit; $\pi^U(\theta^K, \theta^U, \omega^U) \le \pi^U(\theta^J, \theta^K, \omega_U + 1) \le \pi^U(\theta^J, \theta^K, \omega_U)$ is possible. Similarly, consider area B and the change of equilibrium from $(\theta^K, \theta^U, \omega_U)$ to $(\theta^J, \theta^K, \omega_U)$. Then the following orders of profits of multinational *U* hold from $\hat{N}_1(\omega_U) \le N_U \le \hat{N}_1(\omega_U + 1)$ and the functional property of $\pi^U(.)$:

$$\pi(\theta^J,\theta^U,\omega_U) \geq \pi^U(\theta^K,\theta^U,\omega_U) \text{ and } \pi^U(\theta^J,\theta^K,\omega_U) \geq \pi^U(\theta^K,\theta^K,\omega_U)$$

$$\pi^U(\theta^J,\theta^K,\omega_U+1) \geq \pi^U(\theta^J,\theta^U,\omega_U+1) \geq \pi^U(\theta^K,\theta^U,\omega_U+1) \geq \pi^U(\theta^K,\theta^K,\omega_U+1)$$

The order of $\pi^U(\theta^K,\theta^U,\omega_U)$ and $\pi^U(\theta^J,\theta^K,\omega_U)$ is ambiguous. The above inequalities and $\pi^U(.,\omega_U) \geq \pi^U(.,\omega_U+1)$ imply that the profit at the new equilibrium can be higher than before; $\pi^U(\theta^K,\theta^U,\omega_U) \leq \pi^U(\theta^J,\theta^K,\omega_U+1) \leq \pi^U(\theta^J,\theta^K,\omega_U)$ is possible.

Proposition 5.3:

Given V_U, ω_U, and ω_J, suppose $V_U \geq V_1$, $V_J \geq V_3$, and $\hat{N}_4(\omega_J) \geq N_J \geq \hat{N}_3(\omega_J)$. Also suppose $\hat{N}_1(\omega_U) \leq N_U \leq \hat{N}_1(\omega_U+1)$ or $\hat{N}_2(\omega_U) \geq N_U \geq \hat{N}_2(\omega_U+1)$. Then, allowing entry in home country *U* can raise the profit of multinational *U* if one of the following conditions holds;

1. $\omega_U \geq \hat{\omega}_U$, $N_U \geq V_U(\omega_U+1)^2/(a-c)^2$, and $N_U \leq N_U^*$
2. $\omega_U < \hat{\omega}_U$, $N_U \geq V_U(\omega_U+2)^2/(a-c+bd^U)^2$, and $N_U \leq N_U^{**}$

where $N_U^* \equiv \dfrac{b(2a-2c+bd^J-2bd^U)(d^J+2d^U)(\omega_U+1)^2(\omega_U+2)^2}{9[(\omega_U+1)^2(a-c)^2-(\omega_U+1)^2(a-c-bd^U(\omega_U+1))^2]}N_K$, and

$$N_U^{**} \equiv \frac{b(2a-2c+bd^J-2bd^U)(d^J+2d^U)(\omega_U+1)^2}{9(a-c)^2}N_K.$$

Proof:

From proposition 5.1, multinational *U* can change its platform from θ^U to θ^K due to the entry of a new local firm in home country U if the first two inequalities in condition 1 or 2 hold. Further, as discussed before, the profit at the new equilibrium can be higher than that at the previous equilibrium in areas A and B. Supposing the first two inequalities in condition 1 hold, proposition 5.1 shows that multinational U continues to serve home country U with platform θ^K and earns $\pi^U_{SA,SA}(\theta^K,\theta^J,\omega_U+1)$. The entry of a new local firm in home country U increases the profit of multinational U if:

$$\pi^U_{SA,SA}(\theta^K,\theta^J,\omega_U+1)\geq\pi^U_{SA,SA}(\theta^U,\theta^K,\omega_U)$$
$$\leftrightarrow N_U\leq\frac{b(2a-2c+bd^J-2bd^U)(d^J+2d^U)(\omega_U+1)^2(\omega_U+2)^2}{9[(\omega_U+1)^2(a-c)^2-(\omega_U+1)^2(a-c-bd^U(\omega_U+1))^2]}N_K\cdot$$

Supposing the first two inequalities in condition 2 holds, multinational U stops supplying home country U and earns the profit $N_K(a-c+bd^J)^2/9\lambda$ from only the host country. The entry of a new firm in home market U raises the profit of multinational U if;

$$\frac{N_K(a-c+bd^J)^2}{9\lambda}\geq\pi^U_{SA,SA}(\theta^U,\theta^K,\omega_U)$$
$$\leftrightarrow N_U\leq\frac{b(2a-2c+bd^J-2bd^U)(d^J+2d^U)(\omega_U+1)^2}{9(a-c)^2}N_K$$

QED

Proposition 5.3 suggests that, if the host market is sufficiently large, a more competitive home market U can increase the profit of multinational U because multinational U increases its sales in the host market to avoid the severe home competition.

