Economics Bulletin

Volume 30, Issue 3

Partial Privatization, Foreign Competition, and Tariffs Ranking

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Abstract

This paper compares the optimal tariff and revenue maximizing tariffs in the presence of partial privatization. We show that in an international mixed oligopoly with asymmetric costs and partial privatization, when the marginal cost of the privatized firm exceeds a critical value, maximum -revenue tariff is higher than optimum-welfare tariff. Otherwise, optimum-welfare tariff is higher than maximum-revenue tariff. In addition, associating with the market-opening policy, the domestic government should accelerate privatization path and impose a lower welfare-optimum tariff rate.

We thank to anonymous referees and associate editor for their valuable comments and suggestions. Leonard Wang gratefully acknowledges the financial support provided by National Science Council of Taiwan under Grant NSC99-2410-H390-006-MY3.
Citation: Leonard F.S. Wang and Jen-yao Lee, (2010) "Partial Privatization, Foreign Competition, and Tariffs Ranking", *Economics Bulletin*, Vol. 30 no.3 pp. 2405-2412.
Submitted: Jul 07 2010. **Published:** September 16, 2010.

1. Introduction

The issue of maximum-revenue tariff versus optimum-welfare tariffs is interesting and has gained attention, because the tariffs revenue is an important income source of the government before building up an efficient tax system in a developing country. The government in system transition process may adjust its goal from maximum-revenue to optimum-welfare along with the economic improvement and the need of fiscal reform. The aim of this paper is to compare the optimal tariff and revenue maximizing tariffs in the presence of partial privatization.

In a traditional tariff analysis, Johnson (1951-1952) argued that the maximum-revenue tariff is higher than the optimum-welfare tariff because a 'large' country could change the terms of trade in order to raise its social welfare level. Collie (1991) demonstrated that in a quantity competition oligopoly market with a linear demand function and an asymmetric marginal cost, the maximum-revenue tariff will be raised up if domestic marginal cost is higher, and the maximum-revenue tariff will be higher than the optimum-welfare tariff if domestic firm's marginal cost is relatively higher than that of foreign firm. Clarke and Collie (2006) found that in a Bertrand price competition model, the optimum-welfare tariff is higher than the maximum-revenue tariff when the product is highly substitutable. Wang *et al.* (2009) introduced market share delegation in a trade duopoly context, and demonstrated that the home government unambiguously imposes a higher optimum-welfare tariff than maximum-revenue regardless of the form of delegation. Wang *et al*. (2010) re-examined the tariff ranking issue under a linear mixed oligopoly model with foreign competitors and asymmetric costs.[1] In particular, they demonstrated that under Cournot competition, when the sizes of domestic private and foreign private firms become more unequally distributed, the optimum-welfare tariff will exceed the maximum-revenue tariff.

In this paper, we find that in an international mixed oligopoly with asymmetric costs and partial privatization, when the marginal cost of the privatized firm exceeds a critical value, maximum-revenue tariff is higher than optimum-welfare tariff. Otherwise,

[1] Maw (2002) reviewed the empirical evidence and justified adopting partial privatization in transitional economies. Chang (2005) adopted Matsumura's (1998) model to analyze the optimal trade and privatization policies in an international mixed duopoly with cost asymmetry, while Chao and Yu (2006) examined the effect of partial privatization or foreign competition on optimal tariffs and found that foreign competition lowers the optimal tariff rate but partial privatization raises it. Van Long and Stähler (2009) recently established a mixed duopoly model with partial privatization to discuss how state ownership impacts the optimal import tariff and export subsidy. The above papers concern how the degree of partial privatization affects optimal tariff but not the revenue-maximum tariff.

optimum-welfare tariff is higher than maximum-revenue tariff.

This paper is organized as follows. Basic modeling is provided in Section 2. Section 3 contains the analysis of tariff ranking and Section 4 concludes the paper.

