Tariffs, Taxes and Foreign Direct Investment

Koo Woong Park[1]
BK21 PostDoc
School of Economics
Seoul National University
E-mail: kwpark@snu.ac.kr

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[ABSTRACT] We study tax (and tariff) competition between two importing countries A and B and the optimal choice between export and foreign direct investment (FDI) of a monopolist multinational company (MNC) of an exporting country C. Ironically, when the host countries A and B have an absolute cost advantage, they engage in *a non-cooperative tax reduction competition* to induce inward FDI and get extra tax revenue and yet this acts adversely to push down the tax rates to zero and reduce their welfare levels and benefits the MNC of country C. For these results, we do not need any host country market imperfections such as unemployment popular in the tariff-jumping literature.

Key Words: multinational company (MNC), foreign direct investment (FDI), tax, tariff, non-cooperative tax competition.

JEL Classification number: F12, F13, C72.

1. INTRODUCTION

What drives multinational companies (MNCs) to undertake foreign direct investment (FDI)? First of all, MNCs retain intangible assets such as research and development (R&D), strategic planning, marketing and data processing functions that can be replicated, once in place, without much additional cost across multiple production lines. Hence, these assets convey a positive externality and give rise to firm-level scale economies (Markusen 2002, pp.18-20 and pp.25-32). Secondly, exports have been a most popular way of serving foreign markets, but transportation costs, import tariffs, import quota, local contents requirements, and other non-tariff barriers work as major obstacles to export. Hence, FDI

[1]Correspondence author: BK21 PostDoc, School of Economics, College of Social Sciences, Seoul National University, San 56-1, Sillimdong, Kwanakgu, Seoul, 151-742, Republic of Korea. Tel: 00 82 (0)10 7900 0372. Fax: 00 82 2 872 7297.

can be seen as a way of avoiding such obstacles. Thirdly, firms may get necessary production factors more easily or more cheaply abroad than at home. Fourthly, strategic alliances between most advanced companies, otherwise fierce competitors themselves, are becoming more and more popular, be they domestic or international. This leads naturally to a formation of an international joint venture or globalized research and development activities. All these economic circumstances provide a good breeding ground for the MNCs to undertake FDI.

There are two main approaches in studying the choice between export and FDI of the MNCs. The first approach is the classical substitution role of FDI for exports. I.e., exporting firms will switch to FDI when tariffs or other trade barriers are sufficiently high such that FDI becomes more profitable than export even after local tax payments. This approach usually results in a tariff-jumping story in the presence of market imperfections, e.g. unemployment. I.e., potential host countries have an incentive to lower tax rate on FDI below import tariff rate to induce inward FDI and thereby reduce domestic unemployment. Brander and Spencer (1984a) study the profit-shifting motive of tariff in two-country trade with imperfect competition. Brander and Spencer (1984b) analyse the dependence of tariff on the nature of the tariff and demand curves in the presence of a cartel of exporting countries. Brander and Spencer (1985) study export subsidy competition by the governments of exporting countries. Brander and Spencer (1987) introduce a tariff jumping theory in the presence of host country unemployment. Dixit (1984) studies optimal trade policy in the presence of oligopolistic industries. Janeba (1998) studies tax competition between two exporting countries in the presence of market imperfections in the producing countries. The second approach is the more recent complementarity role of FDI to exports. I.e., FDI complements exports rather than replaces them in view of quite wide range of empirical evidence. However, this approach remains so far mainly at the empirical level (Lipsey 2002, Markusen 1984, p.224, and Markusen 2002, p.6 characteristics 5). Yet in another approach, Helpman, Melitz and Yeaple (2004) study the mode of foreign market access of the multinational companies using a proximity-concentration trade-off. They highlight the important role of within-sector firm productivity heterogeneity in making export/FDI decisions in a multi-country, multi-sector monopolistic competition model.

