TRADE LIBERALIZATION AND TAXATION IN OLIGOPOLISTIC INDUSTRIES

Sudesh Mujumdar, University of Southern Indiana, smujumda@usi.edu

ABSTRACT

For many developing countries, import tariffs constitute an important source of revenue and consequently the reductions in tariffs negotiated at the recently concluded Uruguay Round would certainly be a matter of concern to them.

The extent to which a reduction in the tariff that applies to the product of a particular industry is passed on to consumers in the form of a lower price depends on the degree of elasticity of demand for the product and on how competitive the industry is (or on its oligopolistic character). As maintained by Cheasty (1990), if an industry is highly oligopolistic and if demand is relatively inelastic then producers will pass on only a small percentage of the tariff reduction to consumers and make windfall profits. Thus in such an industry imports will get suppressed and the tariff revenues will likely fall.

One way of shoring up the revenues that are collected from these industries is to raise their profit tax rate. The primary question we address in this paper is as follows: Is it possible to raise the profit tax rate to the extent that the revenues collected do not fall and consumers as well as producers are better off in comparison to their respective pre-tariff reduction states? We show that this attainable for some range of parameter values.

INTRODUCTION

In the recently concluded Uruguay Round, countries negotiated tariff reductions with respect to a number of industries. For developing economies, who have historically relied on import tariffs as an important source of revenue and who are under considerable pressure to raise a certain amount of revenue from indirect taxation, the revenue implications of such reductions can be quite serious.

Consider an industry which utilizes an imported input in the manufacture of its product. Further, suppose that the tariff that applies to the import of this input has been reduced. Now, whether or not the total import duty emanating from this industry will shrink would depend on the extent to which its output increases following the tariff reduction. The degree of expansion in output, in turn, depends on how competitive the industry in question is and on the elasticity of demand for its product. If the industry is highly oligopolistically organized and if demand is relatively inelastic then producers are in a position to restrict output expansion and pass on only a small percentage of the tariff reduction to consumers in the form of a lower price. Hence, in such a case, tariff revenue will in all likelihood fall (Cheasty, 1990).

One way of compensating for this short-fall in revenue is for the government to raise the profit tax rate on such an industry. Alternatively, if there are numerous exemptions that apply to the taxation of profit then the government could eliminate them or reduce their number. The question we seek to address in this paper is as follows: Is it possible to raise the profit tax rate to the extent that there is no shortfall in the total revenue collected from the industry and that consumers and producers are better off in comparison to their respective pre-tariff reduction states? The reason for ensuring that both consumers and producers are better off is that it enhances the political feasibility of the government's action. A full fledged examination of the political feasibility of the various revenue raising instruments at the government's disposal is, however, beyond the scope of this study.

It is worth noting here that there have been attempts at analyzing the effects of trade liberalization in oligopolistic settings (e.g., Buffie and Spiller, 1986; Eldor and Levin, 1990). However, these endeavors have not been concerned with the revenue implications of trade liberalization.

In order to address the concern of this paper we first develop a model that reflects the underlying context of our study. This is done in section 2. In section 3 we show how our model captures the different dimensions of Cheasty's contention. Section 4 comes up with an example of a profit tax rate that accomplishes the task described in the question above and section 5 offers some concluding remarks.

THE MODEL

Consider an industry with N firms. For simplicity we assume that these firms are identical. That is, they all have the same cost function. All firms import a certain key input. To keep things simple we assume that production technology is of the 'screw-driver' type and that each firm sells its entire output in the domestic market. Let us explain this 'business conduct' of a firm with an example. Suppose the industry in question in the personal computer industry. Each firm in this industry imports 'computer kits', assembles them into computers and sells these computers in the domestic market.