2. Basic Model

Assuming that domestic demand function is $P = a - Q$, there is one domestic public firm and n foreign private firms engaging in Cournot competition. The supply equation is given by $Q = q_s + \sum_{i=1}^{n} q_{fi}$, where q_s and q_{fi} denote, respectively, domestic public firm's and foreign private firms' productions. We also assume that cost functions are $C_s = c_s q_s$, and $C_{fi} = c_f q_{fi}$ for i from *1* to *n*, with $c_s > c_f > 0$ indicating that the production efficiency of public firm is lower than that of identical foreign private firm[2]. We assume that government could levy tariff on imports and the magnitude of tariff is given by t.

For the foreign firms to maximize profit, the optimization problem is:

$$\underset{\{q_{fi}\}}{Max.}\ \pi_{fi} = Pq_{fi} - C_{fi} - tq_{fi} \tag{1}$$

Following the assumption of literatures[3] and considering the target function of the government is to maximize social welfare,

$$W = CS + \pi_s + t\sum_{i=1}^{n} q_{fi} \tag{2}$$

where $CS = \frac{Q^2}{2}$ is the consumer surplus; $\pi_s = Pq_s - C_s$ is public firm's profit. When government privatizes the public firm partially, the optimization problem for the privatized firm is:

$$\underset{\{q_s\}}{Max.}\ \ S = \theta\pi_s + (1-\theta)W = \pi_s + (1-\theta)\left(CS + \sum_{i=1}^{n} q_{fi}\right) \tag{3}$$

where θ is the weight on producer profits in the decision-making process of the firm, and

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[2] When $c_s \le c_f$, no foreign private firm will be putted into production. Also see Huang, Lee and Chen (2006) for the extended specification.

[3] Public firm may have other different targets, such as maximizing the profit, income, employee's income or with management of license, etc. In order to compare with the literature, we assume that public firm will maximize social welfare, see De Fraja and Delbono (1989), Katsoulacos (1994), Fjell and Pal (1996), Pal and White (1998).

is given exogenously and values in the interval (0, 1). Following Matsumura (1998), the government can indirectly control θ through its shareholding. The fully private firm seeks the firm's profit if $\lambda = 1$; contrarily, a fully nationalized firm maximizes social welfare if $\lambda = 0$.

The government may choose an optimum tariff rate to maximize social welfare or tariff revenue (R), which are denoted by:

$$\underset{\{t\}}{Max.} \quad W$$

$$\underset{\{t\}}{Max.} \quad R = t\sum_{i=1}^{n} q_{fi} \tag{4}$$

3. Tariff Analysis

A backward induction method is used to solve the sub-game perfect Nash equilibrium. In the 2nd stage, we get the first-order derivatives from equations (1) and (3):

$$\frac{\partial \pi_{fi}}{\partial q_{fi}} = a - c_f - t - (1+n)q_{fi} - q_s = 0 \tag{5}$$

$$\frac{\partial S}{\partial q_s} = a - c_s - nq_{fi} - 2q_s + (1-\theta)(nq_{fi} + q_s) = 0 \tag{6}$$

The equilibrium quantities are obtained,

$$q_s^* = \frac{(1+n)(a-c_s) - n\theta(a-c_f-t)}{1+n+\theta} \tag{7}$$

$$q_{fi}^* = \frac{(a-c_f-t)(1+\theta) - (a-c_s)}{1+n+\theta} \tag{8}$$

From Eq. (8) we see that if $t \geq \hat{t} \equiv \frac{(a-c_f)(1+\theta) - (a-c_s)}{1+\theta}$, foreign firm's production is zero which means $\hat{t}$ is a prohibitive tariff rate. We take the partial derivative of Eqs. (7) and (8) with respect to t, respectively,

$$\frac{\partial q_s^*}{\partial t} = \frac{n\theta}{1+n+\theta} > 0, \quad \frac{\partial q_{fi}^*}{\partial t} = -\frac{1+\theta}{1+n+\theta} < 0 \tag{9}$$

