Economics Bulletin

Volume 32, Issue 2

Can Governments Reverse First-Mover Advantages of Foreign Competitors?

Armando Jose Garcia Pires
Institute for Research in Economics (SNF)

Abstract

We show that governments can use export subsidies to reduce or even reverse the first-mover advantages of foreign competitors. In particular, if the cost disadvantage of Stackelberg followers relatively to Stackelberg leaders is not too large, the export subsidy makes the former produce more than the latter. Welfare unambiguously increases in countries with Stackelberg followers and in consumer countries, but decreases in countries with Stackelberg leaders. In turn, depending on the relative difference in cost competitiveness between leaders and followers, welfare can either increase or decrease in the world economy.

We thank Rod Falvey and one anonymous referee for extremely helpful comments and suggestions. The usual disclaimer however applies.
Citation: Armando Jose Garcia Pires, (2012) "Can Governments Reverse First-Mover Advantages of Foreign Competitors?", *Economics Bulletin*, Vol. 32 No. 2 pp. 1527-1536.
Contact: Armando Jose Garcia Pires - armando.pires@snf.no.
Submitted: November 02, 2011. **Published:** May 22, 2012.

1. Introduction

One central result in the strategic trade literature is that governments can use export subsidies to promote "profit-shifting" effects from foreign firms to domestic ones (Brander and Spencer, 1985). This outcome arises in a context where domestic and foreign firms have the same marginal costs and there is no leader in the industry in terms of first-mover advantages. In this paper, we relax these two assumptions, symmetric competitiveness and no first-mover advantages.

To our knowledge, the strategic trade literature has only considered the first case (i.e.: firms differ in marginal costs) but not the second (i.e.: there is a leader in the industry). In particular, de Meza (1986) and Neary (1994) model an export subsidy game similar to Brander and Spencer (1985), where the home and the foreign firms have different marginal costs. It is well-known that when firms differ in marginal costs, the lower cost firm produces more than the higher cost one. de Meza (1986) and Neary (1994) show that, as a consequence, "winners" (i.e.: firms that produce more due to lower marginal costs) are preferred for government support relative to "losers" (i.e.: firms that produce less due to higher marginal costs), given that the former cause larger "profit-shifting" effects than the latter.

In our model, besides asymmetries in marginal costs, we also have asymmetries in the order of moves, in the spirit of von Stackelberg (1934). The result that when firms differ in the order of moves, the Stackelberg leader ends up producing more than the Stackelberg follower, is familiar. Then, like differences in marginal costs, differences in the order of moves also introduce output asymmetries between firms.

In this framework, we show that countries that host Stackelberg followers can use export subsidies to reduce, or even reverse, the first-mover advantages of foreign Stackelberg leaders. In particular, if the cost advantage of Stackelberg leaders over Stackelberg followers is not too large, the latter end up producing more than the former. As a result, countries that host Stackelberg followers and consumer countries are better off with export subsidies than under free trade. The contrary occurs in countries that host Stackelberg leaders. Welfare in the world economy can either increase or decrease, depending on the relative difference in cost competitiveness between leaders and followers.

The paper has the following structure. Next, we present a Stackelberg leader model where firms differ in marginal costs. Then, we find the export

subsidy equilibrium. Thereafter, we calculate welfare levels under the no subsidy and the subsidy cases. We conclude discussing our main results.

2. Asymmetric Stackelberg Model

The world economy consists of: (1) two producer countries, home and foreign; (2) two firms that produce a homogeneous product, the home firm and the foreign firm; and (3) a consumer country, the third country, which is not involved in production and where firms sell all their output. Foreign variables are indicated by an asterisk. This set-up is usually called the "third-market" model after Brander and Spencer (1985).

As in Brander and Spencer (1985), national governments can choose to subsidize exports. Where s is the export subsidy given by the home government to the home firm and s^* is the export subsidy given by the foreign government to the foreign firm.

Following de Meza (1986) and Neary (1994), we model asymmetries in cost competitiveness by assuming that the foreign firm has an advantage in marginal costs relatively to the home firm, i.e.: $c \geq c^*$. Then, when $c > c^*$, the foreign firm has higher competitiveness than the home firm (when $c = c^*$, the foreign firm and the home firm have the same competitiveness).

In addition, we also model asymmetries in the order of moves of players by adopting a standard Stackelberg duopoly model. We consider that the foreign firm is the Stackelberg leader and the home firm is the Stackelberg follower. As such, the foreign firm has a first-mover advantage in outputs relatively to the home firm.

Demand and Profits. Following Brander and Spencer (1981), the home firm and the foreign firm face a linear demand in the third country:

$$P^{Third} = a - b\left(q + q^*\right), \tag{1}$$

where q is the sales of the home firm, q^* is the sales of the foreign firm, a is the intercept of the demand and b is an inverse measure of market size.

