Strategic Trade Policies in a Labour-Managed Economy

TAKAFUMI MATSUBA

Gifu Shotoku Gakuen University

and

MAKOTO TAWADA

Nagoya University

Abstract The analysis of this paper was originated by Brander and Spencer (1985) who proposed a three-country and one commodity model that two countries compete the commodity share in a third country market. They argued in their analysis that export subsidies enhance the country welfare, and supported trade under strategic trade policies rather than free trade. Mai and Hwang (1989) considered the Brander and Spencer model but with a labour-managed firm in one country and concluded that export tariffs are effective in order to raise the social welfare of a labour-managed country.

Then, our next and interesting task is to investigate what sort of policies is effective if both countries are labour-managed. We will focus on this topic. Being different from the previous works of Brander and Spencer (1985) and Mai and Hwang (1989), it will be shown that the optimal trade policy is not uniquely determined. Which is optimal between an export subsidy and export tariff relies on the relation of the slope of the foreign reaction curve to that of the home isowelfare curve.

Key words: Export Tariff, Export Subsidy, Trade Policy, Labour-Managed Firm, International Duopoly

1. Introduction

The analysis of strategic trade policies in international oligopoly markets was originated by Brander and Spencer (1985) who proposed a three-country and one commodity model that two countries compete the commodity share in a third country market. They argued in their analysis that export subsidies enhance the country welfare, and supported trade under strategic policies rather than free trade. Mai and Hwang (1989) considered the Brander and

Spencer model but with a labour-managed firm in one country and concluded that export tariffs are effective in order to raise the social welfare for a labour-managed country.

Then, our next and interesting task is to investigate what sort of policies is effective if both countries are labour-managed. We will focus on this topic in this paper. Being different from the previous works of Brander and Spencer (1985) and Mai and Hwang (1989), it will be shown that the optimal trade policy is not uniquely determined. Which is optimal between an export subsidy and export tariff relies on the reaction of the slope of the foreign reaction curve to the isowelfare curve of the home country.

The paper is organized as follows : The next section describes the model. A simple comparative static analysis concerning the export subsidy is made in section 3. Section 4 and 5 are devoted to the welfare analyses of the home and foreign countries, respectively. Two remarks are given in the last section.

2. The Model

Suppose that there are three countries, one commodity and one factor. The first two countries are called, respectively, the home and foreign countries, each of which has a firm producing an identical commodity and exporting it to the third country. The two firms are supposed to compete with each other in the Cournot fashion in the third country market. We assume that the government of the home country subsidizes the home firm to export the commodity. Let both of the home and foreign firms be labour-managed firms whose aim is to maximize the income per worker.

The production functions of the home and foreign firms are, respectively,

$$q=f(L) \quad \text{and} \quad q^*=f^*(L^*), \quad (1)$$

where q and L are the output and labour input of the home firm and those with asterisk are of the foreign firm. We assume that

$$f' > 0, f^{*'} > 0, f'' < 0, f^{*''} < 0 \\ f(0)=0, f^*(0)=0$$

where $f' \equiv df/dL$, $f'' \equiv d^2f/dL^2$, etc.

Assuming that there is no production in the third country, we introduce the inverse demand function of the third country market as $p=p(Q)$, where $Q \equiv q+q^*$, p is the international price of the commodity and $p'(Q) \equiv dp(Q)/dQ < 0$.

Since the firms act as Cournot oligopolists in the third country market, the behaviour of the home firm is described as the following optimization problem :

$$\max_L V(L, L^*; s) \equiv \frac{p(Q)f(L) - wL - k + sf(L)}{L}, \quad (2)$$

and that of the foreign firm is

$$\max_{L^*} V(L, L^*) \equiv \frac{p(Q)f^*(L^*) - w^*L^* - k^*}{L}, \quad (3)$$

where s is the export subsidy to the home firm and w and k (with asterisk) are, respectively, the wage rate and fixed cost facing to the home (foreign) firm.

The first order conditions of (2) and (3) are

$$V_L = \frac{(p + p'f + s)f' - (pf - k + sq)/L}{L} = 0, \quad (4)$$

$$V_{L^*}^* = \frac{(p + p'f^*)f^{*'} - (pf^* - k^*)/L^*}{L^*} = 0, \quad (5)$$

respectively, where $V_L \equiv \partial V / \partial L$ and $V_{L^*}^* \equiv \partial V^* / \partial L^*$.

