

IMPORT TARIFF, VOLUNTARY EXPORT TAX AND OLIGOPOLISTIC PROFITS

DONG CHEON SHIN*

The paper examines the effects of changing the form of trade protection from an import tariff to a voluntary export tax on the home and foreign firms' profits in a simple general-equilibrium Cournot-Nash trading model with limited entries and constant returns to scale. It is shown that with identical Mill-Graham preferences a voluntary export tax provides more profits to both home and foreign firms than the same-rate import tariff if an international Cournot-Nash tariff equilibrium exists.

I. INTRODUCTION

It has been frequently argued in recent years that some countries (notably Japan) and their exporting firms are profiting from the other countries' protectionism in the form of voluntary export arrangements which governments tend to prefer to import restrictions when they try to protect their import-competing industries from foreign competition. This observation raises a theoretical issue about the relationship between home and foreign firms' profits and the form of trade protection. Can the foreign exporting firms really reap more profits under voluntary export arrangements than under import restrictions without the export tax revenue or quota rent given to them? What about the home import-competing firms? If the home country's trade protection is presumed to be a consequence of political pressure exerted by the narrowly-based home import-competing firms and/or foreign exporting firms with general consumers remaining rationally ignorant, more profits for both home and foreign firms under voluntary export arrangements will motivate them to lobby for voluntary export agreements rather than import restrictions.

This paper compares the effects of a voluntary export tax as one form of voluntary export arrangements and an import tariff on the home and foreign firms'

* Yonsei University, Seoul, Korea

profits in a simple general-equilibrium trading model with limited entries and constant returns to scale.[†] We show that with the Mill-Graham fixed-budget-share preferences a voluntary export tax provides more profits to both home and foreign firms than an import tariff. The idea is that home residents consume their importables at the tariff-inclusive domestic price under import tariff while foreign residents consume their exportables at the domestic price including no tax under voluntary export tax, which implies greater world demand for the foreign country's exportables under voluntary export tax than under import tariff. The greater world demand implies the foreign firms' bigger 'perceived' marginal revenue, higher price and production level under voluntary export tax as compared with the same-rate import tariff. The higher foreign price, in turn, implies bigger 'perceived' marginal revenue and output level for the home import-competing firms. The higher price and output level under voluntary export tax means more profits for both home and foreign firms than under import tariff.

Section 2 constructs a general-equilibrium Cournot-Nash trading model with constant returns to scale. Section 3 develops a method by which one can analyze a change in profits when the home country's protective form changes from an import tariff to a voluntary export tax, and does comparative statics. In section 4 we conclude and make several remarks.

II. THE MODEL

We assume a world economy consisting of two countries, Home and Foreign, producing two commodities, commodity 1 and 2, by using two factors of production in fixed supply with constant returns to scale. The market structure is such that in every country there exists a single firm in the noncompetitive sector supplying commodity 1 while commodity 2 is competitively supplied.[‡] No distortions whatsoever are present in every country's factor markets so that production occurs on its efficient production possibility curve. The tariff or tax revenue is assumed to be redistributed to the public in lump-sum fashion. The country i 's production possibility curve is specified by:

$$(1) \ Y_j^i = F_i(Y_j^i), \ F_i' \equiv \frac{dF_i}{dY_j^i} < 0, \ F_i'' \equiv \frac{d^2F_i}{dY_j^{i2}} < 0.$$

where Y_j^i is the country i 's total supply of commodity j . (The foreign variables and functions will be distinguished by asterisks.) The condition (1) implies that

[†]Markusen(1981) considers a similar model with CES preferences in order to examine the gains from and the pattern of trade.

[‡]We may assume a small fixed number of firms in every country without any significant changes in our results.

the production possibility frontier is strictly concave to the origin. Minus of $F_i''(Y_i)$ becomes the marginal cost at Y_i when the price of commodity 2 is set to 1.