Profits by the home firm and the foreign firm are respectively[1]:

[1] We assume that trade and fixed costs are zero. The introduction of symmetric trade and fixed costs would not change the results, because it would affect the firms symmetrically. Asymmetric trade costs would contribute to the competitiveness of the firm with lower trade costs. However, this is already captured in our model by the asymmetry in marginal costs. Fixed costs would raise issues of non-production that are not central here, since we are interested in analyzing cases where both firms are active in the market.

$$\begin{aligned} \Pi &= (P-c)\,q + sq \\ \Pi^* &= (P-c^*)\,q^* + s^*q^*, \end{aligned} \tag{2}$$

Timing of the Game. The timing of the game is the following: in stage 1 the home country and the foreign country pick s and s^*, respectively; in stage 2 the foreign firm chooses q^*; in stage 3 the home firm sets q.

Production Equilibrium. The game is solved by backward induction. Using the home firm's first order condition (FOC), we can derive the home firm's reaction function:

$$q(q^*, s) = \tfrac{a-c+s-bq^*}{2b}, \tag{3}$$

Output by the foreign firm can be found by substituting equation (3) in equation (2) and solving for the foreign firm's FOC. After some simple algebra, we arrive at the following expression:

$$q^* = \tfrac{2(a-c^*)-(a-c)+2s^*-s}{2b}. \tag{4}$$

We can now compute output production by the home firm by substituting the previous expression into equation (3):

$$q = \tfrac{3(a-c)-2(a-c^*)+3s-2s^*}{4b}. \tag{5}$$

Since we are considering international competition, we want to focus on the cases where, even without a subsidy, both the home firm and the foreign firm can export (standard assumption in the trade literature). Making $s = s^* = 0$ in equations (4) and (5), for this to occur we just need to guarantee that the home firm (Stackelberg follower) exports. This is so if:

$$a > 3c - 2c^*. \tag{6}$$

In other words, both the home firm and the foreign firm export when the cost competitiveness differences between them are not extremely large.

Furthermore, if export subsidies are not considered (i.e.: $s = s^* = 0$), then the foreign firm will always produce more than the domestic firm, since:

$$q^* - q = \tfrac{((a-c^*)+5(c-c^*))}{4b} > 0. \tag{7}$$

Note that this is independent of whether the foreign firm has only first-mover advantages (i.e.: $c = c^*$) or competitiveness advantages as well (i.e.: $c > c^*$).

In addition, the export subsidy is a "beggar-thy-neighbor" policy, given that it results in "profit-shifting" effects. This can be seen by looking at the home firm reaction function (equation (3)), and the output expressions for the home firm and the foreign firm (equations (4) and (5)). In fact, an export subsidy by the home government induces the home firm to produce more and the foreign firm to produce less (and similarly for a subsidy by the foreign government).

3. Export Subsidy

We now pass on to the export subsidy stage. Note first that the foreign country's welfare function equals:

$$W^* = \Pi^* \left[q\left(s, s^*\right); q^*\left(s, s^*\right), s^* \right] - s^* q^*\left(s, s^*\right). \tag{8}$$

We can differentiate the previous expression in relation to s^* to obtain:

$$\frac{dW^*}{ds^*} = \frac{\partial \Pi^*}{\partial q^*}\frac{dq^*}{ds^*} + \frac{\partial \Pi^*}{\partial q}\frac{dq}{ds^*} - s^*\frac{dq^*}{ds^*}. \tag{9}$$

From the envelope theorem, we have that the first term on the right hand side of equation (9) equals zero (i.e.: $\frac{\partial \Pi^*}{\partial q^*} = 0$). The second term also cancels out, since the home firm being a follower cannot influence the strategic choices of the foreign firm (i.e.: $\frac{\partial \Pi^*}{\partial q} = 0$). Finally, for the last term we have that $-s^*\frac{dq^*}{ds^*} = -s^*\frac{1}{b}$. Therefore, the optimal subsidy attributed by the foreign government to the foreign leader is zero:

$$\hat{s}^* = 0. \tag{10}$$

In this sense, an export subsidy to the Stackelberg leader (the foreign firm) reduces the foreign country's welfare. This is a well-known result from the strategic trade literature: a Stackelberg leader does not need an export subsidy, since it already has a first-mover advantage. Accordingly, a subsidy to the Stackelberg leader increases the tax burden of the society but does not generate any welfare gains to compensate. This is so because output decisions made by the Stackelberg leader already take into account the effects on the strategic choices of the Stackelberg follower. In other words, the foreign firm can trigger "profit-shifting" effects by itself without the need of a subsidy.

