

EXPORT SUBSIDY COMPETITION AND THE WTO AGREEMENT

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This paper explains the occurrence of export subsidy competition and a series of accusations by the exporters that follows it, and also examines the welfare implications of the WTO agreement that prohibits export subsidies for the countries concerned and the world as a whole. It is shown that the welfare of the exporter with low costs of production is higher when export subsidization is permitted than when it is prohibited. Furthermore, the world as a whole is better off when exporting countries subsidize their exports.

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1. INTRODUCTION

Although the WTO regards an export subsidy as a prohibited subsidy according to the agreement on Subsidies and Countervailing Measures (hereafter referred to as the WTO agreement) and allows plaintiffs to adopt appropriate retaliation measures, some countries still subsidize their exports in order to strengthen their competitive positions, this giving rise to export subsidy competition among exporting countries. They then accuse each other regarding the adoption of export subsidies through the WTO and follow this with a series of trade disputes. As an illustration, Canada and Brazil have since 1996 been accusing each other with regard to the adoption of export subsidies for civil aircraft.

Typical models in strategic trade theory, such as those of Brander and Spencer (1985), Eaton and Grossman (1986), Helpman and Krugman (1989), and Janeba (1998), assume that there are two firms located in different countries that produce at home and export their commodities to a third country. These studies show that the exporting country could subsidize its exports in order to increase its national welfare through profit shifting if the firms compete in a Cournot fashion. However, it needs to be asked why export subsidy competition exists among exporters and why the accusations that follow it occur.

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Furthermore, who benefits from the WTO agreement, and what are the conditions? Does the WTO agreement make the world better off or worse off? These issues will be explored in this paper and various welfare implications of the WTO agreement for related countries and the world as a whole will be offered.

As in the typical strategic trade theory models, such as Brander and Spencer (1985) and Collie (1994), we model the trade policy game as a multi-stage game. That is, at the beginning of the game the respective governments of the exporting countries decide whether or not to follow the WTO agreement. If a government decides to adopt an export subsidization policy, an export subsidy will be set to maximize the national welfare during the next stage. During the final stage, the firms will choose their outputs to maximize profits given the export subsidies set by the governments. The appropriate solution for the multi-stage game is the subgame perfect equilibrium, which is obtained by a process of backward induction. It can be seen from this that the welfare of the country whose exporting firm has low-cost production technology is higher when exports subsidies are permitted than when they are prohibited. Furthermore, the world as a whole is better off when exporting countries subsidize their exports.

The rest of the paper is organized as follows. Section 2 describes the basic model. Section 3 explains in detail the occurrence of subsidy competition among exporters and the accusations by them that follow. Whether or not the WTO agreement is applicable to every exporting country is examined in Section 4. Analyses of the welfare arising from the WTO agreement in relation to the consuming country and the world as a whole are presented in Sections 5 and 6, respectively. Finally, Section 7 contains the concluding remarks.

2. THE MODEL

Assume that the industry being analyzed is composed of two exporting firms competing in a Cournot fashion that are respectively located in the domestic and foreign countries. All consumers are located in a third country. Domestic (foreign) country variables are represented by a subscript or superscript 1(2). The domestic (foreign) firm has constant average variable cost and marginal cost c_1 (c_2) and fixed cost f_1 (f_2). The domestic (foreign) firm exports q_1 (q_2) to the third country, and hence total sales in the third country equal $Q = q_1 + q_2$. The price in the third country is given by the linear inverse demand function $P(Q) = \alpha - \beta Q$. The domestic (foreign) government uses an export subsidy of s_1 (s_2) per unit.

The firms simultaneously and independently choose their outputs to maximize profits given the export subsidies set by the two governments. The profits of the domestic and the foreign firms are

$$\pi_i = (P - c_i + s_i)q_i - f_i, \quad i = 1, 2. \quad (1)$$

The first-order conditions for a Cournot equilibrium are

$$\partial \pi_i / \partial q_i = \alpha - c_i + s_i - 2\beta q_i - \beta q_j = 0, \quad i, j = 1, 2, \quad i \neq j. \quad (2)$$

Solving for the Cournot equilibrium yields the exports of the domestic and the foreign firms and the market price as a function of the domestic and the foreign export subsidies:

$$q_i = (\alpha - 2c_i + c_j + 2s_i - s_j) / 3\beta, \quad i, j = 1, 2, \quad i \neq j, \quad (3)$$

$$P = (\alpha + c_1 + c_2 - s_1 - s_2) / 3. \quad (4)$$

Assuming that there is an interior solution so that $q_i > 0, \forall i$, the following conditions must be satisfied: (1) $c_i < \alpha, i = 1, 2$; (2) $c_i \in (c_i^l, c_i^u)$, where $c_i^l \equiv -(\alpha - 3c_j) / 2$ and $c_i^u \equiv (\alpha + 2c_j) / 3, i, j = 1, 2$ and $i \neq j$. In addition, since c_i^l must be nonnegative, therefore $\alpha \leq 3c_j, j = 1, 2$.

