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Quotas, Export Trading Companies, and Oligopolistic Rivalry

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This paper examines the economic effects of an import quota and an export trading company in an international oligopolistic environment. Using a simple reaction function analysis, it is shown that a quota can lead to a contraction of the domestic output. In addition, a quota may lead to higher profits for both the domestic and the foreign firms. The creation of an export trading company abroad will increase foreign profits, but will have an ambiguous impact on the volume of imports, domestic production, and domestic profits.

I. Introduction

In recent years, there has been increasing concern in the U.S. over the rising volume of imports at home and the declining share of exports in the world market. A variety of policies have been proposed and implemented in an attempt to narrow the trade imbalance. To limit imports, quantitative restrictions (quotas and voluntary export restraints) have become one of the most popular instruments and have been used at various times in industries such as automobile, textile, footwear, steel, etc. To promote exports, the traditional focus has been on direct cash or credit subsidies. Lately, there is also considerable interest in the role of antitrust as a factor in export promotion. In October 1982, the U.S. Congress passed the Export Trading Company Act, which allows certified U.S. firms to coordinate their activities when engaged in exporting.[1] The idea is that cooperation rather than rivalry among the domestic firms will enhance U.S. international competitiveness. The U.S. is not alone in attempting to provide incentives for the formation of such export cartels. Countries such as

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[1]Actually since the 1918 Webb-Pomerene Act the U.S. has under certain circumstances permitted its exporters to combine to promote their export trade. But businesses have complained about the uncertainty with shifting interpretations of what is legal and illegal under the Act.

Australia, West Germany, and Japan also provide similar antitrust exemption to their exporters (OECD 1984).

The aim of this paper is to provide an analysis of the effects of import quotas and export trading companies in oligopolistic markets. It fits in with the recent interest in the oligopoly approach to trade patterns and trade policies (Jacquemin 1982). The analysis of antimonopoly exemption has so far been neglected in the literature.[2] As for recent studies of quantitative restrictions, Itoh and Ono (1982) and Krishna (1983) examined effects of such trade barriers in oligopolistic markets where producers compete in price. This paper differs from earlier articles by offering a simple reaction function analysis of import quotas. In addition, the markets that we shall be considering here are quantitysetting, i.e. Cournot–Nash and quantity Stackelberg leader–follower.[3]

II. The Basic Model

The model employed here is a standard one (e.g. Dixit 1979, 1986). We consider an industry in the home country with one firm, producing good x. A substitute, good y, is imported from a foreign firm. The profit funtions facing the home firm and the foreign firm are respectively,

$$\pi^1 = xP_x(x, y) - c_1x - F_1 = x(\alpha - \beta x - yy) - c_1x - F_1 \tag{1}$$

$$\pi^2 = yP_y(x, y) - c_2y - t_yy - F_2 = y(\alpha - \beta y - yx) - c_2y - t_yy - F_2 \tag{2}$$

where P_x is the price of the home good x, c_1 is the constant domestic marginal cost and F_1 is the domestic sunk cost. Similar notations hold for (2), with t_y being the specific tariff on the import good, and P_y the home country price of good y (inclusive of the tariff). The inverse demands for the two substitutes are linear with $\beta > y > 0$[4]. First order conditions for profit maximization give the implicit reaction functions :

$$\pi^1_x = \theta_1 - 2\beta x - yy - yxr_1 = 0 \tag{3}$$

$$\pi^2_y = \theta_2 - 2\beta y - yx - yyr_2 - t_y = 0 \tag{4}$$

[2] For an exception, see Dixit (1984).

[3] At least with symmetric firms, our focus on quantity–setting may actually be more appropriate since it was shown that with substitutes, producers would rather play a quantity–setting game than a price–setting game (Singh and Vives 1984).

