Trade Patterns in an International Mixed Oligopoly

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Abstract

Developing a two-country model of international mixed oligopoly, this note makes clear the determinant of trade patterns. We give a simple formula to predict bilateral patterns of trade which relates the degree of a country's privatization and the trading country's competitiveness. If a semi-public firm is not sufficiently privatized in a country, this country exports the non-competitive good.

Citation: Fujiwara, Kenji, (2006) "Trade Patterns in an International Mixed Oligopoly." *Economics Bulletin*, Vol. 6, No. 9 pp. 1-7
Submitted: July 28, 2006. **Accepted:** September 1, 2006.
URL: http://economicsbulletin.vanderbilt.edu/2006/volume6/EB-06F10016A.pdf

1 Introduction

Along recent movements of multilateral and regional trade liberalization, privatization of public firms has also been an important policy debate. It is commonly recognized that privatizing public firms improves efficiency and welfare in an economy and hence is regarded as one of the strong policy instruments. Indeed, privatization of public firms has been in place around the world such as in China and Japan.

Given these observations and facts, there has been an accumulating literature on the welfare analysis of privatization. The basic framework to do it is a model of mixed oligopoly in which a public firm competes with several private firms. In a seminal work, Matsumura (1998) and Matsumura and Kanda (2005) construct a model of mixed oligopoly within which the public firm maximizes a weighted sum of social welfare and profits, whereas private firms behave as a profit maximizer. Thus, an increase in the weight on the public firm's profit is regarded as privatization. Mastsumura's (1998) contribution lies in his conclusion that neither full privatization nor full nationalization is the best policy, i.e., only *partial* privatization achieves social optimum.

Matsumura's (1998) model has recently been applied to incorporate foreign competitors by a few papers.[1] Chang (2005) and Chao and Yu (2006) extend the Matsumura model to a segmented market model of international trade and compute the optimum tariff in the presence of privatization. These extensions are rather natural in view of a large literature on optimal trade policies under oligopoly.

On the other hand, this paper constructs a two-country model of international oligopoly to consider a positive aspect. In particular, we confine our interest to the determination of trade patterns in an international oligopoly in which one public firm in a country competes with private firms in the trading country. We shall demonstrate that the relative degree of privatization to the number of foreign firms plays a decisive role.

The distinction between our model and that of Chang (2005) and Chao and Yu (2006) is now briefly made clear. First, while they assume that the home country's market is segmented from the foreign market, they are completely integrated in our treatment. Second, the above predecessors ignore the possibility of free entry among the private firms. On the contrary, taking into account that free entry and exit make any private firm's profit zero, we seek the direction of bilateral trade.

The rest of the paper is organized as follows. Section 2 sets out a basic model of international mixed oligopoly and describes the world equilibrium. Section 3 makes use of this model to determine the short-run trade pattern such that all firms earn positive profits. Then, allowing for the long-run equilibrium with free entry among private firms, Section 4 further explores the determinant of trade. Section 5 concludes the paper.

[1]Pal and White (1998) also develop a model of international mixed oligopoly, but they allow for no possibility of partial privatization.

2 A Model

The model employed is a simple two-country oligopolistic model of international trade. Two countries, Home and Foreign, are engaging in free trade and share the identical preference. In what follows, all Foreign variables are distinguished by attaching an asterisk (*) to them. Both countries produce two goods, an oligopolized good and a competitive good, which serves as a numeraire. Both goods are produced from only one primary factor, labor, which is fully employed and in inelastic supply. Without loss of generality, one unit of labor produces the same unit of numeraire, from which the wage rate is internationally equalized and fixed to unity.

On the other hand, the production of oligopolized good is subject to increasing returns. Concretely, its cost function is specified by

$$cx + f, \quad c > 0, \quad f > 0,$$

where x is the output of non-competitive good. That is, the cost for producing x units of non-competitive good requires cx units of variable input and f units of fixed input. This technology is shared by all oligopolistic firms irrespective its location.