$$\frac{\partial Q^*}{\partial t} = \frac{-n}{1+n+\theta} < 0 \tag{10}$$

A higher tariff rate will increase domestic production and domestic firm's profit. This is

profit shifting effect called by Brander and Spencer (1984). As mentioned above, government's goal is to choose an optimum t for maximizing social welfare or tariff revenue. In the 1st stage, the domestic government maximizes social welfare or tariff revenue. Solving the maximizing problem, Eq. (2) and (4) are differentiated with respect to t, respectively,

$$\frac{\partial W}{\partial t} = Q\left[\frac{\partial q_s}{\partial t} + n\frac{\partial q_{fi}}{\partial t}\right] + \left[q_s\frac{\partial P}{\partial t} + \left(P - c_s\right)\frac{\partial q_s}{\partial t}\right] + n\left[q_f + t\frac{\partial q_{fi}}{\partial t}\right] \tag{11}$$

$$\frac{\partial R}{\partial t} = n\left[q_{fi} + t\frac{\partial q_{fi}}{\partial t}\right] \tag{12}$$

Eq. (11) indicates the impact of tariff rate on domestic social welfare. It can be decomposed into three effects: firstly, *consumer-surplus effect* is negative, increasing tariff will decrease consumer surplus; secondly, *profit-shifting effect* is positive, domestic firm's profit is raised when tariff is increased. Higher tariff increases foreign firm's marginal cost which will make domestic firm more competitive, profit is shifted from foreign firm to domestic firm; thirdly, *tariff- revenue effect*, it could be either positive or negative. As is well known, the tariff revenue effect is zero when the government practices the maximum-revenue tariff policy. Nevertheless, under optimum-welfare tariff policy, the sign of Eq. (11) depends on the relative magnitudes of *consumer surplus effect* and *profit-shifting effect*. For example, if *consumer-surplus effect* plus *profit-shifting effect* is positive, and *tariff-revenue effect* is negative, then from Eq. (11), optimum-welfare tariff rate is higher than that of maximum-revenue tariff.

Substituting Eqs. (7) and (8) into (2) and (4), we then take the first-order derivative with respect to t, that gives the following optimum tariffs[4]:

$$t_W^* = \frac{\left(a - c_f + c_s\right)\left(1+\theta\right) - \left(a + c_f\theta\right) - \left(c_s - c_f\right)n\theta + \left(2a - c_f - c_s\right)\theta^2}{n + 2\left(1+\theta\right)^2} < \hat{t} \tag{13}$$

$$t_R^* = \frac{\left(a - c_f\right)\left(1+\theta\right) - \left(a - c_s\right)}{2\left(1+\theta\right)} \tag{14}$$

Eq. (14) represents the maximum-revenue tariff, $\frac{dt_R^*}{d\theta} > 0$ is monotone; that is, the maximum-revenue tariff will be higher with a higher degree of privatization. For tariff

[4] The second-order condition is always satisfied.

revenue-maximizing government, it needs to import more to satisfy the domestic demand when the privatized firm decreases output in response to higher degree of privatization, and that will enlarge the tariff-revenue effect.

Eq. (13) is the equivalent expression of optimum-welfare tariff in Eq. (15) of Chao and Yu's (2006) linear demand case. They argued that if the degree of privatization is higher, then domestic country will import more, and the optimum-welfare tariff will be higher. To see how privatization policy influences tariff decision-making, letting $\hat{\theta} \equiv \frac{\sqrt{1+2n}\sqrt{2a^2(2+n)-(4a-nc_f)(2c_s+nc_f)-2nc_sc_f(n-1)+[4+(n-2)n]c_s^2}-2a(1+n)+nc_f+(4+n)c_s}{6a-2nc_f+2(n-3)c_s}$, we get that $\theta \geq \hat{\theta}$, $\frac{dt_w^*}{d\theta} \geq 0$; if $\theta < \hat{\theta}$, then $\frac{dt_w^*}{d\theta} < 0$. When the government startup privatization, profit-inclined privatized firm will reduce its output, deteriorated the consumer-surplus effect, but enhanced both the profit-shifting effect and tariff-revenue effect, and accordingly, the government will need to lower tariff rate for securing social welfare. However, when the path of privatization accelerates, $\theta \geq \hat{\theta}$, privatized firm then lost its market-dominating position, and the government will need to raise welfare-optimum tariff rate for the purpose of protecting profit-inclined privatized firm.