[4] The inverse demands can be shown to arise from the utility–maximizing behavior of an aggregate consumer with a utility function $W(x, y, I) \quad \alpha(x + y) - 1/2(\beta x^2 + 2yxy + \beta y^2) + I$, where I is the total expenditure on all other goods. Concavity of W implies $\beta^2 - y^2 > 0$.

where $\theta_i = \alpha - c_i$; $r_1 = dy/dx$ and $r_2 = dx/dy$ are the domestic and foreign conjectural variations, respectively. The reaction function of firm i determines frim i's optimal output, given the other firm's production, while the conjectural variation r_i(i $= 1, 2$) measures producer i's expectation of how much its rival's output will change as a reaction to a marginal change in its own output. We can solve for x and y explicitly from (3) and (4),

$$x = [(2\beta + yr_2)\theta_1 - y(\theta_2 - t_y)]/\Delta \tag{5}$$

$$y = [(2\beta + yr_1)(\theta_2 - t_y) - y\theta_1]/\Delta \tag{6}$$

$$\Delta = (2\beta + yr_2)(2\beta + yr_1) - y^2 \tag{7}$$

If $r_1 = r_2 = 0$, we have the Cournot–Nash case. If $r_1 = -y/2\beta$, the solpe of the foreign reaction function, and $r_2 = 0$, we have the Stackelberg leader–follower case with the home firm being the leader. If instead $r_2 = -y/2\beta$ and $r_1 = 0$, the foreign firm will be the leader. Basically, a Cournot–Nash firm does not expect its rival to react to a change in its output. A Stackelberg leader knows the follower's reaction function and takes the follower's reaction into account when maximizing profits, whereas a Stackelberg follower sets its output to maximize profits, taking the leader's output as given.

Since t_y only occurs in (4), it is clear that for all three duopoly cases, an increase in tariff will only cause the foreign reaction function to shift in but will not affect the home reaction curve. In general, this will result in an increase in the home output and profits but a decline in the import volume and foreign profits.[5] The tariff here raises the marginal cost of production of the foreign firm, enabling the home firm to capture a larger share of the market and the economic rent. We shall use the tariff case as a point of reference when we analyze the quota.

III. Quota

We first look at the Cournot–Nash case. With a quantity constraint on the foreign good, the foreign reaction function will become kinked since the segment that corresponds to a larger volume of import becomes infeasible. Note that the same Nash equilibrium can be obtained by a shift of the foreign reaction function, i.e. by a tariff (Fig.1). With Cournot–Nash firms, the fact that the home firm knows that the foreign firm is constrained does not affect its own reaction curve. With the same

[5]See Brander and Spencer (1984) for more details for the Cournot–Nash case.

equilibrium point, the import quota will yield the same outputs, prices and domestic profits as the alternative tariff. The foreign firm's profits will, however, be dependent on who is administering the import restraint and how much of the quota rent is extracted by the home country. If the restriction is administered by the foreign country, then the foreign firm can charge the prevailing P_y in the home market and foreign profits will be the same under either the quantity constraint or the tariff.[6] Finally, in this paper, we are exclusively interested in the analysis of exogenously determined trade policies and shall ignore the effects of lobbying and rent-seeking. If such activities are explicitly taken into account, we shall have to endogenize the level of protection and the lobbying expenditure in our model by agents such as the producers. The resultant prices, profits and outputs will then be different from those discussed above.[7]

For the Stackelberg case with the home firm being the leader, a quota will not only turn the foreign reaction function into a kinked one, but will also make the home leader's reaction curve[8] discontinuous. This is because as a leader the home firm is presumed to have knowledge of the slope of the foreign follower's reaction curve. With the quantitative restriction, the foreign reaction curve is kinked, so the leader will set its conjectural variation to :

$$r_1 = \begin{cases} -y/2\beta & y < \bar{y} \\ 0 & y \geqq \bar{y} \end{cases} \tag{8}$$

Where $\bar{y}$ is the quota constraint, $-y/2\beta$ and 0 are the solpes of the two parts of the kinked foreign reaction function. By setting $r_1 = 0$ for $y \geqq \bar{y}$, the home leader essentially switches back to the Cournot reaction curve at and above the quota volume. The new equilibrium can be depicted by point A in Fig.2. Point B is the equilibrium point if there is a tariff that restricts import to $\bar{y}$ rather than a quota (compare Fig. 2 to Fig.1). Comparing A to B and using the isoprofit contours, it can be seen that the home firm has higher profits and a smaller output at A than at B. As the import level is held at $\bar{y}$ for the two trade policies, a smaller domestic output under the quota will mean hiher prices for both goods. The higher price of the import good will also

[6] For the rest of the paper, we shall assume that with a quota the foreign firm can charge the actual market price of its good in the home country.