In our study, we will focus on strategic interactions between two importing countries A and B, and between these importing countries and a monopolist MNC of country C as a supplier of a single consumption good y. Countries A and B are purely consuming countries and have no producing companies. Countries A and B try to maximize their own national welfare levels defined as the sum of consumer surplus and tax/tariff revenue, and the monopolist MNC tries to maximize its profit. Host countries A and B set their own tariff and tax rates independently. We study the impacts of tariffs and taxes on the MNC's export and FDI decision, strategic interactions between host countries A and B, and also the implications of the resulting trade pattern and welfare. Hence, we incorporate both tax competition and strategic trade behaviours in our model. However, the tax competition in our model occurs because of the non-cooperative behaviours between two importing countries A and B rather than market imperfections such as unemployment in the host countries popular in the tariff-jumping literature. As a result, these strategic behaviours in setting tax/tariff rates lead to a welfare-reducing destructive tax competition without any gain for the host countries.

2. MODEL

We briefly describe the structure of our model first. We have three countries, A, B and C. There is a single consumption good y which is supplied by a monopolist multinational company (hereinafter, just MNC) of country C. Country A and country B have no producing firms. The MNC can produce good y either at home or in foreign countries A and/or B. We assume that country A and country B comprise their own governments and a continuum of identical consumers with a mass of L^A and L^B, respectively. In contrast, we assume that

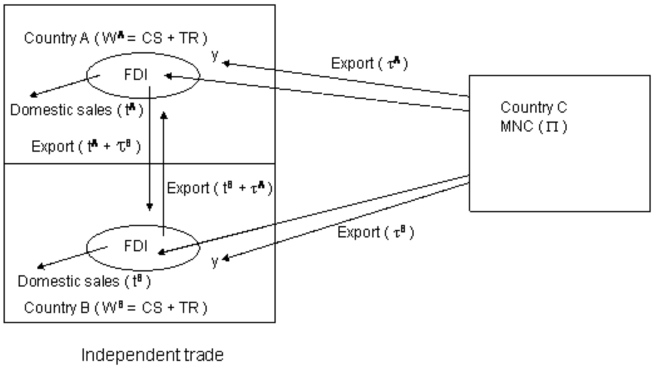

FIG. 1 Schematic diagram of FDI of a monopolist MNC.

country C comprises just a single MNC which supplies good y as a monopolist. Governments of countries A and B independently set their own tariff rates τ^A and τ^B on imports and tax rates t^A and t^B on local production through FDI. Tax on FDI is a source tax. When the tariff rate τ becomes sufficiently high compared to local tax rate, the MNC will invest directly in the host countries A or B rather than export goods from outside. Potential host countries A and B may reduce taxes on FDI somewhat to attract inward investment by the MNC and get higher tax revenue by serving both markets A and B.

If the MNC wants to export good y to countries A or B from home country C, then it has to pay tariff τ^A or τ^B to the importing countries per unit of good y exported. If instead the MNC invests in country A and sells the output in the same country, it has to pay local tax t^A to country A per unit of good y sold. As a special case, if the MNC produces good y in country A and sells the output to country B, then it has to pay local tax t^A to country A and tariff τ^B to the importing country B per unit of good y sold. This is illustrated in Figure 1.

As we can see in Figure 1, the MNC can either export its output to countries A or B, or invest directly in countries A or B and produce and sell locally or re-export the output to a neighbouring country. The MNC will optimize its production location choice and supply pattern to maximize its overall profit, Π. In contrast, country A and country B governments will choose tariff rate τ and national tax rate t on FDI to maximize their own national welfare levels defined as the sum of consumer surplus and tax/tariff revenue.

3. SEQUENCE OF THE GAME

The sequence of the game is defined as follows. First, countries A and B governments set their own external tariff rates τ^A and τ^B as well as their own tax rates t^A and t^B on FDI. Second, the MNC of country C chooses optimal production location and output level among possible countries A, B and C. The actual trade pattern will be determined through the profit maximization of the MNC at this second stage. This definition of sequence is quite different from Brander and Spencer (1987) in the sense that in their model tariff and tax rates are set after the production location is decided by the MNC while in our model tariff and tax rates are set before the MNC decides its production location. In our study, as we have an additional strategic interaction between two importing countries A and B in setting tariff and tax rates, the sequence defined above is reasonable. Nevertheless, the basic idea about Nash bargaining behind Brander and Spencer (1987)'s and ours is the same because Brander and Spencer (1987) have an additional stage of capital investment after tariff and tax rates setting. We solve the equilibrium with backward induction. In our perfect information model, this will give us subgame perfect Nash equilibrium.[2]

We describe each step in turn in the following sections.

