Leonardo Medrano

EXPORT SUBSIDIES, PRICE COMPETITION AND VERTICAL INTEGRATION
Las colecciones de Documentos de Trabajo del CIDE representan un medio para difundir los avances de la labor de investigación, y para permitir que los autores reciban comentarios antes de su publicación definitiva. Se agradecerá que los comentarios se hagan llegar directamente al (los) autor(es).

D.R. © 1997, Centro de Investigación y Docencia Económicas, A. C., carretera México-Toluca 3655 (km. 16.5), Lomas de Santa Fe, 01210 México, D. F., tel. 727-9800, fax: 292-1304 y 570-4277. Producción a cargo del (los) autor(es), por lo que tanto el contenido como el estilo y la redacción son responsabilidad exclusiva suya.

NÚMERO 60
Leonardo Medrano
EXPORT SUBSIDIES, PRICE COMPETITION AND VERTICAL INTEGRATION
ABSTRACT

This paper analyzes the role of exports subsidies when a domestic firm and a foreign firm compete in prices with differentiated goods, and the input to manufacture the exportable good is produced by a local monopoly. It then studies the interaction between government and industry regarding government trade policy and industry vertical integration decisions. In this context, it shows that it is optimal to subsidize exports when industry is not integrated, and not to subsidize exports when industry is integrated. In addition, it shows that national welfare is greater in the former case.

*This paper draws on a chapter of my Ph.D. thesis submitted at the Universitat Autònoma de Barcelona. I am very grateful to Roberto Burguet, Philippe Bacchetta, Mary Paz Espinosa, Massimo Motta, Miguel González, Ramon Fauli and especially to Ramon Caminal for their helpful comments and suggestions. All errors are my own. Financial support from the Consejo Nacional de Ciencia y Tecnología de México (CONACYT) and the Ministerio de Educación y Ciencia de España (Proyecto CICYT PB-0120) is gratefully acknowledged.
The role of export subsidies in imperfect markets has been one of the most controversial issues in international trade theory, a controversy that does not exist in classic theory, which states that an export subsidy is never optimal except to tax exports when the country's producers jointly have market power in international markets. When perfect competition is not assumed there are some cases in which an export subsidy can be justified from the viewpoint of national (but not international) welfare. One such a case is described by Brander and Spencer (1985) who show that, in a Cournot duopoly with one domestic firm and one foreign firm, an export subsidy permits the domestic firm to obtain a greater international market share and that the cost of the subsidy is offset by the increased profits of the domestic firm.\footnote{Other cases in which an export subsidy may be optimal are: first, if the good is produced under increasing returns to scale, the increase in production caused by the subsidy reduces production costs. Second, with high unemployment due to wage rigidities or other kinds of distortions, an increase in production is likely to increase employment and welfare. Obviously, these results depend on the other country's trade policy. (See Krugman and Obstfeld (1988)). Even in competitive environments, Feenstra (1986) and Itoh and Kiyono (1987) have shown that subsidies to some exports may be desirable if as a result the terms of trade for other exports are improved.}

Brander and Spencer's result is far from being robust, as pointed out by Eaton and Grossman (1986), who show that if the strategic variables are not quantities but prices, the optimal policy is to tax exports. The nature of market interaction determines whether government intervention should be used to induce tougher or softer behavior by the firms. Under mild assumptions, models of price competition between differentiated products involve strategic complementarities: by pre-committing to a reaction curve with higher prices than in the one-shot game, the tax induces the foreign firm to charge higher prices in equilibrium, which increases gross profits. In models of Cournot competitions, however, strategic considerations lead the firm to pre-commit to high-quantity responses so as to induce a smaller market share in equilibrium for the rivals. The subsidy results in more aggressive firm
behavior.

Subsequent research studying the optimality of export subsidies under different assumptions and industrial structures, has extended and modified the above conclusions. When there are several domestic firms, Dixit (1984) and Eaton and Grossman (1986) argue that governments may have incentives to tax exports so that the total output of the domestic industry would be equal to that of a domestic cartel. In a general equilibrium framework with several oligopolistic sectors, Dixit and Grossman (1986) argue that when an oligopolistic industry is subsidized it expands its output by drawing resources from other oligopolistic industries so the rent extraction will work at least in part by reducing the rents captured by others. The risk of an excessive entry induced by trade policy is indicated by Horstmann and Markusen (1986). With free entry and increasing returns to scale, an excessive entry induced by subsidies reduces welfare gains because firms work with an inefficient scale of production.