Let us turn to the specification of the demand side. Each country's representative consumer has the following utility function:

$$u = aq - \frac{q^2}{2} + z, \quad a > 0, \tag{1}$$

where u is the utility level, q the consumption of oligopolized good, and z that of numeraire. Due to the quasi-linearity of preference, utility maximization subject to the budget constraint yields the demand function of non-competitive good as:

$$q = a - p.$$

Exactly the same argument applies to the Foreign consumer. Thus, assuming that there is one public firm in Home and $n^* \geq 2$ private firms in Foreign, the world market-clearing condition under free trade becomes

$$q + q^* = 2(a - p) = x + \sum x_j^*,$$

where the summation in Foreign is taken in the closed interval $[1, n^*]$. Inverting this condition, the inverse demand function in the integrated world market is obtained as

$$p = a - \frac{x + \sum x_j^*}{2}. \tag{2}$$

Making use of the above preliminary results, each country's consumer surplus is computed as a function of total supply:

$$\begin{aligned} CS &\equiv aq - \frac{q^2}{2} - pq \\ &= \frac{1}{8}\left(x + \sum x_j^*\right)^2. \end{aligned} \tag{3}$$

And each firm's profit is now defined as follows.

$$\pi \equiv \left(a - c - \frac{x + \sum x_j^*}{2}\right) x - f \tag{4}$$

$$\pi_i^* \equiv \left(a - c - \frac{x + \sum x_j^*}{2}\right) x_i^* - f. \tag{5}$$

Following Matsumura (1998) and Matsumura and Kanda (2005), the Home public firm is presumed to maximize the weighted sum of profit and domestic welfare. This implies that the public firm seeks to maximize

$$\begin{aligned} & \theta\pi + (1-\theta)(CS + \pi) \\ = \; & \pi + (1-\theta)CS, \quad \theta \in [0, 1], \end{aligned} \tag{6}$$

where $\theta = 1$ (resp. $\theta = 0$) means full privatization (resp. nationalization) of the public firm.

Invoking that all the Foreign firms maximize profits by choosing its output, each firm's first-order condition for objective maximization is derived as

$$a - c - \frac{\theta + 3}{4}x - \frac{\theta + 1}{4}x^* = 0 \tag{7}$$

$$a - c - \frac{1}{2}x - \frac{n^* + 1}{2}x^* = 0. \tag{8}$$

This completes the introduction of the basic setup.

3 Short-Run Trade Patterns

On the basis of the previous section's model, we are ready to establish the trade pattern proposition. First of all, we pay attention to the short-run equilibrium such that neither entry nor exit in the oligopolsitic industry is prohibited. Then, the Nash equilibrium outputs are obtained from (7) and (8):

$$x^N = \frac{2[n^*(1-\theta) + 2](a - c)}{2(n^* + 1) + \theta + 1} \tag{9}$$

$$x^{*N} = \frac{2(\theta + 1)(a - c)}{2(n^* + 1) + \theta + 1}. \tag{10}$$

Since the quasi-linear preference has been assumed, Home exports the non-competitive good if and only if its aggregate output exceeds Foreign's aggregate output, i.e., $x > n^*x^*$. Combining this condition with (9) and (10), we have now established the first main proposition:

Proposition 1. *Suppose neither entry nor exit in the oligopolistic market. Then, Home exports the non-competitive good if and only if* $\theta < 1/n^*$.

Proof. As mentioned earlier, Home becomes an exporter of the oligopolistic good if and only if $x > n^* x^*$. Substituting (9) and (10) into this inequality and rearranging, one can obtain

$$n^*(1-\theta) + 2 > n^*(1-\theta),$$

which immediately yields $\theta < 1/n^*$. **Q. E. D.**

Proposition 1 may give a very useful criterion for predicting the trade pattern. Only a simple comparison between the degree of privatization in Home and the competitiveness, i.e., the inverse of the number of private firms, in Foreign enables us to see the trade pattern. According to it, Home tends to export the oligopolized good either if Home's public firm is insufficiently privatized or if Foreign's competitiveness measured by $1/n^*$ is not so strong, or both hold.