Conclusion

The fourth chapter developed a model of the strategic interaction of two multinationals in a host country that is culturally different from their home countries. That simple model assumed symmetric home competition in the sense that only a multinational serves its home market. However, it is sometimes argued that some countries have relatively more competitive markets, while some countries have less competitive markets. Therefore, this chapter has modified the duopoly model in the fourth chapter to allow asymmetric home competition of the two multinationals to examine the effect of asymmetric home competition on multinationals' strategic decision and consumer welfare in both home countries.

To illuminate this, I considered the duopoly model that is essentially the same as that in the fourth chapter except for the number of firms in the two home countries; ω_J and ω_U firms, including multinationals and local firms, enter home markets *J* and *U*, respectively. This modified duopoly model has a similar pattern of equilibrium to that in the fourth chapter. The asymmetric home competition affects the strategic decisions of the multinationals in the following ways. If a home country allows more entrants in the market, given other parameters, the multinational from this country is less likely to adopt the *FL* strategy because the return to the additional R&D cost to develop a platform for the home country is reduced. Therefore the *SA* strategy becomes a more favorable strategy of this multinational. When the multinational chooses the *SA* strategy, the more competitive home market makes the host-preferred variety the more favorable platform of the multinational. Since additional entry of a local firm could make the multinational change its production strategy or optimal platform, it could influence consumer welfare in the home country; consumer welfare increases or, at least, is unchanged. Furthermore, it is possible that the entry of new local firms in a home country can make the multinational stop serving that country. In a specific situation, the multinational changes its platform from the home-preferred variety to the host-preferred variety responding to the entry in its home country, and its competitor in the host market also changes its platform from the host-preferred variety to the home-preferred variety to avoid the competition in the host market; then the entry of a new local firm in a home country can increase consumer welfare in a different home market. In this situation, it is possible that the entry of new local firms in the home country increases the profit of the multinational if the size of the host market is sufficiently large.

Chapter 6. General Conclusion

Although the effect of cultural differences between countries on strategic decision of multinationals was widely perceived by researchers, it has been neglected in most previous studies. The main purpose of this dissertation is to develop a model of multinationals under different cultural backgrounds and apply that model to study the effect of cultural dissimilarity between countries on the strategic behavior of firms.

Another important motive for this dissertation is that most multinationals seem to produce localized or localizable products instead of standard products. Several surveys show that most multinationals prefer to develop a standard product and adjust it to fit local preferences. These types of products and technology were studied in the literature on the flexible technology (Eaton and Schmitt, 1994; Norman and Thisse, 1999; Norman, 2002) but have been neglected in studies of multinationals and exporters.

Using these motivations, this dissertation examines (1) the role of the culture-specific demand on the strategic behavior of the firms, (2) when and why multinationals and exporters introduce localized products instead of standard products when there are cultural difference between countries, and (3) the influence of both the cultural difference between two countries and the strategic decisions of firms on the welfare in the home and the host country.

The second chapter of this dissertation developed a monopoly model to study the effect of the culture-specific demand on the firm's choice of location and production strategy. The main results in the second chapter are as follows. The firm has more incentive to become a multinational if the host country has considerably different preferences from the home country. Furthermore, the cultural similarity between countries affects the firm's choice of production strategy. When the preferences in the home and foreign countries are similar, the firm is more likely to introduce a standard variety (or platform) and adjust it to serve two countries (standardization strategy). If two countries have significantly different preferences, developing two completely different varieties becomes a better choice for the firm (localization strategy). Turning to consumer welfare in home and host countries, being a multinational could harm consumer welfare in the host or home country: the more cost efficient production strategy of a multinational doesn't necessarily mean low marginal costs in *both* countries.

The third chapter developed a duopoly model based on the demand and technology structure discussed in the second chapter, assuming the platforms for the standardization strategy of two multinationals are given by their home-preferred variety; multinational U is assumed to be culturally unfamiliar with the host market, but multinational J is assumed to be relatively culturally familiar. When both multinationals are from home countries that are considerably culturally different from the host country, they are more likely to adopt the localization strategy; that is, they develop a new localized platform to serve the host market. If the two home countries are culturally similar to the host country, the two firms adopt the standardization strategy; they adjust their home-preferred variety to serve the host market. When the two multinationals come from home countries that are culturally dissimilar to each other, firm J may adopt the standardization strategy because it has advantage in adjustment cost, but firm U may develop a new localized variety. When both home countries have similar cultural backgrounds, a symmetric equilibrium or multiple equilibia is the more likely outcome of the duopoly game. In addition, the profit analysis shows that, due to the strategic interaction of the two firms, it is possible that the culturally unfamiliar firm could earn the higher profit in the host country than does the culturally familiar firm.

