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On the revenue implications of trade liberalization under imperfect competition

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Abstract: In a recent paper Mujumder (2004, Economics Letters) argued that only if the industry is a monopoly, we could be certain that the government could use profit tax to make up any shortfall in tariff revenue and also make the consumers and producers better off. We show that this result is not robust when the products are differentiated. We find that there always exists degree of product differentiation such that the government can achieve this goal for any finite number of firms. So, the picture is not so dismal as shown by Mujumder.

Key Words: Imperfect competition, Product differentiation, Trade liberalization
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1. Introduction

One major concern of many developing economies is whether they can make up any shortfall in revenue due to the reduction in import duties (Keen and Ligthart, 2002). While there are some attempts to address this question in perfectly competitive market,[1] the literature did not pay much attention on imperfect competition. In a recent paper in this journal, Mujumder (2004) addressed this question in an imperfectly competitive market and argued that only where the industry in question is a monopoly, we can unequivocally assert that government can rely on profit tax to make up any shortfall in tariff revenue, while making both consumers and producers better off.

We revisit Mujumder (2004) and show that the result is not robust with respect to product differentiation. We find that, given any finite number of firms, there always exists degree of product differentiation such that government can make up any shortfall in tariff revenue and make both consumers and producers better off. Alternatively, there exists degree of product differentiation such that government can make up any shortfall in tariff revenue for any finite number of firms in the industry. Hence, unlike Mujumder (2004), we argue that it is more likely to advice the governments to reduce import duties.

Remainder of the paper is organized as follows. The next section develops a model similar to Mujumder (2004) with horizontal product differentiation and shows the results. Section 3 concludes.

[1] See the relevant references cited in Mujumder (2004).

2. The model and results

Consider a small open economy with an industry with n firms. We assume that the firms are symmetric. That is, they all have the same cost function and import a certain key input. We assume that one unit of output requires one unit of input. The cost of assembling each unit is assumed to be identical across firms and for simplicity, assumed to be zero.[2]

Let p^f denote the import price of the input. Since we consider a small open economy, this input price remains constant irrespective of the imports by the firms. There is an ad valorem tariff t imposed on each unit of input. Let q_i denote output of firm i, where $i = 1,2,...,n$. Therefore, total cost of the ith firm is $C_i = p^f(1+t)q_i$. For simplicity, we assume away any other costs of production.

Assume that the ith firm faces the inverse demand function as

$$P_i = a - q_i - \theta\sum_{j=1}^{n-1} q_j \,, \tag{1}$$

where $i = 1,2,...,n$ and $i \neq j$, and the notations have usual meanings.[3] The term θ shows the degree of product differentiation and lies between 0 and 1. While $\theta = 0$ implies isolated goods, $\theta = 1$ implies homogeneous products.[4] We assume that the firms compete like Cournot oligopolists in the product market.

The objective of the ith firm is to maximize the following objective function:

$$\underset{q_i}{Max}(1-T)[P_i - p^f(1+t)]q_i \,. \tag{2}$$

The optimal output of the ith firm, $i = 1,2,...,n$ is

[2] Needless to say, this assumption of zero cost of assembly does not affect our qualitative results.
[3] One may refer to Singh and Vives (1984) for this type of demand function.
[4] The case of $\theta = 1$ corresponds to Mujumder (2004).

$$q_i^c = \frac{a - p^f(1+t)}{2+\theta(n-1)}. \tag{3}$$

Optimal industry output is

$$nq_i^c = Q^c = \frac{n[a - p^f(1+t)]}{2+\theta(n-1)}. \tag{4}$$

Price charged by the i th firm is

$$P_i^c = \frac{a + [1+\theta(n-1)]p^f(1+t)}{2+\theta(n-1)}. \tag{5}$$

2.1 Effect of tariff reduction

Now, we see whether the government can rely on the profit tax to generate any shortfall of revenue due to tariff reduction. It is clear from (3) and (5) that tariff reduction increases output of each firm and reduces price of each product, and, therefore, makes the consumers better off. Hence, the government can confine its attention only on its revenue and industry profit.

Hence, the government's objective is to satisfy, (i) total revenue in the post-liberalization is equal to its pre-liberalization level, and (ii) the industry's after-tax profit in the post-liberalization is greater than its pre-liberalization level. Due to symmetry, the requirement (ii) implies that each producer has higher after-tax profit under post-liberalization compared to pre-liberalization.

