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THE ROLE OF TARIFFS IN ENTRY PROMOTION AND DETERRENCE UNDER INTERNATIONAL OLIGOPOLY*

Koji ISHIBASHI

Abstract: We consider a situation where a domestic firm tries to enter the home and foreign markets which are monopolised by a foreign incumbent. The international entry game consists of the home and foreign governments' choices of import tariffs and the entry decision of the domestic firm with technological disadvantage. It is shown that the optimal use of import tariffs may lead to entry promotion or deterrence, depending on the parameters of the demands and costs functions. We also consider the welfare implications of the Nash tariff equilibrium.

1. INTRODUCTION

There is a growing concern about strategic entry promotion and deterrence in internationally oligopolistic industries, especially in aircraft and computer industries. These entry policies are also known as targeting policies of foreign governments to U.S. incumbents.[1] The case of incumbent Boeing vs. entrant Airbus in the aircraft industry, is a famous example of such policy games. In this paper, we investigate various effects of home and foreign governments' strategic trade policies when a home firm tries to enter the industry which is monopolised by a foreign incumbent.

Brander-Spencer (1981), using the Stackelberg entry deterrence model, considered the problem of acquiring foreign monopoly rent by means of a domestic import tariff. They showed that the existence of a potential home entrant which induces foreign incumbent to deter entry, enables the home country to extract part of the foreign firm's monopoly rent. But they ignored retaliative policies of the foreign government and adopted the Sylos postulate recently criticized as an irrational assumption. Dixit-Kyle (1985) argued comprehensively the role of protection and subsidy polices under the various types of games whose players are home and foreign governments and firms. In contrast to Brander-Spencer (1981), their analysis includes foreign retaliative policies and chooses the subgame-perfectness, in contrast to the Sylos postulate, as the equilibrium concept.

In this paper, we present a simple homogeneous duopoly model for the purpose

* I am grateful to Professors Kunio Kawamata and Michihiro Ohyama for their helpful comments. Of course, any remaining errors are of my own.

[1] See, for example, Krugman (1984) which discussed extensively on this topic.

of investigating various roles of import tariffs, especially entry promotion and deterrence. The game which we shall consider here is as follows: Players are home and foreign governments and home and foreign firms. First, both governments choose the levels of import tariffs and lump-sum subsidies. Secondly, a home firm decides whether to enter the markets or not. And thirdly, both firms choose the levels of outputs.

Dixit-Kyle (1985) permitted only perfectly prohibitive tariffs. We shall introduce variable rates of tariffs to consider their various effects. We shall also assume that the foreign firm has a technological advantage to the home firm as a result of learning as an incumbent. This assumption enables us to analyse the effect of cost differences on the outcomes of the international entry game. Following Dixit-Kyle (1985), we shall adopt the subgame-perfect equilibrium as the solution concept of the game.

The organization of this paper is as follows. In section 2, we consider the situation where the foreign incumbent is the monopolist, and characterise the market equilibrium and the optimal tariff policy of the home country. In section 3, we define the international entry game which is the main concern of this paper. We present various market structures as the outcomes of the game and analyze market equilibria and corresponding optimal tariffs. Section 4 gives the condition under which entry can be realised in the subgame-perfect equilibrium of the game. In section 5, various effects of import tariffs are presented in comparison with free trade. It is shown that the role of import tariffs varies with demand and cost parameters of both countries. In section 6, we analyze welfare effects of retaliative tariffs in a reciprocal-dumping trade model. This follows Johnson (1954)'s argument in a traditional model of international trade. Conclusions and final remarks are given in section 7.

2. MONOPOLY BY THE FOREIGN FIRM

There are two countries, the home country and the foreign country. At the beginning, both home and foreign markets are monopolized by the foreign firm. The foreign firm supplies y^* to the foreign market, and exports y to the home market. The home government imposes a specific import tariff t. The situation is described in figure 1.

The framework of the model is as follows. Letting q and m be home consumption

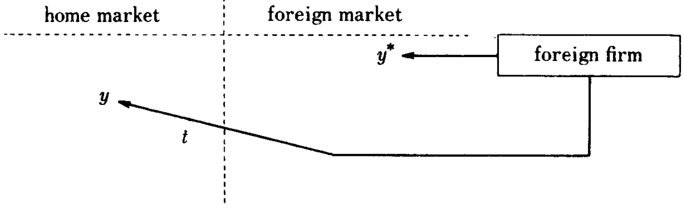

Figure 1

and home income respectively, the utility function of the home representative consumer is assumed to be of the form:

$$U(q, m) = u(q) + m\,, \tag{1}$$

where

$$u(q) = \alpha q - \frac{1}{2}\beta q^2 \quad (\alpha, \beta > 0)\,.$$

Similarly, letting q^* and m^* be foreign consumption and foreign income respectively, we write the utility function of the foreign representative consumer as,

$$U^*(q^*, m^*) = u^*(q^*) + m^*\,, \tag{2}$$

where

$$u^*(q^*) = \alpha^* q^* - \frac{1}{2}\beta^* q^{*2} \quad (\alpha^*, \beta^* > 0)\,.$$

These Marshallian utility functions yield the home demand function

$$p = u'(q) = \alpha - \beta q \tag{3}$$

and the foreign demand function

$$p^* = u^{*\prime}(q^*) = \alpha^* - \beta^* q^*\,, \tag{4}$$

where $p(p^*)$ is the price of the product in the home (foreign) market. In this case, $q = y$ and $q^* = y^*$ hold. The cost function of the foreign firm is assumed to be

$$C^*(y^* + y) = c^*(y^* + y) + F^*\,, \tag{5}$$

where c^* is the marginal cost which is constant, and F^* is the fixed cost. So the profit function of the foreign firm can be represented as

$$\pi^*(y^*, y) = p^* y^* + (p - t)y - c^*(y^* + y) - F^*\,, \tag{6}$$

assuming that the transportation cost is zero.