Chapter four relaxed the assumption of given platforms used in chapter three and allowed firms to choose their platform for the standardization strategy. The size of home markets is a major factor when firms choose their platform for the standardization strategy and production strategy. When a multinational has a relatively large home market, this firm is more likely to use its home-preferred variety as its platform. This choice reduces consumer welfare in the host country, but not its home country. Conversely, if the host market is large, the optimal platform of the firm is the host-preferred variety. Its home country loses consumer welfare from this choice, but the host country doesn't lose the welfare. The relative size of the two home countries also affects the multinationals' decision; the multinational from the relatively small country is more likely to adopt the standardization strategy using its host-preferred platform, and countries that have relatively small market lose consumer welfare. When all countries have the similar size of markets, multiple equilibria is more likely to emerge. In this case, the ex post inefficient outcome can appear.

The fifth chapter modified the duopoly model to allow asymmetric home competition. If a home country has the more competitive market, the multinational from this country is more likely to adopt the standardization strategy. Even if this multinational chooses the *SA* strategy, the more competitive home market makes the host-preferred variety a more favorable platform for the multinational. In a specific situation, the multinational changes its platform from the home-preferred variety to the host-preferred variety responding to the entry in its home country, and its competitor in the host market also changes its platform from the host-preferred variety to the home-preferred variety to avoid the competition in the host market; then the entry of a new local firm in a home country can increase consumer welfare in another home market and can raise the profit of the multinational.

References

Boyer, M., and M. Moreaux, "Capacity Commitment versus Flexibility" *Journal of Economics and Management Strategy* 6 (Summer 1997), 347-376

Buckley, P. J., and M. Casson, *The Future of the Multinational Enterprise*, 25th Anniversary Edition (New York: Palgrave Macmillian, 2002)

Caves, R. E., *Multinational Enterprise and Economic Analysis*, 2nd edition (Cambridge, U.K.: Cambridge University Press, 1996)

Chang, M., "Flexible Manufacturing, Uncertain Consumer Tastes, and Strategic Entry Deterrence" *The Journal of Industrial Economics* 41 (March 1993), 77-90

Chang, M., "Product Switching Cost and Strategic Flexibility," *Journal of Economics and Management Strategy* 7 (1998), 461-488

Davidson, W. M., "The Location of Foreign Direct Investment Activity: Country Characteristics and Experience Effects," *Journal of International Business Studies* 11 (Spring-Summer 1980), 9-22

Deane, R. S., *Foreign Investment in New Zealand Manufacturing* (Wellington, N.Z.: Sweet and Maxwell, 1970)

Dunning, J. H., "Location and the Multinational Enterprise: A Neglected Factor?" *Journal of International Business Studies* 29 (1998), 45-66

Eaton, B. C., and N. Schmitt, "Flexible Manufacturing and Market Structure," *American Economic Review* 84 (1994), 875-888

Lancaster, K., *Variety, Equity, and Efficiency* (New York: Columbia University Press, 1979)

Kang, D., Lee, S., Lee, W., and S. Ahn, " Foreign Direct Investment by Korea-based Manufacturing Firms 2004 (Korean)," *KIET Issue Paper 2004-162*, 2004

Kang, D., Park, C., Lee, W., and C. Byun, "Foreign Direct Investment in Korean Manufacturing 2003 (Korean)," *KIET Issue Paper* 2003-140, 2003

Kang, D., Park, C., Lee, W., and C. Byun, "Foreign Direct Investment by Korea-based Manufacturing Firms 2002 (Korean)," *KIET Issue Paper* 2002-114, 2002

Horstmann, I. J., and J. R. Markusen, "Exploring New Markets: Direct Investment, Contractual Relations and the Multinational Enterprise," *International Economic Review* 37, (Feb 1996), 1-19

Markusen, R. J., "The Boundaries of Multinational Enterprises and the Theory of International Trade," *Journal of Economic Perspective 9* (Spring 1995), 169-189

Markusen, R. J., *Multinational Firms and the Theory of International Trade* (Cambridge, MA: MIT press, 2002)

Mataloni, R. J. Jr., "U.S. Multinational Companies: Operations in 2002," *Survey of Current Business* 84 No. 7 (July 2004), 10-29

Melevar. T. C., and J. Saunders, "International Corporate Visual Identity: Standardization or Localization?" *Journal of International Business Studies* 30 (1999), 583-398

Muffatto, M., "Introducing a Platform Strategy in Product Development," *International Journal of Production Economics* 60-61 (1999), 145-153

Nankani, G. T., *The Intercountry Distribution of Direct Foreign Investment in Manufacturing* (New York: Garland, 1979)