Formally, the government needs to satisfy:

$$T_A\pi_A^p + t_A p^f Q_A^c = T_B\pi_B^p + t_B p^f Q_B^c \tag{6}$$

and

$$(1-T_A)\pi_A^p > (1-T_B)\pi_B^p, \tag{7}$$

where the subscript A (B) is attached to a variable to denote its post-liberalization (pre-liberalization) state and π^p denotes the industry's equilibrium pre-tax profit. Tariff reduction implies $t_A < t_B$.

We get from (6) and (7) that

$$\pi_A^p - \pi_B^p > t_B p^f Q_B^c - t_A p^f Q_A^c. \tag{8}$$

It is easy to check that each firm's and therefore, industry's pre-tax profit rises with tariff reduction, i.e., $\pi_A^p > \pi_B^p$.

The tariff reduction reduces tariff revenue if

$$a > p^f (1 + t_A + t_B). \tag{9}$$

We assume that condition (9) holds. Note that if (9) is satisfied, it ensures that the ith firm, $i = 1,2,...,n$ produces in the market (see (4)).

In case of tariff reduction, if the increase in the industry's pre-tax profit is greater than the shortfall in tariff revenue, the government can set up a profit tax in a way to make up the shortfall in its revenue. Due to symmetry of the firms, we can write (8) as

$$[P_A^c - p^f (1 + t_A)]Q_A^c - [P_B^c - p^f (1 + t_B)]Q_B^c > t_B p^f Q_B^c - t_A p^f Q_A^c \tag{10}$$

or

$$\frac{Q_A^c}{Q_B^c} > \frac{P_B^c - p^f}{P_A^c - p^f}, \tag{11}$$

where P^c shows the equilibrium market price. Note that symmetry of the firms implies that each firm charges the same equilibrium market price, which is denoted by P^c. Further, it is easy to check that $P_A^c > p^f$ and $P_B^c > p^f$.

Using (4) and (5), we get (11) as

$$\frac{a - p^f(1+t_A)}{a - p^f(1+t_B)} > \frac{a - p^f + (1-\theta(n-1))p^f t_B}{a - p^f + (1-\theta(n-1))p^f t_A} \tag{12}$$

or

$$a\theta(n-1)t_A - p^f t_A[\theta(n-1) + (1+\theta(n-1))t_A] > a\theta(n-1)t_B - p^f t_B[\theta(n-1) + (1+\theta(n-1))t_B]$$

or

$$\theta < \frac{p^f(t_A + t_B)}{(n-1)[a - p^f(1+t_A+t_B)]} \equiv \theta^*. \tag{13}$$

If $\theta = 1$, expression (12) reduces to the case considered in Mujumder (2004). Note that $\theta^* > 0$ for any finite number of firms [as $[a - p^f(1+t_A+t_B)] > 0$ from (9)].[5] This implies that, given any finite number of firms, the government can achieve its objective when the products are sufficiently differentiated. As the number of firms increases, it reduces θ^*, and, therefore, it reduces the likelihood that the government can achieve its objective. However, since $\theta^* > 0$, it implies that there always exists degree of product differentiation such that the government can achieve this goal for any finite number of firms.

The following proposition summarizes the above discussion.

Proposition 1: *(i) For any given finite number of firms, there always exists degree of product differentiation such that the government can always find a profit tax to achieve the objective.*

(ii) As the number of firms increases, it reduces the likelihood that the government can always find a profit tax to achieve the objective.

[5] However, $\theta^* \underset{>}{\overset{\leq}{}} 1$ as $(a - p^f) \underset{>}{\overset{\leq}{}} n[a - p^f(1+t_A+t_B)]$

The reason for the above finding is easy to understand. When tariff reduces, it reduces the cost of production for the final goods and increases profit of the final goods producers. However, competition between the final goods producers not necessarily increase industry profits sufficiently to make up for any shortfall in tariff revenue. If the products are getting differentiated, this effect of competition reduces and increases industry profit. For sufficiently large product differentiation, the effect of competition is dominated by the effect of tariff reduction and, so, the government can achieve its objective.

3. Conclusion

In a recent paper Mujumder (2004) argued that only if the industry is monopoly, we could be certain that the government could use profit tax to make up for any shortfall in tariff revenue and also make consumers and producers better off. We show that this result is not robust with respect to product differentiation. If products are differentiated, we find that the government can always achieve this goal for any finite number of firms in the industry. So, in industries with imperfect substitutes, it is more advisable to reduce tariff on the imported inputs.

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