Submission Number: PED11-11-00003

Effects of entry international competition with lobbying for protection

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Effects of Entry in International Competition with Lobbying

for Protection

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Januray 2011

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Keywords:lobbying,protection,rent-seeking,tariff,entry.
JEL Nos:D43,D72,F13,L13.

1. Introduction

Tullock(1967) has first noticed resource wasting phenomenon of rent-seeking with fixed prize,and Tullock(1980) has formulated a formal model of rent-seeking with simple contest success function.Since then,a large number of papers have appeared on rent-seeking refining and extending the original Tullock model.The earlier survey of the literature on rent-seeking is Nitzan(1994),and the most recent and comprehensive one is due to Congleton,Hillman and Konrad(2008),who have collected important papers.In international competition between two countries,home and foreign,the domestic oligopolistic firms competing with foreign firms in the home market may lobby for their favorable import tariff on the foreign goods.Long and Soubeyran(1996) have formulated a rent-seeking model taking into account international competition between two countries and analyzed, under simplifying assumption of constant marginal costs for firms in both countries,the effects on lobbying cost of an increase in heterogeneity among domestic oligopolists.Yamazaki(2004) has extended their model incorporating public good aspect of tariff.In the literature on rent-seeking,whether pure rent net of rent-seeking cost dissipates or not with an increase in the number of agents is one of the most important problems.

The plan of this paper is as follows. In Section 2,we will formulate a general model of international competition among oligopolistic firms in two countries and without lobbying for protection by domestic firms and first prove the existence of a unique Cournot-Nash equilibrium,assuming a given rate of domestic tariff. Then we will conduct comparative statics analysis of a change in the tariff rate.In Section 3,we will formulate a complete model of international competition with endogenous lobbying for protection by the domestic firms and show a paradoxical result that domestic firms' profits will increase if a new domestic firm appears and engage in lobbying activity like incumbents. Section 4 concludes.

2.Model without Lobbying

In this section we will formulate a general model of international competition between two countries.We assume that there are n and $n*$ firms producing identical goods in home and foreign countries,respectively,and .the home country imposes specific tariff on the foreign imports at the rate of t .Let x_i and x_j^* be domestic firm i's and foreign firm j's outputs,respectively,and $p = f(Y), f' < 0$ be the inverse demand function of the home country,where p is the home country price of the goods

produced by firms in two countries, $Y \equiv X + X^*, X \equiv \sum_{i=1}^{n} x_i, X^* \equiv \sum_{j=1}^{n^*} x_j^*$. If $C_i(x_i)$ and

$C_j(x_j^*)$ are domestic firm i's and foreign firm j's cost

functions, respectively, domestic firm i's profits π_i and foreign firm j's profits π_j

are defined as

$$\pi_i \equiv x_i f(Y) - C_i(x_i), i = 1,2,...,n, \tag{1}$$

and

$$\pi_j^* \equiv x_j^* f(Y) - C_j^*(x_j^*) - tx_j^*, j = 1,2,...,n^*, \tag{2}$$

respectively. As is evident, each firm's profit function has its own output and the sum of all firms' outputs as its variables. In this regard our model having (1) and (2) as pay-off functions is an aggregate game in the sense of Selten(1970) and Corchon (1994)(see also Okuguchi,1993). All firms are assumed to form expectations regarding rivals' output a la Cournot. If we assume away corner maximums, the first order conditions for expected profit maximization are given by (3) and (4) for domestic firm i and foreign firm j, respectively. In the following analysis the suffixes i and j are to be understood to take values 1,2,…,n and 1,2,…,n^*, respectively, and all the relevant functions are assumed to be differentiable up to orders as necessary.

$$\frac{\partial \pi_i}{\partial x_i} = f(Y) + x_i f'(Y) - C_i'(x_i) = 0. \tag{3}$$

$$\frac{\partial \pi_j^*}{\partial x_j^*} = f(Y) + x_j^* f'(Y) - C_j^{*'}(x_j^*) - t = 0. \tag{4}$$

We now introduce the following assumptions which have first been formulated by Hahn(1962) and widely been used in analyzing Cournot oligopoly(see Okuguchi,1976,and Okuguchi and Szidarovszky,1990,and Okuguchi and Yamazaki, 2008).

Assumption 1: $f' < C_i'', f' < C_j''$.