Norman, G., "The Relative Advantages of Flexible versus Designated Manufacturing technologies," *Regional Science and Urban Economics* 32 (2002), 419-445

Norman, G., and J. Thisse, "Technology Choice and Market Structure: Strategic Aspects of Flexible Manufacturing," *Journal of Industrial Economics* 47 (1999), 345-371

Onida, F., and G. Viesti, *The Italian Multinationals* (London, U.K.: Croom Helm, 1988)

Salop, S. C., "Monopolistic Competition with Outside Goods," *Bell Journal of Economics* 10 (1979), 141-156

Shy, O., *Industrial Organization* (Cambridge, MA: MIT Press, 1998)

Tirole, J., *The Theory of Industrial Organization* (Cambridge, MA: MIT Press, 1988)

Tsurumi, Y., *The Japanese Are Coming: A Multinational Spread of Japanese Firms* (Cambridge, MA: Ballinger, 1976)

UNCTAD, *World Investment Report 1998: Trends and Determinants* (New York: United Nations Publications, 1998)

Yoshihara, K., *Japanese Investment in Southeast Asia* Monographs of the Center for Southeast Asian Studies, Kyoto University, No. 11 (Honolulu: University Press of Hawaii, 1978)

Appendix 1. Tables

Table 1. Foreign Affiliates of US-based MNE[a] in the high income countries[b] (Population>ten million)

	GDP[c] (capita, ppp)	Population[c] (thousands)	Affiliates[d] (per capita)	Sales[d] (per capita)	Net income[d] (per capita)
Australia	28,290	19,890	41.08 (5)[f]	3068.28 (5)	171.64 (6)
Belgium	28,930	10,348	53.54 (3)	4990.82 (4)	570.83 (2)
Canada	29,740	31,630	60.92 (2)	10649.07 (1)	456.21 (3)
France	27,460	59,725	20.88 (6)	2108.48 (7)	58.05 (8)
Germany	27,460	82,551	17.18 (7)	2491.95 (6)	47.40 (10)
Italy	26,760	57,646	12.73 (10)	1247.87 (8)	37.70 (12)
Japan	28,620	127,210	5.63 (12)	1180.58 (10)	55.44 (9)
Korea, Republic of	17,930	47,912	4.59 (13)	386.31 (13)	27.80 (13)
Netherlands	28,600	16,215	79.19 (1)	6978.17 (2)	1164.60 (1)
Portugal	17,980	10,121	14.52 (8)	689.36 (12)	179.33 (5)
Spain	22,020	41,101	13.48 (9)	1191.92 (9)	91.09 (7)
Taiwan[e]	23,400	22,894	10.00 (11)	1025.68 (11)	46.78 (11)
United Kingdom	27,650	59,280	45.56 (4)	6269.32 (3)	229.25 (4)

a. Majority-owned foreign affiliates: the combined ownership of all U.S. parents exceeds 50 percent.
b. The classification of the high income countries follows the classification of the World Bank
c. World Bank (2003)
d. Number of affiliates, Sales, and Net income of US-based MNEs: Bureau of Economic Analysis (2002)
e. Data for Taiwan: Estimated 2003 GDP per capita and estimated 2005 population, The World Factbook (CIA)
f. Numbers in brackets denote the ranking.

Table 2. The property of the product produced in the host country by Korean-based multinationals

Korea-based Multinationals	Standardized product (%)		Standardized and locally adjustable product (%)		Localized product (%)	
	2002[a]	2004[b]	2002	2004	2002	2004
Motor vehicles and equipment	10	15.6	60	46.9	30	37.5
Electronics	20	25	56	51.8	24	23.2
Machinery and Equipment	13	5.9	60.9	82.4	26.1	11.8
Precision Instrument	13.3	30.8	73.3	46.2	13.3	23.1
Textiles, Apparel, and leather products	28.6	21.4	50	42.9	21.4	35.7
Chemical	44.4	19.4	50	64.5	5.6	16.1
Overall	22.9	19.7	56.1	54.9	21	25.4

a. "Foreign Direct Investment by Korea-based Manufacturing Firms 2002", D. Y. Kang, C. K. Park, W. B. Lee, C. W. Byun, *KIET Issue Paper 2002-114*, 2002
b. "Foreign Direct Investment by Korea-based Manufacturing Firms 2004", D. Y. Kang, S. Y. Lee, W. B. Lee, S. H. Ahn, *KIET Issue Paper 2004-162*, 2004

Table 3. The property of products in Korea produced by Foreign-based multinationals

Year 2003 [a]	Standardized product (%)	Standardized and locally adjustable product (%)	Localized product (%)
Foreign-based MNE in Korea	8	25	67

a. "Foreign Direct Investment in Korean Manufacturing Industry 2003", D. Y. Kang, C. K. Park, W. B. Lee, C. W. Byun, *KIET Issue Paper 2003-140*, 2003

