Tariffs and Potential Entry

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ABSTRACT

Using a duopolistic, segmented market framework, we investigate the Brander and Spencer (1981) partial equilibrium result, whereby a tariff can induce entry in a general equilibrium context. It is found that including income effects in the analysis results in a relatively greater profitability for deterring entry than accommodating entry so that the partial equilibrium result no longer holds. Furthermore, adapting capacity commitment into Dixit's (1979) model will not change the above conclusion even when we permit the post-entry Nash solution to be a Cournot-Nash solution instead of the Stackelberg solution.

INTRODUCTION

The issue of tariffs and entry first arose in Brander and Spencer (1981). The main objective in their paper is to examine the incentives for using tariffs to extract monopoly rents from imperfectly competitive firms with a partial equilibrium framework. In their paper, using a simple Stackelberg entry-deterrence model, an existing foreign firm who is a monopoly supplier to the home country can utilise his first mover advantage to decide whether to deter or accommodate a potential home entrant in the import sector of the home country. They then proceeded to show that a rent-extracting policy is particularly beneficial to the home country in this situation. Subsequently, in one of their side remarks, they also proved that an increase in tariffs increases the relative attractiveness of the Stackelberg solution.
as compared to the entry-deterring solution, to the foreign firm. They stated that an implication of the above mentioned proof is that a tariff may induce entry by making the Stackelberg solution relatively more profitable than deterring entry for the foreign firm.

In this paper, we propose to use Dixit's (1979) entry-deterrence/accommodation model in order to re-examine the issue as to whether entry can in fact be induced by a tariff, in a general equilibrium context, given zero tariffs in the initial state. We assume that initially, profits at both entry-deterrence and entry-accomodation solutions are equal. In a segmented market framework, a tariff is shown to reduce the foreign marginal revenue for linear demands, due to substitution effects. Therefore, the foreign reaction curve for the export market shifts leftwards. The tariff causes a decrease in foreign export profits for both the Stackelberg as well as the entry-deterring solutions, with the decrease greater for the latter case due to the assumption that, initially, the profits at the two solutions are equal and consequently that the latter level of exports must be greater than the former in order for entry to be possible. Hence, the Brander and Spencer result obtains, that is, a tariff can induce entry by making the new Stackelberg equilibrium relatively more profitable than deterring entry.

Considering the income effects alone, it is found that at the initial home price, real income for the home country increases due to the lower foreign supply price. This increases total demand for the home imported good and the corresponding increase in the home marginal revenue curve for linear demands, causes an upward shift in the home reaction curve. Consequently, the level of export required to deter entry has to increase while, in contrast, the Stackelberg leader's export level falls at the new Stackelberg equilibrium.

Including both the income and substitution effects and using the envelope theorem, it is found that the tariff affects the Stackelberg leader's profits in three ways; (1) the loss in profits due to the substitution effects, (2) the gain in profits due to the direct effect of the tariff on domestic prices, at the initial equilibrium level of exports and home production and (3) the effect of the tariff on the home reaction function, multiplied by the slope of the demand curve. It is found that the first two effects cancel out, leaving only the third effect. Since the effect of the tariff on the home reaction function has been shown to be positive while the slope of the demand curve is negative, there is therefore, a net loss.
However, for the entry-deterrence solution, again using the envelop theorem, the effect of the tariff on the foreign export profits consists only of the loss in profits due to the substitution effects and the gain due to the direct effect of the tariff on the home price, at the initial entry-deterring level of exports. Since the home entrant is deterred, the shift in the home reaction function does not affect the foreign export profits directly. As the first two effects cancel out, the net effect is zero.

The issue of credibility can be overcome by adapting capacity commitment ideas into this model. This can be done by assuming a second factor, capital, as the irreversible commitment of the foreign incumbent and further assuming that both goods share the same factor intensity so that as resources move between sectors, factor prices do not change. With capacity commitment, Ware (1984) has shown that the post-entry duopoly solution may be the Cournot-Nash solution instead of the Stackelberg solution. However, allowing for a Cournot-Nash post-entry solution does not change the ranking in the relative profitability of the entry-accommodation and entry-deterrence solutions to the foreign incumbent. Consequently, in a general equilibrium context, the entry-deterrence solution is found to be relatively more profitable than accommodating entry so that the partial equilibrium result no longer holds.