Assumption 2: $f' + x_i f'' < 0, f' + x_j^* < 0$.

The Assumption 1 holds if marginal cost is constant or increasing for any firm. It may also hold even if it is strictly decreasing. The Assumption 2 implies that any two firms' outputs are strategic substitutes in the sense of Bulow *et al* (1985).Define

$$X_i \equiv \sum_{k \neq i}^{n} x_k, X_j^* \equiv \sum_{m \neq j}^{n*} x_m^*, Y_i \equiv X_i + X^*, Y_j^* \equiv X + X_j^*.$$

Then (3) yields the following reaction function for the domestic firm i,

$$x_i \equiv \varphi_i(Y_i). \tag{3.1}$$

$$-1 < \varphi_i' = -\frac{f' + x_i f''}{f' + x_i f'' + f' - C_i''} < 0. \tag{3.2}$$

Take into account the identity

$$x_i + Y_i = Y = \varphi_i(Y_i) + Y_i, \tag{3.3}$$

to derive

$$Y_i \equiv \phi_i(Y), \tag{3.4}$$

$$\phi_i' = \frac{1}{1 + \varphi_i'} > 1. \tag{3.5}$$

Similarly,the corresponding expressions for foreign firm j are as follows.Note that its reaction function depends not only on Y_j^* but also on t.

$$x_j^* \equiv \varphi_j^*(Y_j^*, t). \tag{4.1}$$

$$-1 < \frac{\partial \varphi_j^*}{\partial Y_j^*} = -\frac{f' + x_j^* f''}{f' + x_j^* f'' + f' - C_j^{*''}} < 0. \tag{4.2.1}$$

$$\frac{\partial \varphi_j^*}{\partial t} = \frac{1}{f' + x_j^* f'' + f' - C_j^{*''}} < 0. \tag{4.2.2}$$

$$x_j^* + Y_j^* = \varphi_j^*(Y_j^*, t) + Y_j^*. \tag{4.3}$$

$$Y_j^* \equiv \phi_j^*(Y, t). \tag{4.4}$$

$$\frac{\partial \phi_j^*}{\partial t} = -\frac{\dfrac{\partial \varphi_j^*}{\partial t}}{1 + \dfrac{\partial \varphi_j^*}{\partial Y_j^*}} > 0, \quad \frac{\partial \phi_j^*}{\partial t} = -\frac{\dfrac{\partial \varphi_j^*}{\partial t}}{1 + \dfrac{\partial \varphi_j^*}{\partial Y_j^*}} > 0 \tag{4.5}$$

Summation of (3.4) and (4.4) for all i and j yield the following one variable equations for Y, whose solution is nothing but the equilibrium total supply of goods to the home market.

$$(n + n^* - 1)Y = \sum_{i=1}^{n} \phi_i(Y) + \sum_{j=1}^{n^*} \phi_j^*(Y) \equiv \Phi(Y, t), \tag{5.1}$$

$$Y = \frac{1}{n + n^* - 1} \Phi(Y, t). \tag{5.2}$$

$$\frac{\partial \Phi}{\partial Y} > n + n^*, \frac{\partial \Phi}{\partial t} > 0. \tag{6}$$

Hence, if there exists Y^0 such that $\Phi(Y^0, t) = 0$, the unique equilibrium total supply to the home market exists and is shown in Fig.1 by the intersection E_1 of the

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upward-sloping curve for the RHS of (5.2), whose slope is greater than $1+\dfrac{1}{n+n*-1}$, and the 45 degree line emerging from the origin.The existence of such Y^0 is ensured under the following additional assumptions.

Assumption 3: $f(0) > C_i^{'}(0), f(x_i)+x_i f'(x_i)-C_i^{'}(x_i)<0$ as $x_i \to \infty$. $\qquad$ (7.1)

Assumption 4: $f(0) > C_j^{*'}(0)+t, f(x_j^*)+x_j^* f'(x_j^*)-C_j^{*'}(x_j^*)-t<0$ as $x_j^* \to \infty$. $\quad$ (7.2)

The second inequalities in (7.1) and (7.2) are satisfied if the marginal costs of firms in the two countries are sufficiently high for large outputs.

