

## A STRATEGY FOR THE FOREIGN MARKET PENETRATION UNDER COMPLETE INFORMATION\*

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*This study examines the optimal foreign market penetration strategy of a domestic firm when the firm engages in Bertrand competition with an incumbent firm in a foreign market. The study demonstrates that under complete information about the product quality of the entrant firm, the entrant firm prefers to choose a less expensive entry mode when the foreign consumers' marginal rate of substitution between quality and price is high.*

*A high import tariff of the foreign government induces the entrant firm to prefer FDI to exporting if the MRS is high and FDI has a tariff-jumping effect. If the incumbent firm is a local firm, the entrant firm is more reserved in choosing FDI. When the incumbent firm is a local firm, an import tariff improves foreign social welfare only when MRS is low. When MRS is high, the import tariff deteriorates social welfare of the foreign country.*

### I. INTRODUCTION

This study examines how a firm decides its foreign market penetration strategies when the firm is under Bertrand competition with an incumbent firm in a foreign market. To focus on the strategic aspects of Bertrand competition and its effects on the firm's strategies, we assume complete information about product quality; quality of the entrant firm is a common knowledge to foreign consumers and the incumbent firm.

When a domestic firm tries to enter the foreign market where there is an incumbent firm, two firms are in a duopoly relationship in the foreign market and they compete in prices. We consider how the entrant firm's market penetration strategy is influenced by two different types of the incumbent firm; a local firm and a competing firm which entered the foreign market from a third country ear-

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lier than the entrant firm by choosing exporting. There are two different types of FDI; FDI in sales networks which has no tariff-jumping effect and FDI in manufacturing sector which has a tariff-jumping effect. In this study, we examine the market penetration strategies of a firm in both types of FDI, and we analyze how different FDI types influence the firm's strategies. Finally, we determine how the foreign government trade policy influences the entrant firm's market penetration strategies and what would be the optimal domestic government policy with respect to the market penetration process.

This study demonstrates that under complete information about the product quality of the entrant firm, the entrant firm prefers to choose a less expensive entry mode when the foreign consumers' marginal rate of substitution (MRS) between quality and price is high. When the foreign consumers are more concerned about quality rather than the price level, then it is not essential for the entrant firm to choose the cheapest entry mode and therefore, it might consider other factors of market penetration.

The import tariff of the foreign government has different effects on the firm's market penetration strategies depending on the type of FDI and MRS of the foreign consumers. If the MRS is high and FDI has the tariff-jumping effect, a high import tariff induces the entrant firm to prefer FDI to exporting. If the incumbent firm is a local firm, the entrant firm is more reserved in choosing FDI.

When the incumbent firm is another exporter, an import tariff of foreign country always improves social welfare of foreign country. But when the incumbent firm is a local firm, an import tariff improves foreign social welfare only when MRS is low. When MRS is high, the import tariff deteriorates social welfare of the foreign country.

The remainder of this study is organized as follows: In the next section, the model is presented. The third section describes equilibrium market penetration strategies under Bertrand competition. The fourth section describes the effect of foreign government trade policy on market penetration strategies. The fifth section presents the welfare analysis of the foreign government trade policy. Finally, section six finishes with some concluding remarks.

## II. THE MODEL

A preference of each foreign consumer is described by

$$U = \begin{cases} \theta q - bp, & \text{if she buys a unit at price } p; \\ 0, & \text{if she does not buy} \end{cases}$$

where  $\theta$  is a taste parameter of a consumer which is uniformly distributed over the interval  $\theta \in [\underline{\theta}, \bar{\theta}]$  where  $\bar{\theta} = \underline{\theta} + 1$  and  $\underline{\theta} \geq 0$ .  $b$  is the parameter which represents the magnitude of the consumer's marginal rate of substitution between

price and quality, and  $P$  is the product's price.<sup>1)</sup>

Assume that a domestic firm which tries to enter a foreign market is producing a high quality good ( $q_H$ ) with a high variable cost ( $C_H$ ) and an incumbent firm in the foreign market is producing a low quality good ( $q_L$ ) with a low variable cost ( $C_L$ ).<sup>2)</sup> The domestic entrant firm and the incumbent firm set the price  $P^e$  and  $P^i$  simultaneously. The foreign consumers buy the entrant firm's high quality good only when the consumer surplus from purchasing the high quality good is higher than the surplus from purchasing the low quality good as follows:  $(\theta q_H - bP^e) - (\theta q_L - bP^i) \geq 0$ . Hence, only the consumer whose taste parameter is higher than  $\frac{b(P^e - bP^i)}{q_H - q_L}$  will buy the high quality product.

There are two types of incumbent firms in the foreign market; a local incumbent firm and a competing firm which entered the foreign market from a third country earlier than the entrant firm by choosing exporting. The difference between two types of incumbent firms is that a local incumbent firm does not involve the variable cost of exporting  $S$  and also need not to pay tariff even if the foreign government imposes tariff while the incumbent firm which entered earlier by choosing exporting bears the variable cost of exporting  $S$  and pay the tariff.

Therefore, based on the assumption of the uniform distribution of the taste parameter, the demand functions of the two firms are:<sup>3)</sup>

$$(1) \quad D^e = D_H^e(P^e, P^i) = \left( \bar{\theta} - \frac{b(P^e - P^i)}{q_H - q_L} \right)$$

<sup>1)</sup> With the given utility function, the exact form of the marginal rate of substitution between price and quality is  $\frac{dq}{dP} = \frac{b}{\theta}$ . Therefore,  $b$  is the coefficient which represents the magnitude of the marginal rate of substitution between price and quality. In the demand function and in our further discussion, the consumer's parameter  $\theta$  is canceled out by the assumption of a uniform distribution of the taste parameter between zero and one. Therefore, we use the parameter  $b$  to represent the characteristics of the foreign consumers.

