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A COMMENT ON "LABOR-MANAGED AND CAPITALISTIC FIRMS IN INTERNATIONAL DUOPOLY: THE EFFECTS OF EXPORT SUBSIDY"

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Abstract: The present note recasts the analysis of Okuguchi (1991) by examining the key assumptions of his model and allowing for a linear or constant elasticity demand function of the labor managed firm. This note demonstrates that the reaction function of the labor managed firm is upward sloping and explains the Mai and Hwang's (1989) results intutively by adoping reaction-function analysis.

Journal of Economic Literature Classification Numbers: F12, L13, L21.

1. INTRODUCTION

Mai and Hwang (1989) formulate an international duopoly model in which two different firms compete a la Cournot, that is, one firm maximizes its profit (the capitalistic firm) and the other firm maximizes its per worker profit (the labor-managed firm). Their model is the same as those of the Brander and Spencer (1984a), (1984b), (1985), except for the asymmetry in objectives of duopolists. They establish that a subsidy on exports of the labor-managed firm decreases its own export and increases the rival's export. This finding contrasts the Brander and Spencer result that the export subsidy increases its own export and decreases the rival's export.

Okuguchi (1991) introduces product differentiation into the Mai and Hwang's model and examines the Cournot and Bertrand equilibrium. His assumptions play a crucial role in determining the properties of Jacobian matrix at the

equilibrium and effects of government's subsidy. See conditions (8–1), (8–2), (8–3), (8–4), and (8–5) in his paper. He claims that the reaction functions of the both firms are downward sloping.

The purpose of this comment is twofold: first, to show Okuguchi's assumptions eliminate the possibility that the demand function of the labor-managed firm is linear or constant-elastic: Second to modify his assumptions in order to allow for linear and constant elasticity demand functions and to prove that the reaction function of the labor-managed firm is upward sloping, while that of the capitalistic firm is downward sloping. We then establish propositions 2 and 3 of Mai and Hwang intuitively by using these reaction functions.

2. THE MODEL AND THE ANALYSIS

We briefly restate Okuguchi's model. His model is an international duopoly in which a labor-managed firm (LMF) and a capitalist profit-maximizing firm (PMF) coexist. The LMF (PMF) operates in a domestic (foreign) country and exports its product to a third country. The production function of the LMF (PMF), f, (f^*) exhibits a diminishing returns to scale, that is,

$$q=f(l), \quad f'(\cdot)>0, \quad f''(\cdot)<0,$$
$$q^*=f^*(l^*), \quad f^{*'}(\cdot)>0, \quad f^{*''}(\cdot)<0, \tag{1}$$

where $q(q^*)$ is the output of the LMF (PMF), and $l(l^*)$ is the labor employed by the LMF (PMF). These products are differenciated, then each firm faces a different inverse demand function,

$$p=p(q,q^*), \quad p_i(\cdot)<0, i=1,2,$$
$$p^*=p^*(q,q^*), \quad p_i^*(\cdot)<0, \quad i=1,2, \tag{2}$$

where $p(p^*)$ is the price of the good of LMF (PMF), and subscript denotes the partial differentiation. $p_2(\cdot)<0$ and $p_1^*(\cdot)<0$ imply that the two products are substitutes. The objective of the LMF (PMF), $V(V^*)$ is

$$V(l,l^*)=\frac{\pi}{l}=\{p(f(l), f^*(l^*))f(l)-wl-k+sf(l)\}/l \tag{3}$$

$$V^*(l,l^*)=p^*(f(l), f^*(l^*))f^*(l^*)-w^*l^*-k^*, \tag{4}$$

where π is the profit of the LMF, $w(w^*)$ shows the wage rate in the domestic (foreign) country, s is the domestic export subsidy rate and $k(k^*)$ denotes the fixed cost.

