Export Subsidies and Countervailing Tariffs*

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Abstract

This paper analyses how retaliation affects the profit shifting argument for export subsidies. Trade policy is modelled as a multistage game. At the first stage the foreign country sets its export subsidy, and then at the second stage the domestic country sets its tariff and/or production subsidy. If the domestic country pursues an optimal trade policy then it will always gain from a foreign export subsidy. When the domestic country uses a tariff and a production subsidy, the optimal foreign policy is an export subsidy. If the domestic country only uses a tariff then an export tax is usually the optimal foreign policy.

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1. Introduction

For oligopolistic industries where there are pure profits, Brander and Spencer (1985) have shown that a foreign export subsidy may increase foreign welfare by shifting profits from domestic to foreign firms. The subsidy commits the foreign firms to increase their exports to the domestic country, and as a result domestic firms will usually reduce their output. The foreign industry will gain a larger share of the domestic market and if this increases the profits of the foreign industry, net of the export subsidy, then foreign welfare will increase. Although domestic consumers will benefit from lower prices, the foreign export subsidy will reduce domestic industry profits and may therefore reduce domestic welfare. However, as Bhagwati (1988) has pointed out these arguments assume that the domestic country does not retaliate. But, Dixit (1988) has shown that the optimal domestic response to a foreign export subsidy is to retaliate with a partially countervailing tariff. It is asserted by Grossman (1986) and Bhagwati (1988) that both countries are likely to lose if there is retaliation. Whereas, Brander (1986) has asserted that it is naive to argue that retaliation undercuts the case for export subsidies. But, there has been no formal attempt to model retaliation. The purpose of this paper is to analyse the effects of retaliation on the profit shifting argument for export subsidies.

Trade policy will be modelled as a multistage game. At the first stage, the foreign country sets its export subsidy to maximise its national welfare. Then, in the second stage, the domestic country responds to the foreign export subsidy by setting its tariff and/or production subsidy to maximise its national welfare. Two cases will be considered: In the first case the domestic country uses a tariff and production subsidy, and in the second case it only uses a tariff. At the final stage, domestic and foreign firms engage in Cournot competition.[1] The appropriate solution is the subgame perfect equilibrium. This ensures that the response by the domestic country must be optimal given the foreign export subsidy. And, that the foreign country anticipates the optimal response of the domestic country when it sets its export subsidy.

There are three main results: Firstly, when the domestic country pursues an optimal trade policy it will always gain from a foreign export subsidy. Secondly, when the domestic country uses a tariff and a production subsidy, the optimal domestic response to a foreign export subsidy is generally to increase its tariff and to reduce its production subsidy. And, faced with such a response, the optimal foreign export subsidy is positive for non-linear demand and zero for linear demand. Thirdly, when the domestic country only uses a tariff, the optimal domestic response is a less than fully countervailing tariff. And, faced with such a response, the optimal foreign policy is usually an export tax.

In the previous literature, Dixit (1988) analysed the optimal domestic response to a foreign export subsidy when demand is linear, but did not consider how this affects the profit shifting argument for export subsidies. This paper derives the optimal domestic response when demand is non-linear, and the optimal foreign policy when faced with such a response. Retaliation has been considered by Gasiorek *et al* (1989) using a numerical model, and their results are consistent with those reported in this paper. A different approach has been employed by Spencer (1988), she assumes that rather than using the optimal response the domestic country uses the maximum countervailing tariff permitted by the GATT: The total tariff revenue cannot exceed the total subsidy payments. Spencer (1988) shows that a small subsidy to additional capital, countervailed by the maximum tariff permitted by the GATT, will increase foreign welfare.[2]

In section two the basic model is described and the comparative static results for the effects of trade policy are derived. The effect of a foreign export subsidy when there is no retaliation is also considered. Section three analyses the trade policy game when the domestic country uses a tariff and a production subsidy. And, section four analyses the same trade policy game when the domestic country only uses a tariff. The conclusions are contained in section five.