$\qquad$ Up till now we have taken the specific tariff rate t to be exogenously given. We are now in a position to analyze the effect of a change in the value of t on the basis of Fig.1.Observe that as (6) holds, the upward sloping curve for the RHS of (5.2) shifts upward if t increases from t_1 to t_2, and the new equilibrium corresponds to the intersection E_2,which shows that the equilibrium total supply $Y^e(t)$ decreases from $Y^e(t_1)$ to $Y^e(t_2)$.Hence,

$$Y^e \equiv Y^e(t), \frac{dY^e}{dt}<0. \qquad (8)$$

This fact is also easily derivable by taking into account

$$\frac{dY}{dt}=\frac{\dfrac{\partial \Phi}{\partial t}}{n+n*-1-\dfrac{\partial \Phi}{\partial Y}}. \qquad (9)$$

$\qquad$ Domestic firm i's profits in the equilibrium $\pi_i^e(t)$ are

$$\pi_i^e(t) \equiv \pi_i(Y^e(t)) = \varphi_i(\phi_i(Y^e(t)))f(Y^e(t))-C_i(\varphi_i(\phi_i(Y^e(t))). \qquad (10)$$

Since

$$\frac{d\pi_i^e}{dt}=(1-\varphi_i'\phi_i')x_i f' \cdot \frac{dY^e}{dt}>0, \qquad (11)$$

an increase in the domestic tariff rate causes the domestic firm to increase its profits.

We are now in a position to consider the endogenous determination of the domestic tariff rate by taking into account domestic firm's lobbying activity.Following and generalizing Long and Soubeyran(1996),let direct and indirect lobbying costs of domestic firm i be z_i and $I_i(z_i)$ with $I_i' > 0, I_i'' > 0$.The tariff rate is a function of the total direct lobbying cost by all domestic firms, $t = t(Z), Z = \sum_{i=1}^{n} z_i, t' > 0, t'' \leq 0$ .Firm i 's profits net of direct and indirect lobbying costs are

$$\Pi_i(z_i, Z) \equiv \pi_i(Y^e(t(Z))) - z_i - I_i(z_i) . \tag{12}$$

Assume that each firm form its expectation on all rivals' lobbying costs a la Cournot. Then its first order condition for net profit maximization is

$$\frac{\partial \Pi_i}{\partial z_i} = H_i(Z) - 1 - I_i'(z_i) = 0 , \tag{13}$$

where

$$H_i(Z) \equiv \left\{1 - \varphi_i'(\phi_i(Y^e(t(Z)))) \phi_i'(Y^e(t(Z)))\right\} \varphi_i(\phi_i(Y^e(t(Z)))) f'(Y^e(t(Z))) Y^{e'}(t(Z)) t'(Z) > 0 \tag{14}$$

The second order condition is

$$\frac{\partial^2 \Pi_i}{\partial z_i^2} = H_i'(Z) - I_i''(z_i) < 0 . \tag{15}$$

A simple calculation reveals that if $C_i'' = 0$ and $f'' = 0, H_i' < 0$,ensuring the validity of the second order condition.We therefore introduce the following assumption.

*Assumptio*n 5: $H_i' < 0$.

We derive from (13),

$$z_i \equiv \tau_i(Z) \tag{16}$$

$$\tau_i' = \frac{H_i'}{I_i''} < 0. \tag{17}$$

The equilibrium total direct lobbying cost by all domestic firms is identical to the solution of one variable equation

$$Z = \sum_{i=1}^{n} \tau_i(z) \equiv T(Z). \tag{18}$$

The solution corresponds to the unique intersection of the downward-sloping curve for $T(Z)$ and the 45 degree line emerging from the origin as shown in Fig.2. We note that the unique intersection exists even if $H_i' \geq 0$ as long as $T' < 1$.

Suppose entry of a new domestic firm for which the Assumptions 1,2,3,and 5 hold. For the entrant,firm $n+1$,

$$z_{n+1} = \tau_{n+1}(Z), \tau_{n+1}' < 0,$$

where we now have $Z \equiv \sum_{i-1}^{n+1} z_i$. The new equilibrium corresponds to the new intersection E_2 of the upward sloping curve for $T(Z)$ and the 45 degree line through the origin.The intersection yields a higher equilibrium total direct lobbying cost,hence a higher tariff rate.The higher Z leads to lower z_i and $I_i(z_i)$ .On the other hand, a higher t causes π_i to rises.Hence,entry raises Π_i for all domestic incumbents.It is well known in the literature of Tullock type rent-seeking model that the agent's rent net of rent-seeking cost has a tendency to dissipate with an increase in the number of agents or contestant. Our result on entry in international competition incorporating the domestic firm's lobbying activity for protection contrasts sharply with the result of rent dissipation.