MODEL

Assumptions

1. There are two countries, home and foreign.

2. Two goods, X and Y. Initially, under free trade the foreign monopolist produces and exports X to the home country. X has declining average costs since there are fixed costs involved. The home country has access to the same technology and the presence of monopoly profits in the X industry attracts a potential home entrant, who is also the sole producer in the home country. Y is produced in both countries using identical constant returns to scale technology under perfectly competitive conditions.

3. The two goods are produced from a single factor, labor, (L) which is the total endowment of each country. Labor is assumed to be internationally immobile.

4. Factor markets are assumed to be perfectly competitive in order to focus on output market distortions. This is not such an unreasonable assumption if, for example, there are many other compe-
titive goods in the economy instead of Y alone. With this assumption, the final output of the economy is always located on the production frontier.

5. Initially, there is free trade.

FREE TRADE WITH ENTRY

As in Brander and Spencer (1981), it is assumed that the potential home entrant produces only for the home market and not export. Following Dixit (1979)¹, this potential home entrant behaves in a Cournot fashion, ie; he takes the output of the foreign incumbent as given and if he enters, will produce the corresponding profit-maximizing level of output. The foreign incumbent knows that the potential entrant will follow this Cournot rule and either accepts the Stackelberg leader-follower solution or deters entry, depending on which yields a higher profit. Furthermore, the foreign incumbent who sells both in the foreign and home country faces “segmented markets” such that X can be exported from the foreign to the home country, but no X can be profitably re-exported back to the foreign country.

The foreign country’s profit-maximizing problem is;

\[
\text{Max. } \pi^* = V_F^* + V_H^* + F^*
\]  

where \( V_F^* = p^* \cdot X_F^* - c^* X^* \) or the variable profits selling in the foreign market.

\( X_F^* = \) sales in the foreign market

\( p^* = (P_X/P_Y)^* \) the price faced by the foreign in terms of good \( Y^* \), the numeraire

\( c^* = \) constant foreign marginal costs of production

\( V_H^* = p \cdot X_H^* - c^* X_H^* \) or the variable profit from exports.

\( X_H^* = \) exports to the home country

\( p = P_X/P_Y \) or the free trade price in the export in terms of Y, the numeraire.

\( F^* = \) foreign fixed costs

Since the potential entrant is assumed to produce for the home market only, the foreign firm will be threatened only in his export market. Thus, only the variable profits from the foreign firm will be affected.
Solving;
\[ \frac{\partial V^*_H}{\partial X^*_H} = 0, \]  
(2)

will implicitly define the foreign reaction curve which is shown as \( R^* R'_f \), in figure (1).

The maximization problem for the potential home entrant is given by;

\[ \text{Max. } \pi = pX - cX - F \]

where \( X \) = home production  
\( c \) = home constant home marginal costs of production  
\( F \) = home firm’s fixed costs.

Solving;
\[ \frac{\partial \pi}{\partial X} \bigg|_{X^*_H} = 0, \]
(4)

defines the home reaction curve \( RR'_1 \) in the previous figure. However, it is assumed that the potential home entrant enters only if he receives strictly positive profits. Hence, the relevant part of the reaction curve is actually given by \( RBA \) in Figure 1. It is further assumed that all the standard assumptions that yield downward sloping reaction functions with stable intersections will hold.

In Figure 1 the foreign incumbent’s choice of an optimal strategy is based on comparing the Stackelberg profit with the profit derived from producing the entry-deterring level of exports, \( b^* \), which is determined by the intersection of the vertical tangent line from the point on the home reaction curve where \( x = 0 \), with the X-axis. Excluding blockaded entry\(^2\), the possible outcomes are as follows;

(i) \( b^* = A \iff V(b^*) = V(S) \), where \( A \) is the point of intersection of the Stackelberg isoprofit contour with the X-axis. Hence \( A \) gives the total amount of \( X \) exported when home production goes to zero, which would yield the same level of profits as at the Stackelberg point

(ii) \( b^* > A \iff V(b^*) < V(S) \)

(iii) \( b^* < A \iff V(b^*) > V(S) \)