2. The Basic Model

The basic model is a homogeneous product Cournot oligopoly as in Dixit (1984, 1988). There are two countries labelled domestic and foreign. There are n domestic firms and m foreign firms. Each domestic firm has a constant marginal cost c_1 and a sunk cost F_1. Each foreign firm has a constant marginal cost c_2 and a sunk cost F_2. Markets are assumed to be segmented and since there is no entry or exit and marginal cost is constant, the domestic market can be analysed independently of the foreign market. Domestic firms each sell y and foreign firms each sell x units of output in the domestic market, so domestic production is $Y = ny$, imports are $X = mx$, and total sales in the domestic market are $Q = X + Y$. Domestic consumers are assumed to have utility functions which are additively separable and linear in a competitive numeraire good. Therefore, the aggregate indirect utility function is of the form: $V = V(P) + I$, where P is the price of the product of the oligopolistic industry and I is income. Hence, by Roy's identity $\partial V/\partial P = -Q$, and the inverse demand function is $P = P(Q)$ where Q is consumption of the oligopolistic product. The domestic government uses a specific tariff t, and a production subsidy s. The foreign government uses a specific export subsidy e.

Domestic welfare is given by the sum of consumer surplus, producer surplus and government revenue

$$W_1 = V(P) + (P - c_1)Y + tX \tag{1}$$

Foreign welfare is given by producer surplus from exports

$$W_2 = (P - c_2 - t)X \tag{2}$$

The following assumptions will be made to ensure the existence and uniqueness of the Cournot equilibrium:

(A1) The inverse demand function $P(Q)$ is decreasing, twice continuously differentiable and total revenue, $P(Q).Q$, is bounded.

(A2) The following conditions are satisfied:

$$(n + 1)P'(X+Y) + YP''(X+Y) < 0 \qquad \forall\ X,Y$$

$$(m + 1)P'(X+Y) + XP''(X+Y) < 0 \qquad \forall\ X,Y$$

(A3) The following condition is satisfied:

$$(n + m + 1)P'(Q) + QP''(Q) < 0 \qquad \forall\ Q$$

Then there exists a unique and symmetric Cournot equilibrium, for a proof see Collie (1990a). These conditions are less restrictive than the usual assumption that profit functions are (globally) concave.

Profits of domestic and foreign firms are

$$\pi_1 = (P - c_1 + s)y - F_1$$
$$\pi_2 = (P - c_2 - t + e)x - F_2 \qquad (3)$$

The first order conditions for a Cournot-Nash equilibrium, assuming there is an interior solution where the market is supplied by both domestic production and imports, are[3]

$$\frac{\partial \pi_1}{\partial y} = P + yP' - c_1 + s = 0$$

$$\frac{\partial \pi_2}{\partial x} = P + xP' - c_2 - t + e = 0 \tag{4}$$

To obtain the comparative static results for the effects of the trade taxes and subsidies on the equilibrium outputs of the firms totally differentiate the first order conditions. This yields

$$\begin{bmatrix} (n+1)P' + YP'' & nP' + YP'' \\ mP' + XP'' & (m+1)P' + XP'' \end{bmatrix} \begin{bmatrix} dY \\ dX \end{bmatrix} = \begin{bmatrix} -nds \\ mdt-mde \end{bmatrix}$$

The solution is obtained by matrix inversion

$$\begin{bmatrix} dY \\ dX \end{bmatrix} = \frac{1}{\Delta} \begin{bmatrix} (m+1)P' + XP'' & -(nP' + YP'') \\ -(mP' + XP'') & (n+1)P' + YP'' \end{bmatrix} \begin{bmatrix} -nds \\ mdt-mde \end{bmatrix} \tag{5}$$