Since we assume that there is no consumption in the exporting countries, the welfare of the domestic (foreign) country is represented by the profits of the domestic (foreign) firm less the export subsidy payments:

$$\omega^i = \pi_i - s q_i = (P - c_i) q_i - f_i, \quad i = 1, 2. \quad (5)$$

The welfare of the consuming country, referred to as Country 3 that does not produce the commodity in question, is equal to the consumer surplus:

$$\omega^3 = \int_0^Q P(\Lambda) d\Lambda - PQ = \beta Q^2 / 2. \quad (6)$$

After introducing the basic model, the export subsidy game and various welfare implications of the WTO agreement for related countries and the world will be presented.

3. EXPORT SUBSIDY COMPETITION AND TRADE DISPUTES

We now turn to the question as to why export subsidy competition induces trade disputes. Both governments simultaneously and independently choose their policy to maximize their national welfare, and each exporting country is faced with two choices: to either follow or to violate the terms of the WTO agreement. Therefore, there are four possible policy combinations. The possible outcomes of this game are presented in Table 1 where V represents “violating” and F represents “following” the WTO agreement, the

first subscript represents the policy adopted by the domestic country (i.e., Country 1), and the second subscript represents the policy adopted by the foreign country (i.e., Country 2).

Table 1. The Welfare Sets for Countries 1 and 2 for Various Policy Combinations

Country 1 \ Country 2	V	F
V	$(\omega_{VV}^1, \omega_{VV}^2)$	$(\omega_{VF}^1, \omega_{VF}^2)$
F	$(\omega_{FV}^1, \omega_{FV}^2)$	$(\omega_{FF}^1, \omega_{FF}^2)$

3.1. When both exporting countries subsidize their exports (i.e., violate the WTO agreement)

If at stage zero of the game both governments decide to subsidize their exports (i.e., violate the WTO agreement), they will simultaneously and independently choose their export subsidy level to maximize the national welfare at stage one. Differentiating (5) and using (3) and (4) yields the first-order conditions:

$$d\omega^i/ds_i = (\alpha - 2c_i + c_j - 4s_i - s_j)/9\beta = 0, \quad i, j = 1, 2, \quad i \neq j. \quad (7)$$

Solving for the optimal export subsidy yields

$$s_i^{**} = (\alpha - 3c_i + 2c_j)/5 > 0, \quad i, j = 1, 2, \quad i \neq j, \quad (8)$$

where the superscript ** represents the optimal level in this case. Substituting (8) into (3) and (4) yields the exports of the domestic and the foreign firms, as well as the market price:

$$q_i = 2(\alpha - 3c_i + 2c_j)/5\beta, \quad i, j = 1, 2, \quad i \neq j, \quad (9)$$

$$P = (\alpha + 2c_1 + 2c_2)/5. \quad (10)$$

Substituting (9) and (10) into (5) yields the domestic and foreign welfare

$$\omega_{VV}^i = 2(\alpha - 3c_i + 2c_j)^2/25\beta, \quad i, j = 1, 2, \quad i \neq j. \quad (11)$$

3.2. When one exporting country follows and the other violates the WTO agreement

If the government of exporting country i decides to follow the WTO agreement and the government of exporting country j decides to subsidize its exports at stage zero, then $s_i = 0$ and the optimal export subsidy awarded by the government of exporting country j , s_j^* , is solved by the first-order condition for welfare maximization

$$d\omega^j/ds_j = (\alpha + c_i - 2c_j - 4s_j)/9\beta = 0, \quad i, j = 1, 2, \quad i \neq j, \quad (12)$$

and therefore

$$s_j^* = (\alpha + c_i - 2c_j)/4 > 0, \quad i, j = 1, 2, \quad i \neq j, \quad (13)$$

where the superscript * represents the optimal level in this case. Substituting $s_i = 0$ and (13) into (3) and (4) yields the exports of country i and country j , and the market price:

$$q_i = (\alpha - 3c_i + 2c_j)/4\beta, \quad (14)$$

$$q_j = (\alpha - 2c_j + c_i)/2\beta, \quad (15)$$

$$P = (\alpha + c_i + 2c_j)/4. \quad (16)$$

Substituting (14)-(16) into (5) yields the domestic and foreign welfare when the domestic government follows and the foreign government violates the WTO agreement:

