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Choice of Product Quality by Domestic Firms in Competition with Multinational Corporations

by

Jaime F. Campos[a] [b]

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[a] Universidad de Santiago de Chile and School of Economics, University of Nottingham
E-mail address: jcampos@pegaso.usach.cl
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1. Introduction

After decades of heated debate there seems to be a general agreement that Foreign Direct Investment (FDI) has potential positive effects on the host country economy. Consequently, many governments are eager to attract Multinational Corporations (MNC).

Perhaps the main reason for this positive evaluation of FDI is the potential technological improvement in the host country. There are a number of established facts about the links between MNC, R&D expenditures, growth and international technology diffusion that support this reason[c]. First, the main factor behind economic growth seems to be technological innovation. Second, a high percentage of the technological innovations are the result of voluntary efforts through R&D activities. Third, MNC perform a major part of the private R&D in the world. Fourth, although industrial countries perform more than 95% of the R&D expenditure in the world, the distribution of the growth rates across countries are much more evenly distributed. The first three facts indicate that MNC produce a major part of new technologies. On the other hand, the last fact suggests that an important fraction of the productivity growth in developing countries follow from international technology diffusion. There are a number of channels through which the technology can cross international boundaries. However, foreign direct investment (FDI) appears to be one of the most important.

In this paper we shall make a theoretical analysis of the strategic interaction between a MNC and a domestic firm focused on the effect of this interaction on the technological progress in the home country. As we mentioned above, a high percentage of the technological development is the result of a voluntary effort through R&D activities. Therefore, a natural way to analyse the impact of MNC firms on the technological development in the host country is by focusing on its effect on the R&D expenditure undertaken by domestic firms. In particular, how the incentives to invest in R&D by a

[c] For a comprehensive analysis of the theoretical and empirical literature about MNC see Caves (1996). For a good survey article see Markusen (1995).

domestic firm are affected when it faces the competition of a foreign firm, which can serve the domestic market by exporting or by setting up a subsidiary.

The main objective is to improve the understanding on the following issues:

1. What is the impact of the different ways in which a MNC can serve a domestic market (Exports, FDI) on one of the key determinants for the host country technological development, namely Product R&D expenditure?
2. What are the welfare implications of these on the host economy?
3. What mechanisms can host countries implement to increase the benefits of the MNC presence?

To address these issues, in the context of an oligopolistic market, we analyse how the incentives to devote resources to improve product quality by domestic firms (Product R&D) are modified for the entering of a Multinational Corporation (MNC) Subsidiary. We consider a market for a vertically differentiated product that consist of a domestic firm, which produce only for domestic consumption, and a MNC, which can reach the local market by exporting or by establishing a subsidiary. They compete over two periods by choosing product quality in the first and prices in the second (Bertrand competition). The firms' problem is solved as a dynamic game of complete but imperfect information. The solution concept is subgame perfect equilibrium.

The model is also used to undertake welfare analysis and to obtain policy implications.

In the following section we set up the model. In Section 3 we analyse the model without government intervention. First, the case when the MNC serves the domestic market by exporting, and then when it creates a wholly owned subsidiary. In section 4 we found the optimal government intervention and its impact on welfare. In section 5 we analyse how the income level (and distribution) affect the optimal product quality chosen by both firms. Finally, section 6 gives the main conclusions.

2. The Model

Consider a vertically differentiated oligopolistic market, i.e. a market where consumers have the same ranking of preferences about products and, therefore, they would buy the product with the highest quality if all the varieties were sold at the same price. They differ, however, in their willingness to pay for quality, which follows from differences in income level. Our main objective is to explore how the incentives to improve product quality by a domestic firm (d) are affected when it faces the competition of a foreign firm, which can serve the domestic market by exporting (f) or by setting up a subsidiary (s). As a consequence, the analysis will be focused in the domestic market, where both firms compete over two periods by choosing product quality (μ_d, μ_j , $j=f,s$) in the first and prices (P_d, P_j) in the second.