Since we have excluded blockaded entry in this model, the entry-deterrence solution will require a foreign export level that is greater
than the monopoly level. The natural question to ask then, is whether this limit level of exports can be a credible threat to the potential entrant. Dixit (1980) uses the idea of a strategic pre-entry investment as the credible threat to the potential entrant. This commitment in capacity serves to alter the post-entry marginal cost curve of the foreign incumbent so that it becomes optimal for the foreign incumbent to produce a post-entry output that is equal to his pre-entry capacity choice. It should be further noted that the investment in capacity is viewed as sunk costs or irreversible commitment. Using

FIGURE 1. The effects of tariff on home and foreign reaction curves.
these assumptions, there will be the two reaction functions in Dixit's (1980) model, as shown in Figure 2 by $R^*R_1^*$ and $N^*N_1^*$, where the former becomes the reaction function if capacity costs matter and the latter if there is spare capacity. In this case, with no change in the home reaction function, by his choice of capacity, the foreign incumbent can pick an equilibrium anywhere on the segment TV of RR$_1$.

FIGURE 2. Dixit's (1980) model with capacity commitment
Since the Stackelberg solution may not lie in this segment, it is possible that the post-entry duopoly solution may be the Cournot-Nash solution instead of the Stackelberg solution, as assumed in Dixit (1979). The commitment model was extended by Ware (1984), from a two stage game to a three stage game by allowing the potential entrant the possibility of sinking capacity in the second stage before the final period equilibrium in quantities. Ware then demonstrated that the feasible set of equilibrium capacity choice by the foreign incumbent is reduced in the three stage game, thereby further reducing the likelihood of a Stackelberg outcome as the post-entry duopoly Nash equilibrium. We can easily adapt these capacity commitment models into this model by assuming another factor, capital, as the commitment to capacity and further assuming that both goods share the same factor intensity so that as resources move between sectors, factor prices do not change. However, for simplicity reasons, we will continue to use Dixit's (1979) model for the following analysis although we will also cover the case of a post-entry Cournot-Nash equilibrium solution if the entrant enters, in the light of the diminishing likelihood of the Stackelberg solution as the post-entry duopoly Nash solution in these commitment models.

In addition, Dixit's (1979) model does not give any presumption as to which outcome is more likely. In analyzing the effect of a tariff imposed by the home country on the optimal strategy of the foreign incumbent, we will assume that initially, in the pre-tariff situation, \( A = b^* \), as shown in Figure 1, so that the foreign incumbent is indifferent between deterring or accommodating entry.

**TARIFFS**

First of all, it is necessary to see how the home and foreign reaction curves shift in response to a tariff imposed by the home country on the imports of \( X \). We assume that the foreign country does not follow any retaliatory measures. Furthermore, we assume that the tariff revenue is redistributed back, lump-sum, to the home consumers.

The income in the home country is;

\[
I = pX + Y + tpX^*_H \tag{5}
\]

where \( p = \bar{p} (1 + t) \) and the last term is the tariff revenue. The market clearing condition is given as follows;

\[
X^*_H + X = D\{p; I(p, X, X^*_H, t)\} \tag{6}
\]
This yields a new market clearing price, \( p(X, X_H, t) \). Therefore, the new profit-maximizing conditions for the foreign monopolist in the export sector and the home producer are as follows:

\[
\frac{\partial V^*_H}{\partial X^*_H} = H^* = H^*(X, X_H^*, t, c^*) \tag{7}
\]

and

\[
\frac{\partial \pi}{\partial X^*_H} = H = H(X, X_H^*, t, c) \tag{8}
\]

Totally differentiating (7) and setting the equation to zero, we have:

\[
dH^* = \left( \frac{\partial H^*}{\partial X} \right) dX + \left( \frac{\partial H^*}{\partial X_H^*} \right) dX_H^* + \left( \frac{\partial H^*}{\partial t} \right) dt \tag{9}
\]

since \( c^* \) is constant.