The first order conditions for profit maximization are:

$$\pi^*_{y^*} = \alpha^* - c^* - 2\beta^* y^* = 0\,, \tag{7}$$

$$\pi^*_y = \alpha - c^* - t - 2\beta y = 0\,. \tag{8}$$

Here and hereafter, we denote partial derivatives by subscripts. The conditions (7) and (8) yield the following monopoly equilibrium (denoted by the superscript M) outputs.

$$y^{*M} = \frac{\alpha^* - c^*}{2\beta^*}\,, \qquad y^M(t) = \frac{\alpha - c^* - t}{2\beta}\,. \tag{9}$$

Next, we study the optimal home tariff when foreign firm is the monopolist.

The welfare components of the home country are consumers' surplus and tariff revenue, which add to

$$W(t)=u(y^M(t))-p(y^M(t))y^M(t)+ty^M(t)$$
$$=\frac{1}{2}\beta y^M(t)^2+ty^M(t)\,. \tag{10}$$

The object of the home government is to maximize (10) with respect to t. The condition for welfare maximization is

$$W_t=\beta y^M y_t^M+y^M+ty_t^M=0\,, \tag{11}$$

which yields the following optimal tariff (denoted by the superscript N)

$$t^N=\frac{1}{3}(\alpha-c^*)>0\,. \tag{12}$$

3. ENTRY GAME AND FOUR MARKET STRUCTURES

Now we consider the situation where the home firm, whose technology is inferior to that of the foreign firm, tries to enter the market under the assistance of the home government. At the beginning, the home country pays monopoly rent to the products of the foreign firm. If the home firm enter the market, the home government wishes to assist the entry by imposing the import tariff. However, the foreign government would restrict the home firm's entry in the foreign market by imposing the retariative import tariff. So, in this paper, we study the game with the following moves:

Step 1: Each government chooses the levels of import tariff and lump-sum subsidy.

Step 2: The home firm makes entry decision: there are four choices, i.e., entering both markets, entering the home market only, entering the foreign market only or entering neither markets.

If the home firm enters neither home nor foreign markets,

Step 3: The foreign firm chooses the supply levels in each market, and the game ends.

If the home firm enters at least one of the markets,

Step 3′: Each firm chooses the supply levels of the markets where they are in, and the game ends.

In order to show how the entry promotion by the home government and the entry deterrence by the foreign government can occur as the solution of this game, we adopt the subgame-perfectness as the solution concept from the following two reasons. First, in making an entry decision, the home firm should rationally expect a duopoly equilibrium to result. This stands in contrast with the Sylos postulate, which has been used in the traditional theory of entry deterrence. Secondly, we note that import tariffs are adjusted to maximize welfare levels; they are not used to deter or to promote an entry indiscriminately. The subgame-perfectness of equilibrium rules out incredible threats which may be presented at the Nash equilibria.

There are four distinct market regimes in this game, according to the entry decision of the home firm. Let us characterise the market equilibrium and the optimal (noncooperative) tariff in each regime.

Regime I: Duopoly in both markets (Reciprocal-Dumping)

Consider the situation where the home firm enter both home and foreign markets. Let x, x^* be supplies of the home firm to the home and foreign market, respectively. The specific import tariff of foreign government is denoted by t^*. The situation is as described in figure 2.

First of all, we must have $q = x + y$, $q^* = y^* + x^*$. The cost function of the home firm is assumed to be expressed as

$$C(x + x^*) = c(x + x^*) + F, \tag{13}$$

where marginal cost c is constant. As to c and c^*, the following assumptions are made.

$$c > c^*, \tag{14}$$

$$c < \min\{\alpha, \alpha^*\}, \qquad c^* < \min\{\alpha, \alpha^*\}. \tag{15}$$