2.1 Preferences and Demand

Assume that each consumer can buy 0 or 1 unit of the product and that her preferences are represented by the function[d]

$$U = \begin{cases} u(I-P)+\mu & \text{If consumer with income I buys one unit of product with quality } \mu \text{ at price } P \\ u(I) & \text{if consumer does not buy} \end{cases}$$

Assuming P is a small fraction of the consumer's income, by taking a first order Taylor's expansion the utility function can be restated as

$$U = \begin{cases} \mu-(1/\theta)P & \text{If consumer with income I buys one unit of product with quality } \mu \text{ at price } P \\ u(I) & \text{if consumer does not buy} \end{cases}$$

[d] This formulation follows Tirole (1988), chapter2, pages 96-97.

where $\theta = 1/u'(I)$, i.e. θ is equal to the inverse of the income marginal utility. Assume $u(.)$ is concave, then θ is higher the higher is the consumer's income level. In particular, assume that $\theta \sim U[\underline{\theta}, \overline{\theta}]$ represents a distribution of individual's incomes.

We are now in a position to obtain the demand function faced by both firms. First, notice the followings[e]:

1. For each quality (*i*=*d* and *f* or *s*) there is one consumer (θ_i) who gets net utility of consuming product *i* equal to zero, i.e. $\mu_i - (1/\theta_i)P_i = 0$. Then, for each consumer with $\theta > \theta_i$ the net utility he receives for consuming one unit of a product of that quality is higher than zero. Hence, potential market for variety *i* is $[\theta_i, \overline{\theta}]$
2. Given prices and qualities there is one consumer (θ^*) who is indifferent between buying one or the other product. For that consumer $\mu_d - (1/\theta^*)P_d = \mu_j - (1/\theta^*)P_j$, *j*=*f* or *s*. Thus, from this condition follows $\theta^* = (P_j - P_d)/(\mu_j - \mu_d)$.

By using the previous information and assuming $\mu_d < \mu_j$ we can represent the demand function for each product as follows:

$$q_d = \theta^* - \theta_d = \frac{P_j\mu_d - P_d\mu_j}{(\mu_j - \mu_d)\mu_d} \qquad \text{if } P_d \le P_j \frac{\mu_d}{\mu_j} \qquad j = f, s$$

$$0 \qquad \text{if } P_d > P_j \frac{\mu_d}{\mu_j} \qquad j = f, s$$

$$q_d = \overline{\theta} - \theta^* = \overline{\theta} - \frac{P_j - P_d}{\mu_j - \mu_d} \qquad \text{if } P_d \le P_j \frac{\mu_d}{\mu_j} \; j = f, s$$

$$\overline{\theta} - \theta_j \qquad \text{if } P_d > P_j \frac{\mu_d}{\mu_j} \qquad j = f, s$$

[e] To obtain these conditions we assume the market is not necessarily fully covered, which implies the price charged for the low quality product is higher or equal than the valuation given to that good for the consumer with the lowest income ($\underline{\theta}\mu_d \le P_d$).

When firms choose prices at t=2 quality is given. By using this fact, we can define prices adjusted for quality as the endogenous variables at t=2.

To do this let us define $p_i = \frac{P_i}{\mu_i}$ and $r = \frac{\mu_j}{\mu_d}$ $i=d,j$ and $j=f,s$

Then, assuming that both firms are active the demand functions are:

$$q_d = \frac{r}{r-1}(p_f - p_d) \qquad \text{and} \qquad q_j = \bar{\theta} - \frac{(rp_j - p_d)}{(r-1)} \qquad \textbf{(1)}$$

2.2 Cost of Quality

To this basic demand structure we will now add a quality cost structure to analyse the impact on the incentives to invest in R&D (or quality) that a domestic firm faces when competing with a foreign firm that can reach the domestic market by exporting or by establishing a subsidiary.