To derive the home government subsidy, we start by defining the home country welfare function:

$$W = \Pi\left[q\left(s, s^*\right); q^*\left(s, s^*\right), s\right] - sq\left(s, s^*\right). \tag{11}$$

Differentiating the above expression in relation to s:

$$\frac{dW}{ds} = \frac{\partial \Pi}{\partial q}\frac{dq}{ds} + \frac{\partial \Pi}{\partial q^*}\frac{dq^*}{ds} - s\frac{dq}{ds}. \tag{12}$$

From the envelope theorem we have that the first term on the right hand side of equation (12) equals zero (i.e.: $\frac{\partial \Pi}{\partial q} = 0$). For the second and third terms, we obtain respectively $\frac{\partial \Pi}{\partial q^*}\frac{dq^*}{ds} = \frac{1}{2}q$ and $-s\frac{dq}{ds} = -s\frac{3}{4b}$. It follows that equation (12) simplifies to:

$$\frac{dW}{ds} = \frac{1}{2}q - \frac{3s}{4b}. \tag{13}$$

Solving equation (13) for s and substituting for q from equation (5), we arrive at the optimal subsidy for the home firm:

$$\hat{s} = \frac{3(a-c)-2(a-c^*)}{3}. \tag{14}$$

Note, first, that the amount of subsidy given by the home government is decreasing in the cost competitiveness disadvantage of the home firm, i.e.: the home firm's subsidy is higher when c is closer to c^*. As discussed in the introduction, this resembles the results in de Meza (1986) and Neary (1994). Second, as long as equation (6) holds (the home firm is able to export), regardless of $c = c^*$ (only first-mover advantages) or $c > c^*$ (first-mover advantages plus asymmetries in competitiveness), the subsidy to the home firm is always higher than that to the foreign firm:

$$\hat{s} > \hat{s}^* = 0. \tag{15}$$

We are interested in understanding why this occurs. We start by noting that the outputs of the home firm and the foreign firm equal:

$$\begin{aligned} q &= \frac{3(a-c)-2(a-c^*)}{2b} \\ q^* &= \frac{4(a-c^*)-3(a-c)}{3b}. \end{aligned} \tag{16}$$

Therefore:

$$q - q^* = \frac{15(a-c)-14(a-c^*)}{6b}. \quad (17)$$

The home government subsidy then only makes $q > q^*$ if $a > 15c - 14c^*$. This is a stricter condition than the trade condition for the Stackelberg follower (equation (6)). Therefore, when the cost disadvantage of the Stackelberg follower relatively to the Stackelberg leader is not very large, an export subsidy in addition to "profit-shifting" effects can also produce "first-mover-shifting" effects, i.e.: the Stackelberg follower ends up producing more than the Stackelberg leader. Otherwise, when the cost disadvantage of the Stackelberg follower is substantial, the export subsidy only gives rise to the standard "profit-shifting" effects.

Summing up, the home country has incentives to support a domestic follower, because by playing Stackelberg against the foreign leader, it can preclude the latter from playing Stackelberg against the former. In addition, if the cost differences between the two rivals are not too large, the home government intervention can induce the domestic Stackelberg follower to produce more than the foreign Stackelberg leader, i.e.: the home government subsidy can reverse the first-mover advantage of the foreign Stackelberg leader.

4. Welfare

In our model, due to the third market assumption (i.e.: all demand is in a third country that is not involved in production), we abstract from consumer welfare in the home country and in the foreign country. However, we can still evaluate what occurs to producer surplus in the home country and in the foreign country and to consumer welfare in the third country, resulting from the export subsidy. In order to do this, we calculate welfare levels in the home country, the foreign country and the third country for the no subsidy ($s = s^* = 0$) and the subsidy case (s and s^* from equations (10) and (14)). Welfare levels for the home country and the foreign country are as in equations (8) and (11). As such, for producer countries, the subsidy policy increases welfare if firms' profits net of subsidies are higher than in the no subsidy case. In turn, welfare for the third country equals:

$$W^{Third} = \frac{\left(a-P^{Third}\right)^2}{2b}. \quad (18)$$

For the consumer country, then, the subsidy policy increases welfare if consumption is higher than in the no subsidy case.

We start with the no subsidy case. Substituting in equations (8) and (11) for prices and outputs from equations (1), (4) and (5) (with $s = s^* = 0$), we obtain:

$$\begin{aligned} W &= \frac{(3(a-c)-2(a-c^*))^2}{16b} \\ W^* &= \frac{((a-c^*)+(c-c^*))^2}{8b}. \end{aligned} \tag{19}$$

To derive welfare in the third country, we substitute in equation (18) for prices and outputs from equations (1), (4) and (5) (with $s = s^* = 0$):

$$W^{Third} = \frac{(3a-c-2c^*)^2}{32b}. \tag{20}$$

We turn now to the subsidy case. Substituting in equations (8) and (11) for prices, outputs and export subsidies (equations (1), (4), (5), (10) and (14)):

$$\begin{aligned} W_{Sub} &= \frac{((a-c)-2(c-c^*))^2}{12b} \\ W^*_{Sub} &= \frac{((a-c^*)+3(c-c^*))^2}{18b}, \end{aligned} \tag{21}$$

where the subscript Sub refers to the subsidy game.