[7] For a reference on the effects of rent-seeking, see Bhagwati (1982).

[8] It is obviously misleading to call the Stackelberg leader's first order condition a reaction function. It is used here merely for expositional convenience. The analysis will be the same if we instead use the isoprofit contours to locate the Stackelberg equilibrium.

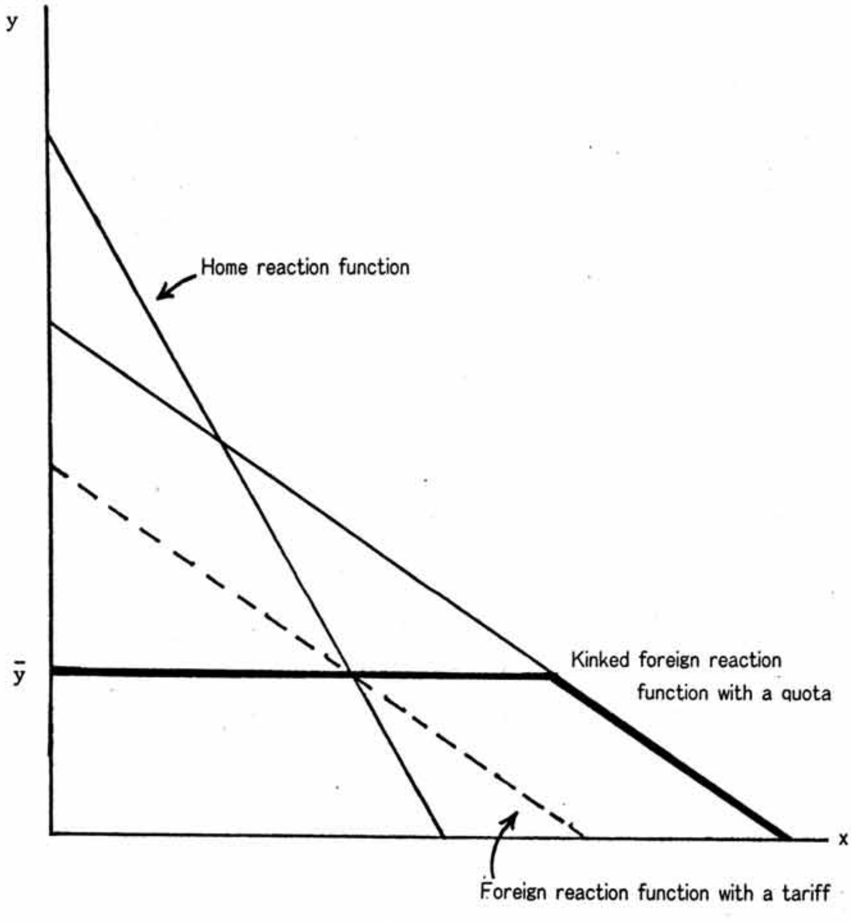
y
Home reaction function
$\bar{y}$
Kinked foreign reaction
function with a quota
x
Foreign reaction function with a tariff