Where $\Delta = ((n+m+1)P'+QP'')P' > 0$ by assumption (A3), and the principal diagonal elements of the matrix are negative by assumption (A2). The sign of the off-diagonal elements depends upon whether domestic and foreign output are strategic substitutes or complements as defined by Bulow *et al* (1985). Domestic and foreign output are strategic substitutes (complements) for the domestic country if $nP' + YP'' < (>) 0$, and for the foreign country if $mP' + XP'' < (>) 0$. The effects of trade policy on price are

$$dP = \frac{(P')^2}{\Delta} \begin{bmatrix} -nds \\ mdt-mde \end{bmatrix} \tag{6}$$

A foreign export subsidy and a domestic production subsidy will both reduce the price of foreign exports, and worsen the terms of trade of the foreign country. A domestic tariff will increase price, and worsen (improve) the foreign country's terms of trade if it increases the price of exports by less (more) than the amount of the tariff, it is under (over) shifted if $\partial(P-t)/\partial t < (>) 0$ and this occurs if $(n+1)P' + QP'' < (>) 0$. A tariff will usually worsen the foreign country's terms of trade. The effect on the terms of trade of the domestic country is the opposite of the effect on the foreign country's terms of trade.

Before analysing the impact of retaliation on the profit shifting argument for export subsidies, consider the effect of a foreign export subsidy when there is no retaliation by the domestic country as in Brander and Spencer (1985). Then, the domestic country does not alter its tariff or production subsidy in response to the foreign export subsidy, and the effect on foreign welfare (2) is

$$\frac{\partial W_2}{\partial e} = (P - c_2 - t)\frac{\partial X}{\partial e} + X\frac{\partial P}{\partial e} \qquad (7)$$

The first term is the profit shifting effect, the subsidy increases exports and since price exceeds marginal cost this has a positive effect on welfare. The second term is the terms of trade effect, the subsidy lowers the price of exports which has a negative effect on welfare. Using the comparative static results from (5) and (6) together with the first order condition for profit maximisation by foreign firms to evaluate the welfare effect at e = 0, yields

$$\frac{\partial W_2}{\partial e} = \frac{mxP'}{\Delta}\left[(n-m+1)P' + nyP''\right] \tag{8}$$

Which is positive if $(n-m+1)P' + nyP'' < 0$. An export subsidy will increase foreign welfare if the number of foreign firms is small relative to the number of domestic firms, and demand is not too convex. For a duopoly with one domestic and one foreign firm, Brander and Spencer (1985) showed that an export subsidy is always optimal if domestic and foreign output are strategic substitutes.

3. Domestic Import Tariff and Production Subsidy

The effect of retaliation on the profit shifting argument for export subsidies will now be considered. In this section the domestic government uses an import tariff and production subsidy in response to the foreign export subsidy. Trade policy is analysed as a multistage game for which the appropriate solution is a subgame perfect equilibrium, this excludes the possibility of non-credible threats. At the first stage the foreign government sets its export subsidy to maximise its national welfare. Then, in the second stage, the domestic government responds to the foreign export subsidy by setting its import tariff and production subsidy to maximise its national welfare. In the final stage firms set outputs to maximise profits given the trade policies set by the two governments in the previous stages. In a subgame perfect equilibrium the foreign government will set its export subsidy realising the effect this will have on the optimal tariff and production subsidy of the domestic country. The subgame perfect equilibrium is obtained by a process of backward induction. Firstly, the Nash equilibrium of the final stage is obtained then this solution is used to derive the Nash equilibrium of the second stage. The solution to the second stage is then used to derive the Nash equilibrium of the first stage. One thus obtains the subgame perfect equilibrium for the entire game.

The Nash equilibrium of the first stage of the game was obtained in section two and the comparative static results obtained there can now be used to derive the Nash equilibrium of the second stage of the game. The domestic government sets its import tariff and production subsidy to maximise its national welfare given the foreign export subsidy. It is assumed that the welfare maximum is an interior solution where the market is supplied by domestic production and imports.[4] Maximising domestic welfare (1) with respect to t and s yields the first order conditions

$$\frac{\partial W_1}{\partial t} = X\left(1 - \frac{\partial P}{\partial t}\right) + (P - c_1)\frac{\partial Y}{\partial t} + t\frac{\partial X}{\partial t} = 0$$

$$\frac{\partial W_1}{\partial s} = - X\frac{\partial P}{\partial s} + (P - c_1)\frac{\partial Y}{\partial s} + t\frac{\partial X}{\partial s} = 0 \tag{9}$$