Each firm participating in the noncompetitive world market of commodity 1 is assumed to behave in a Cournot-Nash fashion, taking his rival's output level as given, and view (or believe) the total incomes of home foreign countries as invariant to his output decision. There is no logical inconsistency associated with this assumption. What the firms 'perceive' to be their marginal revenue matters. The residents of both countries have identical and fixed-budget-share Mill-Graham preferences. The duopolists are assumed to maximize profits as producers rather than maximize their utility as consumers, as Markusen(1981) assumes in his paper. The Mill-Graham preferences generate the demand function of the form:

$$(2) X_i^1(P_i, I_i) = \frac{\alpha I_i}{P_i}$$

where X_i^1 is the country i 's demand for commodity 1, I_i the national income, P_i the relative price of commodity 1, and α the fixed budget share, $0 < \alpha < 1$.

In addition to the above assumptions, we assumed that the home country imports commodity 1 and imposes a tariff on its imports while the foreign country maintains a free-trade policy. In a trading equilibrium, if any, the home country's relative price, P , is equal to $(1 + \tau) P^*$ where P^* is the foreign country's relative price of commodity 1 and τ is the tariff rate. The firm faces the following problem, given the rival firm's output level:

$$\begin{aligned} \text{MAX}_{Y_i^1} [P_i Y_i^1 - \int_0^{Y_i^1} \{-F_i'(z)\} dz], \text{ subject to} \\ \frac{\alpha I}{P} + \frac{\alpha I^*}{P^*} = Y_1 + Y_1^* \text{ and } P = (1 + \tau) p^*. \end{aligned}$$

It is easy to show that the price elasticity of demand for commodity 1 generated by the Mill-Graham preferences is equal to 1. The profit-maximizing duopolist equates his 'perceived' marginal revenue to marginal cost:

$$(3) (1 + \tau)P^* \left[1 - \frac{Y_1}{Y_1 + Y_1^*} \right] = -F'(Y_1)$$

$$(4) P^* \left[1 - \frac{Y_1^*}{Y_1 + Y_1^*} \right] = -F^*(Y_1^*).$$

The home and foreign countries' actual demands for commodity 1 can be derived by rearranging the terms after substituting $I = (1 + \tau)P^*Y_1 + F(Y_1) + \tau P^*(X_1 - Y_1) - R$ and $I^* = P^*Y_1^* + F^*(Y_1^*) + R$ into (2), where R is a unilateral

transfer of the home country to the foreign country and $\tau P^*(X_1 - Y_1)$ is the tariff revenue.

$$(5) X_1 = \frac{\alpha [P^* Y_1 + F(Y_1) - R]}{[1 + \tau (1 - \alpha)] P^*},$$

$$(6) X_1^* = \frac{\alpha [P^* Y_1^* + F^*(Y_1^*) + R]}{P^*}$$

Along with the following world market clearing condition (7), the system of equations (3)-(6) defines an international Cournot-Nash trading equilibrium with a trade tax.

$$(7) X_1 + X_1^* = Y_1 + Y_1^*.$$

It should be noted that the equilibrium values of endogenous variables depend on the value of the transfer amount, R .

III. VOLUNTARY EXPORT TAX VERSUS IMPORT TARIFF: COMPARATIVE STATICS

1. *The effects of a transfer*

The values of home and foreign variables under a voluntary export tax are equal to those under the same-rate import tariff imposed by the home country with the tariff revenue transferred to the foreign country. That is, the system of equations (3)-(7) is the import tariff regime if the transfer amount, R , is set to zero while it is the voluntary export tax regime if the tariff revenue is equal to R . Thus, one possible way of comparing the economic effects of the two trade regimes would be to analyze the effects of a transfer payment of the home country to the foreign country.

Lemma 1. A small change in transfer affects the duopolists' production level and the foreign relative price of commodity 1 in the same direction.

Proof. Totally differentiating (3) and (4) with respect to Y_1 , Y_1^* and P and rearranging the terms, one can obtain:

$$(8) \text{ defining } B \equiv \frac{(F'' Y_1)/(1 + \tau) + (F^{*'} Y_1^*)/Y_1}{F^{*'} + F^{*''} Y_1^*},$$

$$dP^* = -[(F''/(1 + \tau)) dY_1 + F^{*''} dY_1^*],$$

$$\text{and} \quad dY_1^* = B dY_1. \quad (9)$$

Note that B is positive. By substituting (9) into (8), we have:

$$dP^* = A dY_1, \quad (10)$$

where $A = -[F''/(1+\tau) + F^{*''} B]$. Note that A is also positive. So, the sign of (dP^*/dR) is equal to the signs of (dY_1^*/dR) and (dY_1/dR) .