Figure 1

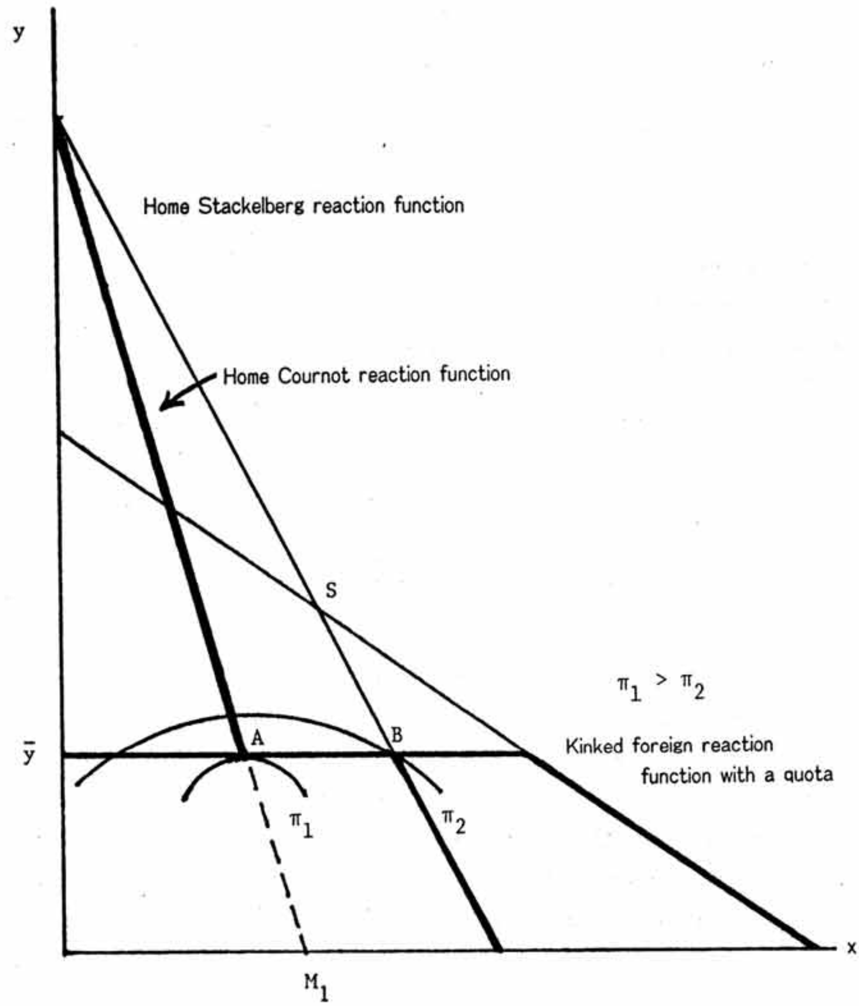
y
Home Stackelberg reaction function
Home Cournot reaction function
S
$\pi_1 > \pi_2$
A
B
$\bar{y}$
Kinked foreign reaction function with a quota
π_1
π_2
x
M_1

Figure 2

mean higher foreign profits. With higher profits under the quota, both the home and the foreign firm will prefer a quantitative restriction to a tariff.

We can further show that for some level of import restriction, both firms will also prefer a quantitative restraint to free trade. In Fig. 3, we have shown the level of profits of the leader and the follower under free trade, using their respective isoprofit contours through S. If a quota is imposed, the equilibrium will switch to some point on the home Cournot reaction function (as in Fig.2). For an effective quota, the volume of imports must be below that under free trade. So we can confine the quota equilibrium to points below the free trade level of y (i.e. below E). Consider points between E and F. They are possible quota equilibria since they lie on the domestic Cournot reaction function. They also represent points that yield higher profits to both firms compared to free trade since they will lie on isoprofit contours that are closer to the two firms' respective monopoly positions, M_1 and M_2.

Note that without the import barrier, points between E and F are not attainable or credible equilibria since they are only on the home Cournot reaction function and entirely off the foreign reaction curve. In essence, the quota allows both the home firm and the foreign firm to raise the prices of the products sufficiently to increase profits. As an example, it was estimated that the quantitative restriction in the U.S. automobile industry benefitted the Japanese producers and their dealers by at least $2 billion per year in price enhancement.[9] The import restraint thus enforces an equilibrium that is more collusive than that possible under free trade so that both producers can gain.