The first term is the terms of trade effect, the second term is the profit shifting effect and the third term is the tariff revenue effect. Substitute the comparative static results from section two into (9) yields

$$\begin{bmatrix} m((n+1)P' + YP'') & -m(nP' + YP'') \\ n(mP' + XP'') & -n((m+1)P' + XP'') \end{bmatrix} \begin{bmatrix} t \\ P-c_1 \end{bmatrix} = \begin{bmatrix} -XP'((n+1)P' + QP'') \\ -XP'\ nP' \end{bmatrix}$$

Solving for the optimal policies then yields

$$t = -x(P' + XP'') \qquad P-c_1 = -x(XP'') \Rightarrow s = -yP' + x(XP'') \qquad (10)$$

These are the optimal policies derived, using a different method, by Dixit (1984, 1988). The tariff is used to extract rent from the foreign producers by improving the domestic country's terms of trade as in Brander and Spencer (1984), and the production subsidy is used primarily to counter the domestic distortion. When demand is convex an import subsidy may be optimal, and if demand is concave it may be optimal to tax domestic production. But, the overall level of protection for the domestic industry is always positive, $t + s = -(x+y)P' > 0$.

In the absence of any domestic intervention, Dixit (1984) has shown that a foreign export subsidy may reduce domestic welfare. Now consider the effect of a foreign export subsidy on domestic welfare when the domestic government sets its tariff and production subsidy optimally. The overall effect on domestic welfare is

$$\frac{dW_1}{de} = \frac{\partial W_1}{\partial e} + \frac{\partial W_1}{\partial t}\frac{dt}{de} + \frac{\partial W_1}{\partial s}\frac{ds}{de} \tag{11}$$

Since the import tariff and production subsidy are set optimally $\partial W_1/\partial t = \partial W_1/\partial s = 0$. Therefore, only the direct effect of a foreign export subsidy on domestic welfare has to be considered since any induced changes in the tariff and production subsidy will have no effect on welfare. Hence, the effect of the foreign export subsidy on domestic welfare (1) is

$$\frac{dW_1}{de} = -X\frac{\partial P}{\partial e} + (P - c_1)\frac{\partial Y}{\partial e} + t\frac{\partial X}{\partial e} \tag{12}$$

And, using the comparative static results from section two and the optimal policies in (10), yields

$$\frac{dW_1}{de} = X > 0 \tag{13}$$

A foreign export subsidy always increases domestic welfare if the domestic country pursues an optimal trade and industrial policy. This is not surprising since if the domestic country applied fully countervailing tariffs, then the net effect of an export subsidy would be to transfer revenue from the foreign country to the domestic country which would increase domestic welfare.

To obtain the comparative static results for a change in the foreign export subsidy on the optimal domestic tariff and production subsidy, totally differentiate the first order conditions for welfare maximisation (9). This yields

$$\begin{bmatrix} \frac{\partial^2 W_1}{\partial t^2} & \frac{\partial^2 W_1}{\partial s \partial t} \\ \frac{\partial^2 W_1}{\partial t \partial s} & \frac{\partial^2 W_1}{\partial s^2} \end{bmatrix} \begin{bmatrix} \frac{dt}{de} \\ \frac{ds}{de} \end{bmatrix} = \begin{bmatrix} -\frac{\partial^2 W_1}{\partial e \partial t} \\ -\frac{\partial^2 W_1}{\partial e \partial s} \end{bmatrix} \tag{14}$$