Assumption (14) means the technology of the home firm is inferior to that of the foreign firm, and (15) is the necessary condition that the monopoly profits can be positive in each market. The profit function of the home firm is

$$\pi(x, x^*, y, y^*) = G(x, y) + G^*(x^*, y^*) - F, \tag{16}$$

where

$$G(x, y) = p(x + y)x - cx,$$

$$G^*(x^*, y^*) = p^*(x^* + y^*)x^* - cx^* - t^*x^*,$$

and that of foreign firm is

$$\pi^*(x, x^*, y, y^*) = H(x, y) + H^*(x^*, y^*) - F^*, \tag{17}$$

where

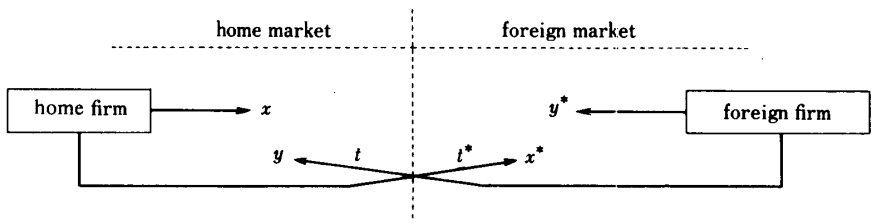

Figure 2

$$H(x, y) = p(x+y)y - c^*y - ty\,,$$
$$H^*(x^*, y^*) = p^*(x^*+y^*)y^* - c^*y^*\,.$$

The best reply conditions are:

$$\pi_x(x, y) = \alpha - \beta(x+y) - \beta x - c = 0\,, \tag{18}$$
$$\pi_{x^*}(x^*, y^*) = \alpha^* - \beta^*(x^*+y^*) - \beta^*x^* - (c+t^*) = 0\,, \tag{19}$$
$$\pi_y(x, y) = \alpha - \beta(x+y) - \beta y - (c^*+t) = 0\,, \tag{20}$$
$$\pi_{y^*}(x^*, y^*) = \alpha^* - \beta^*(x^*+y^*) - \beta^*y^* - c^* = 0\,. \tag{21}$$

These conditions yield the following Cournot-Nash equilibrium (denoted by the superscript N).

$$\begin{aligned} x^N(t) &= \frac{1}{3\beta}(\alpha - 2c + c^* + t)\,, \quad y^N(t) = \frac{1}{3\beta}(\alpha - 2c^* + c - 2t)\,, \\ x^{*N}(t^*) &= \frac{1}{3\beta^*}(\alpha^* - 2c + c^* - 2t^*)\,, \quad y^{*N}(t^*) = \frac{1}{3\beta^*}(\alpha^* - 2c^* + c + t^*)\,. \end{aligned} \tag{22}$$

The variables of the home market x, y can be solved using only conditions of the home market (18) and (20). Similarly x^*, y^* can be solved using only (19) and (21). In this sense, the conditions (18)–(21) are divided into two separate parts. This is due to the assumption of constant marginal costs and makes our analysis quite simple. Dropping this assumption would make our analysis highly complex. Substituting the Cournot-Nash equilibrium (22) into (3) and (4), we obtain the following equilibrium prices.

$$p^N(t) = \frac{1}{3}(\alpha + c + c^* + t)\,, \tag{23}$$

$$p^{*N}(t^*) = \frac{1}{3}(\alpha^* + c^* + c + t^*)\,. \tag{24}$$

It is indicated in (22) that an increase in t induces a rise in the supply of the home firm to the home market x^N and a fall in the import from the foreign firm y^N. Since a fall in y^N is greater than a rise in x^N, an increase in t leads to a rise in the home price p^N. Similar arguments hold about the effects of an increase in t^*.

Next we consider the noncooperative tariff under reciprocal-dumping. Here the welfare of the home country consists of consumers' surplus, profits of the home firm and tariff revenue, as in the following expression:

$$\begin{aligned} W(t, t^*) = {} & u(x^N(t) + y^N(t)) - p(x^N(t) + y^N(t)) \cdot (x^N(t) + y^N(t)) \\ & + [p(x^N(t) + y^N(t)) - c]x^N(t) \\ & + [p^*(x^{*N}(t^*) + y^{*N}(t^*)) - c - t^*]x^{*N}(t^*) - F + ty^N(t)\,. \end{aligned} \tag{25}$$

The subgame-perfectness of the whole game requires the Nash tariff equilibrium to be realized in the full anticipation of the Cournot-Nash equilibrium in the second stage of the game. The best reply conditions to a given t^*, $W_t=0$, yields the following optimal noncooperative tariff, which is positive.[2]

$$t^N=\frac{1}{3}(\alpha-c^*)>0\,. \tag{26}$$

The welfare function of the foreign country is similarly defined and we obtain the following foreign optimal noncooperative tariff.

$$t^{*N}=\frac{1}{3}(\alpha^*-c)>0\,. \tag{27}$$

This Nash tariff equilibrium can be described in a (t, t^*) space, as in figure 3. The upperly convex curves are indifference curves of the home country, i.e., the contours of W. Lower W contours correspond to higher welfare. Similarly indifference curves of the foreign country is indicated by the contours of W^*. It should be noted here that the condition $W_t=0$ determines t independently of t^*. This means that the noncooperative tariff of the home country can be calculated without referring to the best reply condition of foreign country $W^*_{t^*}=0$. Thus (t^N, t^{*N}) are the dominant strategies in the policy game, and the reaction function of the home country is vertical and that of the foreign country is horizontal. This fact is a consequence of the constancy of marginal costs. In figure 3, we find that a situation