$$\omega_{FV}^1 = (\alpha - 3c_1 + 2c_2)^2/16\beta, \quad (17)$$

$$\omega_{FV}^2 = (\alpha + c_1 - 2c_2)^2/8\beta, \quad (18)$$

and the domestic and foreign welfare when the domestic government violates and the foreign government follows the WTO agreement:

$$\omega_{VF}^1 = (\alpha - 2c_1 + c_2)^2/8\beta, \quad (19)$$

$$\omega_{VF}^2 = (\alpha + 2c_1 - 3c_2)^2/16\beta. \quad (20)$$

3.3. When both exporting countries follow the WTO agreement

If at stage zero both governments choose to follow the WTO agreement, that is, $s_1 = 0$ and $s_2 = 0$, substituting the export subsidy value into (3) and (4) yields the exports of the domestic and the foreign firms, respectively, as well as the market price:

$$q_i = (\alpha - 2c_i + c_j)/3\beta, \quad i, j = 1, 2, \quad i \neq j, \quad (21)$$

$$P = (\alpha + c_1 + c_2)/3. \quad (22)$$

Substituting (21) and (22) into (5) yields the domestic and foreign welfare when both governments follow the WTO agreement:

$$\omega_{FF}^i = (\alpha - 2c_i + c_j)^2/9\beta, \quad i, j = 1, 2, \quad i \neq j. \quad (23)$$

3.4. The best policy choice of exporting countries

Using (11) and (17) to compare the domestic welfare when both governments violate the WTO agreement with the welfare that results when the domestic government follows and the foreign government violates the WTO agreement yields:

$$\omega_{VV}^1 - \omega_{FV}^1 = 7(\alpha - 3c_1 + 2c_2)^2/400\beta > 0. \quad (24)$$

Therefore, the domestic welfare is lower if the domestic government does not subsidize its exports than if it subsidizes its exports when the foreign government adopts an export subsidy policy.

Using (19) and (23) to compare the domestic welfare when the domestic government subsidizes its exports and the foreign government follows the WTO agreement with the resulting welfare when both governments follow the WTO agreement yields:

$$\omega_{VF}^1 - \omega_{FF}^1 = (\alpha - 2c_1 + c_2)^2/72\beta > 0. \quad (25)$$

Clearly, the domestic welfare is greater if the domestic government subsidizes its exports than if it does not when the foreign government adopts a free trade policy. From the above, setting an optimal export subsidy at stage one is a dominant strategy for the domestic government regardless of whether the foreign government subsidizes its exports or not.

Similarly, using (11), (18), (20) and (23) yields:

$$\omega_{VV}^2 - \omega_{VF}^2 = 7(\alpha + 2c_1 - 3c_2)^2/400\beta > 0, \quad (26)$$

$$\omega_{FV}^2 - \omega_{FF}^2 = (\alpha + c_1 - 2c_2)^2 / 72\beta > 0, \quad (27)$$

which indicates that adopting an export subsidy policy at stage one is also a dominant strategy for the foreign government regardless of the policy adopted by the domestic government.

Accordingly, in the subgame perfect equilibrium both the exporting countries will violate the WTO agreement at stage one, even though doing so will not necessarily be better than where both exporting countries follow the WTO agreement at stage one in the case of all the individual exporters.¹ In other words, the welfare of an individual exporter may be lower when all exporters subsidize their exports than when they do not, but no subsidy on exports will make the exporter worse off if its rivals decide to subsidize their exports. This leads to the following proposition:

Proposition 1: *If there is no intervention, the dominant strategy for any exporting country is to subsidize its exports (i.e., violate the WTO agreement) regardless of whether its rivals adopt an export subsidy policy or a free trade policy.*

Thus, for the WTO agreement (i.e., a free trade policy) to be followed, a sufficient penalty will be necessary so that $\omega_{FV}^1 > \omega_{VV}^1$, $\omega_{FF}^1 > \omega_{VF}^1$, $\omega_{VF}^2 > \omega_{VV}^2$, and $\omega_{FF}^2 > \omega_{FV}^2$. The threat of penalty will make the free trade policy a dominant strategy for any exporting country if the penalty is indeed put into effect once an exporter violates the agreement. This implies:

Corollary 1: *For the WTO agreement on export subsidies to be followed, the imposition of a sufficiently large penalty on countries that subsidize their exports will be necessary.*

Therefore, the WTO agreement allows its member countries to retaliate against an exporting country that violates the agreement. When both exporting countries violate the WTO agreement, it is very likely that a series of accusations and retaliations among the exporters will follow.