A sufficient condition for welfare maximisation is that the above Hessian matrix is negative definite. Then, the principal diagonal elements must be negative and the determinant positive. The second order partial derivatives evaluated at the welfare maximum can be shown to be

$$\frac{\partial^2 W_1}{\partial t^2} = \frac{mP'}{\Delta^2}\left[2((n+1)P'+QP'')^2 + mZ\right]$$

$$\frac{\partial^2 W_1}{\partial s^2} = \frac{n^2P'}{\Delta^2}\left[2m(P')^2 + Z\right]$$

$$\frac{\partial^2 W_1}{\partial t \partial s} = \frac{nmP'}{\Delta^2}\left[2P'((n+1)P'+ QP'') - Z\right]$$

$$\frac{\partial^2 W_1}{\partial s \partial t} = \frac{nmP'}{\Delta^2}\left[2P'((n+1)P'+ QP'') - Z\right] \tag{15}$$

$$\frac{\partial^2 W_1}{\partial e \partial t} = \frac{-mP'}{\Delta^2}\left[((n+1)P'+QP'')((n-m+1)P'+QP'') + mxP''((n+m+1)P'+QP'') + mZ\right]$$

$$\frac{\partial^2 W_1}{\partial e \partial s} = \frac{-nmP'}{\Delta^2}\left[P'((n-m+1)P'+QP'') - xP''((n+m+1)P'+QP'') - Z\right]$$

Where $Z = (P')^2 + mx^2(P'P''' - 2(P'')^2)$. And, the determinant of the Hessian matrix can be shown to be

$$H = \begin{vmatrix} \dfrac{\partial^2 W_1}{\partial t^2} & \dfrac{\partial^2 W_1}{\partial s \partial t} \\ \dfrac{\partial^2 W_1}{\partial t \partial s} & \dfrac{\partial^2 W_1}{\partial s^2} \end{vmatrix} = \frac{2n^2 mZ}{\Delta^2} \qquad (16)$$

Therefore, if it is assumed that $Z > 0$ then the second order conditions for welfare maximisation will be satisfied. Using (15) and (16) to solve (14) yields the optimal domestic response to a foreign export subsidy

$$\frac{dt}{de} = \frac{1}{2} + \frac{mxP'P''}{Z}$$

$$\frac{ds}{de} = \frac{-m}{n}\left[\frac{1}{2} + \frac{xP''((n+1)P' + QP'')}{Z}\right] \qquad (17)$$

In general, the optimal domestic response to a foreign export subsidy is to increase the tariff and reduce the production subsidy. The export subsidy increases the rent earned by foreign firms, and the tariff is increased to extract some of this extra rent. Also, the export subsidy lowers price which reduces the domestic distortion, and hence a lower production subsidy is required to counter this distortion. The optimal countervailing tariff fraction is less (greater) than a half if demand is convex (concave), this extends the results of Dixit (1988). These comparative static results can now be used to solve the first stage of the game.

In the first stage of the game the foreign government sets its export subsidy to maximise its national welfare realising the effect that its decision will have upon the optimal tariff and production subsidy set by the domestic country in the second stage. The effect of an export subsidy on foreign welfare (2) is

$$\frac{dW_2}{de} = (P-c_2-t)\left[\frac{\partial X}{\partial e} + \frac{\partial X}{\partial t}\frac{dt}{de} + \frac{\partial X}{\partial s}\frac{ds}{de}\right] + X\left[\frac{\partial P}{\partial e} + \left(\frac{\partial P}{\partial t} -1\right)\frac{dt}{de} + \frac{\partial P}{\partial s}\frac{ds}{de}\right] \quad (18)$$

The first term is the profit shifting effect and the second term is the terms of trade effect. The export subsidy itself has a positive profit shifting effect but will worsen the terms of trade. The optimal domestic response to the export subsidy is generally to increase the tariff and reduce the production subsidy. An increase in the tariff will have a negative profit shifting effect and will usually worsen the terms of trade. Whereas, a reduction in the production subsidy will have a positive profit shifting effect and will improve the terms of trade. Therefore, the increase in the tariff will reduce foreign welfare and the reduction in the production subsidy will increase foreign welfare. Thus, the overall effect of domestic retaliation on foreign welfare is ambiguous. The total effect of an export subsidy on foreign welfare is obtained by using the comparative static results from (5) and (6) together with the optimal domestic response to the export subsidy from (17) to evaluate (18) at e = 0, which yields