Let P^f denote the import price of the 'input kit'. We assume that the firms are price takers with respect to this import price and changes in the total quantity demanded of the input kits by the concerned industry does not affect P^f (this is akin to the familiar small, open economy assumption). The tariff (ad valorem) that applies to the import of an 'input kit' is given by t. The cost of assembling each unit is assumed to be identical across firms and is equal to c. Let q_i denote the output of some firm i where $i = 1,...,N$. We can now describe the total cost function of firm i as $C_i = [P^f(1+t)+c]q_i$. The aggregate demand for the industry's product is represented by the inverse demand function; $P = a - bQ$, where $Q = \sum_{i=1}^{N} q_i$ is the total industry output. Firm profit is taxed at the rate T and the objective of a firm is assumed to the maximization of its after-tax profit. Lastly, firms compete in quantities.

Without loss of generality consider the profit maximization problem of firm 1.

$$\text{Max}_{q_1} \quad \pi_1 = (1-T)\{Pq_1 - [c + P^f(1+t)]q_1\}$$

The first order condition is given by:

$$(1) \quad a - b\sum_{i=2}^{N} q_i - 2bq_1 - c - (1+t)P^f = 0$$

$$(2) \quad \Rightarrow \quad q_1 = \frac{a - c - (1+t)P^f}{2b} - \frac{1}{2}\sum_{i=2}^{N} q_i$$

Now, (2) represents the reaction function of firm 1. Using the symmetry condition we can derive the Cournot-Nash equilibrium output level of any firm i as

$$(3) \quad q^c = \frac{a - c - P^f(1+t)}{(N+1)b}$$

EFFECTS OF A TARIFF REDUCTION ON TOTAL OUTPUT, PRICE, TARIFF REVENUE, AND FIRM PROFIT

Proposition 1: *A reduction in the tariff rate results in an increase in industry output and consequently in a decrease in the price of the industry's product.*

Proof: Total industry output is given by:

$$Q^c = Nq^c = \left(\frac{N}{N+1}\right)\left[\frac{a - c - P^f(1+t)}{b}\right].$$

Let us differentiate Q^c with respect to t.

$$\frac{\partial Q^c}{\partial t} = -\left(\frac{N}{N+1}\right)\frac{P^f}{b} < 0$$

Q.E.D

Proposition 2: *Ceteris paribus, the less competitive the industry (that is, the smaller the number of firms) the smaller is the increase in output from a given reduction in the tariff rate.*

This is easily discerned from the above expression of the derivative of total output with respect to the tariff rate.

Proposition 3: *Ceteris paribus, the more inelastic market demand is, the smaller is the increase in output for a given reduction in the tariff rate.*

Examining the expression for the derivative of total output with respect to the tariff rate we find that (ceteris paribus) the higher the value of b, implying a steeper demand curve and hence a more inelastic market demand, the smaller is the increase in total output for a given reduction in the tariff rate.

We can use the above two propositions to show how our model reproduces Cheasty's story. Consider the expression for tariff revenue; $tP^f Q^c$. Now, combining

propositions 2 and 3 we can say that the less competitive an industry is (or the more oligopolistically organized it is) and the more inelastic market demand is, the smaller will be the increase in total output for a given reduction in the tariff rate and consequently it is more likely, as we can see from the above expression for tariff revenue, that tariff revenue will fall.

How will a firm's after-tax profit change with a reduction in the tariff rate? This is addressed by the following proposition.

Proposition 4: *A firm's after-tax profit will rise with a reduction in the tariff rate.*

Proof: Without loss of generality, consider the expression for firm 1's after tax profit:

$$\pi_1 = (1-T)\{P^c q_1^c - [P^f(1+t)+c]q_1^c\},$$ where

P^c is the market price that corresponds to the quantity Q^c.