Comparing these two tariff rates, we have

$$t_W^* - t_R^* = \frac{c_f n(1+\theta)(1+2\theta) - c_s[n+2\theta(n+\theta)(1+\theta)] + a\theta[2\theta(1+\theta)-n]}{2(1+\theta)[n+2(1+\theta)^2]} \tag{15}$$

Letting $\tilde{c}_s \equiv \frac{nc_f(1+\theta)(1+2\theta)+a\theta(2\theta(1+\theta)-n)}{2\theta^2(1+\theta)+n(1+2\theta(1+\theta))}$, we obtain that when $c_s < \tilde{c}_s$, $t_W^* > t_R^*$; otherwise, $t_W^* \leq t_R^*$.

Proposition 1: ***In an international mixed oligopoly with asymmetric costs and partial privatization, when the marginal cost of the privatized firm exceeds a critical value, maximum-revenue tariff is higher than optimum-welfare tariff. Otherwise, optimum-welfare tariff is higher than maximum-revenue tariff.***

Differentiating $\tilde{c}_s$ with respect to n and θ, we have

$$\frac{\partial \tilde{c}_s}{\partial n} = -\frac{2(a-c_f)\theta^2(1+\theta)^2(1+2\theta)}{\left(2\theta^2(1+\theta)+n(1+2\theta(1+\theta))\right)^2} < 0 \tag{16}$$

$$\frac{\partial \tilde{c}_s}{\partial \theta} = \frac{n(a-c_f)\left[4\theta(1+\theta)^3 + n(2\theta^2-1)\right]}{\left(2\theta^2(1+\theta)+n(1+2\theta(1+\theta))\right)^2} < 0 \text{ , if } \quad n > \frac{4\theta(1+\theta)^3}{1-2\theta^2} \tag{17}$$

From Eq. (16) , a negative relationship between c_s and n indicates that in a mixed oligopoly with partial privatization, the critical level of marginal cost makes the sum of consumer surplus effect and profit-shifting effect be positive but gradually decrease along with an increasing number of foreign private firms. That is to say, it is highly possible that the optimum-welfare tariff will be lower than the maximum-revenue tariff when the number of foreign firms increases, *ceteris paribus*. Accordingly, the possibility that the optimum-welfare tariff is greater than the optimum-revenue tariff may decline. Associating with the market-opening policy, the domestic government should accelerate privatization path and impose a lower welfare-optimum tariff rate.

4. Conclusion

Collie (1991) argued that when the marginal cost of domestic firm is higher than that of foreign firm under a pure Cournot duopoly market, the maximum-revenue tariff may be higher than the optimum-welfare tariff. This paper re-examined this important tariff ranking issue in mixed oligopoly with partial privatization and extended the optimal tariff finding of Chao-Yu (2006) and Van Long and Stähler (2009) in linear mixed oligopoly.

Two major findings of this paper are that: firstly, in a mixed oligopoly with partial privatization and asymmetric marginal costs, when the marginal cost of privatized firm is higher than a critical value, the optimum-welfare tariff will be higher than the maximum-revenue tariff; secondly, when the number of foreign firms increases, it is highly possible that the optimum-welfare tariff will be lower than the maximum-revenue tariff, *ceteris paribus*.

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