In order to derive the second order conditions, calculate $V_{LL} \equiv \partial^2 V / \partial L^2$, $V_{LL^*} \equiv \partial^2 V / \partial L \partial L^*$, etc. Then we have

$$V_{LL} = \frac{(p''q + 2p')(f')^2 + (p + p'q + s)f''}{L}, \quad (6)$$

$$V_{LL^*} = \frac{f^{*'}(p'(f' - f/L) + p''qf')}{L}, \quad (7)$$

$$V_{L^*L^*}^* = \frac{(p''q^* + 2p')(f^{*'})^2 + (p + p'q^*)f^{*''}}{L^*}, \quad (8)$$

$$V_{L^*L}^* = \frac{f''(p'(f^{*'} - f^*/L^*) + p''q^*f^{*'})}{L^*}, \quad (9)$$

where $p'' \equiv \partial^2 p / \partial Q^2$.

Let the inverse demand function satisfy

Assumption 1

$$p'' \geq 0, \quad p''q^* + p' < 0, \quad p''q + p' < 0.$$

Then, $V_{LL} < 0$, $V_{L^*L^*}^* < 0$, $V_{LL^*} > 0$, and $V_{L^*L}^* > 0$ are assured, so that the second order conditions of (2) and (3) hold.

Employing (4) and (5), we can define the reaction functions of the home and foreign firms as $L = R(L^*; s)$ and $L^* = R^*(L)$, respectively. These functions satisfy

$$R_{L^*} = -V_{LL^*} / V_{LL} > 0, \quad (10)$$

$$R_L^* = -V_{L^*L}^* / V_{L^*L^*}^* > 0, \quad (11)$$

where $R_{L^*} \equiv \partial R(L^*; s) / \partial L^*$ and $R_L^* \equiv \partial R^*(L) / \partial L$. Therefore, both reactions functions have positive derivatives.

To proceed farther, we impose the following stability assumption :

Assumption 2

$$|\Delta| \equiv V_{LL}V_{L^*L^*}^* - V_{LL^*}V_{L^*L}^* > 0.^{1)} \quad (12)$$

1) If we employ the adjustment process,

$$\dot{L} = \alpha V_L, \quad \dot{L}^* = \beta V_{L^*}^*,$$

where α and β are positive and constant, a sufficient condition for the stability is to satisfy that $V_{LL} < 0$, $V_{L^*L^*}^* < 0$ and $|\Delta| > 0$.

Figure 1

Assumption 2 means that in figure 1 the reaction curve of the home firm R is steeper than that of the foreign firm R^* . Under this assumption, the labour employment of each firm at the Cournot equilibrium is represented at point C in figure 1, where L^c and L^{*c} are the Cournot equilibrium labour employment of the home and foreign firm, respectively.

3. The Preliminary Analysis

First of all, we investigate the effect of the export subsidy to the behaviour of each firm. So we differentiate (4) and (5) totally and obtain

$$\begin{bmatrix} V_{LL} & V_{LL^*} \\ V_{L^*L} & V_{L^*L^*} \end{bmatrix} \begin{bmatrix} dL \\ dL^* \end{bmatrix} = \begin{bmatrix} -\frac{1}{L} \left(f' - \frac{f}{L} \right) \\ 0 \end{bmatrix} ds. \quad (13)$$

By Assumption 2 and equation (13), we immediately establish

Theorem 1. Suppose an increase in the export subsidy to the home firm. Then, (i) the labour employment of each firm decreases, so that the output of each firm decreases. (ii) The income per worker rises in both firms.

Proof. Solving (13) yields

$$L_s = \frac{1}{|A|} \left(-\frac{1}{L} \left(f' - \frac{f}{L} \right) \right) V_{L^*L^*} < 0, \quad (14)$$

$$L_s^* = \frac{1}{|A|} \left(\frac{1}{L} \left(f' - \frac{f}{L} \right) \right) V_{L^*L} < 0, \quad (15)$$

where $L_s \equiv dL/ds$ and $L_s^* \equiv dL^*/ds$. Hence (i) holds.

We also have,

$$\begin{aligned}\frac{dV}{ds} &= V_L L_s + V_{L^*} L_s^* + V_s \\ &= \frac{p' f'' f}{L} L_s^* + \frac{f}{L} > 0, \\ \frac{dV^*}{ds} &= V_L^* L_s + V_{L^*}^* L_s^* \\ &= \frac{p' f'' f^*}{L} L_s > 0,\end{aligned}$$

by the differentiation of (2) and (3) and by the use of (4) and (5), where $V_s \equiv \partial V / \partial s$. Thus, (ii) holds.

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It is possible to give a geometrical exposition of Theorem 1. To do so, notice that an increase in s removes the home reaction function curve to the left. This because differentiation of (4) gives

$$V_{LL} dL + \frac{1}{L} \left(f' - \frac{f}{L} \right) ds = 0,$$

and thus $dL/ds < 0$, for any given L^* . Therefore, according to an increase in s the home reaction curve R moves to the broken curve R' while the foreign reaction curve keeps its initial position. Thus, the equilibrium point shifts from C to C' , whence (i) of Theorem 1 is evident.