Table 4. Duopoly profits of firms *J* and *U* in the host country, exclusive of entry costs

state	Profit of firm *J* and firm *U*
(θ^J, θ^U)	$\pi^U_{J,U} = \frac{N_K}{9\lambda}\left[a-c-2bd^J+bd^U\right]^2$
	$\pi^U_{J,U} = \frac{N_K}{9\lambda}\left[a-c-2bd^U+bd^J\right]^2$
(θ^J, θ^K)	$\pi^J_{J,K} = \frac{N_K}{9\lambda}\left[a-c-2bd^J\right]^2$
	$\pi^U_{J,K} = \frac{N_K}{9\lambda}\left[a-c+bd^J\right]^2 - V_U$
(θ^K, θ^U)	$\pi^J_{K,U} = \frac{N_K}{9\lambda}\left[a-c+bd^J\right]^2 - V_J$
	$\pi^U_{K,U} = \frac{N_K}{9\lambda}\left[a-c+2bd^U\right]^2$
(θ^K, θ^K)	$\pi^J_{K,K} = \frac{N_K}{9\lambda}\left[a-c\right]^2 - V_J$
	$\pi^U_{K,K} = \frac{N_K}{9\lambda}\left[a-c\right]^2 - V_U$

a. From the structure of profits, the following hold for all parameters:
$\pi^J_{x,U} > \pi^J_{x,K}$ and $\pi^U_{J,y} > \pi^U_{K,y}$, provided $\left|d^h\right| > 0$, $x = J, K$, $y = U, K$, and $h = J, U$
No matter which strategy firm *h* plays, it earns higher profits when the other firm uses its original platform rather than the localized platform.

Table 5. Summary of the corollary 3.1.1

	$d^U \uparrow (\downarrow)$	$d^J \uparrow (\downarrow)$
(*FL*, *FL*)	Same	+ (-)
(*FL*, *SA*)	+ (-)	- (+)
Multiple equilibria	- (+)	+ (-)
(*SA*, *SA*)	- (+)	- (+)

Table 6. Summary of the corollary 3.1.2

	$d^U \uparrow, d^J \uparrow$	$d^U \downarrow, d^J \downarrow$	$d^U \uparrow, d^J \downarrow$	$d^U \downarrow, d^J \uparrow$
(*FL*, *FL*)	+	-	-	+
(*FL*, *SA*)	?	?	+	-
Multiple equilibria	?	?	-	+
(*SA*, *SA*)	-	+	?	?

Table 7. Duopoly profits of the firms *J* and *U* in the home and the host countries when both firms adopt the *SA* strategy (Chapter 4)

State	Profit of firm *J*, profit of firm *U*
$\left(\theta^J,\theta^U\right)$	$\pi^J_{SA,SA}=\frac{N^J}{4\lambda}\left(a-c\right)^2+\frac{N^K}{9\lambda}\left(a-c-2bd^J+bd^U\right)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{4\lambda}\left(a-c\right)^2+\frac{N^K}{9\lambda}\left(a-c-2bd^U+bd^J\right)^2-E_U-V_U$
$\left(\theta^J,\theta^K\right)$	$\pi^J_{SA,SA}=\frac{N^J}{4\lambda}\left(a-c\right)^2+\frac{N^K}{9\lambda}\left(a-c-2bd^J\right)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{4\lambda}\left(a-c-bd^U\right)^2+\frac{N^K}{9\lambda}\left(a-c+bd^J\right)^2-E_U-V_U$
$\left(\theta^K,\theta^U\right)$	$\pi^J_{SA,SA}=\frac{N^J}{4\lambda}\left(a-c-bd^J\right)^2+\frac{N^K}{9\lambda}\left(a-c+bd^U\right)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{4\lambda}\left(a-c\right)^2+\frac{N^K}{9\lambda}\left(a-c-2bd^U\right)^2-E_U-V_U$
$\left(\theta^K,\theta^K\right)$	$\pi^J_{SA,SA}=\frac{N^J}{4\lambda}\left(a-c-bd^J\right)^2+\frac{N^K}{9\lambda}\left(a-c\right)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{4\lambda}\left(a-c-bd^U\right)^2+\frac{N^K}{9\lambda}\left(a-c\right)^2-E_U-V_U$

Table 8. Duopoly profits of the firms *J* and *U* in the home and the host countries when both firms adopt the *SA* strategy (Chapter 5)