On the other hand, Carmichael (1987) among others, criticize the typical assumption in international trade and industrial organization literature that the government can commit itself to a trade policy before firms have decided their production and prices. Forward-looking firms anticipate this and set prices in the first stage of the game because they know how the government will react in the second stage. Then, under equilibrium the government subsidizes exports even when firms compete in prices. This is because firms have incentives to inflate their prices in order to get a greater subsidy.

A common assumption in this literature is that the input's market is

---

2 He shows evidence that, sometimes, the subsidy is paid on the price and not on the quantity, and the amount of the subsidy is fixed not before but after an export contract has been secured and a price agreed between the exporting firm and the foreign buyer. This evidence is referred to the operational bureaucracy of the Eximbank (Export-Import Bank of the United States).

3 Neary (1989) shows that welfare is greater when firms set prices after government sets the trade policy (as in the Eaton and Grossman model) than when firms set prices before the government sets the level of the subsidy (as in the Carmichael model). In the second case, firms extract resources from government and the country's interests are second to the interests of the firms so the repercussions on welfare are negative.
competitive. However, several industries are characterized by the presence of market power in their input's market and this is likely to generate new arguments for or against export subsidies. The purpose of this paper is then to analyze the optimality of export subsidies when input markets are not competitive.

Assume that an export firm purchases its input from a domestic monopoly (the input market is imperfect), competes in prices with a foreign firm and the exportable goods are not gross substitutes. Under these conditions, it is optimal to subsidize exports even when government commits itself to a trade policy before the export firm has determined its prices (contrary to the result of Eaton and Grossman). The optimality of the export subsidy is explained by the double marginalization inefficiency (that we call efficiency effect). When the goods are gross substitutes, however, exports would be taxed because a subsidy would produce a negative effect due to the "strategic interaction" of price competition above analyzed (and that we call strategic effect).

We also show that export policy could create incentives for the firm to maintain double marginalization. This happens when the government decides its trade policy after the industry has decided its vertical integration. In order to understand this result, assume that the industry decides to integrate and eliminate double marginalization. Government does not have incentives to provide any subsidies and the industry obtains lower profits than if it maintains double marginalization and gets the subsidy. Furthermore, if the industry totally eliminates double marginalization, we get the Eaton and Grossman model, so government would have incentives to tax exports and industry would have less profits.

Alternatively, if government commits itself to a trade policy, and

---

4 That is, the domestic monopoly cuts its production in order to increase the price of intermediate goods without considering the profits of the export firm. The latter also cuts its production to increase the price of final goods. As a consequence, final good production is too low with respect to the production that would maximize total industry profits. (See Tirole, 1988, ch. 4).
industry is not able to influence the government's decision, we show that the industry will have incentives to reduce, but not necessarily to eliminate, double marginalization. A reduction in double marginalization has two effects: 1) It increases efficiency and profits and 2) generates the strategic effect which has a negative repercussion on profits. With the trade off between these opposite effects, it is optimal for the industry to maintain the intermediate market mark-up⁵. This last fact prevents the need for an export subsidy, that is, the optimal trade policy is non-intervention (free trade).

We then have two possibilities for government trade policy: 1) a commitment to non-intervention so the firms integrate and 2) the setting of subsidies after the decision on vertical integration of the industry. Alternatively, we can assume that the firms, and not the government, are able to determine the stages of the game: not to integrate and obtain the subsidy or integrate and not obtain the subsidy. We show that welfare is greater when the firms are not vertically integrated and get an export subsidy than when they are vertically integrated and do not get any subsidy. The intuition behind this result is as follows. Vertical integration and subsidies can substitute each other in the sense that they have the same goals: to correct double marginalization inefficiency and avoid the strategic effect of price competition. However, firms are more aggressive when they are vertically integrated than when they are not vertically integrated but subsidized by the government.