¹ Using (9), (10), (21) and (22) yields

$$P^{VV} - P^{FF} = -(2\alpha - c_1 - c_2)/15 < 0,$$

$$q_i^{VV} - q_i^{FF} = (\alpha - 8c_i + 7c_j)/15\beta, \quad i, j = 1, 2, \quad i \neq j,$$

where P^{VV} (P^{FF}) and q_i^{VV} (q_i^{FF}) represent the market price and the exports of firm i when both governments violate (follow) the WTO agreement. It can be seen that subsidizing exports reduces the market price but does not necessarily increase exports.

4. CONDITIONS BENEFICIAL TO THE EXPORTING COUNTRIES

From the previous section, we know that each exporter will adopt an export subsidy policy when export subsidization is permitted and will only adopt a free trade policy if export subsidization is prohibited by means of an effective penalty. However, it still needs to be asked under what conditions the WTO agreement is beneficial for the exporting countries. This is the focus of the following discussion. By using (11) and (23) to compare the welfare of the exporting countries when each exporter in the industry subsidizes exports with that resulting when they adopt a free trade policy at stage one yields:

$$\omega_{VV}^i - \omega_{FF}^i = [62(\alpha - c_i)^2 - 116(\alpha - c_i)(\alpha - c_j) + 47(\alpha - c_j)^2]/225\beta, \quad (28)$$

$$i, j = 1, 2, i \neq j.$$

From (28) it is easy to derive $d^2(\omega_{VV}^i - \omega_{FF}^i)/dc_i^2 = 124/225\beta > 0$, which implies that $\omega_{VV}^i - \omega_{FF}^i$ is convex for $c_i \in (c_i^l, c_i^u)$. By denoting c_i^y as the value of c_i at which $\omega_{VV}^i = \omega_{FF}^i$ that is located in the range (c_i^l, c_i^u) , we obtain $c_i^y = [(2/31) - (15\sqrt{2}/62)]\alpha + [(29/31) + (15\sqrt{2}/62)]c_j$. According to the above, the following diagram can be constructed:

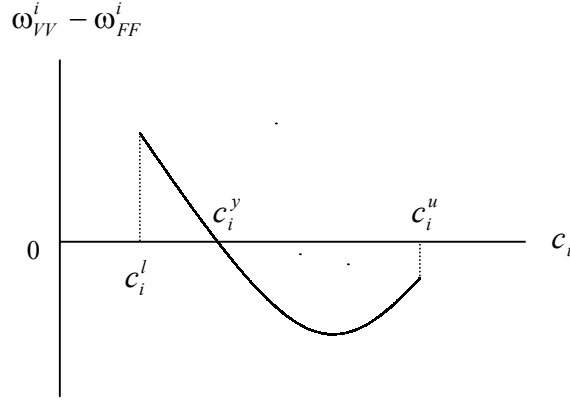


Figure 1

In this figure, it is clear that $\omega_{VV}^i > (<) \omega_{FF}^i$ as $c_i < (>) c_i^y$. That is, the WTO agreement is beneficial for the exporting countries with high average variable cost (i.e., $c_i > c_i^y$), but it is not fitting for the countries with low average variable cost. The intuition is that for each exporter with low average variable cost not only does an export subsidy policy bring it a higher profit than a free trade policy, but also the incremental profits outweigh the subsidy payments made by the government.

Proposition 2: *For the countries whose exporting firm has a low average variable cost of production, the outcome where both countries subsidize exports is better (or Pareto-superior) than the outcome where both countries adopt a free trade policy.*

However, in the special case with $c_1 = c_2$, (28) reduces to

$$\omega_{VV}^i - \omega_{FF}^i = -7(\alpha - c_i)^2 / 225\beta < 0, \quad i = 1, 2. \quad (29)$$

This means that when the two competing countries have identical marginal cost the outcome where both countries follow the WTO agreement is Pareto-superior to the outcome where both countries subsidize exports.