The Cournot equilibrium is characterized as follows:

$$\pi_1(l,l^*)l-\pi(l,l^*)=0, \tag{5}$$

$$(p_2^*q^*+p^*)f^{*'}-w^*=0. \tag{6}$$

The Jacobian matrix of (5), (6), J, is given by

$$J = \begin{bmatrix} V_{11} & V_{12} \\ V_{21}^* & V_{22}^* \end{bmatrix}.$$

We assume the following:

ASSUMPTION 1.

$$p_{21}^* q^* + p_1^* < 0 .$$

Under this assumption, V_{21}^* is negative because $V_{21}^* = (p_{21}^* q^* + p_1^*) f' f^{*'}$.

ASSUMPTION 2.

$$2p_1 + q p_{11} < 0 , \qquad 2p_2^* + q^* p_{22}^* < 0 .$$

The two assumptions imply that V_{11} and V_{22}^* are negative. Let's examine V_{12}^*.

$$V_{12} = l \cdot f^{*'} \left[p_{12} f f' + p_2 \left(f' - \frac{f}{l} \right) \right] .$$

ASSUMPTION 3.

$$p_{12}(\cdot) \geq 0 .$$

When both firms produce a homogeneous good, this assumption means that the inverse demand function is convex. Both linear and the constant elasticity demand function satisfy Assumption 3. Since we assume that $p_2 < 0$ and f exhibits a diminishing returns to scale, V_{12} is positive under Assumption 3. Okuguchi, however, assumes $V_{12} < 0$. (See (8–2) in his paper). His assumption is not satisfied when the demand function of LMF is linear or constant elastic. Considering these demand functions are popular in this literature, we think that our assumption is more plausible than Okuguchi's assumption $V_{12} < 0$.

We proceed to examine the reaction functions of the both firms. The slopes of the reaction functions are

$$\frac{dl}{dl^*} = -\frac{V_{12}}{V_{11}}$$

$$\frac{dl^*}{dl} = -\frac{V_{21}^*}{V_{11}^*}$$

The reaction function of the LMF is upward sloping, while the PMF's is downward sloping. Since Okuguchi assumes $V_{12} < 0$, his reaction function of the LMF is downward sloping. (See Fig. 1 in Okuguchi (1991).) The point E_0 in Fig. 1 corresponds to the Cournot equilibrium. $V(V^*)$ is the iso-profit curve of the LMF (PMF) running at the equilibrium.

Finally we examine the effect of the export subsidy by the domestic government. The shift in the reaction function of the LMF is given by
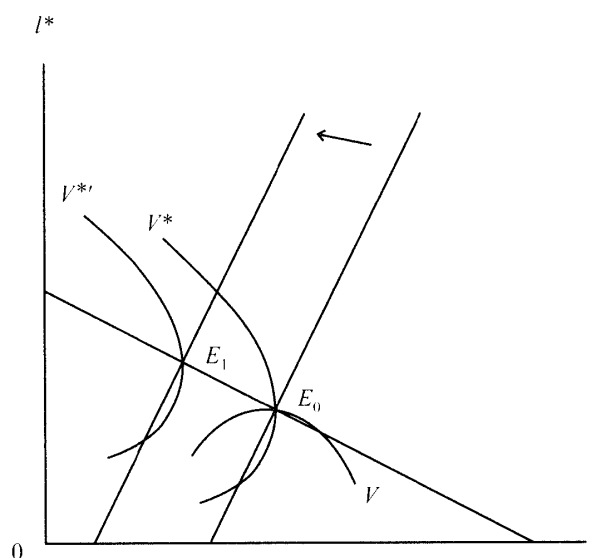
Fig. 1.

$$\left.\frac{dl}{ds}\right|_{l^* = \text{const}} = \frac{l}{V_{11}}\left\{\frac{f(l)}{l} - f'(l)\right\} < 0 .$$

The reaction function of the LMF moves leftward when s increases since V_{11} is negative and f exhibits diminishing returns to scale. The equilibrium changes from E_0 to E_1. The labor employment of the LMF decreases whereas that of the PMF increases. Since the new iso-profit curve of the PMF runs under the old one, the profit of the PMF increases. These results correspond to propositions 2 and 3 of Mai and Hwang (1989).

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