The paper is organized as follows. In the next section we develop the model and compute equilibrium for the intermediate good and final good markets. In section 2 we assume that there is no consumption of final goods in producer countries. In section 2.1 we study trade policy and the decision to integrate vertically when government has the advantage of the first move and in section 2.2 when industry has the advantage of the first move. In section 2.3 we compare both equilibriums. In section 3 we check the results assuming that there is consumption in producer countries. In section 4 we

⁵ This result is related to Bonano and Vickers (1988) and Lin's (1988) term "vertical separation".
2. THE MODEL

We assume that there are two countries. In country \( i = 1,2 \) there is an upstream monopoly firm \( U_i \) and a downstream export firm \( D_i \). Firm \( U_i \) produces an intermediate good at constant marginal cost and, for the sake of simplicity, we will assume that this cost is zero. Firm \( D_i \) needs one unit of input or intermediate good to produce one unit of output or final good. The input is not tradeable between countries, so firm \( D_i \) can only purchase it from monopoly \( U_i \) at market price. That is, \( D_i \) is price taker in the input market. Under this industrial structure, firms \( U_i \) and \( D_i \) (or country \( i \) industry) have incentives to integrate vertically. In order to analyze these incentives, we assume ownership and control to be separated, that is, firm owners delegate control to managers. This assumption allows us to apply the ideas from Fershtman and Judd (1987), Fershtman (1985), Vickers (1985) and Sklivas (1987) about incentive contracts that owners choose for their managers. In our case, we assume that the contract for the managers of firm \( U_i \) gives them incentives to maximize:

\[
  u = \pi U_i + \delta_i \pi D_i
\]

where \( \pi U_i \) and \( \pi D_i \) are the profits for firms \( U_i \) and \( D_i \), respectively. Regarding the managers of firm \( D_i \), we assume that they are compensated according to the profits of the firm they manage, so they maximize \( \pi D_i \). The owners determine the value of \( \delta_i \) to maximize total profits.\(^6\) In terms of vertical integration, if \( \delta_i = 0 \), the firms are not integrated at all. When \( \delta_i > 0 \)

---

\(^6\) Alternatively, we can assume that firm \( U_i \) purchases a proportion \( \delta_i \) of firm \( D_i \) stocks and adopt Flath's (1989, 1991) assumption: "silent financial interest" according to which the goal of a firm is to maximize the value of its assets, taking into account its returns on its stocks in other firms, but just controlling its own production. However, the property right loss of firm \( D_i \) managers (when \( \delta_i > 1/2 \)) would be able to distort team incentives, as is held by Hart and Moore (1990) and Grossman and Hart (1986). So we assume that other people take over both firms, maintain the independent management structure implementing the incentive scheme defined above and replace old manager teams with new ones.
there is a degree of integration. We call $\delta_i$ "integration level".

As in Brander and Spencer (1985) and Eaton and Grossman (1986), we adopt the following assumptions: there is no final goods consumption in producer countries, that is, firms $D_i$, $i=1,2$ compete in a third market; the government from country $i=1,2$ taxes (or subsidizes) output and import country government does not participate. In the fourth section we allow final goods consumption in producer countries.

Regarding trade policy, we consider two games, each one of which has four stages. The stages for the first game (game A) are: 1) Governments set trade policy. 2) Industry from country $i=1,2$ decides vertical integration. 3) Firms $U_i$, $i=1,2$ price intermediate good. 4) Firms $D_i$, $i=1,2$ price final good. The second game (game B) changes the order of the first two stages of game A. In each stage decisions are independent and simultaneous.

As in Neary (1989), we can view both games as two possibilities for government trade policy. If government commits itself to a trade policy before the firms have decided their integration level (and this commitment is credible), it adopts game A. If government decides trade policy after industry has decided its integration level, it adopts game B. In the latter case forward-looking firms anticipate how the government will react in the second stage, when determine their integration level in the first stage. In a previous stage (stage zero) governments set simultaneously the game in which welfare is maximized. Alternatively, we can assume that firms decide in stage zero, that is, firms can decide not to integrate and wait for the subsidy or integrate and not get any subsidy.

---

7 This decision order is the most common in trade policy literature and is used by Dixit (1984), Brander and Spencer (1985) and Eaton and Grossman (1986) among many others.