To see (ii) of theorem 1, consider the $L-L^*$ curves where the same income per worker of the home firm is realized. it is shown that they are concave and their highest points are on the home reaction curve. One of these curves is seen as H in Figure 1. Moreover, the lower the curve the higher the income per worker. Hence the income per worker becomes higher corresponding to an infinitesimal increase in s . A similar explanation can be applied to the income per worker of the foreign firm by the use of curve F in Figure 1.

4. The Home Welfare Analysis

This section deals with the analysis of the social welfare of the home country, which is our main concern in this paper. Before starting the analysis, we define the home country welfare as the total labour income minus the government spending for the export subsidy. Therefore the home country welfare, say W , is expressed as

$$W \equiv L \left(V - \frac{sq}{L} \right) = p(Q) f(L) - wL - k, \quad (16)$$

implying that the welfare is not affected by the level of the export subsidy.

Now we begin with the inspection of the isowelfare curves of the home country. For this purpose, we differentiate (16), holding W constant. Then it follows that

$$dW = \frac{\partial W}{\partial L} dL + \frac{\partial W}{\partial L^*} dL^* = 0,$$

from which we have

$$\left. \frac{dL^*}{dL} \right|_{W=\text{const.}} = - \frac{p'f'f + pf' - w}{p'f^*f}. \quad (17)$$

Here we define the profit function of the home firm as

$$\Pi(L, L^*; s) = pf - wL - k + sf.$$

Then, obviously, $W = \Pi(L, L^*; 0)$. Consequently, the isowelfare curve is identical with the isoprofit curve without the export subsidy to the home firm. It is well-known that the isoprofit curves are displayed in Figure 2 as the concave curves whose highest points are all located on the locus of $L = r(L^*)$, where $L = r(L^*)$ is the profit maximizing reaction function of the home firm under the condition that $s = 0$. Since the isowelfare curves are the isoprofit curves, the home country welfare declines according to the upward shift of the isowelfare curve in Figure 2.

Returning to (17), when $s = 0$, the following relationship is obtained :

$$\left. \frac{dL^*}{dL} \right|_{W=\text{const.}} = - \frac{p'f'f + pf' - w}{p'f^*f} \begin{cases} > 0 \\ = 0 \\ < 0 \end{cases} \Leftrightarrow V(L, L^*; 0) \begin{cases} > 0 \\ = 0 \\ < 0 \end{cases}$$

from (4). Suppose $V(L, L^*; 0) > 0$, implying that, when there is no subsidy, a positive income per worker is assured at the Cournot equilibrium. Then, making use of the above relationship, we easily observe that when $s = 0$ the Cournot equilibrium C of Figure 1 has to situate somewhere below the locus of $L = r(L^*)$ in Figure 2.

The subsequent analysis can be made by considering two cases separately.

Figure 2

Figure 3

- (i) The case where the reaction curve of the foreign firm is steeper than the isowelfare curve of the home country at the initial equilibrium point C as in figure 3.

In this case, an increase in the level of s makes the home reaction curve to move left, so that the home welfare rises. This is easily confirmed by Figure 3. The highest level of the home welfare is attained at C' in the figure. Hence, in order to maximize the home welfare, s should be raised up to the level such that R becomes R' .

As a result, if $s=0$ at C , the introduction of the export subsidy to the home firm is effective in the sense that it brings forth of an increase in the home welfare.

- (ii) The case where the isowelfare curve of the home country is steeper than the foreign reaction curve at the initial point C as in Figure 4.

An analysis similar to that of (i) can be applied to this case. Then, we reach the conclusion that the introduction of the export tariff is effective in order to raise the country welfare if there is no policy intervention initially. Obviously, the maximum welfare is accomplished at C' in Figure 4 in this case. So the optimum export tariff is the one such that the home reaction curve becomes R' so as to realize the equilibrium at C' .

Eventually we can state

Theorem 2. Suppose that there is no policy intervention initially and that the isowelfare curve of the home country is milder (steeper) than the foreign reaction curve at the initial equilibrium point as in Figure 3(4). Then the introduction of the export subsidy (tariff) to the home firm enhances the home welfare.