[2]For subgame perfection in multistage game, refer to Fudenberg and Tirole (1991), pp.107-141.

4. MNC'S PROFIT MAXIMIZATION

As a first step, we solve profit maximization of the monopolist MNC of country C. The MNC will decide output of good y in each possible country A, B or C, taking tariff rates τ^A and τ^B, and tax rates t^A and t^B of the potential host countries A and B as given. We assume that good y is produced with a fixed cost and a constant marginal cost.

$$C^j(y) = F + c^j y \tag{1}$$

Here, $C^j(y)$ is total cost of producing output y in country $j = A$, B or C, F is firm-level fixed cost and c^j is location-specific constant marginal cost of producing good y in country j. $F > 0$ and $c^j > 0$ are constants. We further assume that even if the MNC runs production lines in more than one location, fixed cost F is incurred only once. One rationale behind this is that the MNC-specific intangible assets can be reproduced without additional cost, once they are in place, without reducing their value or productivity. I.e., the MNC can command economies of scale at firm-level.

We assume identical linear demand functions of good y in countries A and B.

$$p^A = \alpha - \beta Y^A \tag{2}$$

$$p^B = \alpha - \beta Y^B \tag{3}$$

where p^A and p^B are consumer prices of good y, Y^A and Y^B are demands for good y in countries A and B, respectively. We assume $\alpha > 0$ and $\beta > 0$ are constants. We define couple of notations for our study. Double superscript variable Y^{ij} is the amount of good y produced in country $i = A$, B or C and sold in country $j = A$ or B. Single superscript variable Y^j denotes the amount of good y consumption in country $j = A$ or B.

Then, the profit function of the MNC is given by

$$\begin{aligned}\Pi \;=\;& \left(p^A - t^A\right) Y^{AA} \;+\; \left(p^A - t^B - \tau^A\right) Y^{BA} \;+\; \left(p^A - \tau^A\right) Y^{CA} \\ &+\; \left(p^B - t^A - \tau^B\right) Y^{AB} \;+\; \left(p^B - t^B\right) Y^{BB} \;+\; \left(p^B - \tau^B\right) Y^{CB} \\ &-\; F \;-\; c^A \left(Y^{AA} + Y^{AB}\right) \;-\; c^B \left(Y^{BA} + Y^{BB}\right) \;-\; c^C \left(Y^{CA} + Y^{CB}\right)\end{aligned} \tag{4}$$

where Π is the MNC's profit, t^j is tax rate on FDI and τ^j is the import tariff rate of country $j = A$ and B, respectively.

Maximizing (4) over Y^{AA}, Y^{BA}, Y^{CA}, Y^{AB}, Y^{BB} and Y^{CB}, we find that the monopolist MNC will serve each market by producing good y in the countries with lowest effective marginal production costs $\tilde{c}^A$ and $\tilde{c}^B$, given tax rates t^A and t^B and tariff rates τ^A and τ^B. This is a standard result for a profit maximizing monopolist.

$$p^A \left(1 - \frac{\beta Y^A}{p^A}\right) \;=\; \min\left(c^A \;+\; t^A,\; c^B \;+\; t^B \;+\; \tau^A,\; c^C \;+\; \tau^A\right) \;\equiv\; \tilde{c}^A \tag{5}$$

$$p^B \left(1 - \frac{\beta Y^B}{p^B}\right) \;=\; \min\left(c^A \;+\; t^A \;+\; \tau^B,\; c^B \;+\; t^B,\; c^C \;+\; \tau^B\right) \;\equiv\; \tilde{c}^B \tag{6}$$

We have to note here that whenever the effective marginal production costs are the same among multiple countries, the MNC is indifferent among those countries and the actual production location becomes indeterminate. To avoid this indeterminacy problem, we make the following assumptions.