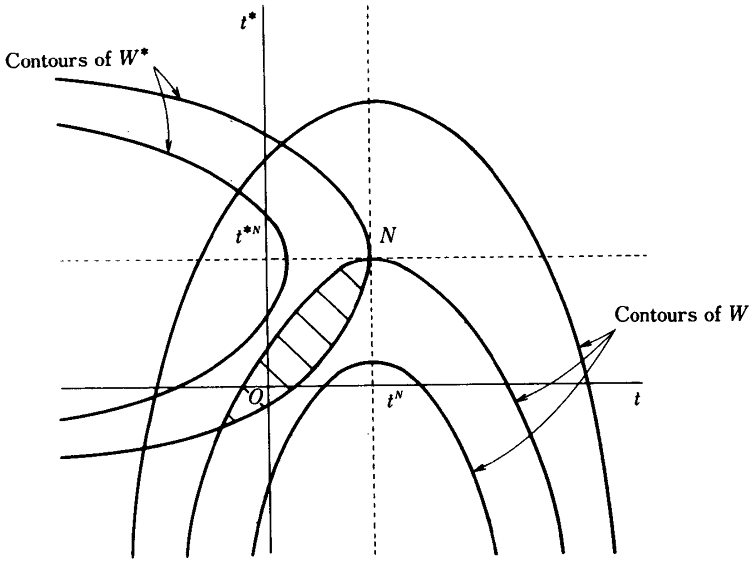

Figure 3

[2] The welfare effects of an import tariff under the assumption of segmented markets were analyzed by Dixit (1984) and Markusen and Venables (1988) among others. The result obtained here is consistent with their conclusion that an import tariff raises domestic welfare.

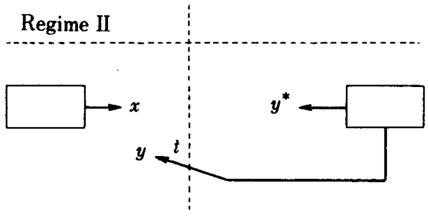

Figure 4

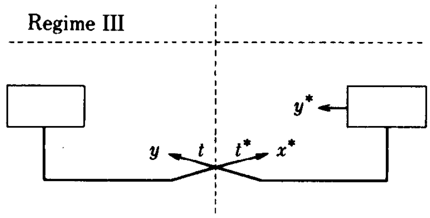

Figure 5

similar to the case of prisoner's dilemma is taking place here. Namely in the shaded area, welfare levels of both countries are higher than those in the noncooperative Nash tariff equilibrium $N(t^N, t^{*N})$.[3]

Regime II: The case where the home firm enters the home market only

The situation is described in figure 4. Equilibrium outputs are as follows;

$$x=x^N(t)\,,\quad x^*=0\,,\quad y=y^N(t)\,,\quad y^*=y^{*M}(t^*)\,. \tag{28}$$

Also the optimal noncooperative tariff of the home country is computed as

$$t^N=\frac{1}{3}(\alpha-c^*)>0\,. \tag{29}$$

Regime III: The case where the home firm enters the foreign market only

The situation is described in figure 5. Equilibrium outputs are as follows;

$$x=0\,,\quad x^*=x^{*N}(t^*)\,,\quad y=y^M(t)\,,\quad y^*=y^{*N}(t^*)\,. \tag{30}$$

Also the optimal noncooperative tariff of the home country is computed as

$$t^N=\frac{1}{3}(\alpha-c^*)>0\,. \tag{31}$$

$$t^{*N}=\frac{1}{3}(\alpha^*-c)>0\,. \tag{32}$$

Regime IV: The case where the home firm does not enter any market

The equilibrium outputs and optimal noncooperative tariffs are as explained in section 2.

By reffering to (12), (26), (29) and (31), we can confirm that the same rate optimal tariffs obtains in each of four different market structures. The profit of the home firm in the foreign market does not depend on t so that the optimal tariffs in Regime I and in Regime II are of the same rate. Similarly, Regime III and Regime IV is associated with the same rate of optimal tariffs. Thus the level of optimal tariff is independent of the domestic market structure, be it monopoly or duopoly.[4] Recent literatures on trade policy, such as Dixit (1984) and Eaton

[3] The welfare implications of Nash tariff equilibrium are investigated in detail in section 6.

[4] This fact depends on the assumption that demand and cost functions are linear.

and Grossman (1986), derived the optimal rates of tariffs under given market structures, but they didn't compare the optimal rates of tariffs under various market structures. In the model of linear demand and cost functions, we can get a clear result on the comparison of the optimal tariffs under different market structures.

4. MARKET STRUCTURES UNDER THE SUBGAME-PERFECT EQUILIBRIUM

Since the rate of optimal tariff is independent of market structures, the conditions for the positivity of equilibrium outputs are given by

$$x(t^N)>0 \Leftrightarrow c<(2/3)\alpha+(1/3)c^* \equiv h\,, \tag{33}$$

$$y(t^N)>0 \Leftrightarrow c^*<(1/4)\alpha+(3/4)c\,, \tag{34}$$

$$y^*(t^{*N})>0 \Leftrightarrow c^*<(2/3)\alpha^*+(1/3)c\,, \tag{35}$$

$$x^*(t^{*N})>0 \Leftrightarrow c<(1/4)\alpha^*+(3/4)c^* \equiv i\,. \tag{36}$$

From the assumptions (14) and (15), the conditions (34) and (35) always hold. This implies that the supply of the foreign products to the foreign market and the exports to the home market are always positive under the noncooperative home tariff. Therefore it has been shown that the home government's perfectly prohibitive policy, which shuts out the foreign products completely, is not based on its welfare maximizing behaviour.