4 Long-Run Trade Patterns

In the foregoing section, we have focused on the short-run equilibrium in which all oligopolistic firms earn positive profits due to no entry into the oligopolistic sector. However, it is no wonder that at least any private firm earns zero profit in the long-run since free entry makes each private firm's profit driven to zero.[2] This section is devoted to describing such a long-run outcome and deriving the trade pattern there.

To this end, let us calculate the equilibrium profit of each private firm. Summing up (9) and (10), the world supply of non-competitive good is

$$n + n^* x^* = \frac{4(n^*+1)(a-c)}{2(n^*+1)+\theta+1}. \tag{11}$$

Substituting (11) into the definition of the Foreign firm's profit (5) yields its equilibrium profit:

$$\begin{aligned} \pi^* &= \left[a - c - \frac{2(n^*+1)(a-c)}{2(n^*+1)+\theta+1}\right] \frac{2(\theta+1)(a-c)}{2(n^*+1)+\theta+1} - f \\ &= 2\left[\frac{(\theta+1)(a-c)}{2(n^*+1)+\theta+1}\right]^2 - f. \end{aligned} \tag{12}$$

[2]Matsumura and Kanda (2005) also characterizes such a long-run equilibrium in a closed economy context.

Setting (12) to zero and solving for n^*, the free entry number of private firms is explicitly derived as

$$n^* = \frac{(\theta+1)\left[(a-c)\sqrt{\frac{2}{f}}-1\right]-2}{2}. \tag{13}$$

With the help of the information so far, we can establish:

Proposition 2. *Suppose free entry in Foreign's oligopolistic industry such that any Foreign firm's profit is driven to zero. Then, the necessary and sufficient condition for Home to export the non-competitive good is*

$$\theta < \frac{2}{(a-c)\sqrt{\frac{2}{f}}-1} \tag{14}$$

Proof. Our starting point is the condition of $\theta < 1/n^*$ or equivalently $\theta n^* < 1$ in order for Home to export the oligopolized good. Substituting (13) into this condition, we have

$$n^*\theta = \frac{\theta(\theta+1)\left[(a-c)\sqrt{\frac{2}{f}}-1\right]-2\theta}{2} < 1,$$

which is simplified to (14). **Q. E. D.**

The above proposition sheds light on the importance of increasing returns for the determination of trade patterns. To understand this, suppose that $f = 2(a-c)^2$. Then, the right-hand side in (14) diverges to infinity and hence Home necessarily exports the oligopolized good. Proposition 2 also provides a simple formula to determine the trade pattern since all we need to do is the comparison between the degree of privatization (θ) and the index which can be easily calculated by substituting the level of fixed costs (f).

5 Concluding remarks

The purpose of this paper has been to apply a model of international mixed oligopoly to a positive aspect of international trade with particular attention to trade patterns. Assuming no cost asymmetries between countries, the interaction between the degree of privatization in Home and the number of firms, i.e., competitiveness, in Foreign has played a key role.

Proposition 1 gives a simple criterion for determining trade patterns. If Home's degree of privatization is less than the inverse of the number of firms in Foreign, Home exports the oligopolized good and imports the numeraire good. While Proposition 1 rests on the assumption of the fixed number of firms, Proposition 2 relaxes it and reconsiders the determinant of trade patterns in a free entry equilibrium. If the fixed cost is sufficiently large, i.e., under large economies of scale, Home is likely to export the non-competitive good. These results well fit into some reality of modern trade between the developed and developing countries such as the United States and China.

We now give a possible direction of future research. As mentioned above, we allow for no cost heterogeneity between countries, which seems unacceptable in view of the modern world economy. Thus, it is needed to incorporate such a asymmetric cost into the present model and reformulate an oligopolistic Ricardian model to evaluate the trade patterns in terms of technology.

References

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