There are two ways in which quality affect costs. First, firms need to invest resources in R&D to develop a product with the desired quality. This cost, which can be thought as a sunk cost, is incurred in the first period. Second, production costs can also be affected by the product quality. This cost affects, as a consequence, the marginal cost of production at t=2. Therefore, in general by improving product quality firms can face both sunk costs and higher production cost. The relative importance of these two channels has implications in terms of market structure.

Let us define $FC_j(\mu_j)$ as the R&D cost incurred by firm j to develop a product with quality μ_j and C_j as the product *j* marginal production cost (*j=d, f or* s).

In the following sections we shall assume that $C_j = \alpha\mu_j^{\beta}$, where C_j is the product *j* marginal production cost (*j=d, f or* s). Parameters α and β are both greater than zero. β

is the product quality elasticity of the marginal production cost. Also, we assume that $FC'(\mu_j) > 0$ and $FC''(\mu_j) > 0$.

In summary, we can state the firm's problems as:

Period 1:

Domestic firm Max μ_d $\quad \pi_d(\mu_d, \mu_j) - FC(\mu_d)$

Foreign Firm Max μ_j $\quad \pi_j(\mu_j, \mu_d) - FC(\mu_j)$ $\qquad$ *j=f or s*

Period 2:

Domestic firm Max p_d $\quad \pi_d = (p_d \mu_d - C_d) q_d$

Foreign Firm Max p_j $\quad \pi_j = (p_j \mu_j - C_j) q_j$ $\qquad$ *j=f or s*

Where q_d, q_j defined in (1) and C_d, C_j defined above.

3. The Model without Government Intervention

The basic structure defined in section 2 will now be used to analyse two types of interaction in the domestic market. The first case emerges when the MNC serves the domestic consumers through exports. The second case is when the MNC create a wholly owned subsidiary. A common assumption to the two cases is that the domestic economy is a small economy, which implies that decisions on price and R&D expenditure taken at the MNC level are not affected by decision taken by the domestic firm.

3.1 First Case: p_f^* is endogenous and μ_f is exogenous

In this case the foreign firm serves the domestic market by exporting. Therefore, in addition to the marginal cost of production in the parent firm it has to face transport cost plus tariffs. The assumption that the domestic economy is small coupled with the fact the domestic firm produce only for domestic consumption imply the foreign product quality can be considered as exogenous. Hence, in this case there is no strategic interaction in quality (just in prices) and the domestic firm maximises profits by choosing quality at t=1 taking μ_f as given.

The sequence of decisions is: 1. At period 1 the domestic firm chooses μ_d taking μ_f as given and 2. At period 2 both firms choose simultaneously p_d and p_f, in a Bertrand fashion, taking qualities as given. The firms' maximisation problem, however, is solved backwards. As a consequence, when the domestic firm chooses μ_d take into consideration its impact on p_f.

In summary, we can state the firm's problems as:

Period 1:

$$\text{Domestic firm Max}_{\mu_d} \quad \pi_d(\mu_d, \mu_j) - FC(\mu_d) \qquad \textbf{(2a)}$$

Period 2:

Domestic firm Max $_{p_d}$ $\pi_d = (p_d \mu_d - C_d) q_d$ **(2b)**

Foreign Firm Max $_{p_j}$ $\pi_j = (p_j \mu_j - C_j) q_j$ $j=f \text{ or } s$

Where q_d, q_j defined in (1) and C_d, C_j defined above.