The conditions (33)–(36) presume that fixed costs of both firms are zero. But the rational policies of both governments in the first stage of the game require that,

$$s=F\,, \qquad s^*=F^*\,. \tag{37}$$

where s and s^* be lump-sum subsidy of the home and foreign government respectively. This reflects the fact that a lump-sum subsidy, a transfer from the government to the domestic firm, yields a net benefit to the country whenever fixed costs prevents the domestic firm from entering the market and acquiring the profits which could be obtained if fixed costs were zero.

Since

$$y(t^N)>0\,, \qquad y^*(t^{*N})>0 \tag{38}$$

always hold, the possible market structures under the subgame-perfect equilibrium consist of those four types which are given in section 3. Comparing the right-hand sides of the conditions (33) and (36), we can derive the following results.

(i) $c^*<(1/5)(8\alpha-3\alpha^*) \Rightarrow [x^*(t^{*N})>0 \Rightarrow x(t^N)>0]$

(ii) $c^*=(1/5)(8\alpha-3\alpha^*) \Rightarrow [x^*(t^{*N})>0 \Leftrightarrow x(t^N)>0]$

(iii) $c^*>(1/5)(8\alpha-3\alpha^*) \Rightarrow [x(t^N)>0 \Rightarrow x^*(t^{*N})>0]$

Corresponding to (i), (ii) and (iii), the market structures under the subgame-perfect equilibrium may be classified as follows.

Case (i): $(1/4)\alpha^* + (3/4)c^* < (2/3)\alpha + (1/3)c^*$

$$
\begin{array}{lll}
c < (1/4)\alpha^* + (1/4)c^* & \Rightarrow x > 0\,, \quad x^* > 0: & \text{Regime I} \\
(1/4)\alpha^* + (3/4)c^* \leqq c < (2/3)\alpha + (1/3)c^* & \Rightarrow x > 0\,, \quad x^* = 0: & \text{Regime II} \\
(2/3)\alpha + (1/3)c^* \leqq c & \Rightarrow x = 0\,, \quad x^* = 0: & \text{Regime IV}
\end{array}
$$

Case (ii): $(1/4)\alpha^* + (3/4)c^* = (2/3)\alpha + (1/3)c^*$

$$
\begin{array}{lll}
c < (1/4)\alpha^* + (3/4)c^* = (2/3)\alpha + (1/3)c^* & \Rightarrow x > 0\,, \quad x^* > 0: & \text{Regime I} \\
c \geqq (1/4)\alpha^* + (3/4)c^* = (2/3)\alpha + (1/3)c^* & \Rightarrow x = 0\,, \quad x^* = 0: & \text{Regime IV}
\end{array}
$$

Case (iii): $(1/4)\alpha^* + (3/4)c^* > (2/3)\alpha + (1/3)c^*$

$$
\begin{array}{lll}
c < (2/3)\alpha + (1/3)c^* & \Rightarrow x > 0\,, \quad x^* > 0: & \text{Regime I} \\
(2/3)\alpha + (1/3)c^* \leqq c < (1/4)\alpha^* + (3/4)c^* & \Rightarrow x = 0\,, \quad x^* > 0: & \text{Regime III} \\
(1/4)\alpha^* + (3/4)c^* \leqq c & \Rightarrow x = 0\,, \quad x^* = 0: & \text{Regime IV}
\end{array}
$$

5. COMPARISON WITH FREE TRADE

To investigate the role of import tariffs, let us compare the above results with the case of free trade, where $t = t^* = 0$. Under free trade, we have

$$x(t=0) \quad > 0 \Leftrightarrow c \ < \frac{1}{2}\alpha + \frac{1}{2}c^* \equiv j\,, \tag{39}$$

$$y(t=0) \quad > 0 \Leftrightarrow c^* < \frac{1}{2}\alpha + \frac{1}{2}c\,, \tag{40}$$

$$y^*(t^*=0) > 0 \Leftrightarrow c^* < \frac{1}{2}\alpha^* + \frac{1}{2}c\,, \tag{41}$$

$$x^*(t^*=0) > 0 \Leftrightarrow c \ < \frac{1}{2}\alpha^* + \frac{1}{2}c^* \equiv k\,. \tag{42}$$

Due to the assumptions (14) and (15), conditions (40) and (41) always hold. Comparing the right-hand sides of (39) and (42), we can see that

(A) $\alpha > \alpha^* \Rightarrow [x^*(t^*=0) > 0 \Rightarrow x(t=0) > 0]$

(B) $\alpha = \alpha^* \Rightarrow [x^*(t^*=0) > 0 \Leftrightarrow x(t=0) > 0]$

(C) $\alpha < \alpha^* \Rightarrow [x(t=0) > 0 \Rightarrow x^*(t^*=0) > 0]$.

Corresponding to (A), (B) and (C), the market structures under free trade may be classified as follows.