The shift in the foreign reaction function due to the tariff can be stated as;

\[
\frac{\partial X_H^*}{\partial t} = \left( \frac{\partial H^*}{\partial X_H^*} \right) \tag{10}
\]

From profit maximization, \( \frac{\partial H^*}{\partial X_H^*} < 0 \),

Therefore,

\[
\frac{\partial X_H^*}{\partial t} \bigg|_{\bar{X}} \geq 0 \text{ iff } \frac{\partial H^*}{\partial t} \geq 0
\]

Likewise, the shift in the home reaction function due to the imposition of the tariff is given by;

\[
\frac{\partial X_H}{\partial t} \bigg|_{\bar{X}} = \frac{\left( \frac{\partial H}{\partial t} \right)}{\left( \frac{\partial H}{\partial X} \right)} \tag{11}
\]

Again, since \( \frac{\partial H}{\partial X} < 0 \) from profit maximization,

\[
\frac{\partial X}{\partial t} \bigg|_{\bar{X}} \geq 0 \text{ iff } \frac{\partial H}{\partial t} \geq 0
\]

The effect of the tariff on the foreign and home marginal revenue can be ascertained by considering the impact of the tariff on the demand facing the foreign and home producers respectively. As explained in Jones (1987), the foreign monopolist is interested in \( \bar{p} \) or
the price that he receives for his export. We assume zero tariffs initially. Given home production, $X$, and total demand, $D_X$, the demand facing the foreign monopolist is therefore $(D_X - X)$ due to the Cournot assumption. Given that $D_X = D_X(p, y)$, or that demand for the commodity $X$ depends on the domestic price ratio, $p$, and real income, $y$, (see Caves and Jones 1985);

$$dD_X = \frac{\partial D_X}{\partial p} dp + \frac{\partial D_X}{\partial y} dy$$

where $dy = (-X_H^*) d\tilde{p} + (p - c) dX$ under the assumption of zero tariffs initially. Note that $dy$ differs from the traditional perfectly competitive model by the profit term, $(p - c)$.

Defining;

(i) $\eta = \frac{-p}{X_H^*} \frac{\partial D_X}{\partial p}$

(ii) $m = p \frac{\partial D_X}{\partial \tilde{p}}$(12)

(iii) $\theta_\pi = \frac{(p - c)}{p}$

$$dD_X = -X_H^* \eta \frac{dp}{p} - m \frac{p}{p} X_H^* d\tilde{p} + m \theta_\pi (dX) \quad (12)$$

At given $\tilde{p}$, the foreign monopolist takes $X$ as given so that the change in demand is given by;

$$dD_X = -X_H^* \eta \frac{dp}{p} \quad (13)$$

Therefore, the demand curve shifts inwards. In terms of the effect on the foreign marginal revenue, Finger (1971) has noted that the shift in demand, for the case of a monopolist, may result in a converse shift in the marginal revenue due to the change in the elasticity of demand as the demand curve shifts.

However, he also demonstrated that this will not happen in the case of linear demands. Hence, we can conclude that the leftward shift in the demand will also yield a leftward shift in the foreign marginal revenue for the case of linear demands.
Thus, \( \frac{\partial X_H^*}{\partial t} \bigg|_{x} < 0 \) and the foreign reaction curve shifts leftwards from \( R^*R_1^* \), to \( R^*\tilde{R}_1^* \), in figure (1).

In the case of the home monopolist, from equation (12), at the initial equilibrium home price,

\[
dD_x = -mX_H^* \frac{d\tilde{p}}{\tilde{p}} + m\theta_\pi \, dX
\]

(12')

For the second term, at the initial home price level and the Cournot assumption of given foreign output, there will be no change in the home output as yet. The shift in demand will be the same as that explained by Jones (1987), that is, there is an improvement in the terms of trade because the foreign supply price, \( \tilde{p} \), is lower than the domestic price by the amount of the tariff. Hence, this yields a positive income effect thereby causing a rightward shift in the demand curve. Again from Finger (1971), we can conclude that for linear demands, the home marginal revenue will also shift rightwards so that

\[
\frac{\partial X}{\partial t} \bigg|_{X_H^*} > 0 \text{ and the home reaction curve shifts from } RR_1 \text{ to } R'\tilde{R}_1', \text{ in Figure 1.}
\]

In order to see the effect of the tariff on the optimal strategy of the foreign incumbent, we have to compare the effect of the tariff on the Stackelberg solution, \( S = \{s^*, s\} \) and on the entry-deterring level of output, \( b^* \), as the home and foreign reaction functions shift according to the analysis in the previous section.