8 In order to justify this stage sequence, we turn to Helpman and Krugman (1989) who argue that firms make strategic movements designed to influence government decisions and they can be justified by the cost of vertical integration. Given these expenses, it is hoped that the decision of firms regarding vertical integration are based on their expectations about the government's trade policy which could be export subsidy. This assumption is used in different contexts by González (1993), Carmichael (1987), Kleit (1992) and Dixit and Kyle (1985), among others.
2.1 Final Good Market

We assume differentiated final goods or products. Firms $D_i$ face linear and symmetric demands:

$$x_i(p_i, p_j) = 1 - p_i + b p_j \quad i, j = 1, 2; i \neq j$$

(2)

where $p_i$ and $x_i$ are, respectively, final good prices and outputs and $0 \leq b < 1$. If $b = 0$ demands are independent from each other. If $b \to 1$ goods are perfect substitutes.

The managers of firm $D_i$ set the price $p_i$ to maximize profits:

$$\Pi_D = (p_i - t_i - w_i) x_i(p_i, p_j)$$

(3)

where $t_i$ is export tax and $w_i$ is intermediate good price. From first order conditions (FOC) we obtain:

$$p_i = x_i + t_i + w_i \quad i = 1, 2$$

(4)

Using (2), (3) and (4), the equilibrium output and profits are:

$$x_i = 1 - \frac{2-b^2}{4-b^2} (t_i + w_i + 1) + \frac{b}{4-b^2} (t_j + w_j + 1)$$

(5.1)

$$\Pi_D = x_i^2$$

(5.2)

2.2 Intermediate Goods Market

Firm $U_i$ managers face intermediate good market demand given by (5.1) and set price $w_i$ to maximize:

$$u_i = \Pi_U + \delta_i \Pi_D = w_i x_i + \delta x_i^2$$

(6)

From this optimization problem FOC we get:

$$w_i = (H - 2 \delta_i) x_i$$

(7)
where $H = \frac{4-b^2}{2-b^2}$, $2 \leq H < 3$.  

Using (2), (4) and (7), the equilibrium final good output is:

$$X = \frac{bt - [(1-b^2)B(\delta_j) + b^2]t_1 + (1+b)B(\delta_j) - b}{B(\delta_i)B(\delta_j) - b^2[B(\delta_i) - 1][B(\delta_j) - 1]}$$

where $B(\delta) = H + 2(1-\delta) > 2$.

The effect of a change in integration level on output and prices is given by next lemma:

**Lemma 1:** An increase in the integration level of industry of country $i$ increases output and reduces the prices of intermediate and final goods.

**Proof:** See Appendix

When $\delta_i = 0$, firm $U_i$ does not consider the effects of its decisions on the profits of firm $D_i$ and we recover the non-integrated structure. In this case, $w^{m}_i = Hx_i > 0$ is the monopoly price. If $\delta_i > 0$ then $w_i < w^{m}_i$, that is, an increase in $\delta_i$ reduces the mark-up of intermediate market.

### 3. Trade Policy

Before setting the optimal trade policy we define the government's objective function (social welfare function). As we have assumed that there is no domestic consumption, welfare is given by

$$\Omega_i = \Pi_i + t_i x_i$$

where: $\Pi_i = (p_i - w_i - t_i)x_i + w_i x_i$ represents country $i$'s industry profits and

$^9$ Second order condition is: $\delta_i < H$. 

\( t_{i1} \) is the tax (subsidy) income (cost). Using (4) and (7), we can rewrite country i industry profits as:

\[
\Pi_i = (p_i - w_i - t_i) x_i + w_i x_i = (B(\delta_i) - 1)x_i^2
\]  

(10)

In the next sub-section we solve game A. In sub-section 3.2 we solve game B. Later we set the high profit game (that is, we solve stage zero).

3.1 Game A

In the first stage, both countries' governments decide simultaneously to tax or subsidize exports. In the second stage, given the trade policy, industry decides \( \delta_i \) to maximize its profits given by (10). Country i's industry reaction function is given implicitly by:

\[
\frac{\partial \Pi_i}{\partial \delta_i} = K \left\{ B(\delta_i) - \frac{(2-b^2)B(\delta_j) + b^2}{(1-b^2)B(\delta_j) + b^2} \right\} = 0
\]

(11)

where \( K \) is positive. Let \( \delta^*_i = \delta_i(\delta_j) \) be the solution of equation (11) (reaction function).\(^{11}\) Note that \( \delta^*_i \) does not depend on \( t_i \) and \( t_j \), that is, the integration level is independent from the trade policy. (In fact, it does not depend on production cost either).