Assumption 1. ***(Tie-breaking rules 1)*** *If the effective marginal production costs are the same between host countries A or B and home country C, then the MNC will produce all its output in the host countries A or B.*

Assumption 2. ***(Tie-breaking rules 2)*** *If the effective marginal production costs are the same between host countries A and B, then each local market* *will be served by local production for countries A and B, respectively.*

Assumptions 1 and 2 can be justified if we think of a small transportation cost from country C to countries A or B, or between countries A and B, the former being greater than the latter.

5. WELFARE MAXIMIZATION OF HOST COUNTRIES A AND B

As a second step, we solve welfare maximization of countries A and B. Governments of countries A and B independently set their own national tax rates t^A and t^B on local production and own tariff rates τ^A and τ^B on imports to maximize their own national welfare levels, taking the optimal tax/tariff rates decision of the other government as given and taking into account the effect of their own tax/tariff rates on the optimal production (location and amount) choice of the MNC of country C.

5.1. Country A government

Country A government maximizes its own national welfare W^A, defined as the sum of consumer surplus CS^A and tax/tariff revenue.

$$\begin{aligned} \max_{t^A,\tau^A} W^A &= \mathit{consumer\ surplus} + \mathit{tax/tariff\ revenue} \qquad (7) \\ = \quad & CS^A + \left\{t^A\left(Y^{AA}+Y^{AB}\right)+\tau^A\left(Y^{BA}+Y^{CA}\right)\right\} \end{aligned}$$

The second bracketed term in (7) is tax/tariff revenue collected from the MNC's production in and exports into country A. The consumer surplus with linear demand function (2) can be evaluated by integrating the area under the demand curve and above the equilibrium price level.

$$CS^A = \int_{p^A}^{\alpha} y(p)\, dp = \int_{p^A}^{\alpha} \frac{1}{\beta}(\alpha - p)\, dp \tag{8}$$
$$= \frac{1}{2\beta}\left(\alpha - p^A\right)^2$$
$$= \frac{\beta}{2}\left(Y^A\right)^2$$

where p^A is the equilibrium consumer price of good y and Y^A is the equilibrium consumption level in country A, respectively.

5.2. Country B government

Similarly, country B government optimizes over local production tax rate t^B and import tariff rate τ^B to maximize its own national welfare W^B.

$$\max_{t^B,\tau^B} W^B = consumer\ surplus + tax/tariff\ revenue \tag{9}$$
$$= CS^B + \left\{t^B\left(Y^{BA} + Y^{BB}\right) + \tau^B\left(Y^{AB} + Y^{CB}\right)\right\}$$

with appropriate definitions. We can also evaluate consumer surplus of country B as follows.

$$CS^B = \int_{p^B}^{\alpha} y(p)\, dp = \int_{p^B}^{\alpha} \frac{1}{\beta}(\alpha - p)\, dp = \frac{\beta}{2}\left(Y^B\right)^2 \tag{10}$$

with appropriate definitions.

Substituting (8) and (10) into (7) and (9), we get

$$W^A = \frac{\beta}{2}\left(Y^A\right)^2 + \left\{t^A\left(Y^{AA} + Y^{AB}\right) + \tau^A\left(Y^{BA} + Y^{CA}\right)\right\} \tag{11}$$

$$W^B = \frac{\beta}{2}\left(Y^B\right)^2 + \left\{t^B\left(Y^{BA} + Y^{BB}\right) + \tau^B\left(Y^{AB} + Y^{CB}\right)\right\} \tag{12}$$