$$\frac{dW_2}{de} = \frac{x(mxP'')^2}{Z} \geq 0 \tag{19}$$

The total effect of an export subsidy on foreign welfare is positive for non-linear demand, and zero for linear demand. When the domestic country sets its tariff and production subsidy optimally it was shown above that a foreign export subsidy will always increase domestic welfare. Therefore, if demand is non-linear, then both the domestic country and the foreign country will gain from a foreign export subsidy. Setting $dW_2/de = 0$ yields the optimal foreign export subsidy

$$e = \frac{-2mx^3P'(P'')^2}{(P')^2 + mx^2P'P'''} \geq 0 \tag{20}$$

For linear demand the optimal foreign export subsidy is zero, and for non-linear demand it is positive despite the retaliation by the domestic country. This is a somewhat surprising result. The explanation is that the optimal response of the domestic country to a foreign export subsidy is usually to increase its tariff and to reduce its production subsidy. The countervailing tariff will reduce foreign welfare which will deter the foreign country from subsidising exports. Whereas, the reduction in the production subsidy will increase foreign welfare which will encourage the foreign country to subsidise its exports. And, overall the effect of retaliation may be to encourage the foreign country to subsidise its exports. This is a case where retaliation does not undercut the argument for profit shifting export subsidies.

4. Domestic Import Tariff

In the previous section the domestic government was able to use both an import tariff and a production subsidy to countervail the foreign export subsidy but in practice governments tend to use only import tariffs. In this section the domestic government is assumed to use only an import tariff. Therefore, at the first stage of the game, the foreign government sets its export subsidy to maximise its national welfare. Then, in the second stage, the domestic government sets its import tariff to maximise its national welfare given the foreign export subsidy. And, in the final stage, firms set their outputs to maximise profits given the export subsidy and tariff. In a subgame perfect equilibrium the foreign government realises the effect its export subsidy will have on the optimal domestic tariff and takes this into account when setting the export subsidy. As usual the game is solved by backward induction. The equilibrium of the final stage of the game was derived in the second section and the comparative static results obtained there can now be used to solve the second stage of the game.

At the second stage the domestic government sets its import tariff to maximise its national welfare in response to the foreign export subsidy. The welfare maximum is assumed to be an interior solution where the market is supplied by domestic production and imports.[5] Maximising domestic welfare (1) with respect to t yields the first order condition

$$\frac{\partial W_1}{\partial t} = x\left(1 - \frac{\partial P}{\partial t}\right) + (P - c_1)\frac{\partial Y}{\partial t} + t\frac{\partial X}{\partial t} = 0 \qquad (21)$$

Using the comparative static results from (5) and (6) together with the domestic firm's first order condition for profit maximisation (4) to solve for the optimal tariff yields

$$t = \frac{-xP'((n+1)P' + QP'') - yP'(nP' + nyP'')}{(n+1)P' + nyP''} \qquad (22)$$

The tariff is used to extract rent from foreign firms by improving the domestic country's terms of trade and, in the absence of a production subsidy, to shift profits from foreign to domestic firms. The optimal tariff is usually positive. But, if $(n+1)P' + QP'' > 0$ then the tariff is overshifted and the terms of trade effect is negative, and if $nP' + nyP'' > 0$ then domestic and foreign output are strategic complements and the profit shifting effect is negative. Therefore, for sufficiently convex demand the optimal policy will be an import subsidy.