In Figure 3, the leftward shift in the foreign reaction curve means that the whole set of foreign isoprofit contours has shifted leftwards. This is shown by the new set of isoprofit contours drawn with dotted lines. Since the Stackelberg position is derived from the tangency point between the highest foreign isoprofit contour and a given home reaction curve, then this leftward shift in the foreign isoprofit map will yield a new tangency position, \( S' \), which will lie to the left of the old Stackelberg position, \( S \). Excluding income effects as in the partial equilibrium framework of Brander and Spencer (1981) means that the home reaction curve does not shift and hence the entry-deterring level of exports, \( b^* \), does not change in Figure 3.
In their partial equilibrium framework, the market-clearing price, $p(X + X_H)$ is obtained from the following market-clearing condition:

$$X_H + X = D(p)$$  \hspace{1cm} (14)
Hence, foreign export profits is given by:

\[ V^*_H (X, X^*_H, t) = X^*_H p(X + X^*_H) - c^* X^*_H \]

\[ \frac{t}{(1 + t)} p(X + X^*_H) X^*_H \]

\[ = \frac{1}{(1 + t)} X^*_H p(X + X^*_H) - c^* X^*_H \quad (15) \]

The new Stackelberg equilibrium is found by maximizing equation (15) subject to the home reaction function, \( X = h(X^*_H) \). The first order-condition is then obtained as follows;

\[ \frac{\partial V^*_H}{\partial X^*_H} = \frac{1}{(1 + t)} p(X + X^*_H) + \frac{X^*_H}{(1 + t)} \frac{dp}{dz} \left( \frac{\partial X}{\partial X^*_H} + 1 \right) - c^* \]

\[ (16) \]

where \( z \equiv (X + X^*_H) \). Setting (16) to zero, we obtain;

\[ c^* = \frac{1}{(1 + t)} p(X + X^*_H) + \frac{X^*_H}{(1 + t)} \frac{dp}{dz} \left( \frac{\partial X}{\partial X^*_H} + 1 \right) \quad (17) \]

The effect of the tariff on foreign export profits at the new Stackelberg equilibrium is:

\[ \frac{dV^*_H}{dt} = \frac{1}{(1 + t)} p(X + X^*_H) \frac{dX^*_H}{dt} + \frac{X^*_H}{(1 + t)} \frac{dp}{dz} \]

\[ \left( \frac{\partial X}{\partial X^*_H} \frac{dX^*_H}{dt} + \frac{dX^*_H}{dt} \right) - c^* \frac{dX^*_H}{dt} - \frac{pX^*_H}{(1 + t)^2} \]

\[ = \frac{dX^*_H}{dt} \left\{ \frac{p}{(1 + t)} + \frac{X^*_H}{(1 + t)} \frac{dp}{dz} \left( \frac{\partial X}{\partial X^*_H} + 1 \right) - c^* \right\} - \frac{pX^*_H}{(1 + t)^2} \]

Substituting the first-order condition into the above equation, we obtain;

\[ \frac{dV^*_H}{dt} = -\frac{pX^*_H}{(1 + t)^2} \quad (19) \]

For the entry-deterrence solution, the foreign export profits is given by;

\[ V^*_H (b^*, t) = \frac{1}{(1 + t)} b^* p(b^*) - c^* b^* \quad (20) \]
Using the same method as before, we obtain,

$$\frac{dV_H^*}{dt} = \frac{-pb^*}{(1 + t)^2}$$  \hspace{1cm} (21)

Comparing equations (19) and (21), with constant marginal costs, and the assumption that (i) $V(S) = V(b^*)$ and therefore, the Stackelberg leader's initial level of exports is less than the entry-deterring level of exports, then the total revenue at the Stackelberg equilibrium must be less than that at the entry-deterring level. Hence, the loss in foreign export profits at the former equilibrium is less than that at the latter equilibrium. Therefore, in Figure 3, the new iso-profit contour (as shown by the dotted line) passing through the new Stackelberg equilibrium is lower than that passing through the unchanged entry-deterring level of exports. Note that although Brander Spencer used specific tariffs in their model, the use of ad valorem tariffs in this model does not change their results, that is, a tariff will reduce foreign export profits by a relatively greater amount for the entry-deterrence solution as compared to the Stackelberg solution.