Second Period

Profits functions are

$$\pi_d^{t=2} = q_d (P_d - C_d) = q_d (p_d \mu_d - C_d) = \left[\frac{r}{(r-1)} (p_f - p_d) \right] [p_d \mu_d - C_d] \quad \textbf{(3a)}$$

$$\pi_f^{t=2} = q_f (P_f^* - C_f) = q_f (p_f^* \mu_f - C_f) = \left[\bar{\theta} - \frac{[r(p_f^* + \delta) - p_d]}{(r-1)} \right] [p_f^* \mu_f - C_f] \quad \textbf{(3b)}$$

where,

$P_f = P_f^* + \tau + t$ = Price paid by domestic consumers for each unit of q_f

$P_f^* =$ Price received by the foreign firm for each unit of q_f they sell in the domestic market

τ = Transport cost per unit of imports

t = Tariff per unit of imports

$\delta = \dfrac{\tau + t}{\mu_f}$ = Unit tariff plus transport cost per unit of quality

By solving the f.o.c. of the maximisation problem (2a) we can found the Nash equilibrium in prices at t=2, which is:

$$p_d = \frac{(r-1)}{(4r-1)} \bar{\theta} + \frac{2r}{(4r-1)} \frac{C_d}{\mu_d} + \frac{r}{(4r-1)} \left(\frac{C_f}{\mu_f} + \delta \right) \quad \textbf{(4a)}$$

$$p_f^* = 2\left\{\frac{(r-1)}{(4r-1)}\right\}\bar{\theta} + 2\left\{\frac{r}{(4r-1)}\right\}\frac{C_f}{\mu_f} - \frac{(2r-1)}{(4r-1)}\delta + \frac{1}{(4r-1)}\frac{C_d}{\mu_d} \qquad \textbf{(4b)}$$

As a consequence demands faced by each firm are:

$$q_d = \frac{r}{r-1}[p_f - p_d] = \frac{r}{r-1}\left\{\frac{(r-1))}{(4r-1)}\bar{\theta} + \frac{r}{(4r-1)}\left(\frac{C_f}{\mu_f} + \delta\right) - \frac{(2r-1)}{(4r-1)}\frac{C_d}{\mu_d}\right\} \qquad \textbf{(5a)}$$

$$q_f = 2\left\{\frac{r}{(4r-1)}\right\}\bar{\theta} + \frac{r}{(4r-1)(r-1)}\frac{C_d}{\mu_d} - \left\{\frac{r(2r-1)}{(r-1)(4r-1)}\right\}\left(\frac{C_f}{\mu_f} + \delta\right) \qquad \textbf{(5b)}$$

By introducing the Nash equilibrium in prices into the profit function we obtain the domestic profit function in t=1, which is:

$$\pi_d^{t=1} = \frac{r(r-1)}{(4r-1)^2}\mu_d\left\{\left[\bar{\theta} - c_d\right] + \frac{r}{(r-1)}\left[\hat{c}_f - c_d\right]\right\}^2 - FC_d(\mu_d) \qquad \textbf{(6)}$$

where,

$c_i = \frac{C_i}{\mu_i}$ = product *i* unit cost of production per unit of quality (*i=d,f*)

$\hat{c}_f = c_f + \delta$

We get the optimal value for the domestic product quality from the f.o.c.

$MR\mu_d = MC\mu_d$,taken μ_f as given.

Note that if $r \to 1$ the profit function converge to $-C_d(\mu_d)$. This happens because Bertrand competition with identical products generates operational profits equal to zero.

Also, it is possible to show that $MR(\mu_d = 0) > 0$ and given $MC(\mu_d = 0) = 0$ we have that the optimal level for μ_d is higher than zero.

To illustrate the characteristics of the equilibrium assume $C_i = \alpha\mu_i$, which implies that $c_i = \alpha$, where *i=d,f*.

Hence domestic profits at t=1 can be stated as:

$$\pi_d^{t=1} = \frac{r(r-1)}{(4r-1)^2}\mu_d\left\{\overline{\theta} - \alpha + \frac{r}{(r-1)}\delta\right\}^2 - FC_d(\mu_d) \qquad \textbf{(7)}$$

and the f.o.c. is,

$$\left[\phi(r) - \phi'(r)r\right](\overline{\theta} - \alpha + \frac{r}{(r-1)}\delta)^2 = FC'(\mu_d) \qquad \textbf{(8)}$$

where $\phi(r) = \frac{r(r-1)}{(4r-1)^2}$

By totally differentiating Equation (8) we can observe that the equilibrium value for the domestic product quality increase with the foreign product quality (μ_f), the level of protection of the domestic market (δ), the domestic income level ($\overline{\theta}$) and the level of efficiency to improve product quality ($FC'(\mu_d)$).