<sup>2)</sup> An anonymous referee suggested to check the case when the incumbent firm produces a high quality product, and also the case when the incumbent firm can change its product quality, i.e., the case when quality is a strategic variable. The introduction of quality as a choice variable will produce many interesting implication of the firm's strategy. However, in the case where the incumbent firm produces a high quality product, the basic direction of the firm's strategy will be same as described in Corollary 1 and 2. The change of the incumbent firm's quality from  $L$  to  $H$  will change the coefficient of the equilibrium condition, (13) and (25). However, the direction of the optimal entry strategy of the entrant firm is determined by the comparative statics of the equilibrium condition such as (13) and (25). Therefore, even if product quality of the incumbent firm is changed from  $L$  to  $H$ , the direction of entry strategy will not be changed.

<sup>3)</sup> The assumption " $\underline{\theta} \geq 0$ " means that the minimum taste parameter is non-negative and therefore consumer surplus is also non-negative because no firm will charge the price which yields a negative consumer surplus. Therefore, based on the assumption, every consumer buys one unit of the good, whether it is a product of the incumbent firm or the entrant firm.

$$(2) \quad D^i = D_i^i(P^e, P^i) = \left( \frac{b(P^e - P^i)}{q_H - q_L} - \underline{\theta} \right)$$

Then, when both the incumbent and the entrant firm are exporting firms, the profit functions of the entrant firm( $H$ ) and the incumbent firm( $L$ ) are as follows:<sup>4)</sup>

$$(3) \quad \Pi_H^e = (P^e - C_H - S) \left[ \bar{\theta} - \frac{b(P^e - P^i)}{q_H - q_L} \right]$$

$$(4) \quad \Pi_L^i = (P^i - C_L - S) \left[ \frac{b(P^e - P^i)}{q_H - q_L} - \underline{\theta} \right]$$

The reaction functions of the two firms are:

$$(5) \quad P^e = \frac{P^i + C_H + S}{2} + \frac{\Delta q \bar{\theta}}{2b}, \quad P^i = \frac{P^e + C_L + S}{2} - \frac{\Delta q \underline{\theta}}{2b}$$

where  $\Delta q = q_H - q_L$

The above reaction functions show that the two goods are strategic complements with upward sloping reaction functions. The Nash equilibrium price levels are

$$(6) \quad P^e = \frac{2C_H + C_L + 3S}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P^i = \frac{2C_L + C_H + 3S}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms under complete information about product quality as follows:

$$(7) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2, \quad \Pi_L^i = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b\Delta C}{\Delta q} \right)^2$$

where  $\Delta C = C_H - C_L$

### III. EUQILIBRIUM MARKET PENETRATION STRATEGIES UNDER BERTRAND COMPETITION

When the entrant firm chooses Foreign Direct Investment(FDI) as its entry mode, then, it involves a sunk cost of FDI( $f$ ), and no longer bears the variable

<sup>4</sup> In complete information games, there is no difference between a one-period game and a multi-period game because there is no structural difference of information between the periods.

cost of exporting. If the incumbent firm is another exporter, then it bears the marginal cost of exporting  $S$ .<sup>5)</sup>

**a). When the incumbent firm is another exporting firm<sup>6)</sup>**

When the incumbent firm is another exporting firm, if the entrant firm chooses FDI, the profit functions of the entrant firm ( $H$ ) and the incumbent firm ( $L$ ) are as follows:

$$(8) \quad \Pi_H^e = (P^e - C_H) \left[ \bar{\theta} - \frac{b(P^e - P^l)}{q_H - q_L} \right] - f$$

$$(9) \quad \Pi_L^l = (P^l - C_L - S) \left[ \frac{b(P^e - P^l)}{q_H - q_L} - \underline{\theta} \right]$$

The two firms' reaction functions are

$$(10) \quad P^e = \frac{P^l + C_H}{2} + \frac{\Delta q \bar{\theta}}{2b}, \quad P^l = \frac{P^e + C_L + S}{2} - \frac{\Delta q \underline{\theta}}{2b}$$

where  $\Delta q = q_H - q_L$

From the above reaction functions, we can obtain the following Nash equilibrium prices:

$$(11) \quad P^e = \frac{2C_H + C_L + S}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P^l = \frac{2C_L + C_H + 2S}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

<sup>5)</sup> An anonymous referee suggested to drop the section III because is a special case of section IV. However, to find out the effect of the government intervention whether it is a domestic government or a foreign government, we think it would be necessary to check the case where is no government intervention as a milestone of further discussion on the effect of government intervention. So, even if we fully agree with the referee's idea, for the readers' convenience to understand the effect of government intervention, we leave the section III in this revised version.

<sup>6)</sup> An anonymous referee also pointed out the necessity of the analysis with the assumption that the incumbent firm also chooses FDI. This additional analysis will give us more insights on the firm's strategy in various market situations if we have concrete information about the technology variables such as quality and costs. Even in that case, the basic direction of the firm's strategy will be same as described in Corollary 1 and 2 with the same reason described in footnote 1. That is, the change of the incumbent firm's entry mode from exporting to FDI will change the marginal cost of the incumbent firm. However, the direction of the optimal entry strategy of the entrant firm is determined by the comparative statics of the equilibrium condition such as (13) and (25). Therefore, even if there is a change in the marginal cost of the incumbent firm, the direction of entry strategy will not be changed.

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits when the entrant firm chooses FDI as follows:

$$(12) \quad \Pi_H^{e, FDI} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C - S)}{\Delta q} \right)^2 - f,$$

$$\Pi_L^I = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b\Delta(C - S)}{\Delta q} \right)^2$$

**Proposition 1.** When the incumbent firm in the foreign market is a firm which entered the foreign market earlier by choosing exporting, the entrant firm prefers FDI to exporting as an entry mode if

$$(13) \quad f \leq \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(S - 2\Delta C)}{\Delta q} \right).$$

**Proof:** The entrant firm chooses FDI only if its profit from FDI is larger than exporting as follows:

$$(14) \quad \Pi_H^{e, FDI} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C - S)}{\Delta q} \right)^2 - f \geq$$

$$\Pi_H^{e, EXP} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2$$

By rearranging (14), we obtain the condition (13). QED.