In the previous section it was shown that when the domestic government sets its import tariff and production subsidy optimally then a foreign export subsidy will always increase domestic welfare. When the domestic country only uses an optimal tariff the overall effect of a foreign export subsidy on domestic welfare is

$$\frac{dW_1}{de} = \frac{\partial W_1}{\partial e} + \frac{\partial W_1}{\partial t}\frac{dt}{de} \tag{23}$$

Since the import tariff is set optimally, $\partial W_1/\partial t = 0$. And, again only the direct effect of the foreign export subsidy on domestic welfare has to be considered. Thus

$$\frac{dW_1}{de} = -X\frac{\partial P}{\partial e} + (P - c_1)\frac{\partial Y}{\partial e} + t\frac{\partial X}{\partial e}$$

Using the comparative static results from (5) and (6) together with the optimal tariff from (22) to evaluate the welfare effect, yields

$$\frac{dW_1}{de} = X > 0 \tag{24}$$

Whenever the domestic government sets its import tariff optimally it will gain from a foreign export subsidy. Therefore, whether the domestic country uses a tariff and a production subsidy or only a tariff in response to the foreign export subsidy, it will always gain. A country which pursues an optimal trade policy should welcome foreign export subsidies.

To obtain the effect of a foreign export subsidy on the optimal domestic tariff totally differentiate the first order condition (21) which yields

$$\frac{\partial^2 W_1}{\partial t^2}\frac{dt}{de} + \frac{\partial^2 W_1}{\partial e \partial t} = 0 \qquad (25)$$

The second order conditions for welfare maximisation require that $\partial^2 W_1/\partial t^2 < 0$. The second order partial derivatives evaluated at the welfare maximum can be shown to be

$$\frac{\partial^2 W_1}{\partial t^2} = \frac{mN}{\Delta} + \frac{mP'}{\Delta^2 N}\left[((n-m+1)P'+nyP'')N^2 + B \right] < 0$$

$$\frac{\partial^2 W_1}{\partial e \partial t} = \frac{-mP'}{\Delta^2 N}\left[((n-m+1)P'+nyP'')N^2 + B \right] \qquad (26)$$

where Z, N and B are defined as

$Z = (P')^2 + mx^2(P'P''' - 2(P'')^2) > 0$

$N = (n+1)P' + nyP'' < 0$

$$B = \underset{(-)}{m(n+1)P'Z} + \underset{(-)}{(mxP'')^2(nP'+2N)} + \underset{(-/+)}{3mxP''N^2} + \underset{(-/+)}{mny^2P'(P'P'''-2(P'')^2)}$$

From (25) and (26) the effect of a foreign export subsidy on the domestic tariff, the optimal countervailing tariff, is given by

$$\frac{dt}{de} = \frac{mP'}{\Delta^2 \Omega N}\left[((n-m+1)P'+nyP'')N^2 + B \right] \qquad (27)$$

Where $\Omega = \partial^2 W_2/\partial t^2 < 0$. The optimal countervailing tariff has the opposite sign to the expression in the square brackets. There are two terms in the square brackets. From (8), the first term is negative if an export subsidy will increase foreign welfare when there is no retaliation by the domestic country. Thus, the larger are the potential gains to the foreign country from a profit shifting export subsidy, the larger will be the countervailing tariff imposed by the domestic country. The second term in the square brackets B has an ambiguous sign, it is negative for linear demand functions, and will usually be negative. If B is negative and an export subsidy will increase foreign welfare when there is no retaliation, then the optimal countervailing tariff is positive. In other cases it is quite possible that the optimal countervailing tariff may be negative.[6] Although the sign of the countervailing tariff is ambiguous, from (25) and (26) it can be shown that

$$1 - \frac{dt}{de} = \frac{mN}{\Delta\Omega} > 0 \qquad (28)$$

And, therefore it follows that $dt/de < 1$. This shows that the optimal domestic response to a foreign export subsidy is never a fully countervailing tariff. Collie (1990b) has shown that this result also holds when there is no domestic production.