3.2. Second Case: p_s and μ_s are endogenous

In this case the foreign firm serves the domestic market by setting up a subsidiary (s). As a consequence, both price (p_s) and quality (μ_s) are endogenously determined. The sequence of decisions is: both firms simultaneously choose qualities at t=1 and then, in the second period they choose prices taken qualities as given. We keep the assumption that the host country is a small economy. This assumption allows us to ignore the effects that changes in the domestic product quality could have in the product quality choice by the MNC parent firm. In other words, the latter product quality is exogenous. The product quality choice made by the subsidiary is, however, endogenous. Details about that decision are below.

Second Period

Profit functions in t=1 are:

$$\pi_d^{t=2} = q_d(P_d - C_d) = q_d(p_d\mu_d - C_d) = \left[\frac{r}{(r-1)}(p_s - p_d)\right][p_d\mu_d - C_d] \qquad \textbf{(9a)}$$

$$\pi_s^{t=2} = q_s(P_s - C_s) = q_s(p_s\mu_s - C_s) = \left[\bar{\theta} - \frac{[rp_s - p_d]}{(r-1)}\right][p_s\mu_s - C_s] \qquad \textbf{(9b)}$$

Nash equilibrium in prices at t=2 is:

$$p_d = \frac{(r-1)}{(4r-1)}\bar{\theta} + \frac{2r}{(4r-1)}c_d + \frac{r}{(4r-1)}c_s \qquad \textbf{(10a)}$$

$$p_s = \frac{2(r-1)}{(4r-1)}\bar{\theta} + \frac{2r}{(4r-1)}c_s + \frac{1}{(4r-1)}c_d \qquad \textbf{(10b)}$$

Note that both equilibrium price increase with $\bar{\theta}$, and with own and other firm unit cost of production per unit of quality.

Also, we can obtain equilibrium quantities, which are:

$$q_d = \frac{r}{(r-1)}\left[\frac{(r-1)}{(4r-1)}\overline{\theta} + \frac{r}{(4r-1)}c_s - \frac{(2r-1)}{(4r-1)}c_d\right] \quad \textbf{(11a)}$$

$$q_s = \frac{r}{(r-1)}\left[\frac{2(r-1)}{(4r-1)}\overline{\theta} + \frac{1}{(4r-1)}c_d - \frac{(2r-1)}{(4r-1)}c_s\right] \quad \textbf{(11b)}$$

First Period

Now firms choose quality levels. Before doing that note the following details in the foreign firm profit function. First, by setting up a subsidiary the foreign firm avoid transport costs and tariffs. The new the unit cost of production is $C_{s,}$ which depend on the product quality chosen by the subsidiary and the factor costs faced in the host economy. Also, the foreign firm incurs in the cost of setting up a subsidiary which is given by $\overline{S}_s$. Then, the foreign firm save in transport and tariff costs, but it has additional costs in building production facilities. Therefore, a necessary condition for this strategy to be profitable is $C_s < C_f + \tau + t$. Finally, in this case the subsidiary undertakes R&D in the host country, which aims to choose a product quality more suitable for the host economy. Remember that the product quality chosen by the parent firm is exogenous. Therefore, by undertaking R&D expenditure the subsidiary has the opportunity of making a better choice to serve the domestic market.