Another implication of the Stackelberg case is that compared to the free trade situation, the imposition of a quota can lead to a reduction of the domestic output. This can be seen by noting that point A occurs at a lower volume of x than the original pre–quota equilibrium S. We can derive the condition for such an occurrence. The original free trade Stackelberg domestic output x^s is given by (5) with $r_1 = -y/2\beta$ and $r_2 = 0$. With a quota, domestic output x^q is $(\theta_1 - y\bar{y})/2\beta$.[10] The production of the home good will drop if $x^q < x^s$. Setting $t_y = 0$ for convenience, $x^q < x^s$ can be simplified to:

$$\bar{y} > (\beta\theta_2 - y\theta_1)/(2\beta^2 - y^2) \tag{9}$$

From (9), we see that the more lenient the quota is (larger $\bar{y}$), the more likely

[9] See Crandall (1985).

[10] This is obtained from (3) by setting $y = \bar{y}$ and $r_1 = 0$.

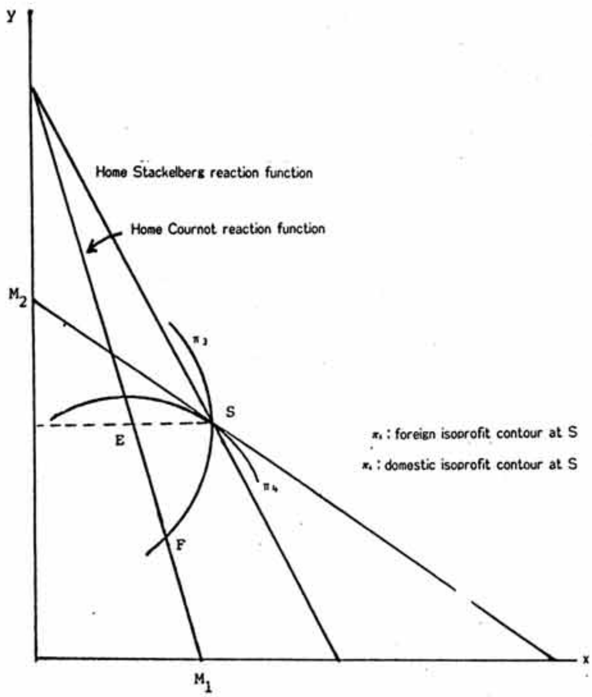

Figure 3

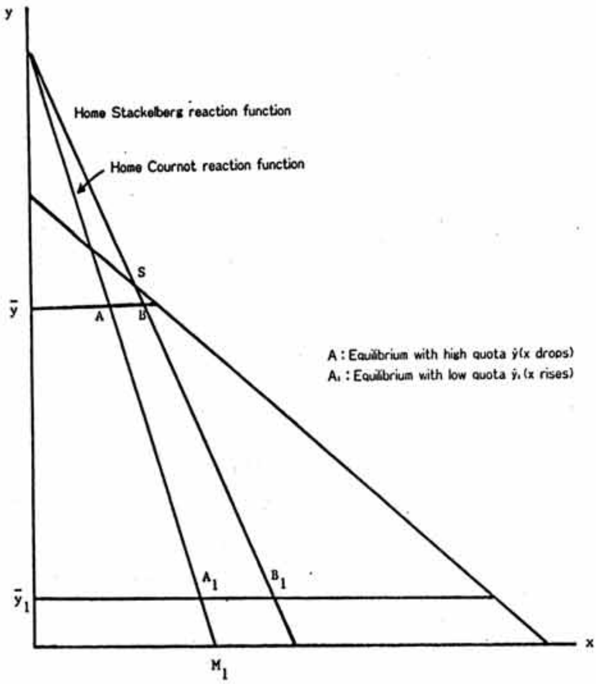

Figure 4

will domestic output decline (Fig. 4).