The results of proposition 1 and other results of different cases are summarized in table 1.

The proposition 1 gives us the following properties of the firm's market penetration strategy.

**Corollary 1.** a). When the marginal cost of exporting is relatively high, the entrant firm prefers FDI to exporting as an entry mode if the foreign consumers' marginal rate of substitution(MRS) between quality and price is high.

b). When the marginal cost of exporting is relatively low, the entrant firm prefers FDI to exporting if the foreign consumers' MRS between price and quality is low.

c). When the entrant firm chooses FDI, the incumbent firm's profit always decreases.

**Proof:** a). When we denote the right hand side of the condition of condition (13) as  $A$ , if  $S > 2\Delta C$ , then the partial derivative of  $A$  with respect to  $b$  turns out to

**[Table 1]** The Market Penetration Strategies under Bertrand Competition

	When the incumbent firm is another exporter	When the incumbent firm is a local firm
When foreign consumers' MRS between price and quality( $b$ ) is high	If exporting is expensive ( $S > 2\Delta C$ ), the entrant firm prefers FDI to exporting. If exporting is not expensive, the entrant firm prefers exporting to FDI.	The entrant firm prefers exporting to FDI.
When foreign consumers' MRS between price and quality( $b$ ) is low	If exporting is expensive ( $S > 2\Delta C$ ), the entrant firm prefers exporting to FDI. If exporting is not expensive, the entrant firm prefers FDI to exporting.	The entrant firm prefers FDI to exporting. The entrant firm is more reserved in choosing FDI than the case when the incumbent firm is another exporter.

be positive as follows:  $\frac{\partial A}{\partial b} = \frac{S(S - 2\Delta C)}{9\Delta q} > 0$  where

$A = \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(S - 2\Delta C)}{\Delta q} \right)$ . That is, when the exporting is relatively more expensive, if the marginal rate of substitution is higher, the coefficient interval supporting the equilibrium with FDI becomes bigger.<sup>7</sup>

b). If  $S < 2\Delta C$ , then the partial derivative of  $A$  with respect to  $b$  turns out to be negative as follows:  $\frac{\partial A}{\partial b} = \frac{S(S - 2\Delta C)}{9\Delta q} < 0$  where

$A = \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(S - 2\Delta C)}{\Delta q} \right)$ . That is, when the exporting is relatively cheaper, if the marginal rate of substitution is lower, the coefficient interval supporting the equilibrium with FDI becomes bigger.

c). When the entrant firm chooses FDI, the marginal cost of the entrant firm is relatively cheaper than the incumbent firm's marginal cost and therefore, the entrant firm becomes more price competitive as long as the condition (13) is satisfied. This is shown as follows: The average marginal cost when the entrant firm chooses FDI is  $\frac{f}{D}$ . The demand level for the entrant firm is

$$D_H^e = \bar{\theta} - \frac{b(P^e - P^I)}{q_H - q_L} = \frac{1}{6} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(2S - 2\Delta C)}{\Delta q} \right).$$

<sup>7</sup> The above analysis shows that when  $b$  is high,  $A$  becomes higher and therefore, the critical value of the sunk cost in (13) becomes higher. Therefore, it is more likely that the equilibrium with FDI holds. Therefore, we the above 'coefficient interval' can be rephrased as condition.

Therefore, the marginal cost entrant firm which chooses FDI is the following average sunk cost, which is smaller than the marginal cost of exporting.

$$\frac{f}{D_H^e} = \frac{2S}{3} \left( \frac{4\bar{\theta} - 2\theta + b(S - 2\Delta C)/\Delta q}{4\bar{\theta} - 2\theta + b(2S - 2\Delta C)/\Delta q} \right) < S \quad \text{QED.}$$

The Corollary 1 demonstrates that when the foreign consumers' marginal rate of substitution between price and quality is relatively high, the entrant firm prefers to choose relatively less expensive entry mode. The implication of Corollary 1 is that when foreign consumers are sensitive to price level, the entrant firm always has to choose the least expensive entry mode without other options.

**b). When the incumbent firm is a local firm**

When the incumbent firm is a local firm, the incumbent firm does not involve the marginal cost of exporting. Therefore, when the entrant firm chooses exporting, the profit functions of the entrant and incumbent firms are as follows:

$$(15) \quad \Pi_H^e = (P^e - C_H - S) \left[ \bar{\theta} - \frac{b(P^e - P^l)}{q_H - q_L} \right]$$

$$(16) \quad \Pi_L^l = (P^l - C_L) \left[ \frac{b(P^e - P^l)}{q_H - q_L} - \underline{\theta} \right]$$

The two firms' reaction functions are

$$(17) \quad P^e = \frac{P^l + C_H + S}{2} + \frac{\Delta q \bar{\theta}}{2b}, \quad P^l = \frac{P^e + C_L}{2} - \frac{\Delta q \underline{\theta}}{2b}$$

The Nash equilibrium price levels are

$$(18) \quad P^e = \frac{2C_H + C_L + 2S}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P^l = \frac{2C_L + C_H + S}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

The Nash equilibrium profits of the two firms, when the incumbent firm is a local firm and the entrant firm is choosing exporting, are as follows:

$$(19) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + S)}{\Delta q} \right)^2,$$

$$\Pi_L^l = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b\Delta(C + S)}{\Delta q} \right)^2$$



Above results show that when the incumbent firm is a local firm, if the entrant firm chooses exporting, the profits of the entrant firm is smaller than the case when the incumbent firm is another exporter. The reason for this result is that the marginal cost of the entrant firm becomes relatively higher when the incumbent is a local firm even though the absolute price level is the same as the case when the incumbent firm is another exporter.