Hence, the firms' profit function at t=1 can be expressed as:

$$\pi_d^{t=1} = q_d(P_d - C_d) - FC(\mu_d) = \left[\frac{r}{(r-1)}(p_f - p_d)\right][p_d\mu_d - C_d] - FC_d(\mu_d) \quad \textbf{(12a)}$$

$$\pi_s^{t=1} = q_s(P_s - C_s) - \overline{S}_s - FC(\mu_s) = \left[\overline{\theta} - \frac{(rp_s - p_d)}{(r-1)}\right][\mu_s p_s - C_s] - \overline{S}_s - FC_s(\mu_s) \quad \textbf{(12b)}$$

By substituting in the Nash equilibrium prices into the profit function we obtain profits at t=1, which are:

$$\pi_d^{t=1} = \frac{r(r-1)}{(4r-1)^2}\mu_d\left[\overline{\theta} - c_d + \frac{r}{(r-1)}[c_s - c_d)\right]^2 - FC_d(\mu_d) \quad \textbf{(13a)}$$

$$\pi_s^{t=1} = \frac{r(r-1)}{(4r-1)^2}\mu_s\left[2\overline{\theta} + \frac{1}{(r-1)}c_d - \frac{(2r-1)}{(r-1)}c_s\right]^2 - \overline{S}_s - FC_s(\mu_s) \quad \textbf{(13b)}$$

In the remaining of this section we will assume $c_i(\mu_i) = \alpha\mu_i$, *i=d,s*. This is, the elasticity of the unit cost of production is equal to one. Later, we will discuss in which way the results we will obtain are modified if we consider the elasticity to be different from 1.

With this simplification profit functions are:

$$\pi_d^{t=1} = \frac{r(r-1)}{(4r-1)^2}\mu_d\left[\overline{\theta} - \alpha\right]^2 - FC_d(\mu_d) \quad \textbf{(14a)}$$

$$\pi_s^{t=1} = 4\frac{r(r-1)}{(4r-1)^2}\mu_s\left[\overline{\theta} - \alpha\right]^2 - \overline{S}_s - FC_s(\mu_s) \quad \textbf{(14b)}$$

Maximisation of profits with respect to μ_d and μ_s yields the following f.o.c.:

$$\left[\phi(r) - \phi'(r)r\right](\overline{\theta} - \alpha)^2 = FC'(\mu_d) \quad \textbf{(15a)}$$

$$4\left[\phi(r) + \phi'(r)r\right](\overline{\theta} - \alpha)^2 = FC'(\mu_s) \quad \textbf{(15b)}$$

where $\phi(r) = \frac{r(r-1)}{(4r-1)^2}$

The solution to the system of Equations (15.a) and (15.b) give us the optimal value for μ_d and μ_s. From the f.o.c. we, also, can obtain the reaction functions, which can be shown are positive sloped making qualities strategic complements.

4. Optimal Government Intervention and its Impact on Welfare

Domestic country welfare can be defined as:

$$W = \int_{p_d}^{\theta^*} [\theta\mu_d - P_d]d\theta + \int_{\theta^*}^{\bar{\theta}} [\theta\mu_s - P_s]d\theta + [R_d - (1-s)FC(\mu_d)] - sFC(\mu_d) \qquad \textbf{(16)}$$

The first and second term to the right represent the net surplus obtained by consumers whom buy the domestic and subsidiary product, respectively. The third term represent net of subsidy (tax) profits obtained by the domestic firm. Finally, the last term is the total government expenditure (revenue) on the subsidy (tax).

An indirect way to find the optimal policy is to compare the social marginal benefit (SMB μ_d) with the social marginal cost (SMC μ_d) of domestic quality at the equilibrium without government intervention. If they are equal implies no intervention is required. On the other hand, if SMB μ_d>SMC μ_d (SMB μ_d<SMC μ_d) the optimal intervention is a subsidy (tax) to incentive (disincentive)) further improvements in the domestic product quality.