Solving (11) simultaneously for \( \delta_i \) and \( \delta_j \), the equilibrium is:

\[
\delta^* = \delta^* = \frac{H + 1 - d}{2} = \frac{3 - b^2}{2 - b^2} - \frac{1}{2(1 - b^2)^{1/2}}
\]

(12)

where \( d = (1-b^2)^{-1/2} > 1 \). Note that \( \delta^* < 1 \) and \( w^i = (d-1)x_i > 0 \). Moreover, note that if \( 0 < b < 0.97 \) then \( 0 < w^a_i < w^m_i \) and if \( b \geq 0.97 \) then \( \delta^* = 0 \) and \( w^a_i = w^m_i \). So we are able to state:

We assume that the shadow price of tax collection is zero.

\(^{11}\) The second order condition is: \((1 - b^2)B(\delta_j) + b^2 > 0\), inequality that always is true, so in \( \delta^*_i \). \( \Pi_i \) is concave and gets a maximum.
Proposition 1: For any trade policy, industry does not eliminate double marginalization. If the final goods are gross substitutes \((b>0.97)\) industry decides not to integrate at all.

We can explain this result by identifying the effects of a reduction in the price of intermediate good (induced by vertical integration) in country \(i\)'s industry profits. On the one hand, industry has incentives to reduce the price of intermediate good in order to reduce the double marginalization inefficiency and, in this way, increase its profits. We call this effect efficiency effect. On the other hand, a reduction in the price of the intermediate good induces firm \(D_j\) to reduce its price. Since the slopes of the reaction function are positive in both the intermediate and final good markets (strategic complementarities), firm \(U_i\) reduces its price and firm \(D_j\) also reduces its price, and this double effect (that we call strategic effect) has negative repercussions on the profits of country \(i\)'s industry. This strategic effect is greater when the reduction in \(w_i\) is greater. In order to reduce or avoid the strategic effect, firm \(U_i\) applies a mark-up in the intermediate good market \((w_i>0)\). The more similar the final goods are the greater this mark-up will be \((\partial w_i/\partial b>0)\), reaching the extreme case of applying monopoly price \((w_i=w^*_i)\) when final goods are gross substitutes \((b<0.97)\). In this case, industry avoids the strategic effect by not integrating at all \((\delta^*=0)\).

Proposition 1 is related to Bonano and Vickers's (1988) term "vertical separation" and Lin's (1988) term "vertical disintegration". These authors consider that there is vertical separation or disintegration when firm \(U_i\) is able to extract profits from firm \(D_i\) through a franchise and \(w_i\) is chosen to maximize the relation value. (In our case it is equivalent to fix \(\delta_i=1)\). If \(w_i\) is equal to marginal cost there is vertical integration. With these definitions they show that, in equilibrium, the industry decides \(w_i>0\), which they call vertical separation. In our case, however, we take vertical integration as a joint decision, permit \(0<w_i=w^*_i\) and consider the strategic effect in both intermediate and final good markets, setting a mark-up in the intermediate market can be interpreted as a vertical integration strategy and not as vertical separation or disintegration \((b<0.97)\).
Next, we solve the first of stage game A. Because $\delta^*$ is independent from trade policy (expression (11) does not depend on $t_1$), we are able to set $t_1$ to maximize the welfare (9) for any $\delta_i$ and $\delta_j$ and evaluate on $\delta^*$. From this problem FOC we obtain:

$$
t_1(\delta_i, \delta_j) = \left\{ \frac{(2-b^2)B(\delta_j) + b^2}{(1-b^2)B(\delta_j) + b^2} - B(\delta_i) \right\} x_1
$$

Using (11) and (13) we get:

$$
t_1 = -\frac{\partial \Pi}{\partial \delta} = 0
$$

Note that this result is independent on $t_j$ and $\delta_j$ and is the equilibrium for Game A. Then, we can state:

**Proposition 2:** For any $t_j$ and $\delta_j$, under game A equilibrium the government decides not to intervene ($t_1 = 0$).