2. Conclusion

In this paper we have formulated a general model of international competition among domestic and foreign firms in the home market,in which the domestic firms are

assumed to be engaged in lobbying for a higher import tariff rate on the foreign imports. In the first paper of our paper,we have presented a constructive proof of the existence of a unique Cournot equilibrium assuming that the tariff rate is given.In the second part,we have determined the optimum total lobbying cost by all domestic firms.We have shown that the profits of net of direct and indirect lobbying costs increase for all domestic incumbents if a domestic firm emerges and engages in lobbying activity like all incumbents.In classical rent-seeking model formalized first by Tullock,net rents dissipate as agents increases. In our model,however,entry causes a higher domestic tariff rate,leading to higher profits net of lobbying costs for all domestic incumbents.Finally,we note that in classical Cournot oligopoly without international competition and lobbying,the unique Cournot equilibrium exists if the Assumptions 1,2 and 3 are satisfied. This proof gives an alternative existence proof to Szidarovszky and Yakowitz(1977) ,which has been adapted by Szidarovszky and Okuguchi(1997) to prove the existence of a unique Nash equilibrium in rent-seeking games with general lottery production functions for agents.

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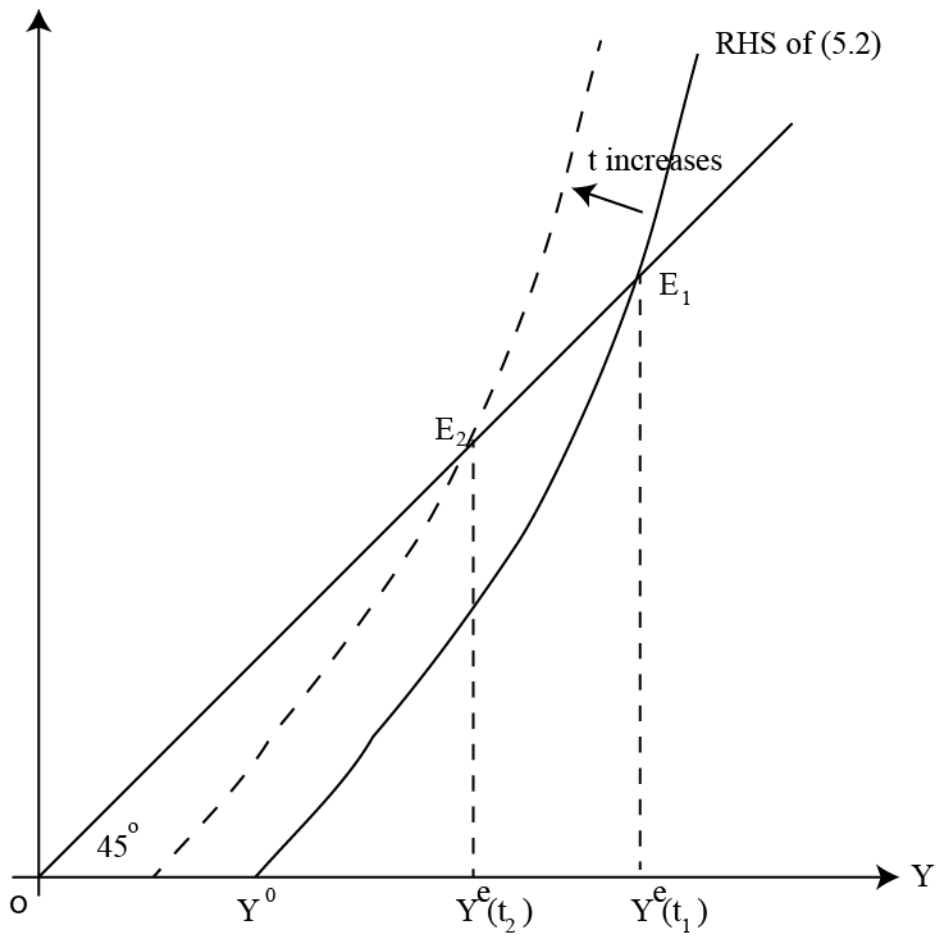Yamazaki,T.(2004) "Tariff Rate as a Public Good", *Review of International Economics*,95-107.
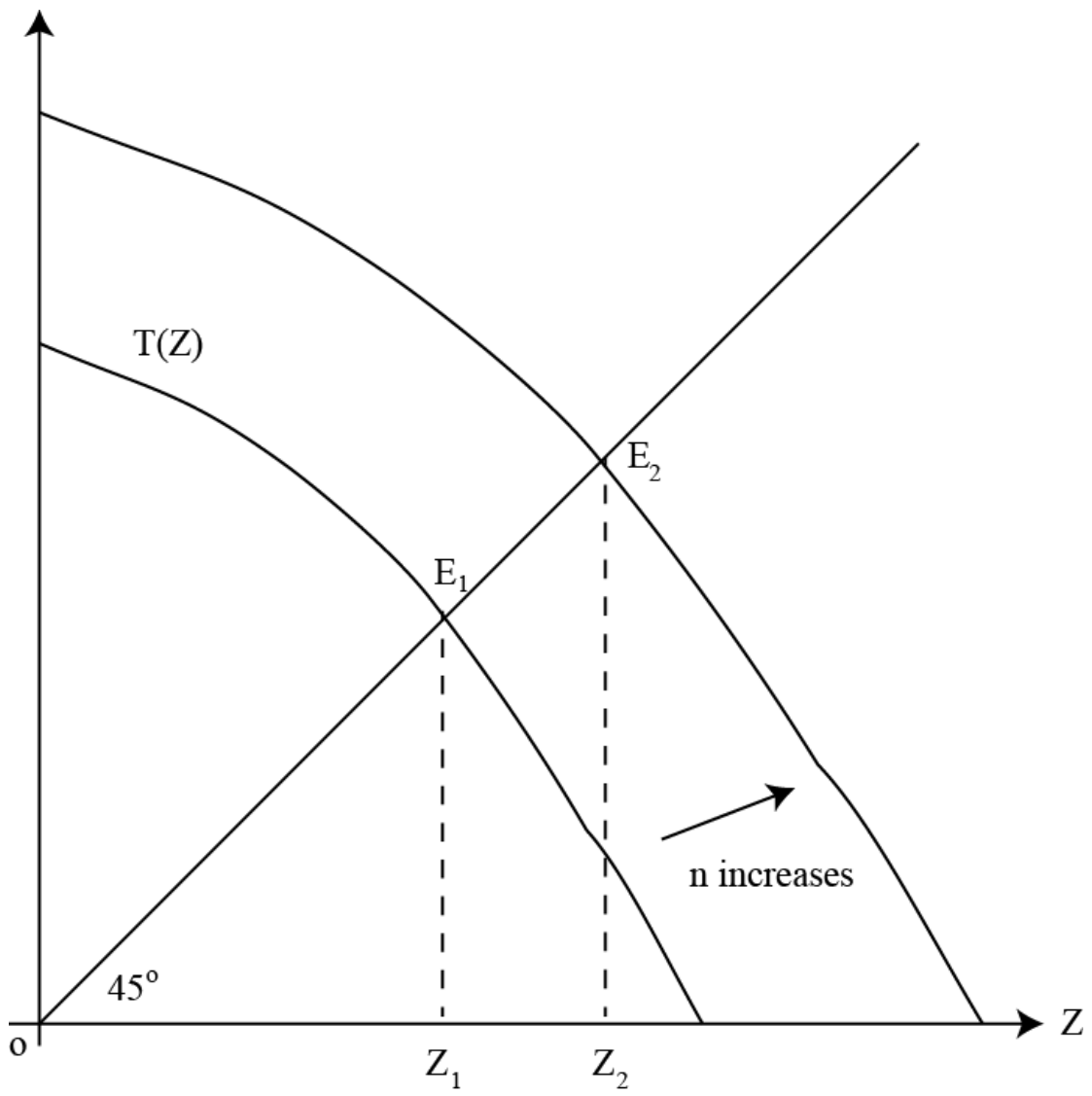
Fig.1.Equilibrium total supply

Fig.2.Effect of entry