Figure 4

Proof. Differentiate (16) with respect to s and use (14) and (15). Then, we have

$$\begin{aligned} \frac{dW}{ds} &= \frac{\partial W}{\partial L} L_s + \frac{\partial W}{\partial L^*} L_s^* + \frac{\partial W}{\partial s} \\ &= (p'f'f + pf' - w)L_s + p'f^*fL_s^* \\ &= \frac{p'f^*fV_{L^*L^*}^*}{L|\Delta|} \left(f' - \frac{f}{L} \right) \left[-\frac{p'f'f + pf' - w}{p'f^*f} + \frac{V_{L^*L}^*}{V_{L^*L^*}^*} \right]. \end{aligned}$$

Since $p'f^*fV_{L^*L^*}^*(f' - f/L)/L|\Delta| < 0$, it follows that

$$\frac{dW}{ds} \begin{cases} > 0 \\ = 0 \\ < 0 \end{cases} \Leftrightarrow -\frac{p'f'f + pf' - w}{p'f^*f} \begin{cases} < \\ = \\ > \end{cases} -\frac{V_{L^*L}^*}{V_{L^*L^*}^*}.$$

Therefore, Theorem 2 is obtained by (11) and (17).

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5. The Foreign Welfare Analysis

The welfare of the foreign country is expressed as

$$W^* = p(Q)f^*(L^*) - w^*L^* - k^*. \quad (18)$$

Differentiation of (18) with respect to s yields

$$\begin{aligned} \frac{dW^*}{ds} &= p'f^*f^*L_s + (p'f^*f^* + pf^{**} - w^*)L_s^* \\ &= \frac{-1}{|\Delta|} \frac{1}{L} \left(f' - \frac{f}{L} \right) (p'f^*f^*V_{L^*L^*}^* - (p'f^*f^* + pf^{**} - w^*)V_{L^*L}^*) \end{aligned}$$

Applying the same technique as that of the previous section, we obtain

$$\frac{dW^*}{ds} \begin{cases} > 0 \\ = 0 \\ < 0 \end{cases} \Leftrightarrow \frac{p'f^*f^*}{p'f^*f^* + pf^{**'} - w^*} \begin{cases} > \\ = \\ < \end{cases} - \frac{V_{L^*L}^*}{V_{L^*L^*}^*}$$

from (2) and the reasonable assumption that $V^*(L, L^*) > 0$. Since

$$\left. \frac{dL^*}{dL} \right|_{W=const.} = - \frac{p'f^*f^*}{p'f^*f^* + pf^{**'} - w^*}.$$

and

$$R_L^* = - \frac{V_{L^*L}^*}{V_{L^*L^*}^*},$$

we immediately reach

Theorem 3. Suppose that the isowelfare curve of the foreign country is milder (steeper) than the foreign reaction curve at an initial equilibrium point, namely,

$$\left. \frac{dL^*}{dL} \right|_{W^*=const.} < (>) \frac{dR^*}{dL}.$$

Then, an increase (decrease) in the export subsidy of the home country enhances the welfare of the foreign country.

In the above theorem, s is allowed to take either positive or negative value initially. Thus, if $s < 0$ initially, we can interpret an increase (decrease) in the export subsidy as a decrease (increase) in the export tariff in the theorem.

Figure 5 shows the case where

$$\left. \frac{dL}{dL} \right|_{W^*=const.} > \frac{dR^*}{dL}.$$

Let the initial equilibrium be C in the figure. Obviously, a rise in s removes the equilibrium point to C' , so that the isowelfare curve of the foreign country moves from W^* to a higher level $W^{*'}.$

6. Remarks

Two remarks now in order.

Remark 1. Combining Theorem 2 together with Theorem 3, we can easily recognize the followings.

(i) If

$$\left. \frac{dL^*}{dL} \right|_{W=const.} < (>) \frac{dR^*}{dL} < (>) \left. \frac{dL^*}{dL} \right|_{W^*=const.}$$

at the initial equilibrium point where $s=0$, the introduction of a positive (negative) s raises both home and foreign welfare levels. If

Figure 5

$$\left. \frac{dL^*}{dL} \right|_{W=const.} \begin{matrix} < \\ > \end{matrix} \frac{dR^*}{dL} \text{ and } \left. \frac{dL^*}{dL} \right|_{W^*=const.} \begin{matrix} < \\ > \end{matrix} \frac{dR^*}{dL}$$

at the initial equilibrium point where $s=0$, the introduction of a positive (negative) s enhances the home welfare but deteriorates the foreign welfare.

Remark 2. In the present paper, we consider only the home government trade policy. It is surely more interesting to suppose that the governments of both countries use the trade policies for their countries. Then, along the line of Hamilton and Slutsky's analysis (1990), we develop the present analysis to the endogenous timing of trade policies²⁾. Though we will not go into this topic here, the extension of the analysis to the direction is possible and worth while doing.

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