The intuition behind this result is as follows. As we have assumed that there is no consumption in producer countries, welfare and gross profits from industry are the same. This fact implies that government incentives in choosing its trade policy and industry incentives in choosing its integration level are the same: to increase efficiency and avoid the strategic effect. The industry, choosing its integration level, has already weighted the efficiency effect and the strategic effect, so government does not have incentives to intervene.

3.2 Game B

In this sub-section we analyze the case in which, in the first stage, industry chooses its integration level and in the second stage government decides export subsidy/tax given the integration level. The subsidy/tax to maximize welfare is given by:

$$
t_1(\delta_i, \delta_j) = \left\{ \frac{(2-b^2)B(\delta_j) + b^2}{(1-b^2)B(\delta_j) + b^2} - B(\delta_i) \right\} x_1
$$
This expression, together with (8), characterizes the second stage equilibrium output. The next lemma shows the effect of an increase in integration level on the equilibrium of this stage.

**Lemma 2:** For any \( t \) and \( \delta \), an increase in integration level of country \( i \)'s industry reduces the price, profits and subsidies (increases the tax) for intermediate good.

**Proof:** See Appendix.

First stage equilibrium is a consequence of lemma 2 and the sign of expression (15):

**Proposition 3:** In game B equilibrium, country \( i \)'s industry does not integrate \((\delta = \delta^b = 0, \ i=1,2)\) and government subsidizes (taxes) exports if \( b<0.97 \) \((b>0.97)\).

In this case, if in the first stage industry decides not to integrate \((\delta = 0)\), government has incentives to intervene weighting the efficiency effect and the strategic effect. When final goods are not very similar, a subsidy corrects these effects and transfers resources from government to industry so the last one increases its profits. If industry decides to integrate it does not get any subsidy. In other words, by not integrating, the industry compels the government to achieve what it got in game A and additionally obtains resources from the government.

The difference between subsidizing exports when \( b<0.97 \) and taxing them when \( b>0.97 \) is explained by the same reasons given in proposition 1 but in terms of government intervention: an increase in the subsidy has two effects on profits. One the one hand, due to the efficiency effect, the subsidy increases profits and welfare. On the other hand, due to the strategic effect, the subsidy has a negative repercussion on profits. The more similar final goods are, the smaller the gain due to the efficiency effect and the greater the loss due to the strategic effect. The latter effect is dominant if \( b>0.97 \) and, in this case, it is better to tax exports.
3.3 Welfare.
In this section we solve stage zero. Following Neary (1989), we assume that each government can either decide not to give any subsidy, so industry decides to integrate (game A), or decide the subsidy after the industry has decided the integration level avoiding, in this way, integration (game B). Alternatively, we can assume that in stage zero, the industry chooses between game A and game B. This game equilibrium is given by:

**Proposition 4:** *A dominant strategy for each government (each country's industry) is not to commit itself to a trade policy (not to integrate). That is, welfare and net profits are greater when industry decides not to integrate and government gives a subsidy than when industry is vertically integrated and government does not intervene.*

**Proof.** See Appendix.

Government can even be committed ex-ante to a trade policy it will not ultimately follow. In order to explain this result, we analyze the role of vertical integration and tax/subsidy as trade policy instruments. From the above results, we can conclude that both instruments serve two goals: to correct inefficiency due to double marginalization and to avoid the strategic effect. In this sense, both instruments are substitutes. The difference between them stems from the response magnitude of prices, output and the rest of the model variables due to changes in integration level or subsidy. With the instruments and functional forms settings, the model variables are more sensitive to integration level changes than to subsidy changes. Welfare loss -due to the prisoner's dilemma- occurs in both countries as industry and governments strategically set trade policy instruments; this loss is greater with vertical integration than with subsidies. We are able to interpret that the industry is more aggressive in choosing the integration level than the government in choosing the subsidy. In fact, if we consider the cooperative cases, the prisoner's dilemma loss vanishes and the welfare level is the same in both games. For obvious reasons, game B is better for the industry.
4. TRADE POLICY WHEN FINAL GOODS ARE CONSUMED DOMESTICALLY

Thus far we have ruled out domestic consumption of final goods. This has allowed us to focus on profit-shifting and terms of trade motives for trade policy. However, this assumption neglects a third way in which trade policy may yield welfare gains when markets are imperfectly competitive. Since oligopolistic markets are generally characterized by a gap between price and marginal cost of a product, there is a potential role for trade and industrial policy to reduce this distortion. In this section, we review the robustness of the above results assuming that firms $D_i$, $i=1,2$, compete in country $i=1,2$ markets. The third market is outside the model. First we assume that both countries' markets are integrated. Later, we assume segmented markets.