Now, if the entrant firm chooses FDI, when the incumbent firm is a local firm, the profit functions of the entrant and the local incumbent firms are as follows:

$$(20) \quad \Pi_H^e = (P^e - C_H) \left[ \bar{\theta} - \frac{b(P^e - P')}{q_H - q_L} \right] - f$$

$$(21) \quad \Pi_L' = (P' - C_L) \left[ \frac{b(P^e - P')}{q_H - q_L} - \underline{\theta} \right]$$

The two firms' reaction functions are as follows:

$$(22) \quad P^e = \frac{P' + C_H}{2} + \frac{\Delta q \bar{\theta}}{2b}, \quad P' = \frac{P^e + C_L}{2} - \frac{\Delta q \underline{\theta}}{2b}$$

The Nash equilibrium price levels are

$$(23) \quad P^e = \frac{2C_H + C_L}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P' = \frac{2C_L + C_H}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms as follows:

$$(24) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2, \quad \Pi_L' = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b\Delta C}{\Delta q} \right)^2$$

From the above results, we obtain proposition 2 about the strategy of entrant firm.

**Proposition 2.** When the incumbent firm is a local firm which involves no marginal cost of exporting, the entrant firm prefers FDI to exporting as an entry mode if

$$(25) \quad f \leq \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} - \frac{b(S + 2\Delta C)}{\Delta q} \right).$$

**Proof:** The entrant firm chooses FDI only if its profit from FDI is larger than the profit exporting as follows:

$$(26) \quad \Pi_H^{e, FDI} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2 - f \geq$$

$$\Pi_H^{e, EXP} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + S)}{\Delta q} \right)^2$$

By rearranging (26), we obtain the condition (25). QED.

**Corollary 2.** When the incumbent firm is a local firm, if the foreign consumers' marginal rate of substitution between the quality and price is low, the entrant firm prefers FDI to exporting as an entry mode. When the incumbent firm is a local firm, the entrant firm is more reserved in choosing FDI than the case when the incumbent firm is another exporting firm.

**Proof:** When we denote the right hand side of the condition (25) as  $B$ , the partial derivative of  $B$  with respect to  $b$  turns out to be negative as follows:

$\frac{\partial B}{\partial b} = -\frac{S(S+2\Delta C)}{9\Delta q} < 0$  where  $B = \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} - \frac{b(S+2\Delta C)}{\Delta q} \right)$ . This implies that when the marginal rate of substitution is low, the coefficient interval supporting the equilibrium with FDI becomes larger.

The fact that the entrant firm is more reserved in choosing FDI when the incumbent is a local firm is shown by that the entrant firm chooses FDI only if the sunk cost is lower than the case when the entrant firm is another exporting firm. This can be shown by comparing the condition (13) and (25). QED.

The reason why the entrant firm is more reserved in choosing FDI is that the relative price of the entrant firm becomes less competitive than the case when the entrant firm is another exporter if the entrant firm chooses FDI. This is shown by following relation:

$$\frac{P'(I=local)}{P^{I=local}} = \frac{b(2C_H + C_L) + \Delta q(2\bar{\theta} - \underline{\theta})}{b(C_H + 2C_L) + \Delta q(\bar{\theta} - 2\underline{\theta})} >$$

$$\frac{P'(I=exporter)}{P^{I=exporter}} = \frac{b(2C_H + C_L + S) + \Delta q(2\bar{\theta} - \underline{\theta})}{b(C_H + 2C_L + 2S) + \Delta q(\bar{\theta} - 2\underline{\theta})}$$

The above relation is the result of the fact that the marginal cost of the local incumbent firm ( $C_L$ ) is lower than the marginal cost of an incumbent firm which is another exporting firm ( $C_L + S$ ).

When the incumbent firm is a local, the profit of incumbent firm decreases when the entrant firm chooses FDI just like when it is another exporting firm.

#### IV. THE EFFECTS OF FOREIGN GOVERNMENT TRADE POLICY ON MARKET PENETRATION STRATEGIES

When the foreign government levies an import tariff, this import tariff has different effects on the entrant firm's market penetration strategies depending on whether the entrant firm chooses FDI in direct sales outlet or FDI in manufacturing and whether the incumbent firm is a local firm or not. If the entrant firm chooses FDI in manufacturing sector, it has a tariff-jumping effect, but FDI in direct sales outlet has no tariff-jumping effect. In this section, the effect of foreign government import tariff on the entrant firms strategy is discussed in each different cases as mentioned above.

##### a). When the incumbent firm is another exporter

When the incumbent firm is another exporter, if the foreign government imposes an import tariff, the incumbent firm also has to pay. Therefore, if the entrant firm chooses exporting and if the foreign government imposes a specific import tariff, the profit functions of the entrant and incumbent firms are as follows:

$$(27) \quad \Pi_H^e = (P^e - C_H - S - t) \left[ \bar{\theta} - \frac{b(P^e - P')}{q_H - q_I} \right]$$

$$(28) \quad \Pi_I' = (P' - C_I - S - t) \left[ \frac{b(P^e - P')}{q_H - q_I} - \underline{\theta} \right]$$

Then, the Nash equilibrium price levels are

$$(29) \quad P^e = \frac{2C_H + C_I + 3S + 3t}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P' = \frac{2C_I + C_H + 3S + 3t}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms as follows:

$$(30) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2, \quad \Pi_I' = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b\Delta C}{\Delta q} \right)^2$$

Above results show that when the incumbent firm is another exporter and if the entrant firm chooses exporting, the import tariff of the foreign government

has no effect on the profit level of the two firms. Under Bertrand competition, the profit level is mainly influenced by the price difference between the two firms. Therefore, when there is the same cost increase effect as a result of tariff, the price of both firms increase by the same scale and there is no change in price competitiveness. Hence, the import tariff has no effects on the profit level of both firms.