5.3. Optimal tax/tariff rates

Before finding the optimal tax/tariff rates, we need to look closely at the behaviours of the participating countries. Setting tax and tariff rates, country A and country B can evaluate the prospective optimal production location and output level of the MNC of country C and thereby the resulting trade pattern. This, in turn, determines the resulting welfare levels of countries A and B for given pair of tax/tariff rates. After this, we need to check any possibility of an incentive to deviate for countries A and B to find a Nash equilibrium. Optimal tax and tariff rates will be given as a point value for a binding strategic variable and a range for a non-binding one. Meanwhile, because the actual trade pattern, output and thus welfare formulas (11) and (12) of countries A and B will change depending on the actual tax and tariff rates chosen by countries A and B, we need to analyse the best responses of countries A and B in a piecewise fashion. I.e., we need to divide the strategy domains of countries A and B into more specified sub-domains. We are effectively changing 2-dimensional continuous strategy domain in tax and tariff rates to 1-dimensional finite strategy domain (set) for each of country A and country B.

There are basically three sub-domains each for countries A and B across which the actual trade pattern changes.

Definition 1. (*Sub-domains of strategy sets of countries A and B*): We define three sub-domains of strategy set for each of countries A and B, each of which leading to a specific trade pattern.

- For country A demand; the MNC will

◦ $A1 = export\ from\ home\ country\ C.$ This requires,

$$\begin{aligned} \tilde{c}^A &= c^C + \tau^A < c^A + t^A \\ and\ c^C + \tau^A &< c^B + t^B + \tau^A \end{aligned} \tag{13}$$

∘ $A2 \; = \; undertake\ FDI\ in\ country\ A\ and\ supply\ locally.$ This requires,

$$\begin{aligned} \tilde{c}^A &= c^A + t^A \leq c^B + t^B + \tau^A \\ and\ c^A + t^A &\leq c^C + \tau^A \end{aligned} \tag{14}$$

∘ $A3 \; = \; undertake\ FDI\ in\ country\ B\ and\ export\ to\ country\ A.$ This requires,

$$\begin{aligned} \tilde{c}^A &= c^B + t^B + \tau^A < c^A + t^A \\ and\ c^B + t^B + \tau^A &\leq c^C + \tau^A \end{aligned} \tag{15}$$

Strategy sub-domains $A1 \sim A3$ are exhaustive for country A.

- For country B demand;

∘ $B1 \; = \; export\ from\ home\ country\ C.$ This requires,

$$\begin{aligned} \tilde{c}^B &= c^C + \tau^B < c^A + t^A + \tau^B \\ and\ c^C + \tau^B &< c^B + t^B \end{aligned} \tag{16}$$

∘ $B2 \; = \; undertake\ FDI\ in\ country\ A\ and\ export\ to\ country\ B.$ This requires,

$$\begin{aligned} \tilde{c}^B &= c^A + t^A + \tau^B < c^B + t^B \\ and\ c^A + t^A + \tau^B &\leq c^C + \tau^B \end{aligned} \tag{17}$$

∘ $B3 \; = \; undertake\ FDI\ in\ country\ B\ and\ supply\ locally.$ This requires,

$$\begin{aligned} \tilde{c}^B &= c^B + t^B \leq c^A + t^A + \tau^B \\ and\, c^B + t^B &\leq c^C + \tau^B \end{aligned} \tag{18}$$

Strategy sub-domains $B1 \sim B3$ are exhaustive for country B. □

Let's find the optimal tax/tariff rates for each sub-domains. Thanks to symmetry between countries A and B, we can check them pairwise. We solve here for Configuration $(A1, B1)$ as an example.

- Configuration $(A1 = export\ from\ C, B1 = export\ from\ C)$

We have $Y^A = Y^{CA}$ and $Y^B = Y^{CB}$. I.e., this is a pure exports case. Then, we get from (11) and (12),

$$W^A = \frac{\beta}{2}\left(Y^A\right)^2 + \tau^A Y^A$$

$$W^B = \frac{\beta}{2}\left(Y^B\right)^2 + \tau^B Y^B$$

Substituting for $Y^A = \frac{\alpha - \tilde{c}^A}{2\beta} = \frac{\alpha - c^C - \tau^A}{2\beta}$ and $Y^B = \frac{\alpha - \tilde{c}^B}{2\beta} = \frac{\alpha - c^C - \tau^B}{2\beta}$,

$$W^A = \frac{1}{4}\left(\alpha - c^C + 3\tau^A\right)\left(\frac{\alpha - c^C - \tau^A}{2\beta}\right)$$

$$W^B = \frac{1}{4}\left(\alpha - c^C + 3\tau^B\right)\left(\frac{\alpha - c^C - \tau^B}{2\beta}\right)$$