Case (A): $\alpha > \alpha^*$

$$
\begin{array}{lll}
c < \frac{1}{2}\alpha^* + \frac{1}{2}c^* & \Rightarrow x > 0\,, \quad x^* > 0: & \text{Regime I}
\end{array}
$$

$$\frac{1}{2}\alpha^*+\frac{1}{2}c^*\leqq c<\frac{1}{2}\alpha+\frac{1}{2}c^*\Rightarrow x>0\,,\quad x^*=0:\quad \text{Regime II}$$

$$\frac{1}{2}\alpha+\frac{1}{2}c^*\leqq c \qquad\qquad \Rightarrow x=0\,,\quad x^*=0:\quad \text{Regime IV}$$

Case (B): $\alpha=\alpha^*$

$$c<\frac{1}{2}\alpha^*+\frac{1}{2}c^*=\frac{1}{2}\alpha+\frac{1}{2}c^*\Rightarrow x>0\,,\quad x^*>0:\quad \text{Regime I}$$

$$c\geqq\frac{1}{2}\alpha^*+\frac{1}{2}c^*=\frac{1}{2}\alpha+\frac{1}{2}c^*\Rightarrow x=0\,,\quad x^*=0:\quad \text{Regime IV}$$

Case (C): $\alpha<\alpha^*$

$$c<\frac{1}{2}\alpha+\frac{1}{2}c^* \qquad\qquad \Rightarrow x>0\,,\quad x^*>0:\quad \text{Regime I}$$

$$\frac{1}{2}\alpha+\frac{1}{2}c^*\leqq c<\frac{1}{2}\alpha^*+\frac{1}{2}c^*\Rightarrow x=0\,,\quad x^*>0:\quad \text{Regime III}$$

$$\frac{1}{2}\alpha^*+\frac{1}{2}c^*\leqq c \qquad\qquad \Rightarrow x=0\,,\quad x^*=0:\quad \text{Regime IV}$$

We are interested in the order of the magnitudes of four real numbers h, i, j and k on the right-hand sides of (33), (36), (39) and (42) respectively. The assumption (14) implies that

$$h>j\,,\qquad i<k\,. \tag{43}$$

This means that

$$x(t=0)>0\Rightarrow x(t^N)>0\,, \tag{44}$$

$$x^*(t^{*N})>0\Rightarrow x^*(t^*=0)>0\,. \tag{45}$$

In (44), we can see the entry-protective role of the home import tariff: if the home firm can enter the home market under free trade then it can also enter under the noncooperative tariff. While in (45), we can see the entry-obstructive role of the foreign import tariff: if the home firm can enter the foreign market under the noncooperative tariff then it can also enter under free trade. From (43), the possible orderings of h, i, j and k are limited to the following six cases except for the unlikely cases where some of the four numbers have the same value.

Case 1: $i<k<j<h$, Case 2: $j<h<i<k$
Case 3: $i<j<k<h$, Case 4: $j<i<h<k$
Case 5: $i<j<h<k$, Case 6: $j<i<k<h$

We describe in table 1 whether the home firm enters the home or foreign market, both under optimal noncooperative tariffs and under free trade.

Table 1

Case 1:

	$c<i$	$i\leqq c<k$	$k\leqq c<j$	$j\leqq c<h$	$h\leqq c$
$x(t=0)$	+	+	+	0	0
$x(t^N)$	+	+	+	+	0
$x^*(t^*=0)$	+	+	0	0	0
$x^*(t^{*N})$	+	0	0	0	0

Case 2:

	$c<j$	$j\leqq c<h$	$h\leqq c<i$	$i\leqq c<k$	$k\leqq c$
$x(t=0)$	+	0	0	0	0
$x(t^N)$	+	+	0	0	0
$x^*(t^*=0)$	+	+	+	+	0
$x^*(t^{*N})$	+	+	+	0	0

Case 3:

	$c<i$	$i\leqq c<j$	$j\leqq c<k$	$k\leqq c<h$	$h\leqq c$
$x(t=0)$	+	+	0	0	0
$x(t^N)$	+	+	+	+	0
$x^*(t^*=0)$	+	+	+	0	0
$x^*(t^{*N})$	+	0	0	0	0

Case 4:

	$c<j$	$j\leqq c<i$	$i\leqq c<h$	$h\leqq c<k$	$k\leqq c$
$x(t=0)$	+	0	0	0	0
$x(t^N)$	+	+	+	0	0
$x^*(t^*=0)$	+	+	+	+	0
$x^*(t^{*N})$	+	+	0	0	0

Case 5:

	$c<i$	$i\leqq c<j$	$j\leqq c<h$	$h\leqq c<k$	$k\leqq c$
$x(t=0)$	+	+	0	0	0
$x(t^N)$	+	+	+	0	0
$x^*(t^*=0)$	+	+	+	+	0
$x^*(t^{*N})$	+	0	0	0	0

Case 6:

	$c<j$	$j\leqq c<i$	$i\leqq c<k$	$k\leqq c<h$	$h\leqq c$
$x(t=0)$	+	0	0	0	0
$x(t^N)$	+	+	+	+	0
$x^*(t^*=0)$	+	+	+	0	0
$x^*(t^{*N})$	+	+	0	0	0