When the incumbent firm is another exporter, if the entrant firm chooses FDI in the direct sales outlet and if the foreign government levies an import tariff, the profits of the entrant firm and the incumbent firm are same as the case when there is no tariff. The reason is that when the entrant firm chooses FDI in direct sales outlet, there is no tariff-jumping effect as a result of FDI. Hence, the import tariff has the same cost increase effect and when the cost increase by the same amount, there is no change in the profits when two firms are under Bertrand competition. Therefore, the entrant firm's market penetration strategy is not influenced at all when the foreign government imposes an import tariff.

But when the entrant firm chooses FDI in manufacturing sector, FDI has the tariff-jumping effect. In that case, the profit functions of the two firms are

$$(31) \quad \Pi_H^{e, FDI} = (P^e - C_H) \left[ \bar{\theta} - \frac{b(P^e - P')}{q_H - q_L} \right] - f$$

$$(32) \quad \Pi_L' = (P' - C_L - S - t) \left[ \frac{b(P^e - P')}{q_H - q_L} - \underline{\theta} \right]$$

Then, the Nash equilibrium price levels are

$$(33) \quad P^e = \frac{2C_H + C_L + S + t}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P' = \frac{2C_L + C_H + 2S + 2t}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms as follows:

$$(34) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C - S - t)}{\Delta q} \right)^2,$$

$$\Pi_L' = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b(\Delta C - S - t)}{\Delta q} \right)^2$$

From above results, we obtain proposition 3.

**Proposition 3.** When the incumbent firm is another exporter, if the foreign government imposes a specific tariff, the entrant firm prefers to choose FDI in manufacturing sector as an entry mode if

$$(35) \quad f \leq \frac{(S+t)}{9} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(S+t-2\Delta C)}{\Delta q} \right).$$

**Proof:** The entrant firm chooses FDI only if its profits from FDI is larger than exporting as follows:

$$(36) \quad \begin{aligned} \Pi_H^{e.FDI} &= \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C - S - t)}{\Delta q} \right)^2 - f \geq \\ \Pi_H^{e.EXP} &= \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2 \end{aligned}$$

By rearranging (36), we obtain the condition (35). QED.

The result of proposition 3 about the effect of tariff and results of other cases are summarized in table 2.

**Corollary 3.** a). When the foreign consumers' marginal rate of substitution between the quality and price is high, if the foreign government imposes a high import tariff, the entrant firm prefers FDI in manufacturing sector to exporting as an entry mode.

b). When the foreign consumers' MRS between price and quality is low, if the foreign government imposes a low import tariff, then, the entrant firm prefers FDI in manufacturing sector to exporting.

**Proof:** a). When we denote the right hand side of the condition of condition (35) as  $D$ , if  $t > 2\Delta C - S$ , then the partial derivative of  $D$  with respect to  $b$  turns out to be positive as follows:

$$\frac{\partial D}{\partial b} = \frac{(S+t)(S+t-2\Delta C)}{9\Delta q} > 0 \quad \text{where } D = \frac{(S+t)}{9} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(S+t-2\Delta C)}{\Delta q} \right).$$

When  $t$  is high, if  $b$  is high, the coefficient interval supporting the equilibrium with FDI becomes bigger.

b). If  $t < 2\Delta C - S$ , then the partial derivative of  $D$  with respect to  $b$  turns out to be negative as follows:

$$\frac{\partial D}{\partial b} = \frac{(S+t)(S+t-2\Delta C)}{9\Delta q} < 0 \quad \text{where } D = \frac{(S+t)}{9} \left( 4\bar{\theta} - 2\underline{\theta} + \frac{b(S+t-2\Delta C)}{\Delta q} \right).$$

This result implies that when  $t$  is low, if  $b$  is low, the coefficient interval supporting the equilibrium with FDI becomes bigger. QED.

When the foreign consumers' marginal rate of substitution of price and quality is high, if the foreign government imposes a high import tariff, the high im-

**[Table 2]** The Effects of Foreign Government Import Tariff

	When the incumbent firm is another exporter	When the incumbent firm is a local firm
When FDI has no tariff-jumping effect. (FDI in direct sales outlet)	An import tariff has no effect on the firms strategy.	An import tariff induces the entrant firm to prefer exporting to FDI in direct sales outlet. The entrant firm becomes more reserved in choosing FDI in direct sales outlet than the case without an import tariff.
When FDI has tariff-jumping effect. (FDI in manufacturing sector)	When the tariff rate is sufficiently high ( $t > 2\Delta C - S$ ), if $b$ is high, the entrant firm prefers FDI to exporting. If $b$ is low, the firm prefers exporting. When the tariff rate is not sufficiently high ( $t < 2\Delta C - S$ ), if $b$ is high, the entrant firm prefers exporting to FDI. If $b$ is low, the firm prefers FDI.	If $b$ is low, an import tariff induces the entrant firm to prefer FDI in manufacturing sector to exporting. If $b$ is high, the firm prefers exporting. The entrant firm is more reserved in choosing FDI than the case when the incumbent is another exporter, but less reserved than the case of FDI in direct sales outlet.

port tariff rate induces the entrant firm to prefer FDI in manufacturing sector to exporting because FDI is cheaper entry mode as a result of tariff-jumping effect. But when the foreign consumers' MRS between price and quality is low, then the high tariff surprisingly induces the entrant firm to prefer exporting to FDI. This surprising result implies that when the foreign consumers are more concerned about the quality instead of price, then it is not essential for the entrant firm to choose the cheapest entry mode. That is, the entrant firm has relatively more room to consider other factors of marketing in addition to cost factors.