Maximizing these with respect to τ^A and τ^B respectively, we get

$$\tau^{A^*} = \tau^{B^*} = \frac{1}{3}\left(\alpha - c^C\right) \tag{19}$$

and

$$W^{A^*} = W^{B^*} = \frac{\left(\alpha - c^C\right)^2}{6\beta} \tag{20}$$

where * denotes optimal values.

Furthermore, ruling out zero or negative optimal consumption level, we must have $\alpha - c^C - \tau^{A^*} > 0$ and $\alpha - c^C - \tau^{B^*} > 0$, and hence $\tau^{A^*} > 0$, $\tau^{B^*} > 0$, $\alpha - c^C > 0$, $W^{A^*} > 0$ and $W^{B^*} > 0$ from (19) and (20).[3] Hence, $\alpha > c^C$ is implicitly assumed.

Conditions (13) and (16) imply

Participation constraints

$$
\begin{aligned}
t^{A^*} &> c^C - c^A + \tau^{A^*} = \frac{1}{3}\left(\alpha - 3c^A + 2c^C\right) \\
t^{B^*} &> c^C - c^B \\
t^{A^*} &> c^C - c^A \\
&\quad \textit{and} \qquad\qquad \text{(PC)} \\
t^{B^*} &> c^C - c^B + \tau^{B^*} = \frac{1}{3}\left(\alpha - 3c^B + 2c^C\right)
\end{aligned}
$$

Repeating the same steps as for Configuration $(A1, B1)$, we can find the optimal tax/tariff rates and the resulting welfare levels for all other configurations. Summarizing the results, we get the following equilibrium national welfare levels pair $\left(W^{A^*}, W^{B^*}\right)$ within each configuration as in Table 1, with $(0, 0)$ for infeasible configurations.[4]

Table 1. Equilibrium national welfare within each configuration

	$B1$	$B2$	$B3$
$A1$	$\left(\frac{(\alpha-c^C)^2}{6\beta}, \frac{(\alpha-c^C)^2}{6\beta}\right)$	$(0, 0)$	$\left(\frac{(\alpha-c^C)^2}{6\beta}, \frac{(\alpha-c^B)^2}{6\beta}\right)$
$A2$	$\left(\frac{(\alpha-c^A)^2}{6\beta}, \frac{(\alpha-c^C)^2}{6\beta}\right)$	$\left(\frac{88(\alpha-c^A)^2}{19^2\beta}, \frac{24(\alpha-c^A)^2}{19^2\beta}\right)$	$\left(\frac{(\alpha-c^A)^2}{6\beta}, \frac{(\alpha-c^B)^2}{6\beta}\right)$
$A3$	$(0, 0)$	$(0, 0)$	$\left(\frac{24(\alpha-c^B)^2}{19^2\beta}, \frac{88(\alpha-c^B)^2}{19^2\beta}\right)$

[3] Negative output is meaningless for obvious reason and zero output level means zero utility, zero tax/tariff revenue and zero national welfare level. Also note that for a linear (or, not too convex) demand function and a constant or increasing marginal cost with specific tariff rate, optimal tariff rate will be strictly positive in general. ref. Brander and Spencer (1984b, pp.228-232). See also Krugman (1979, p.476) and Feenstra (2004, p.139).

[4] If we do not get an equilibrium for a configuration, then we can assume that consumption is zero and hence we get zero consumer surplus and zero tax/tariff revenue leading to zero national welfare. Corresponding optimal tax/tariff rates and details are available from the author on request.

In Table 1, the first entry of each configuration represents country A optimum national welfare, W^{A^*}, and the second entry represents country B optimum national welfare, W^{B^*}, respectively.