On the other hand, in a general equilibrium setting, the incorporation of the income effects means that the home reaction curve shifts upwards. Consider now the effect of this shift on foreign exports.

In Figure 4, the new Stackelberg equilibrium shifts north-westwards of S to some point like $S''$. The total change in foreign exports and home production from S to $S''$ is given by the following:

$$SS' + \{s's'' - s^*s^*\}$$  \hspace{1cm} (22)

At the same time, the upward shift in the home reaction curve yields a new entry-deterring level of exports to the right of B, along R'R'1. This can be explained with the use of the partial equilibrium diagram in Figure 5.

In this figure, TD and TMR are the total demand and total marginal revenue curves respectively. The demand curve for the home producer is $(D - b^*)$ and the corresponding home marginal revenue is HMR. The equilibrium position is at 'e' and this yields the home equilibrium output, Ob. Let bB be the level of foreign output. The two quantities together gives the equilibrium price, $p^B$. This results in a net revenue over variable cost which is equal to the fixed cost, F, so that net home profit is zero.
Now, the income effects causes an outward shift in total demand from TD to TD', at the initial home price level. At unchanged levels of home production and foreign exports, this will result in an increase in the equilibrium price from $p^B$ to $p^{B'}$. Consequently, at the initial level of home production, $O_b$, the home monopolist will now obtain positive net profits as shown by the shaded area in the same diagram. Therefore, at the initial zero home profit position, $B$, along $R'R_1$ in Figure 4, there is a new home isoprofit contour passing through $B$ and reaching a maximum along $R'R'_1$ such that $\tilde{\pi}(B) > 0$, where the tilde indicates the new home profits. Obviously then, the new zero home isoprofit contour will lie to the right of $B'$, along $R'R'_1$.

![Figure 4. The general equilibrium case](image)
From the above analysis, the upward shift in the home reaction curve decreases foreign exports at the new Stackelberg equilibrium. On the other hand, in order to deter entry, foreign exports has to increase.

We will now investigate the impact of the leftward and upward shifts in the foreign and home reaction functions respectively, on the relative profitability of the foreign producer at the new Stackelberg and the new entry-deterrence solutions. Including the income effects, the market-clearing condition is given by \( p(X + X^*_H, t) \). Therefore, foreign export profits is given by the following equation;

\[
V^*_f (X, X^*_H, t) = \frac{1}{(1 + t)} X^*_H p(X + X^*_H, t) - c^* X^*_H
\]

Again maximizing the above with respect to the home reaction function, \( X = h(X^*_H, t) \) yields the following first-order condition;

\[
\frac{\partial V^*_H}{\partial X^*_H} = \frac{1}{(1 + t)} p(X + X^*_H, t) + \frac{X^*_H}{(1 + t)} \frac{\partial p}{\partial X^*_H} \left\{ \frac{\partial X}{\partial X^*_H} + 1 \right\} - c^* \]

Therefore,

\[
\frac{dV^*_H}{dt} = \frac{X^*_H}{(1 + t)} \frac{\partial p}{\partial X^*_H} \left( \frac{dx}{dt} - \frac{\partial X}{\partial X^*_H} \frac{dX^*_H}{dt} \right) + \frac{X^*_H}{(1 + t)} \frac{\partial p}{\partial t} - \frac{pX^*_H}{(1 + t)^2}
\]

The above equation includes both the substitution and income effects, whereby comparing with equation (19), we can see that the last term is due to the substitution effects, while the first and second terms are due to the income effects. The second term demonstrates the direct effect of the tariff on the domestic price, at the initial equilibrium level of home exports and home production. From \( p = \tilde{p}(1 + t) \), at the initial levels of foreign exports and home production;

\[
\frac{\partial p}{\partial t} = \tilde{p}
\]

\[
\frac{dV^*_H}{dt} = \frac{X^*_H}{(1 + t)} \frac{\partial p}{\partial X^*_H} \left( \frac{dx}{dt} - \frac{\partial X}{\partial X^*_H} \frac{dX^*_H}{dt} \right) + \frac{X^*_H}{(1 + t)} \left( \tilde{p} - \tilde{p} \right)
\]

since \( \frac{p}{1 + t} = \tilde{p} \)

Hence,

\[
\frac{dV^*_H}{dt} = \frac{X^*_H}{(1 + t)} \frac{\partial p}{\partial X^*_H} \left( \frac{dx}{dt} - \frac{\partial X}{\partial X^*_H} \frac{dX^*_H}{dt} \right)
\]
From $X = h(X_H^*, t)$, we can see that:

$$\frac{\partial X}{\partial t} = \frac{dX}{dt} - \frac{\partial X_H^*}{\partial X_H} \frac{dX_H^*}{dt}$$  \hspace{1cm} (29)$$

Earlier it has been shown that effect of the tariff on the home reaction function has been shown to be positive. Since $\frac{\partial p}{\partial z} < 0$, then equation (28) is negative.