A sufficient condition for the quantitative restraint to depress home output is for the pre-quota Stackelberg equilibrium S to exceed the home firm's pure monopoly output M_1 (see e.g. Fig. 2). With $t_y = 0$, $x^s > M$ can be reduced to[11]:

$$y\theta_1 > \beta\theta_2 \tag{10}$$

Comparing this with (9), it can be seen that the right-hand side of (9) will be negative so that the condition for a smaller domestic output is automatically satisfied.

A general intuition of the above results is that when the foreign rival is restrained, the domestic firm can behave more monopolistically and reduce output. However, several comments on the intuition are necessary. Note that in the Cournot-Nash case, domestic production is never smaller under a quota compared to the free trade situation (Fig. 1).

This is because with Cournot-Nash firms, the conjectural variations are set to zero with or without the quota. With the Stackelberg case, the leader is assumed to take the change to the foreign reaction function under a quota into account. Unlike a Cournot-Nash producer, the home leader takes advantage of this new information and changes its behavior. Thus the quantitative restraint alone is not sufficient to generate the possibility of the decline of the home output. A second comment relates to the imposition of a "just-binding" quota.[12] For example in Fig. 4, if a quota is imposed just below S, domestic output falls to the home country's Cournot reaction function (to a point such as A). There seems to be a paradox here because the quota that constrains the foreign firm actually causes the domestic firm to produce an output that is further away from its monopoly output M_1. An explanation of this is that it is the home and foreign output combination, and not just home production alone that determines profits. The best output vector (x, y) for the home firm is obviously $(M_1, 0)$. In general, the further up along the home Cournot reaction function away from $(M_1, 0)$, the lower the home profits will be. If we draw in the isoprofit contours similar to those in Fig. 2, we can easily see that at A, the home profits are higher than at S. Thus, even for the case of a "just-binding" quota, the domestic firm benefits from the restraint of the foreign rival.

If instead we have the situation where the foreign firm is the leader, then imposing a quota on the foreign firm will not change the reaction pattern of the home firm, since the follower is assumed to set its conjectural variation to zero at any event. This will

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[11] x^s is given by (5) and M_1 is obtained from (3) by setting $y = 0$ and $r_1 = 0$.

[12] I am indebted to the referee for showing me this point.

mean that in this case the amount of domestic production will always increase.

Ⅳ. Export Trading Companies

In the above section, we analyze the economic effects of a quota, given the exogenous oligopolistic market structure. Often, however, national governments attempt to influence the organization of the industry in order to help their firms compete more successfully abroad. An example of this is the creation of export trading companies, i.e. firms that are allowed to collude in their export sales. To analyze this policy in our model, we now assume that there is more than one firm in each country and that now the home firms export to the foreign market. Let $n_1 (\geqq 2)$ be the number of identical home firms and $n_2 (\geqq 2)$ the number of identical foreign firms. Then the inverse demands are :

$$P_x = \alpha - \beta n_1 x_i - y n_2 y_i \tag{11}$$

$$P_y = \alpha - \beta n_2 y_i - y n_1 x_i \tag{12}$$

where x_i and y_i are the outputs of a representative home firm and a representative foreign firm, respectively. Suppose, before the exemption policy, the foreign market consists of Cournot-Nash firms. The equilibrium outputs will be :

$$x_i^{CN} = [(1+n_2)\beta\theta_1 - y n_2 \theta_2]/[(1+n_1)(1+n_2)\beta^2 - n_1 n_2 y^2] \tag{13}$$

$$y_i^{CN} = [(1+n_1)\beta\theta_2 - y n_1 \theta_1]/[(1+n_1)(1+n_1)\beta^2 - n_1 n_1 y^2] \tag{14}$$

With a policy of allowing the domestic exporters to collude, the home firms will be able to centralize production to cut cost, increase their market power and behave like a dominant firm, while the n_2 firms in the foreign county will then become the "competitive" fringe. In other words, exempting the domestic firms from antitrust can be interpreted to mean a change of the "rules of the game" from one of symmetric Cournot-Nash to that of the Stackelberg leader-follower.[13] We can solve for the Stackelberg equilibrium for the leader and a representative follower :

$$y_i^f = [(2\beta - (n_2 y^2)/\beta(1+n_2))\theta_2 - y\theta_1]/(2\beta^2(1+n_2) - 2y^2 n_2) \tag{15}$$