$$\frac{\partial W}{\partial \mu_d} = \int_{p_d}^{\theta^*} [\theta - p_d]d\theta + \mu_d \left[\frac{\partial \int_{p_d}^{\theta^*} (\theta - p_d)d\theta}{\partial \mu_d} \right] + \frac{\partial \mu_s}{\partial \mu_d} \int_{\theta^*}^{\bar{\theta}} [\theta - p_s]d\theta + \mu_s \left[\frac{\partial \int_{\theta^*}^{\bar{\theta}} (\theta - p_s)d\theta}{\partial \mu_d} \right] + \frac{\partial \pi_d^{t=1}}{\partial \mu_d} \qquad \textbf{(17)}$$

from the optimisation problem in the previous section we can show that:

1. $\frac{\partial \pi_d^{t=1}}{\partial \mu_d} = 0$

2. $\frac{\partial \mu_s}{\partial \mu_d} > 0$ and $\frac{\partial r}{\partial \mu_d} < 0$

3. $\frac{\partial \theta^*}{\partial r} > 0$

4. $\frac{\partial p_s}{\partial r} = 2\frac{\partial p_d}{\partial r} > 0$

Also, note that the net surplus received by consumer j ($j \in [\theta_d, \bar{\theta}]$) is

$s_j = \theta_j \mu_i - P_i = \mu_i(\theta_j - p_i)$ $\quad$ $i=d,s$

Then in the case considered it is clear that a marginal increase in the domestic product quality (starting from the equilibrium without government intervention) make each consumer who buy the good better off.

We can conclude that evaluated at the optimum without government intervention $\frac{\partial W}{\partial \mu_d} > 0$. Therefore, a subsidy on the expenditure in R&D undertaken by the domestic firm would be welfare improving.

5. The Role played by $\overline{\theta}$ or Income level in the Host Economy

From the f.o.c. (15a) and (15b) we have:

1. $\frac{\partial MR\mu_d}{\partial \overline{\theta}} = 2\left[\phi(r) - \phi'(r)r\right](\overline{\theta} - \alpha) > 0$ **(18a)**

2. $\frac{\partial MR\mu_s}{\partial \overline{\theta}} = 8\left[\phi(r) + \phi'(r)r\right](\overline{\theta} - \alpha) > 0$ **(18b)**

Also, we know that $\frac{\partial MC\mu_i}{\partial \overline{\theta}} = 0$, i=*d,s*.

Therefore, the higher the value of $\overline{\theta}$ the higher is the equilibrium value for the product quality chosen both by the domestic and subsidiary firms. In other words, there is a link between the qualities chosen by the subsidiary firm with the income level in the host economy. Remember that we can interpret θ as the inverse of the MU of the Income, which is higher, the higher the domestic income. We can expect, therefore, that it could be optimal for the MNC, when it establishes a subsidiary, to reduce the quality to serve the host economy market. The reason for this is that domestic consumers have a lower willingness to pay for quality.

5. Main Conclusions

In this paper we analyse how the incentives to devote resources to improve product quality by a domestic firm (Product R&D) are affected when considering the different ways in which a Multinational Corporation can reach the domestic market, namely by exporting or by establishing a subsidiary. We consider a vertically differentiated oligopolistic market under the assumption the domestic economy is a small economy. Small in the sense that the decisions on price and R&D expenditure taken at the MNC level are not affected by decision taken by the domestic firm.

A key feature in the analysis is that we consider that product quality affects firm's cost in two different ways. First, firms need to invest in R&D resources to develop a product with the desired quality, which can be thought as a sunk cost. Second, we can also expect that unit production cost increase with product quality.

When we consider the case in which sunk cost are convex in product quality and the elasticity of the unit production cost with respect to quality is one a subsidy on the expenditure in R&D undertaken by the domestic firm would be welfare improving

The model, also, suggests that income level in the domestic country could be one of the variables to consider when MNC firms decides about optimal product quality to be offered in the host country. For instance, it could be optimal for the subsidiary to reduce product quality to serve a market in which the income is lower than the income in the market served by the MNC.

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