State	Profit of firm *J*, profit of firm *U*
(θ^J,θ^U)	$\pi^J_{SA,SA}=\frac{N^J}{(\omega_J+1)^2\lambda}(a-c)^2+\frac{N^K}{9\lambda}(a-c-2bd^J+bd^U)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{(\omega_U+1)^2\lambda}(a-c)^2+\frac{N^K}{9\lambda}(a-c-2bd^U+bd^J)^2-E_U-V_U$
(θ^J,θ^K)	$\pi^J_{SA,SA}=\frac{N^J}{(\omega_J+1)^2\lambda}(a-c)^2+\frac{N^K}{9\lambda}(a-c-2bd^J)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{(\omega_U+1)^2\lambda}(a-c-\omega_U bd^U)^2+\frac{N^K}{9\lambda}(a-c+bd^J)^2-E_U-V_U$
(θ^K,θ^U)	$\pi^J_{SA,SA}=\frac{N^J}{(\omega_J+1)^2\lambda}(a-c-\omega_J bd^J)^2+\frac{N^K}{9\lambda}(a-c+bd^U)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{(\omega_U+1)^2\lambda}(a-c)^2+\frac{N^K}{9\lambda}(a-c-2bd^U)^2-E_U-V_U$
(θ^K,θ^K)	$\pi^J_{SA,SA}=\frac{N^J}{(\omega_J+1)^2\lambda}(a-c-\omega_J bd^J)^2+\frac{N^K}{9\lambda}(a-c)^2-E_J-V_J$
	$\pi^U_{SA,SA}=\frac{N^U}{(\omega_U+1)^2\lambda}(a-c-\omega_U bd^U)^2+\frac{N^K}{9\lambda}(a-c)^2-E_U-V_U$

Table 8. The choice of platform in different cases

	$N_U \ge \hat{N}_1$ $N_J \ge \hat{N}_3$	$N_U \le \hat{N}_2$ $N_J \le N_4$	$N_U \ge \hat{N}_2$ $N_J \le \hat{N}_4$	$N_U \le \hat{N}_2$ $N_J \ge \hat{N}_4$	$N_U \ge \hat{N}_1$ $\hat{N}_4 \le N_J \le \hat{N}_3$	$\hat{N}_2 \le N_U \le \hat{N}_1$ $N_J \ge \hat{N}_3$	$\hat{N}_2 \le N_U \le \hat{N}_1$ $\hat{N}_4 \le N_J \le \hat{N}_3$
(FL, FL)	(FL, FL)	(FL, FL)	(FL, FL)	(FL, FL)	(FL, FL)	(FL, FL)	(FL, FL)
(SA, FL)	(SA^J, FL) [a]	(SA^K, FL)	(SA^K, FL)	(SA^J, FL)	(SA^J, FL)	(SA^J, FL)	(SA^J, FL)
(FL, SA)	(FL, SA^U)	(FL, SA^K)	(FL, SA^U)	(FL, SA^K)	(FL, SA^U)	(FL, SA^U) [c]	(FL, SA^U)
(SA, SA)	(SA^J, SA^U)	(SA^K, SA^K)	(SA^K, SA^U)	(SA^J, SA^K)	(SA^K, SA^U)	(SA^J, SA^K)	(SA^i, SA^j) [b]

a. Superscript refers the platform of a firm: J, U, and K mean θ^J, θ^U, and θ^K respectively.

b. $i = J, K$ and $j = U, K$, $i \ne j$: multiple equilibria exist

Table 9. The critical values of V_U and V_J in the each equilibrium of the duopoly game (the first stage)

	$N_U \geq \hat{N}_1$ $N_J \geq \hat{N}_3$	$N_U \leq \hat{N}_2$ $N_J \leq N_4$	$N_U \geq \hat{N}_2$ $N_J \leq \hat{N}_4$	$N_U \leq \hat{N}_2$ $N_J \geq \hat{N}_4$	$N_U \geq \hat{N}_1$ $\hat{N}_4 \leq N_J \leq \hat{N}_3$	$\hat{N}_2 \leq N_U \leq \hat{N}_1$ $N_J \geq \hat{N}_3$
$\hat{V}_1$	$\hat{V}_1^I = V_1$ [a]	$\hat{V}_1^A$ [b]	$\hat{V}_1^{BE} = V_2$	$\hat{V}_1^{CF} = \hat{V}_1^A$	$\hat{V}_1^H = V_1^H$ [c]	$\hat{V}_1^G = \hat{V}_1^A$
$\hat{V}_2$	$\hat{V}_2^I = V_2$	$\hat{V}_2^A = \hat{V}_1^A$	$\hat{V}_2^{BE} = \hat{V}_1^A$	$\hat{V}_2^{CF} = \hat{V}_1^A$	$\hat{V}_2^H \geq V_2$	$\hat{V}_2^G = V_2$
$\hat{V}_3$	$\hat{V}_3^I = V_3$	$\hat{V}_3^A$ [b]	$\hat{V}_3^{BE} = \hat{V}_3^A$	$\hat{V}_3^{CF} = V_3$	$\hat{V}_3^H = \hat{V}_3^A$	$\hat{V}_3^G = V_3^G$ [c]
$\hat{V}_4$	$\hat{V}_4^I = V_4$	$\hat{V}_4^A = \hat{V}_3^A$	$\hat{V}_4^{BE} = \hat{V}_3^A$	$\hat{V}_4^{CF} = V_4$	$\hat{V}_4^H = V_4$	$\hat{V}_4^G = V_4$

a. V_1, V_2, V_3, and V_4 are defined in the chapter 3.