According to lemma 1, it suffices to examine only the effect of a small transfer on home firm's output level.

Lemma 2. A small from the home country to the foreign country increases the output level of every firm producing commodity 1 and raises the foreign relative price of commodity 1.

Proof. Totally differentiating (7) with respect to Y_1 , Y_1^* , P and R after substituting (5) and (6) into (7), we have: defining $T = \{1 + \tau(1-\alpha)\}$,

$$[\{\alpha(P^* + F') - TP^*\} + (\alpha-1)A\{(1+\tau)Y_1 + TY_1^*\} + TB\{(\alpha-1)P^* + \alpha F^{*'}\}] dY_1 + \tau(\alpha-1) dR. \quad (11)$$

The coefficient of dY_1 is negative since $\alpha(P^* + F') < P^*$, $T \equiv (1 + \tau(1-\alpha)) \geq 1$, and $\{(\alpha-1)P^* + \alpha F^{*'}\} < 0$. So, if the tariff rate is greater than zero,

$$\frac{dY_1}{dR} > 0,$$

and, by lemma 1,

$$\frac{dY_1^*}{dR} > 0 \text{ and } \frac{dP^*}{dR} > 0.$$

The intuition behind the result is as follows. An increase in transfer payment raises the world demand for commodity 1 since the marginal propensity to consume commodity 1 of the home country is lower than that of the foreign country due to a tariff. This increased world demand for commodity 1 will raise the foreign firm's 'perceived' marginal revenue so that the foreign firm expand its production. This expansion of the foreign firm's output, in turn, reduces the home firm's market share initially, raising its 'perceived' marginal revenue. So, the home firm also increases its supply of commodity 1.³

³ Under free trade, a transfer makes no change in the home country's international terms of trade and the duopolists' output level since both countries have the same marginal propensity to consume commodity 1. This can be seen by setting $\tau=0$ in equation(11).

2. Profits and voluntary export tax

A transfer payment of the home country to the foreign country has been shown to increase every country's production level of commodity 1 and the foreign relative price. These changes will affect each duopolist's profit position.

Lemma 3. A small transfer from the home to the foreign country increases both home and foreign firms' profits.

Proof. Differentiating the home firm's profit function

$$\pi \equiv (1 + \tau) P^* Y_1 - \int_0^{Y_1} \{-F'(z)\} dz,$$

one can obtain:

$$\frac{d\pi}{dR} = \{(1 + \tau) P^* + F'\} \frac{dY_1}{dR} + Y_1 \frac{dP^*}{dR}.$$

Obviously, by lemma 2,

$$\frac{d\pi}{dR} > 0,$$

since $\{(1 + \tau) P^* + F'\} > 0$ (the home duopolist's marginal cost, $-F'$, is less than the home domestic relative price.).