FIGURE 5. The effect of tariff on the profit of the home firm
For the entry-deterring level of exports, the foreign export profits can be shown as follows;

\[ V_H^* (b^*, t) = \frac{1}{(1 + t)} b^* p(b^*, t) - c^* b^* \] (30)

By the same method, we have;

\[ \frac{dV_H^*}{dt} = \frac{b^*}{(1 + t)} \frac{\partial p}{\partial t} - \frac{pb^*}{(1 + t)^2} \] (31)

The above equation is zero by the previous argument in the case of the last two terms for the Stackelberg equilibrium.

Hence, in the general equilibrium framework, the new Stackelberg profit is lower than the new entry-deterrence level of exports. Therefore, the partial equilibrium result is found not to hold in the case when income effects are also incorporated into the analysis.

Note that if we obtain a Cournot-Nash equilibrium as the post-entry Nash solution, then the first-order condition in equation (24) becomes;

\[ c^* = \frac{p}{(1 + t)} + \frac{X_H^*}{(1 + t)} \frac{\partial p}{\partial z} \] (24')

In this case, the effect of the tariff on the foreign export profits at the Cournot-Nash equilibrium is;

\[ \frac{dV_H}{dt} = \frac{X_H^*}{(1 + t)} \frac{\partial p}{\partial z} \frac{dX}{dt} + \frac{X_H^*}{(1 + t)} \frac{\partial p}{\partial t} - \frac{pX_H^*}{(1 + t)^2} < 0 \] (25')

Since the last two terms cancel out while the first term is still negative because the slope is negative, then the effect of the tariff on the home output is positive as shown before.

Hence, having a Cournot-Nash equilibrium solution as the post-entry duopoly outcome if the entrant enters, does not alter the ranking in the relative profitability of the entry-deterrence and the entry-accommodation solutions.

CONCLUSION

Excluding income effects, it is found that a small tariff causes the relative profitability of the new Stackelberg equilibrium to be greater than that at the entry-deterrence solution. However, with income
effects, it is found that the tariff results in a relatively greater profit for entry-deterrence than for entry-deterrence so that a tariff can no longer induce entry as in the partial equilibrium case. This is found to hold even if the post-entry duopoly Nash solution is the Cournot-Nash solution instead of the Stackelberg solution.

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NOTES

1 In Dixit’s model, the two firms do not produce identical goods. In fact, the two goods produced are substitutes.

2 Blockaded entry as defined by Bain, occurs when the established firm can price at the monopoly level and still not incur entry.

3 The literature in industrial organisation draws a distinction between sunk costs and fixed costs which are necessary for production but do not vary with the output level. Fixed costs may be eliminated if a firm decides not to produce while sunk costs are defined as costs which cannot be eliminated, even by ceasing production, so that they are not part of the opportunity cost of production to the established firm though they are to the entrant. For further reference, see Waterson (1984).

4 Note that for the capacity commitment models to work in an international context, we require segmented markets. If each export market is separated from one another as well as from the foreign country’s own market, the foreign incumbent can alter the post-entry marginal cost curve in each export market, separately, in order to achieve the required capacity to be the credible threat in that market.

5 The derivation of this expression can be obtained from the derivation for the case of the perfectly competitive model, that is, reproducing the basic equation from Caves and Jones (1985).

\[ dD_Y + dD_X + (\bar{p} - p) dD_X = - Md\bar{p} + (dY + p dX) + (\bar{p} - p) dX \]

However, unlike the perfectly competitive model, \((dY + pdX)\) is not equal to zero. Instead, it is equal to \((p - c)dX\) due to the intersection of the price line with the production possibility frontier.
REFERENCES


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