b. $\hat{V}_1^A = \left(\dfrac{b\omega_U d^U N_U}{(\omega_U+1)^2 \lambda}\right)\left(2(a-c)-\omega_U b d^U\right)$; $\hat{V}_3^A = \left(\dfrac{b\omega_J d^J N_J}{(\omega_J+1)^2 \lambda}\right)\left(2(a-c)-\omega_J b d^J\right)$

c. V_1^H and V_3^G are defined in the chapter 4.

Appendix 2. Figures

Figure 1. Equilibrium states and R&D: given initial platform or case (i)

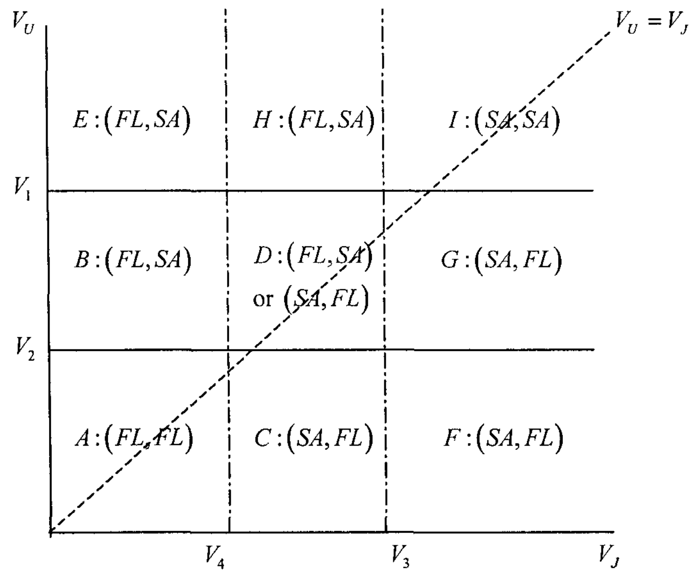


Figure 2. Equilibrium states of the sub-game (SA,SA) in (N_J,N_U) space

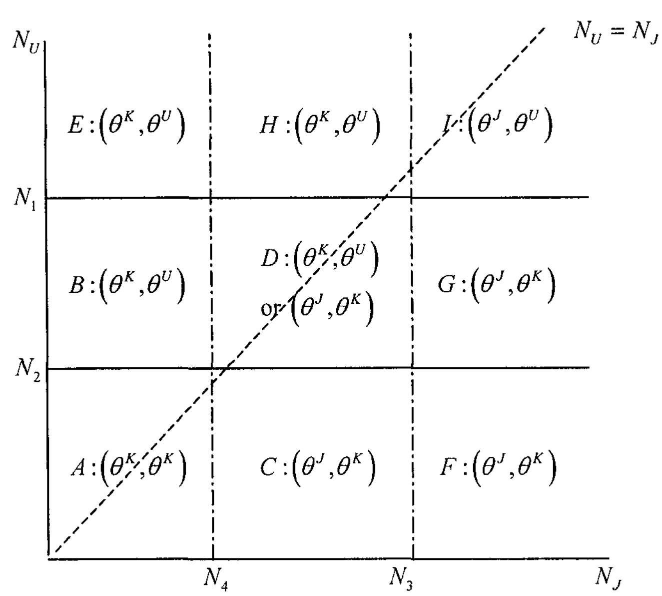
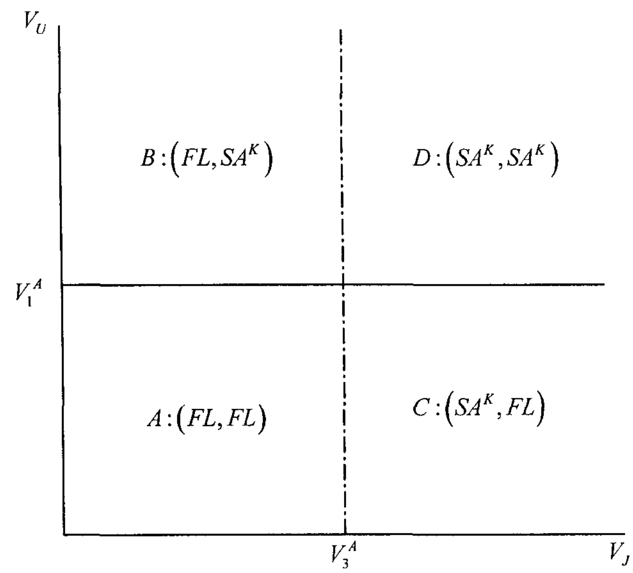