Now,

$$\frac{\partial \pi_1}{\partial t} = (1-T)\left\{P^c \frac{\partial q_1^c}{\partial t} + q_1^c \frac{\partial P^c}{\partial t} - c\frac{\partial q_1^c}{\partial t}\right.$$

$$\left. - P^f(1+t)\frac{\partial q_1^c}{\partial t} - q_1 P^f\right\} = -(1-T)P^f q_1^c \frac{2}{N+1} < 0$$

Q.E.D

THE PROFIT TAX RATE AND INDUSTRY REVENUE

In this section we construct an example to show how raising the profit tax rate can make up for any shortfall in the total revenue collected from the industry and yet leave consumers and producers better off in comparison to their respective pre-tariff reduction states. Before we present the example we need to fix some notation. Let the superscript b denote 'before liberalization' (that is, before the tariff reduction) and the superscript a denote 'after liberalization'. Further, let Z_i represent the before-tax profit of firm i.

We are looking for a profit tax rate, T^a, such that

(i) $$T^b \sum_{i=1}^{N} Z_i^b + t^b P^f Q^{c(b)} = T^a \sum_{i=1}^{N} Z_i^a + t^a P^f Q^{c(a)}$$

(ii) $$\sum_{i=1}^{N} \pi_i^a > \sum_{i=1}^{N} \pi_i^b$$

(iii) $$\int_0^{Q^{C(a)}} P(x)dx - P^{c(a)}Q^{c(a)} >$$
$$\int_0^{Q^{C(b)}} P(x)dx - P^{c(b)}Q^{c(b)}$$

Now, (i) simply states that the contribution of the industry to government revenue, in terms of profit tax revenue and tariff revenue, before liberalization is equal to its contribution after liberalization. What (ii) states is that the industry's after-tax profit or producer surplus after liberalization is greater than the after-tax profit or producer surplus prior to liberalization. Finally, (iii) indicates that consumer surplus after liberalization is greater in comparison to that before liberalization.

It is easily seen that raising the profit tax rate will not alter Q^c. Consequently, following the increase in the profit tax rate, consumer surplus in the post-liberalization period will continue to be larger than that in the pre-liberalization period. Our concern then is with only (i) and (ii). We are now in a position to set up our numerical example.

Let $$N = 2, P^f = 1000, a = 4400, b = 1, t^b = 1.5,$$
$$c = 100, T^b = 0.3, t^a = 0.75, T^a = 0.52$$

Note that we have chosen our parameters in such a way that tariff revenue will fall with a tariff reduction.

Before Liberalization:
We can calculate that tariff revenue will be 1,800,000 and that profit tax revenue will be 216,000. Further, after-tax total industry profit or producer surplus will be 504,000.

After Liberalization:
Now tariff revenue will be 1,275,000 and profit tax revenue will be 751,400. Also, after-tax total industry profit or producer surplus will be 693,600.

Note that the combined revenue (from the tariff and the profit tax) and producer surplus are higher following the tariff reduction.

CONCLUDING REMARKS

We will not summarize the paper here but instead offer some thoughts on further work that this paper may benefit from and on possible extensions.

The parameter space over which our results hold needs to be clearly delineated. We also need to check if our results are robust to alternative specifications of the demand and cost functions.

One possible extension is to work with a general social welfare function for the government – one that allows for different weights on consumer and producer surplus. Such a welfare function will make it possible to examine the government's choice between alternative revenue raising instruments – for example – its choice between raising the profit tax rate or the sales tax rate.[1] It may be the case that for a certain range of weights on consumer and producer surplus, the government might end up choosing the more distortionary sales tax instrument.

REFERENCES

Buffie, Edward and Spiller, Pablo (1986). 'Trade Liberalization in Oligopolistic Industries.' *Journal of International Economics*, vol. 20, pp. 65-81.

Cheasty, Adrienne (1990). 'The Fiscal Implications of Reducing Trade Taxes.' *Finance and Development*, pp. 37-39.

Eldor, Rafael and Levin, Dan (1990). 'Trade Liberalization and Domestic Monopoly: A Welfare Analysis.' *International Economic Review*, vol. 31, pp. 773-782.

---

[1] In our model we had just one tax instrument. Had we made room for the sales tax instrument it would be still be efficient to use the profit tax since it less distortionary.