4.1 Integrated markets

With integrated markets and zero transportation costs, both market prices are the same and firms are not able to discriminate each country's consumers. Each country's trade and industrial policy consists in subsidizing all production, whether it is destined for domestic consumption or export. This situation is similar to a common market where each country is able to subsidize its producers but, due to a trade agreement, there are no tariffs. Under these assumptions, the model only changes with regard to the definition of the welfare function. Final good total demands are given by (2). Let $\lambda_i$ be the proportion of country $i$'s demand for each good and $\lambda_j = 1 - \lambda_i$ the proportion of country $j$'s demand for each good. Then, good $i=1,2$ demand from country $j=1,2$ consumers is given by $\lambda_j x_i$. So the welfare function is given by:

$$
\Omega_i = \frac{\lambda_i x_i^2}{2} + \frac{\lambda_j x_j^2}{2} + (B(\delta_i)-1)x_i^2 + t_i x_i
$$

(16)

where the first and second terms are consumer surplus for domestic and foreign goods consumption, respectively. The third term is the industry profits (equation 10). The fourth term is tax/subsidy collection/cost.

The tax/subsidy to maximize welfare is given by:
\[ t_1 = \left\{ \frac{(2-b^2)B(\delta^*_j) + b^2}{(1-b^2)B(\delta^*_j) + b^2} - B(\delta^*_j) \right\} x_1 - \lambda_1 x_1 + \frac{\lambda_1 b}{(1-b^2)B(\delta^*_j) + b^2} x_j \]  

(17)

where the first term is equal to expression (13) and is explained by the same reasons. The second term is due for domestic final good market mark-up. The third term arises from imported good consumption. This last term is positive and increases domestic industry's cost, thus inducing a greater consumer surplus due to a greater consumption of imported goods.

4.1.1 Game A

With respect to integration decisions, the result is the same as in proposition 1 because, as we have seen in section 4.1, \( \delta^* \) depends neither on trade policy nor production costs. So the first term of (17) disappears and the only role of a subsidy is to reduce final market mark-up.

4.1.2 Game B

Applying lemma 2, the industry does not integrate in order to get a greater subsidy (the first term of (17) is negative) and consequently greater profits.

4.1.3 Welfare

From section 3.3, we know that game B equilibrium welfare (gross profits) is greater than game A equilibrium welfare. However, when there is consumption in producer countries, the lower prices under game A imply welfare gains due to a greater consumer surplus and this positive effect would be able to reverse proposition 4. The conditions under which this does not occur are given in the next result:

Proposition 5: A dominant strategy for both governments is to choose game B if any of the following conditions is true:

i) \( \forall \lambda \) and \( b > 0.45 \).

ii) \( \forall b \) and \( \lambda \equiv 1/2 \).

Proof: See Appendix.
4.2 Segmented Markets

With segmented markets firms are able to discriminate both country consumers. This assumption also allows government to discriminate subsidies, that is, it gives a production subsidy for domestic consumption and a production subsidy for foreign consumption. Under these assumptions and with constant marginal costs, country $i$ market equilibrium is independent of country $j$ market equilibrium. So we focus on market $i$ equilibrium where domestic and foreign industry compete. Market $j$ equilibrium is symmetric. Final good demands are given by (2). Country $i$ welfare is given by:

\[ \Omega_i = \frac{x_i^2}{2} + \frac{x_j^2}{2} + (B(\delta_i)-1)x_i^2 + t_i x_i \]  

(18)

and country $j$ welfare is given by:

\[ \Omega_j = (B(\delta_j)-1)x_j^2 + t_j x_j \]  

(19)

Note that (18) and (19) are special cases from (16) with $\lambda_i=1$ and $\lambda_i=0$, respectively. So, the conclusions with regard to segmented markets are given by proposition 5.