In view of table 1, the role of import tariffs differs depending on parameters of demand and cost functions. With regard to the home import tariff t, there are three distinct cases. First is the case

$$x(t=0)>0 \quad \text{and} \quad x(t^N)>0\,. \tag{46}$$

Here, duopoly occurs in the home market even under free trade, so the home import tariff is irrelevant to entry decision. It is introduced on the basis of profit-shifting motive. Second is the case

$$x(t=0)=0 \quad \text{and} \quad x(t^N)>0\,. \tag{47}$$

The home firm cannot enter the home market under free trade, but the home import tariff which protects home products, enables the home firm to enter the home market. This is, the home import tariff has the role of entry promotion. Third is the case

$$x(t=0)=0 \quad \text{and} \quad x(t^N)=0\,. \tag{48}$$

The home firm can enter the home market neither under free trade nor under noncooperative import tariff. The home government does not wish to assist the entry of the home firm. Here, the role of the home import tariff is the extraction of monopoly rents.

Let us also consider the role of the foreign import tariff t^*. There also exist three cases. First, in the case

$$x^*(t^*=0)>0 \quad \text{and} \quad x^*(t^{*N})>0\,, \tag{49}$$

the foreign market is in duoply both under free trade and under noncooperative foreign import tariff. The foreign import tariff has the role of profit-shifting from the home firm to the foreign firm. Secondly, in the case

$$x^*(t^*=0)>0 \quad \text{and} \quad x^*(t^{*N})=0\,, \tag{50}$$

the home firm can enter the foreign market under free trade, but the foreign noncooperative import tariff prevents the home firm from entering the foreign market. Therefore, the foreign import tariff has the role of entry detterence. Thirdly, in the case

$$x^*(t^*=0)=0 \quad \text{and} \quad x^*(t^{*N})=0\,, \tag{51}$$

the home firm cannot enter the foreign market whatever the level of foreign import tariff may be. Thus in this case, the foreign import tariff has no impact on the entry decision of the home firm.

To sum up, there are three cases for the role of the import tariffs of each country, the occurence of which is is determined by the parameters of demand and cost functions of both countries. Table 1 describes in detail the relationship of the relative magnitudes of the parameters and the effect of import tariffs on equilibrium outputs.

6. THE NASH TARIFF EQUILIBRIUM AND WELFARE

In section 3, we introduced the concept of the Nash tariff equilibrium of this model. In this section we shall study its welfare implications, limitting our arguments to the case of the market regime I (reciprocal-dumping).

As we showed in figure 3, the Nash tariff equilibrium suffers from the prisoner's dilemma. That is, the noncooperative tariff $N(t^N, t^{*N})$ is not on the contract curve. This is clear because the social indifference curves are tangent to each other on the contract curve, while at the noncooperative tariffs they cross each other at right angles. To make this point more appealing, we shall consider the world optimal tariff. The welfare function of the foreign country is

$$\begin{aligned} W^*(t, t^*) = & u^*(x^{*N}(t^*) + y^{*N}(t^*)) \\ & - p^*(x^{*N}(t^*) + y^{*N}(t^*)) \cdot (x^{*N}(t^*) + y^{*N}(t^*)) \\ & + [p^*(x^{*N}(t^*) + y^{*N}(t^*)) - c^*] y^{*N}(t^*) \\ & + [p(x^N(t) + y^N(t)) - c^* - t] y^N(t) - F^* + t^* x^{*N}(t^*) . \end{aligned} \tag{52}$$

From (25) and (52), the world welfare function with equal weights on the home and the foreign countries is given by

$$\begin{aligned} W(t, t^*) + W^*(t, t^*) = & u(x^N(t) + y^N(t)) - c(x^N(t) + x^{*N}(t^*)) - F \\ & + u^*(x^{*N}(t^*) + y^{*N}(t^*)) - c^*(y^{*N}(t^*) + y^N(t)) - F^* . \end{aligned} \tag{53}$$

The conditions for world welfare maximization are

$$\frac{\partial\{W(t, t^*) + W^*(t, t^*)\}}{\partial t} = 0 , \qquad \frac{\partial\{W(t, t^*) + W^*(t, t^*)\}}{\partial t^*} = 0 . \tag{54}$$

These conditions yield the following world optimal tariff (denoted by the superscript C)

$$t^C = -\alpha - 4c + 5c^* < 0 , \tag{55}$$

$$t^{*C} = -\alpha^* - 4c^* + 5c . \tag{56}$$

This result is consistent with the conclusion of Brander-Spencer (1984) that at world optimal position, some country's tariff may be positive, but the noncooperative tariff rates exceed the cooperative world optimal tariff rates.[5] Of course, the cooperative tariffs given in (55) and (56) are on the contract curve. But the origin of (t, t^*) plane, which corresponds to the case of free trade, is not on the contract curve. Thus, free trade is not always Pareto optimal under international oligopoly.

The foregoing arguments reveal that world welfare levels under the noncooperative tariffs (t^N, t^{*N}) and under free trade are both lower than the welfare level under the cooperative tariffs (t^C, t^{*C}). But now does the welfare level under

[5] This result also holds under the market regimes I, II and III.