Now consider the first stage of the game when the foreign government sets its export subsidy to maximise its national welfare realising the effect this will have upon the optimal tariff set by the domestic government in the second stage of the game. The effect of an export subsidy on foreign welfare (2) is

$$\frac{dW_2}{de} = (P-c_2-t)\left[\frac{\partial X}{\partial e} + \frac{\partial X}{\partial t}\frac{dt}{de}\right] + X\left[\frac{\partial P}{\partial e} + \left(\frac{\partial P}{\partial t} - 1\right)\frac{dt}{de}\right] \qquad (29)$$

The first term is the profit shifting effect and the second term is the terms of trade effect. Using the comparative static results from (5) and (6) together with the optimal countervailing tariff from (27) to evaluate the welfare effect at e = 0, yields

$$\frac{dW_2}{de} = \frac{-m^2 xP'B}{\Delta^2 \Omega N} \qquad (30)$$

An export subsidy will reduce (increase) foreign welfare if B is negative (positive). Above (27) it was shown that the countervailing tariff has two terms. The first term makes the countervailing tariff larger, the larger are the gains from an export subsidy. This term exactly offsets the welfare effects of the export subsidy. If B is negative (positive) then the second term will make the countervailing tariff larger (smaller) than that required to offset the welfare effects of the export subsidy. Hence, the foreign country will lose (gain) from an export subsidy if B is negative (positive). Setting $\partial W_2/\partial e = 0$ and solving for the optimal export subsidy yields

$$e = \frac{xP'B}{N^3} \qquad (31)$$

The optimal foreign policy will be an export tax if B is negative and an export subsidy if B is positive. Since, B is usually negative, retaliation with a countervailing tariff will usually deter the foreign country from subsidising its exports.

5. Conclusions

This paper has considered the effect of retaliation on the profit shifting argument for export subsidies. The results depend upon which policy instruments are used by the domestic country in response to the foreign export subsidy. The first case considered was when the domestic country uses a tariff and a production subsidy. Then, if the domestic country sets its tariff and production subsidy optimally, it will always gain from a foreign export subsidy. The optimal domestic response to a foreign export subsidy is generally to increase the tariff and reduce the production subsidy. When the foreign country faces such a response its optimal export subsidy is zero if demand is linear and positive if demand is non-linear. This is an example where retaliation does not negate the profit shifting argument for export subsidies.

The second case considered was when the domestic country only uses a tariff. Since, in practice, governments only use tariffs to respond to foreign export subsidies this is the case which is relevant to policy making. In this case if the domestic country sets its tariff optimally then it will always gain from a foreign export subsidy. By pursuing an optimal policy the domestic country ensures that a foreign export subsidy will not reduce domestic welfare. The optimal domestic response to a foreign export subsidy is a less than fully countervailing tariff. In practice most governments use fully countervailing tariffs, but this is never optimal. When the foreign country anticipates the optimal domestic response there is usually no profit shifting motive for an export subsidy, and its optimal policy is usually to tax exports. Therefore, in practice, it seems most likely that the possibility of retaliation with a countervailing tariff will negate the profit shifting argument for export subsidies.

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Footnotes

[1]The paper analyses Cournot competition because this is the market structure which provides the strongest argument for profit shifting export subsidies. Eaton and Grossman (1986) have shown that there is usually no profit shifting argument for export subsidies under Bertrand competition.

[2]The explanation is that for a small subsidy to additional capital the maximum countervailing tariff is actually zero, and there is no retaliation so the result is basically the same as in Spencer and Brander (1983).

[3]Assumption (A2) implies that profit functions are locally concave at a symmetric Cournot equilibrium therefore the second order conditions for profit maximisation are satisfied.

[4]There will be an interior solution if foreign firms have a cost advantage, but not such a large advantage that domestic production is not worthwhile: $0 < c_1 - c_2 + e < -2xP'$. Boundary solutions are analysed by Dixit (1984, 1988), Venables (1986) and Collie (1990b).

[5]In this case there may be an interior solution even when the foreign firms have a cost disadvantage. For constant elasticity demand functions, Venables (1986) shows that there may be one local welfare maximum with a positive tariff and domestic production, and another with a negative tariff and no domestic production. Therefore, the interior solution is not necessarily a global welfare maximum.

[6]For example, it will be negative if demand is linear and the number of foreign firms is large relative to the number of domestic firms.