[13] If our industry originally is one where the foreign firms constitute the Stackelberg leader and the home firms are the followers, then the home export trading company can be interpreted to have an effect of changing the oligopoly solution back to Cournot-Nash. Similar analysis can then follow. For a rigorous justification of how a larger firm assumes the role of a Stackelberg leader, see Kambhu (1984).

$$x^{\ell} = [\beta(1+n_2)\theta_1 - yn_2\theta_2]/(2\beta^2(1+n_2) - 2y^2n_2) \tag{16}$$

The creation of the domestic export trading company will increase export to the foreign country iff $x^{\ell} > n_1 x_i^{CN}$. Using (14) and (16), we see that this is true iff:

$$H \quad \beta^2(1+n_2-n_1) - n_1n_2(\beta^2 - y^2) > 0 \tag{17}$$

However, even without taking the gain in scale economy into account, the profits of the export trading company will always be unambiguously larger than the sum of the original n_1 uncoordinated Cournot–Nash firms:

$$(P_x^{\ell} - c_1)x^{\ell} - n_1[(P_x^{CN} - c_1)x_i^{CN}] > 0 \tag{18}$$

Furthermore, the same condition (17) governs the impact of the trading company on the foreign fringe firms. In particular, the profits and the output of each foreign firm will drop iff (17) is holding. In addition, P_x and P_y will decline iff (17) is holding.[14]

Intuitively, the formation of a domestic export trading company has two conflicting effects on outputs and profits. One is the "game–changing effect." Since the export firms become a Stackelberg leader, the domestic output and profits tend to rise. The foreign output and profits tend to decline because the foreign firms become followers. The second effect is the "monopoly effect." The original n_1 home firms now consolidate into one firm, which tends to reduce domestic output. This gives the foreign firms an opportunity to expand production and to capture a larger share of the market. Furthermore, if the amount of exports does decline due to the home export trading company, then the total market output in the foreign market will also unambiguously shrink.[15] This can be seen by examining (19):

$$(x^{\ell} + n_2y_j^{\ell}) - (n_1x_i^{CN} + n_2y_i^{CN}) = (x^{\ell} - n_1x_i^{CN})([\beta(1+n_2) - n_2y]/\beta(1+n_2)) \tag{19}$$

Equation (19) is negative iff $x^{\ell} < n_1x_i^{CN}$, so that a drop in the level of export will mean a drop in total market output. This in essence moves all the firms closer to the industry monopoly output. Prices of x and y will tend to go up and the profits of both the home and the foreign firms will increase.

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[14] These results are obtained by using (11) to (16).

[15] Note that we are adding two differentiated products together, which is not necessarily meaningful. The procedure is meant merely to provide us with some intuition.

Combining the two effects, we see that the profits of the export trading company will always go up, but the profits of the foreign firms may go up or down. The amount of x and y produced are also ambiguous, depending on which effect dominates. If originally we have a large number of domestic firms, then the increasingly monopolistic behavior (due to a change from large n_1 to one) will dominate the outcome and the amount of export will be lowered. This can be confirmed by noting that as n_1 is increased, the likelihood that (17) is satisfied is diminished,

$$H/\quad n_1 = n_2(y^2 - \beta^2) - \beta^2 < 0 \tag{20}$$

V. Conclusion

In this paper we analyze the effects of two trade policies in an oligopolistic setting : the imposition of an import quota and the creation of an export trading company. With a quota, the Stackelberg home leader will have two values for its conjectural variation, which leads to the possibility of a decline in domestic output. For the Cournot–Nash and the home follower case, the domestic firm will instead retain its original behavioral pattern, so that domestic production will always increase. With a domestic export trading company, the home firms' profits will rise even though exports may decline. As for the foreign firms, the change to profits and outputs are both ambiguous.

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