6. Conclusions

In this paper we have studied the optimality of export subsidies when the exportable good is produced from an intermediate good and the market of the latter is imperfect. In this context, we show that government has incentives to subsidize exports when exporting firms compete in prices and the trade policy is set before firms set their prices. The subsidy arises to eliminate intermediate market inefficiency due to double marginalization. We also show that the possibility of being subsidized gives industry incentives to maintain intermediate good inefficiency (not to integrate vertically). In contrast, if government decides not to subsidize exports, industry will integrate to correct the intermediate good market inefficiency. Finally, we show that domestic welfare is greater if industry does not integrate and is subsidized than if it integrates and does not get any subsidy.
It is important to remember that some contributions to the theory have criticized strategic trade policy. Also the first empirical studies have reinforced doubts about the scope of an interventionist argument. In an empirical evaluation, Montet (1994) points to the great inefficiency of aid assistance policies directed towards several industries in Europe and Japan and the difficulties that United States institutions have in adopting credible trade policies. However, our findings, as the other authors, may be useful for trade liberalization negotiations and invite to follow developing industrial organization and trade policy models.
APPENDIX: PROOFS

Proof Lemma 1: Let $B_i = B(\delta_i)$, $B_j = B(\delta_j)$ and $D$ the denominator of expression (7). The effect of an increase in $\delta_i$ in output (8) in given by:

$$\frac{\Delta x_{i1}}{\Delta \delta_i} = \frac{\Delta x_{i1}}{\Delta B_i} \frac{\Delta B_i}{\Delta \delta_i} = -2 \frac{\Delta x_{i1}}{\Delta B_i} = -2 \frac{x_{i1}}{D} \left( B_j (1-b^2) + b^2 \right) > 0$$

To see the effect in the price of the intermediate good we re-rewrite (7) as:

$$w_i = (H-2\delta_i)x_i = (B_i - 2)x_i$$

so

$$\frac{\partial w_i}{\partial \delta_i} = -2 \frac{\partial w_i}{\partial B_i} = -2 \frac{x_{i1}}{D} \left( B_j (2-b^2) + b^2 \right) < 0$$

Deriving (4) we obtain:

$$\frac{\partial p_i}{\partial \delta_i} = \frac{\partial w_i}{\partial \delta_i} + \frac{\partial x_{i1}}{\partial \delta_i} = -2 \frac{x_{i1}}{D} B_j < 0$$

Proof Lemma 2: Let $B_i = B(\delta_i)$, $B_j = B(\delta_j)$. From (8) and (13) we get the third stage game B equilibrium output:

$$x_i = \frac{bt_j + (1+b)B_j - b}{2B_j}$$

So, $\partial x_i / \partial \delta_i = 0$

Deriving (7): $\frac{\partial w_i}{\partial \delta_i} = -2x_i < 0$

Deriving (16): $\frac{\partial t_i}{\partial \delta_i} = 2x_i > 0$

Deriving (4): $\frac{\partial p_i}{\partial \delta_i} = 0$
and deriving (10) $\frac{\partial \Pi_i}{\partial \delta_i} = -2x_i^2 < 0$.

**Proof Proposition 4 and 5:** We have the following game for both governments:

<table>
<thead>
<tr>
<th>Country j</th>
<th>Game A</th>
<th>Game B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game A</td>
<td>$\Omega_i^A$, $\Omega_j^A$</td>
<td>$\Omega_i^B$, $\Omega_j^B$</td>
</tr>
<tr>
<td>Country i</td>
<td>$\Omega_i^A$, $\Omega_j^A$</td>
<td>$\Omega_i^B$, $\Omega_j^B$</td>
</tr>
<tr>
<td>Game B</td>
<td>$\Omega_i^B$, $\Omega_j^B$</td>
<td>$\Omega_i^B$, $\Omega_j^B$</td>
</tr>
</tbody>
</table>

where $\Omega_i^{RK}$ is country $i$ welfare when it chooses game $R=A,B$ and country $j$ chooses game $K=A,B$. As these expressions only depend on parameters $b$ and $\lambda_i$, this game solution is obtained graphically.
REFERENCES


Flath, D., 1991, "When is it Rational for Firms to Acquire Silent Interests in Rivals?" International Review of Industrial Organization 9, 573-583.


