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Economics Letters 88 (2005) 27–31

economics letters

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On the revenue implications of trade liberalization under imperfect competition

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Received 22 March 2004; received in revised form 8 November 2004; accepted 20 December 2004

Abstract

In a recent paper Mujumder [Mujumder, S., 2004, Revenue implications of trade liberalization under imperfect competition, Economics Letters, 82: 83-89] 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.

Keywords: Imperfect competition; Product differentiation; Trade liberalization

JEL classification: F12; H20

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 Lighthart, 2002). While there are some attempts

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doi:10.1016/j.econlet.2004.12.023

to address this question in a perfectly competitive market,[1] the literature did not pay much attention to 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 a degree of product differentiation such that the government can make up any shortfall in tariff revenue and make both consumers and producers better off. Alternatively, there exists a degree of product differentiation such that the 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 advise the governments to reduce import duties.

The 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.

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 $i=1,2,\ldots,n$. 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 $i=1,2,\ldots,n$ 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:

$$\max_{q_i} (1-T)\left[P_i - p^f(1+t)\right]q_i. \tag{2}$$

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

[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).

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

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

Optimal industry output is

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

Price charged by the ith 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 Eqs. (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 to 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 Eqs. (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 (Eq. (9)) holds. Note that if Eq. (9) is satisfied, it ensures that the ith firm, $i=1,2,\ldots,n$, produces in the market (see Eq. (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 Eq. (8) as

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

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 Eqs. (4) and (5), we get Eq. (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 (Eq. (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 Eq. (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 a 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 a 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.

Proposition 1(i) is in contrast to Mujumder (2004) and shows that product differentiation introduces a bias in favor of profit taxes relative to tariffs as a source of revenues. The reason for the above finding is easy to understand. When the tariff rate reduces, it reduces tariff revenue on one hand, and, on the other hand, it increases profit by reducing the cost of production of the final goods. The higher profit along

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

with the higher profit tax rate increases the profit tax revenue. If the product differentiation is maximal, each of the n firms is monopolist for its products. Hence, in this situation, the result of Mujumder (2004) holds for each of the n monopolists and the higher profit tax revenue can compensate the loss of tariff revenue. Since outputs and profits are continuous with respect to the degree of product differentiation, each firm becomes a near monopolist for its products when the products are sufficiently differentiated. Hence, following Mujumder (2004), the government can use the higher profit tax revenue to compensate the loss of tariff revenue for sufficiently higher degree of product differentiation. But, if the products are not very much differentiated, the higher competition between the final goods producers does not increase their profits significantly following a tariff rate reduction. In this situation, profit tax revenue may not be high enough to compensate the loss of tariff revenue.

The above argument immediately implies that our results are not due to particular demand function considered in this paper. For *any* demand function, as long as the products are very much differentiated, each producer becomes monopolist for its products and, following Mujumder (2004), higher profit tax can compensate the loss of tariff revenue. But, competition between the producers increases as the products become more substitutes and, in this situation, it is ambiguous whether higher profit tax will be enough to compensate the loss of tariff revenue.

Proposition 1(ii) follows from the negative relationship between n and θ^* (see Eq. (13)). As n increases, it increases competition between the final goods producers. Hence, higher product differentiation is required to increase profit significantly so that enough profit tax can be generated to compensate the loss of tariff revenue. So, for a given degree of product differentiation, an increase in n reduces the likelihood that higher profit tax compensates the loss of tariff revenue following the tariff rate reduction.

3. Conclusion

In a recent paper Mujumder (2004) argued that only if the industry is a 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.

Acknowledgements

We would like to thank an anonymous referee of this journal for helpful comments and suggestions. The usual disclaimer applies.

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