Similarly for the foreign firm,

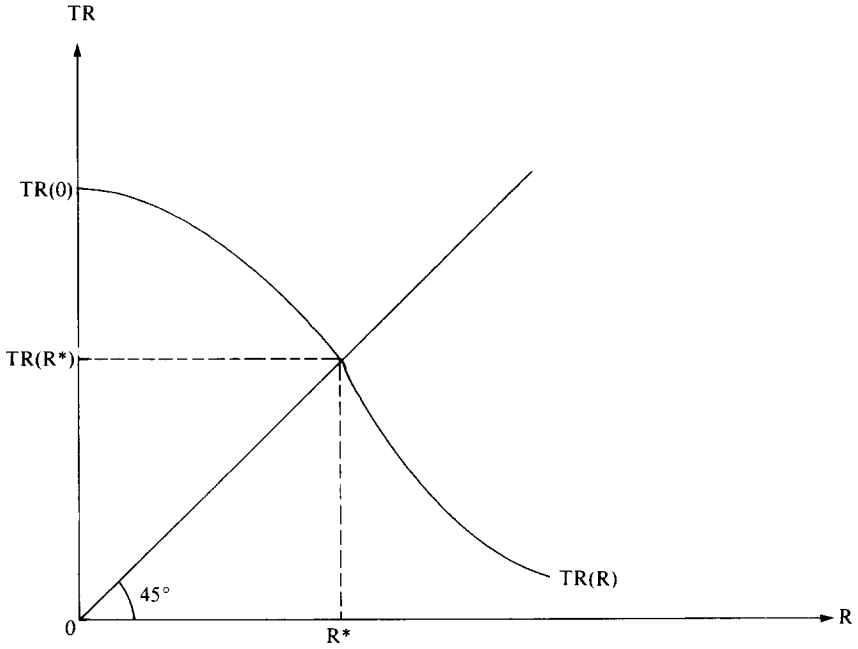
$$\frac{d\pi^*}{dR} > 0.$$

Thus, a transfer increases both duopolists' profits.

As already noted, a voluntary export tax is equivalent to an import tariff with the tariff revenue transferred to the exporting country. That is, the values of endogenous variables under voluntary export tax is equal to those under import tariff with the tariff revenue being equal to the transfer amount. Thus, the foreign country's tax revenue under voluntary export tax is a fixed point R^* where $TR(R^*) \equiv \tau P^*(R^*) [X_1(R^*) - Y_1(R^*)] = R^*$. Is there such a fixed point? The following lemma shows that there is one.

Lemma 4. There exists a fixed point R^* such that $TR(R^*) = R^*$.

Proof. Differentiating tariff revenue TR with respect to R , one obtains:



[Figure 1]

$$\begin{aligned} \frac{dTR}{dR} &= \tau (X_1 - Y_1) \frac{dP^*}{dR} + \tau P^* \left[\frac{dX_1}{dR} - \frac{dY_1}{dR} \right] \\ &= \frac{\tau}{T} [(\alpha - 1)(1 + \tau) \Delta Y_1 + \{\alpha(P^* + F) - T P^*\}] \frac{dY_1}{dR} - \frac{\tau \alpha}{T}. \end{aligned}$$

The coefficient of $\frac{dY_1}{dR}$ is negative since $\Delta > 0$ and $\{\alpha(P^* + F) - T P^*\} < 0$ so that the tariff revenue decreases with the transfer payment. Starting from zero transfer amount in case of which the system is an import tariff, the tariff revenue, TR , declines as the transfer payment increases. So, there is a fixed point R^* which is the export tax revenue of the foreign country (as shown in figure 1).

Now, it is straightforward to prove our main proposition.

PROPOSITION. Voluntary export tax provides more profits for both home and foreign firms than import tariff with the same tax rate.

Proof. The difference in profits between import tariff and voluntary export tax is, for the home firm,

$$\pi(R^*) - \pi(0) = \int_0^{R^*} \frac{d\pi}{dR} dR,$$

where $\pi(R^*)$ and $\pi(0)$ are the home firm's profits under voluntary export tax and under import tariff respectively. Since the integrand is positive by lemma 3, a voluntary export tax provides more profits to the home duopolist than the same-rate import tariff. Similarly, one can show that the foreign firm can also reap more profits under voluntary export tax.

Voluntary export arrangements are considered to be a form of trade protection which brings lower international and domestic political cost to home governments trying to protect the domestic import-competing industry. In addition to this lower political cost, voluntary export arrangements may provide the mechanism for more profits to both home and foreign firms, as shown in the above.

IV. CONCLUDING REMARKS

We have examined the difference in profits between a voluntary export tax and an import tariff in a simple general-equilibrium trading model. With identical Mill-Graham preferences, a voluntary export tax has been shown to provide more profits to home and foreign firms than an import tariff. Main cause for this result turns out to be the difference of marginal propensity to consume between countries which exists due to a tariff and contributes to the expansion of world demand for the foreign country's exportables when the trade regime changes from an import tariff to a voluntary export tax. The result has an implication for a country's political choice of protective form when the country's government is 'captured' by narrowly-based special interest groups in that the home import-competing and foreign exporting firms have a strong incentive to lobby for voluntary export arrangements rather than import restrictions.

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