**b). When the incumbent firm is a local firm**

When the incumbent firm is a local firm, if the foreign government imposes an import tariff, only the entrant firm has to pay the tariff. Therefore, if the entrant firm chooses exporting and if the foreign government imposes an import tariff, the profit functions of the entrant and incumbent firms are as follows:

$$(37) \quad \Pi_H^e = (P^e - C_H - S - t) \left[ \bar{\theta} - \frac{b(P^e - P^I)}{q_H - q_L} \right]$$

$$(38) \quad \Pi_L^I = (P^I - C_L) \left[ \frac{b(P^e - P^I)}{q_H - q_L} - \underline{\theta} \right]$$

Then, the Nash equilibrium prices are

$$(39) \quad P^e = \frac{2C_H + C_L + 2S + 2t}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P^I = \frac{2C_L + C_H + S + t}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms as follows:

$$(40) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + S + t)}{\Delta q} \right)^2,$$

$$\Pi_L^I = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b(\Delta C + S + t)}{\Delta q} \right)^2$$

Above results show that when the incumbent firm is a local firm and if the entrant firm chooses exporting, the import tariff of the foreign government decreases the entrant's profit and increases the incumbent's profit sharply. The price difference caused by the tariff results in a big difference of profit between the two firms under the intense price competition.

When the incumbent firm is a local firm, if the entrant firm chooses FDI in the direct sales outlet and if the foreign government levies an import tariff, the profit functions of the entrant and incumbent firms are as follows:

$$(41) \quad \Pi_H^{e, FDI} = (P^e - C_H - t) \left[ \bar{\theta} - \frac{b(P^e - P^I)}{q_H - q_L} \right] - f$$

$$(42) \quad \Pi_L^I = (P^I - C_L) \left[ \frac{b(P^e - P^I)}{q_H - q_L} - \underline{\theta} \right]$$

Then, the Nash equilibrium price levels are

$$(43) \quad P^e = \frac{2C_H + C_L + 2t}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b},$$

$$P^I = \frac{2C_L + C_H + t}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms as follows:

$$(44) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + t)}{\Delta q} \right)^2 - f,$$

$$\Pi_L^e = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b(\Delta C + t)}{\Delta q} \right)^2$$

**Proposition 4.** When the incumbent firm is a local firm, if the foreign government imposes a specific import tariff,  $t$ , the entrant firm prefers to choose FDI in direct sales outlet as an entry mode if

$$(45) \quad f \leq \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} - \frac{b(S + 2t + 2\Delta C)}{\Delta q} \right).$$

**Proof:** The entrant firm chooses FDI only if its profits from FDI is larger than exporting as follows:

$$(46) \quad \Pi_H^{e, FDI} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + t)}{\Delta q} \right)^2 - f \geq$$

$$\Pi_H^{e, EXP} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + S + t)}{\Delta q} \right)^2$$

By rearranging (46), we obtain the condition (45). QED.

The proposition 4 gives us the following implication about the influence of tariff on the firm's market penetration strategy when the incumbent firm is a local firm.

**Corollary 4. a).** When the incumbent firm is a local firm, an import tariff of the foreign government induces the entrant firm to prefer exporting to FDI in direct sales outlet.

b). An import tariff makes the entrant firm more reserved in choosing FDI in direct sales outlet as an entry mode than the case when there is no tariff.

**Proof:** a). When we denote the right hand side of the condition of condition (45) as  $E$ , the partial derivative of  $E$  with respect to  $t$  turns out to be always negative as follows:

$$\frac{\partial E}{\partial t} = \frac{-2bS}{9\Delta q} < 0 \quad \text{where } E = \frac{S}{9} \left( 4\bar{\theta} - 2\underline{\theta} - \frac{b(S + 2t + 2\Delta C)}{\Delta q} \right).$$

Therefore, as  $t$  increases, the coefficient interval supporting the equilibrium with FDI gets smaller and hence, the entrant firm prefers exporting to FDI in direct sales outlet as an entry mode.



b). When the incumbent firm is a local firm, if the foreign government imposes a tariff, the interval of the sunk cost supporting the equilibrium with FDI in direct sales outlet is lower than the case without the import tariff. This is shown by the comparison of (25) and (45). Therefore, with tariff, the entrant firm is more reserved in choosing FDI. QED.

The intuition behind this result is that when the tariff is imposed, the price increase ratio of the entrant firm which chooses FDI in direct sales outlet is higher than the case when it chooses exporting as follows:

$$\frac{\Delta P^{*, FDI}(t > 0)}{P^{*, FDI}(t = 0)} = \frac{2b}{b(2C_H + C_L) + \Delta q(2\bar{\theta} - \underline{\theta})} >$$

$$\frac{\Delta P^{*, EXP}(t > 0)}{P^{*, EXP}(t = 0)} = \frac{2b}{b(2C_H + C_L + 2S) + \Delta q(2\bar{\theta} - \underline{\theta})}$$

When the incumbent firm is a local firm and the entrant firm chooses FDI in manufacturing sector which has a tariff-jumping effect, if the foreign government imposes an import tariff, then the profit functions of two firms are

$$(47) \quad \Pi_H^{*, FDI} = (P^e - C_H) \left[ \bar{\theta} - \frac{b(P^e - P^i)}{q_H - q_i} \right] - f$$

$$(48) \quad \Pi_L^i = (P^i - C_L) \left[ \frac{b(P^e - P^i)}{q_H - q_i} - \underline{\theta} \right]$$

Then, the Nash equilibrium price levels are

$$(49) \quad P^e = \frac{2C_H + C_L}{3} + \frac{\Delta q(2\bar{\theta} - \underline{\theta})}{3b}, \quad P^i = \frac{2C_H + C_L}{3} + \frac{\Delta q(\bar{\theta} - 2\underline{\theta})}{3b}$$

Substituting these Nash equilibrium prices into the profit functions, we obtain the Nash equilibrium profits of the two firms as follows:

$$(50) \quad \Pi_H^e = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2 - f,$$

$$\Pi_L^i = \frac{\Delta q}{9b} \left( \bar{\theta} - 2\underline{\theta} + \frac{b\Delta C}{\Delta q} \right)^2$$

**Proposition 5.** When the incumbent firm is a local firm, the entrant firm prefers to choose FDI in manufacturing sector as an entry mode if

$$(51) \quad f \leq \frac{(S+t)}{9} \left( 4\bar{\theta} - 2\underline{\theta} - \frac{b(S+t+2\Delta C)}{\Delta q} \right).$$

**Proof:** The entrant firm chooses FDI only if its profits from FDI is larger than exporting as follows:

$$(52) \quad \Pi_H^{e, FDI} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b\Delta C}{\Delta q} \right)^2 - f \geq$$

$$\Pi_H^{e, EXP} = \frac{\Delta q}{9b} \left( 2\bar{\theta} - \underline{\theta} - \frac{b(\Delta C + S + t)}{\Delta q} \right)^2$$

By rearranging (52), we obtain the condition (51). QED.