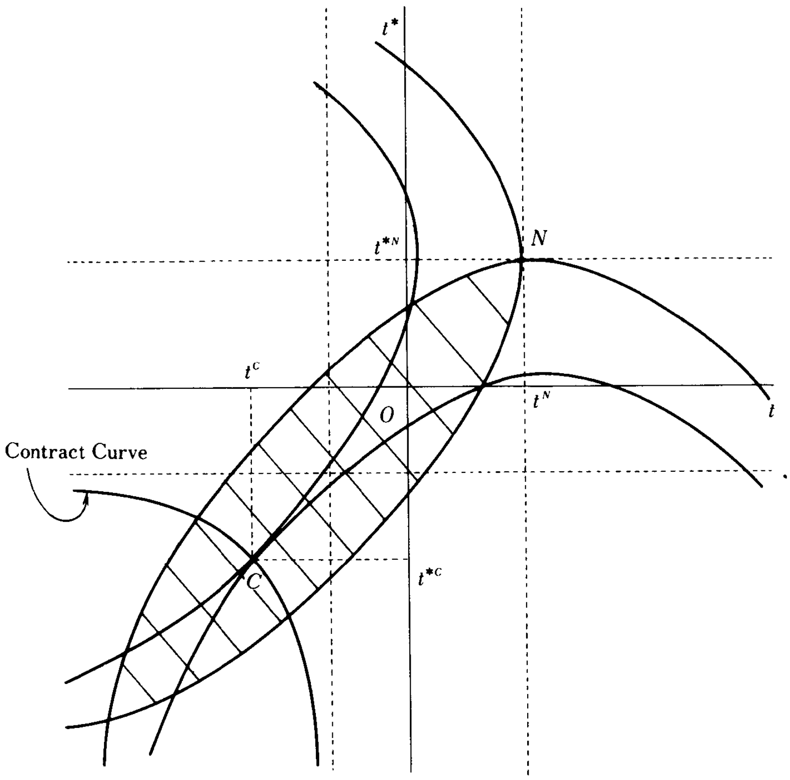

Figure 6 Symmetric Case

the noncooperative tariff compare with that under free trade? Or equivalently, whether the shaded area in figure 3 contains the origin or not? This question has been put aside by the recent literatures on strategic trade policy. Unfortunately, however, the answer is ambiguous. The situation is somewhat similar to what Johnson (1954) presented as a criticism of Scitovsky (1942) under the traditional setting of perfectly competitive trade. Only in the symmetric case where the demand and cost functions of both countries are identical ($\alpha=\alpha^*$, $\beta=\beta^*$, $c=c^*$), we can obtain clear conclusions as summarised in figure 6.

In this symmetric case, the noncooperative and cooperative tariffs are denoted by the point N and C respectively. And they are calculated as

$$t^N=t^{*N}=\frac{1}{3}(\alpha-c)>0\,, \tag{57}$$

$$t^C=t^{*C}=c-\alpha<0\,. \tag{58}$$

The contract curve becomes a hyperbola and its asymptotes are $-(5/17)(\alpha-c)$. In this case, the origin is contained in the shaded area, and at the points in this shaded area, welfare levels are higher than that at the point N. That is, each country's welfare level under the Nash tariffs are lower than that under free trade. Although, as we have noted, this conclusion does not hold generally, it is almost always true in the model of linear demands and linear costs. Indeed, we can show that the home (foreign) country benefits from the Nash tariffs only when $\alpha(\alpha^*)$ is remarkably large than the other parameters.

7. CONCLUSION AND REMARKS

In this paper, we considered an international entry game involving governments' choices of import tariffs and the entry decision of the home firm with technological disadvantage. The equilibrium of this multi-stage game gives rise to various market structures depending on international cost differences and other parameters. The rate of optimal tariff is, however, shown to be independent of market structures. The role of import tariffs would vary with demands and costs parameters. The home import tariff plays the roles of profit-shifting, entry promotion and acquisition of foreign nonopoly rents. In contrast the foreign import tariff is given the roles of profit-shifting and entry deterrence. We also made clear that each country's welfare level under the noncooperative Nash tariffs is lower than that under free trade except for the case where the two countries are extremely dissimilar.

Let us reflect on the limitations of this model. First, the linearity assumptions lack generality. But the assumption of constant marginal costs is indispensable to the simple analysis of strategic interdependence, as in the other related literature on strategic international trade. Secondly, we assumed that the Cournot-Nash competition prevails among firms. But, as the recent theory of strategic trade policy indicates, different natures of market competition would require different types of noncooperative tariff policies. Thirdly, we considered only import tariffs and lump-sum subsidies as policy instruments. Further analysis would be needed to cover other policy instruments such as export subsidies and production subsidies. Fourthly, we confined ourselves to static analysis from the beginning to the last. The problem of protecting the home entrant with cost disadvantage is usually discussed in relation to dynamic factors, such as learning effects and competition styles over time. It should be noted that the optimal policy proposed in this paper might be modified in the context of long-run dynamic competition. Fifthly, we assumed that not only firms but also governments of both countries have complete information about the forms of demand and cost functions. This information requirement may be unrealistic. To solve this problem, we must invoke the theory of incomplete information games.

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