5. THE WELFARE OF THE CONSUMING COUNTRY

If at stage one both the exporting countries subsidize their exports (i.e., violate the WTO agreement), substituting (9) into (6) yields the welfare of the consuming country:

$$\omega_{VV}^3 = 2(2\alpha - c_1 - c_2)^2 / 25\beta. \quad (30)$$

Substituting (14) and (15) into (6) yields the welfare of the consuming country when the domestic government violates and the foreign government follows the WTO agreement at stage one:

$$\omega_{VF}^3 = (3\alpha - 2c_1 - c_2)^2 / 32\beta, \quad (31)$$

and the welfare of the consuming country when the domestic government follows and the foreign government violates the WTO agreement at stage one:

$$\omega_{FV}^3 = (3\alpha - c_1 - 2c_2)^2 / 32\beta. \quad (32)$$

Substituting (21) into (6) yields the welfare of the consuming country when both exporting countries follow the WTO agreement at stage one:

$$\omega_{FF}^3 = (2\alpha - c_1 - c_2)^2 / 18\beta . \quad (33)$$

Using (30)-(33) yields:²

$$\omega_{FF}^3 < \omega_{VF}^3 < \omega_{VV}^3 , \quad \omega_{FF}^3 < \omega_{FV}^3 < \omega_{VV}^3 ,$$

which implies that the welfare of the consuming country reaches its highest level when both exporting countries subsidize their exports, its second highest level when only one exporting country violates the WTO agreement, and its lowest level when both exporting countries follow the agreement.³ Thus, the well-known result that the consuming country benefits from foreign export subsidies can be further enhanced as:

Proposition 3: *Foreign export subsidies always benefit the consuming country, and the larger the number of exporting countries that adopt export subsidization, the higher will be the consuming country's welfare.*

6. THE VIEWPOINT OF WORLD WELFARE

From the viewpoint of world welfare, the question that needs to be asked is whether it is better to permit export subsidization or to prohibit it. Since there are only three countries involved in this export subsidy game, the world welfare when export subsidization is permitted and that when it is prohibited can be compared by using (11), (23), (30), and (33):

$$\sum_{i=1}^3 (\omega_{VV}^i - \omega_{FF}^i) = [229(c_1 - c_2)^2 + 16(\alpha - c_1)(\alpha - c_2)] / 450\beta > 0 . \quad (34)$$

That is, the possible losses of the exporting countries are more than offset by the benefits to the consuming country when an export subsidy policy instead of a free trade policy is

$$\begin{aligned} {}^2 \omega_{VF}^3 - \omega_{FF}^3 &= (\alpha - 2c_1 + c_2)(17\alpha - 10c_1 - 7c_2) / 288\beta > 0 , \\ \omega_{VV}^3 - \omega_{VF}^3 &= (\alpha + 2c_1 - 3c_2)(31\alpha - 18c_1 - 13c_2) / 800\beta > 0 , \\ \omega_{FV}^3 - \omega_{FF}^3 &= (\alpha + c_1 - 2c_2)(17\alpha - 7c_1 - 10c_2) / 288\beta > 0 , \\ \omega_{VV}^3 - \omega_{FV}^3 &= (\alpha - 3c_1 + 2c_2)(31\alpha - 13c_1 - 18c_2) / 800\beta > 0 . \end{aligned}$$

³ Bagwell and Staiger (1997) assume that the exporting firms compete in a Bertrand fashion and face positive fixed costs of production, and that only one firm profits in the market. It is shown that export subsidy competition among exporting countries can make both consuming countries and the whole world worse off when fixed costs are sufficiently small.

adopted. Therefore, the world welfare is greater when export subsidization is permitted than when it is prohibited.

Proposition 4: *The welfare of the world as a whole will be greater when the WTO agreement is relaxed, so that exporting countries can subsidize their exports, than when the WTO agreement is required to be followed.*

It is noted that subsidizing exports may lead to distortion in resource allocation within the exporting countries, a possibility that is not considered in this model.

7. CONCLUDING REMARKS

This paper shows that, for every exporting country, subsidizing exports is a dominant strategy regardless of whether the rivals adopt an export subsidy policy or a free trade policy if there are no penalties for non-compliance. Consequently, a sufficiently large penalty needs to be imposed on those exporters that violate the WTO agreement if a country is to abandon its export subsidy policy. Furthermore, from the analysis we also learn that every exporting country will accuse the other exporting countries of violating the agreement in order to prevent them from receiving subsidies on their exports, thereby resulting in an increase in the accuser's welfare. As a result, accusations among exporters will follow an export subsidy competition.

Furthermore, it is found that a country whose exporting firm has low-cost production technology will be better off when export subsidization is permitted. The WTO agreement is available when the exporting countries have high production costs or their production costs are identical. Therefore, the WTO agreement does not always improve the exporters' welfare. On the other hand, as is well known, the consuming countries will always benefit from the subsidies of the exporting countries and the benefits will increase as the number of countries subsidizing exports increases. Finally, our analysis shows that the possible losses of the exporting countries will be more than offset by the benefits of the consuming countries when export subsidization is adopted, i.e., the welfare of the world as a whole will be higher when export subsidization is permitted than when it is prohibited.

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