Proposition 5 gives us the following implications about the effect of tariff.

**Corollary 5.** a). When the incumbent firm is a local firm and when the foreign consumers' MRS between price and quality is low, an import tariff of the foreign government induces the entrant firm to prefer FDI in manufacturing sector to exporting.

b). When the incumbent firm is a local firm, with the import tariff, the entrant firm is more reserved in choosing FDI in manufacturing sector than the case when the incumbent firm is another exporter, but less reserved in choosing FDI in manufacturing sector than the case when the entrant firm chooses FDI direct sales outlet.

**Proof:** a). When we denote the right hand side of the condition of condition (51) as  $G$ , the partial derivative of  $G$  with respect to  $t$  turns out to be always positive as follows:

$$\frac{\partial G}{\partial t} = \frac{(4\bar{\theta} - 2\underline{\theta})\Delta q - 2b\Delta C}{9\Delta q} > 0 \quad \text{where } G = \frac{(S+t)}{9} \left( 4\bar{\theta} - 2\underline{\theta} - \frac{b(S+t+2\Delta C)}{\Delta q} \right).$$

Therefore, as  $t$  increases, the coefficient interval supporting the equilibrium with FDI gets larger and the entrant firm is more likely to choose FDI in manufacturing sector as its entry mode.

b). When the incumbent firm is a local firm, if the foreign government imposes a tariff, the interval of the sunk cost supporting the equilibrium with FDI in manufacturing sector becomes smaller than the case without the import tariff. This is shown by the comparison of (25) and (51). Therefore, with tariff, the entrant firm is more reserved in choosing FDI. In addition, when we compare the condition (51) with (35) and (45), we can observe that when FDI in the manufacturing sector, the coefficient interval supporting equilibrium with FDI is larger than the case when FDI is on direct sales outlet, (35). But the interval is smaller when it is compared to the case when the incumbent is another sales agent (45). QED.

The intuition behind corollary 5 is that when the entrant firm chooses FDI in

manufacturing sectors which has the tariff-jumping effect, almost always the choice of FDI is optimal for the entrant firm to choose FDI as the tariff rate increases. The lower the foreign consumers' MRS between price and quality, it is the more likely that the entrant firm chooses FDI.

## V. THE WELFARE ANALYSIS OF THE FOREIGN GOVERNMENT TRADE POLICY

When the foreign government imposes an import tariff, not only the market penetration strategies of the entrant firm are influenced, but also the surplus of foreign consumer and the foreign local firm are influenced too. Hence, in this section, we discuss how the trade policy of foreign government influences the surplus of each sector and social welfare of the foreign country. Through this discussion, we determine what is the optimal trade policy of foreign government to maximize the foreign social welfare. The discussion in this section gives us the implication on the optimal domestic government's policy, too.

When the foreign government imposes an import tariff  $t$ , the foreign consumer's surplus is

$$(53) \quad CS = \left( \bar{\theta} - \frac{b(P^e - P^i)}{q_H - q_L} \right) \int_{\bar{\theta}}^{\tilde{\theta}} (\theta q_H - bP_H^e) d\theta + \\ \left( \frac{b(P^e - P^i)}{q_H - q_L} - \underline{\theta} \right) \int_{\underline{\theta}}^{\tilde{\theta}} (\theta q_L - bP_L^e) d\theta$$

where  $\tilde{\theta} = \frac{b(P^e - P^i)}{q_H - q_L}$

When we simplify the consumer surplus, we obtain the following formula for the consumer surplus:

$$(54) \quad CS = (\bar{\theta} - \tilde{\theta})^2 \left( \frac{q_H}{2} (\bar{\theta} + \tilde{\theta}) - bP_H^e \right) + (\tilde{\theta} - \underline{\theta})^2 \left( \frac{q_L}{2} (\tilde{\theta} + \underline{\theta}) - bP_L^e \right)$$

When we substitute the price of the entrant firm and the incumbent firm of each cases into the above formula, we can obtain the value of the consumer surplus. But it is difficult to compare the value of consumer surplus of each different cases with the parameters. Therefore, we will substitute specific values for the parameters to check the effect of the import tariff on consumer surplus and also on social welfare of the foreign country.

The result of this simulation demonstrates that when the incumbent is another exporter, higher tariff is more efficient to improve social welfare of the foreign country regardless of the value of the marginal rate of substitution of foreign consumers. The reason for this result is that when the incumbent is another

exporter, the tariff revenue takes a significant portion of social welfare of foreign country. Therefore, when the foreign government imposes a high import tariff, although consumer surplus decreases, the increase of the tax revenue compensates this loss in consumer surplus and finally improves total social welfare of foreign country.

When the incumbent firm is a local firm, if the marginal rate of substitution between price and quality is high, the import tariff of the foreign government deteriorates social welfare of the foreign country. The main reason is that when foreign consumers are more concerned about price level, the price increase caused by the tariff sharply decreases the consumer surplus. Additionally, when the incumbent firm is a local firm, the tariff revenue takes a small portion of social welfare of the foreign country because the incumbent firm does not pay the tariff. Therefore, when the foreign government imposes an import tariff, the decrease of consumer surplus surpasses the increase of tariff revenue as a result of an import tariff. Therefore, an import tariff deteriorates social welfare of the foreign country when the foreign consumer's marginal rate of substitution of between price and quality is high.