Figure 3 Equilibrium states and R&D cost: case (*ii*)



Note: Superscript refers the platform of a firm

Table 4. Equilibrium states and R&D cost: case (*iii*)

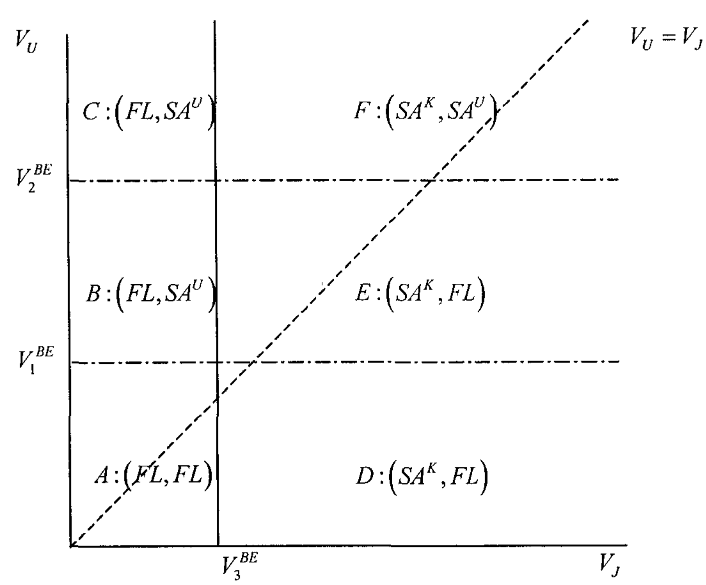
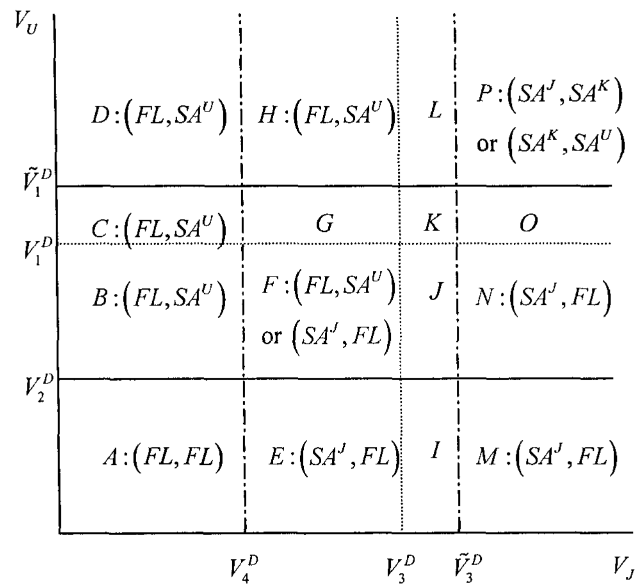


Figure 5: Equilibrium states and R&D cost



I: (SA^J, FL)

G and J: (SA^J, FL) and (FL, SA^U)

K: (SA^J, FL), (FL, SA^U), (SA^J, SA^K), or (SA^K, SA^U)

L: (FL, SA^U), (SA^J, SA^U), or (SA^K, SA^U)

O: (SA^J, FL), (SA^J, SA^U), or (SA^K, SA^U)

Figure 6. Equilibrium states of the sub-game (SA, SA) in (N_J, N_U) space: chapter 5

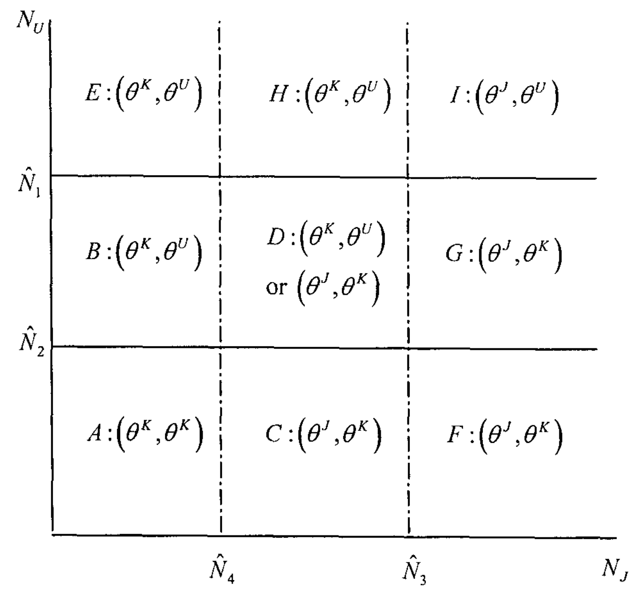


Figure 7. Change of equilibrium states of the sub-game (SA, SA) due to increase in ω_U