For the third country, we substitute in equation (18) for prices, outputs and export subsidies (from equations (1), (4), (5), (10) and (14)):

$$W^{Third}_{Sub} = \frac{(5a-3c-2c^*)^2}{72b}. \tag{22}$$

Next we ask how the subsidy policy changes welfare relative to the no subsidy case. For the home country and the foreign country, we have:

$$\begin{aligned} W_{Sub} - W &= \frac{((a-c)-2(c-c^*))^2}{48b} > 0 \\ W^*_{Sub} - W^* &= -\frac{(5(a-c^*)+9(c-c^*))((a-c)-2(c-c^*))}{72b} < 0 \end{aligned} \tag{23}$$

The home country is then better-off in the subsidy case. The reason is that the home country benefits from "profit-shifting" and "first-mover-shifting" effects. However, as long as equation (6) is satisfied, the foreign country is worse off. This is so since, as we have already noted, the subsidy policy of the home country has "beggar-thy-neighbor" effects.

In turn, for the third country:

$$W_{Sub}^{Third} - W^{Third} = \frac{(19a-9c-10c^*)(a-3c+2c^*)}{288b} > 0. \quad (24)$$

As long as equation (6) holds, welfare in the consumer country always increases. The rationale is that the export subsidy by the home country to the Stackelberg follower can reduce the first-mover advantages of the Stackelberg leader, and therefore increase competition.

It is then interesting to know, if the world is better-off in the no subsidy or in the subsidy case. If we only consider the producer countries, we have:

$$(W + W^*) - (W_{Sub} + W_{Sub}^*) = \frac{(27(c-c^*)+7(a-c^*))((a-c)-2(c-c^*))}{144b} < 0 \quad (25)$$

As long as equation (6) is satisfied, the losses of the country with the Stackelberg leader ("beggar-thy-neighbor" effects) are larger than the gains of the country with the Stackelberg follower ("profit-shifting" and "first-mover-shifting" effects). However, if we also consider the consumer country:

$$\begin{aligned}\left(W + W^* + W^{Third}\right) - \left(W_{Sub} + W_{Sub}^* + W_{Sub}^{Third}\right) = \\ -\frac{(5a-63c+58c^*)(a-3c+2c^*)}{288b} \lesseqgtr 0 \end{aligned} \quad (26)$$

World welfare can then increase or decrease with the subsidy policy. To see this note that, as long as equation (6) is satisfied (i.e.: $a > 3c - 2c^*$), the second term in the numerator of equation (26) is always positive. However, the first term can either be positive or negative. The first term is negative (i.e.: world welfare increases with the subsidy policy) if $3c - 2c^* < a < \frac{(63c-58c^*)}{5}$. This is so when the cost competitiveness disadvantage of the Stackelberg follower relatively to the Stackelberg leader is low. The rationale for this is that when the leader and the follower have similar cost competitiveness levels, the export subsidy can induce higher "profit-shifting" and "first-mover shifting" effects, and therefore the gains of the home country and the third country are larger (equations (23) and (24)) and the losses of the foreign country are smaller (equation (23)).

5. **Discussion**

In this paper, we have shown that governments can use export subsidies to reduce or even reverse the first-mover advantages of foreign competitors. In particular, if the cost disadvantage of domestic followers is not very large *vis-à-vis* foreign leaders, the export subsidy in addition to "profit-shifting" effects can also have "first-mover-shifting" effects, i.e.: to make domestic Stackelberg followers produce more than foreign Stackelberg leaders.

In terms of welfare, we have found that countries that host Stackelberg followers are better-off once the export subsidy has "profit-shifting" and "first-mover shifting" effects. Consumer countries are also better-off, because the subsidy can eliminate the first-mover advantage of Stackelberg leaders, increasing competition. Countries with Stackelberg leaders, on the contrary, are worse-off, since the subsidy policy has "beggar-thy-neighbor" effects. The world economy however can gain with export subsidies when the leaders and the followers are very similar in terms of costs competitiveness, since it makes it more likely that the positive effects of subsidy (increase in competition, "profit-shifting" and "first-mover shifting" effects) compensate for the negative ones ("beggar-thy-neighbor" effects).

References

Brander, J. and B. Spencer (1985) "Export Subsidies and International Market Share Rivalry" *Journal of International Economics* 18, 83-100.

de Meza, D. (1986) "Export Subsidies and High Productivity: Cause or Effect?" *Canadian Journal of Economics* 19, 347-350.

Neary, P. (1994) "Cost Asymmetries in International Subsidy Games: Should Governments Help Winners or Losers?" *Journal of International Economics* 37, 197-218.