When the foreign consumer's marginal rate of substitution between price and quality is low, the import tariff improves social welfare of the foreign country. The main reason is that when consumers are more concerned about quality rather than price level, even if there is an increase in the price level as a result of a tariff, the decrease of consumer surplus is relatively small. In addition, the increase of the producer surplus and the tax revenue surpasses the decrease of consumer surplus. Therefore, when the marginal rate of substitution of price and quality is low, an import tariff of the foreign government improves social welfare of the foreign country.

Table 3 summarizes the effects of an import tariff on foreign social welfare.

**[Table 3]** The Effects of Import Tariff on Social Welfare of the Foreign Country

	When the incumbent firm is another exporter	When the incumbent firm is a local firm
When foreign consumers' MRS between price and quality( $b$ ) is high	An import tariff of the foreign government improves social welfare of the foreign country.	An import tariff of the foreign government deteriorates social welfare of the foreign country
When foreign consumers' MRS between price and quality( $b$ ) is low	Same as above.	An import tariff of the foreign government improves social welfare of the foreign country

**[Table 4]** The Effects of Import Tariff on Social Welfare (Simulation Result 1)

When the incumbent firm is another exporter				When the incumbent firm is a local firm			
$b = 0.5, t = 1$	$b = 0.5, t = 0.5$	$b = 1/3, t = 1$	$b = 1/3, t = 0.5$	$b = 0.5, t = 1$	$b = 0.5, t = 0.5$	$b = 1/3, t = 1$	$b = 1/3, t = 0.5$
CS: 1.35 PS: 0 TR: 1 SW: 2.35	CS: 1.54 PS: 0 TR: 0.5 SW: 2.04	CS: 1.94 PS: 0 TR: 1 SW: 2.94	CS: 2.07 PS: 0 TR: 0.5 SW: 2.57	CS: 1.10 PS: 0.5 TR: 0.5 SW: 2.10	CS: 2.80 PS: 0.35 TR: 0.29 SW: 3.44	CS: 1.52 PS: 0.33 TR: 0.67 SW: 2.52	CS: 1.71 PS: 0.23 TR: 0.36 SW: 2.30

\* This simulation is about the case when the entrant firm chooses exporting.

\*\*  $t$ : specific tariff rate, CS: Consumer Surplus, PS: Producer Surplus, TR: Tariff Revenue, SW: Social Welfare

\*\*\* The parameter values used in this simulation is:

$\Delta C = 1, \Delta q = 1, q_H = 3, q_L = 2, C_H = 2, C_L = 1, \bar{\theta} = 2, \underline{\theta} = 1$ . These parameter values assume a non-linear technology, that is, the quality-cost ratio of high quality is higher than low quality.

**[Table 5]** The Effects of Import Tariff on Social Welfare (Simulation Result 2)

	$b = 1, t = 1$	$b = 0.5, t = 1$
When the entrant firm chooses exporting ( $t = 0$ )	CS: 0.59 SW: 0.59	CS: 1.71 SW: 1.71
When the entrant firm chooses FDI ( $t = 0$ )	CS: 1.50 SW: 1.50	CS: 2.5 SW: 2.5
When the entrant firm chooses exporting ( $t > 0$ )	CS: 0.15 TR: 1.0 SW: 1.15	CS: 1.35 TR: 1.0 SW: 2.35
When the entrant firm chooses FDI in direct sales outlet ( $t > 0$ )	CS: 1.03 TR: 1.0 SW: 2.03	CS: 2.0 TR: 1.0 SW: 3.0
When the entrant firm chooses FDI in manufacturing sector ( $t > 0$ )	CS: 1.17 TR: 0 SW: 1.17	CS: 2.33 TR: 0 SW: 2.33

\* This simulation is about the case when the incumbent firm is another exporter. This simulation needs more works on other values of  $b$  and  $t$  to produce more implication about the effect of tariff.

\*\*  $t$ : specific tariff rate, CS: Consumer Surplus, PS: Producer Surplus, TR: Tariff Revenue, SW: Social Welfare

\*\*\* The parameter values used in this simulation is:

$\Delta C = 1, \Delta q = 1, q_H = 3, q_L = 2, C_H = 2, C_L = 1, \bar{\theta} = 2, \underline{\theta} = 1$ . These parameter values assume a non-linear technology, that is, the quality-cost ratio of high quality is higher than low quality.

Table 4 and 5 summarize the result of the simulations about the effect of an import tariff on foreign social welfare.

## VI. CONCLUDING REMARKS

In this study, we examined the optimal foreign market penetration strategy when a firm engages in Bertrand competition with the incumbent firm in a foreign market. The study demonstrates that under complete information about product quality of the entrant firm, the high quality entrant firm can get a higher profit by choosing the more expensive entry mode because of the strategic effect under Bertrand competition which reduces the intense competition when the foreign consumers are more concerned about quality rather than the price level. The intuition behind this result is that the choice of the expensive entry mode has the effect of the precommitment and therefore giving the first mover advantage to the entrant firm.

When the entrant firm is competing in price under complete information, an export tax of the domestic government is the best policy to improve domestic social welfare. An export tax has an strategic effects which reduces the intense price competition and improves the domestic and foreign social welfare. The import tariff of the foreign government has different effects on the firm's market penetration strategies depending on the type of the incumbent firm, and depending on the tariff-jumping effect of FDI, and depending on the foreign consumers' marginal rate of substitution between quality and price. When the incumbent firm is a local firm, an import tariff improves foreign social welfare only when MRS is low. When MRS is high, the import tariff deteriorates social welfare of the foreign country. In this study, we assumed that the quality variable of the entrant firm is exogenously given. However, the introduction of the quality variable as an endogenous variable will give us more interesting implication of the firm's strategy and the government policy. Additionally, the introduction of incomplete information in each case we considered in the study would be an interesting issue for future study.

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