6. NASH EQUILIBRIUM

Using the results of Section 5, we find the Nash equilibria of the entire system. We focus on the cases $c^C = c^A = c^B = c$ and $c^C \neq c^A = c^B = c$.

6.1. Case 1; $c^A = c^B = c^C = c$

National welfare becomes as in Table 2. Table 2 must be seen as a 3x3 normal form game in trade patterns, between countries A and B, induced by particular tax/tariff rates.

Table 2. Equilibrium national welfare when $c^A = c^B = c^C = c$

	$B1$	$B2$	$B3$
$A1$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$	$(0,0)$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$
$A2$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$	$\left(\frac{88(\alpha-c)^2}{19^2\beta}, \frac{24(\alpha-c)^2}{19^2\beta}\right)$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$
$A3$	$(0,0)$	$(0,0)$	$\left(\frac{24(\alpha-c)^2}{19^2\beta}, \frac{88(\alpha-c)^2}{19^2\beta}\right)$

In Table 2, $A3 = export\ from\ B$ and $B2 = export\ from\ A$ are strictly dominated by $A2 = FDI\ in\ A$ and $B3 = FDI\ in\ B$, respectively. Country A is indifferent between $A1 = export\ from\ C$ and $A2 = FDI\ in\ A$ against sub-domains $B1 = export\ from\ C$ and $B3 = FDI\ in\ B$ of country B. Country A's best response against $B2 = export\ from\ A$ is $A2 = FDI\ in\ A$. Country B is indifferent between $B1$ and $B3$ against $A1$ and $A2$. Country B's best response against $A3 = export\ from\ B$ is $B3 = FDI\ in\ B$. Hence, we get potentially four Nash equilibria $(A1 = export\ from\ C, B1 = export\ from\ C)$, $(A1 = export\ from\ C, B3 = FDI\ in\ B)$, $(A2 = FDI\ in\ A, B1 = export\ from\ C)$ and $(A2 = FDI\ in\ A, B3 = FDI\ in\ B)$ with national welfare $\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$. This result is reasonable given the identical marginal costs across the three countries.

Can these be Nash equilibria? We need to check whether there is any incentive to deviate out of the assumed configuration for either country A or country B to confirm the Nash equilibria. E.g., country A government might have an incentive to deviate from its optimal tax/tariff rates choice to achieve higher welfare level given country B's optimal choice of tax/tariff rates and vice versa. Let's check this incentive for each candidate Nash equilibrium.

For $(A1 = export\ from\ C, B1 = export\ from\ C)$, because $A3$ and $B2$ are strictly dominated, we only need to check incentives to deviate to $A2$ for country A and to $B3$ for country B. We have $\tau^{A^*} = \tau^{B^*} = \frac{1}{3}\left(\alpha - c^C\right)$, $t^{A^*} > \frac{1}{3}\left(\alpha - 3c^A + 2c^C\right)$ and $t^{B^*} > \frac{1}{3}\left(\alpha - 3c^B + 2c^C\right)$ under $(A1, B1)$. Suppose country A lowers its tax rate to $\hat{t}^{A^*} = \frac{1}{3}\left(\alpha - c^A\right) - \varepsilon < \tau^{A^*} = \tau^{B^*}$ where ε is a small positive amount, with country B's optimal choice being unchanged. Then, the MNC will move production activity from country C to country A and country A will get tax revenue from both market supplies. This will clearly increase the monopolist MNC's profit. Furthermore, for the deviation from $(A1 = export\ from\ C, B1 = export\ from\ C)$ to $(A2 = FDI\ in\ A, B2 = export\ from\ A)$ by country A to be feasible, country A can only optimize over t^A and τ^A taking country B's optimal tax/tariff rates t^{B^*} and τ^{B^*} under $(A1, B1)$ as given. Meanwhile, $\hat{t}^{A^*}$ and $\hat{\tau}^{A^*}$ thus obtained also have to satisfy necessary conditions for $(A2, B2)$ given by (14) and (17).[5] Hence, the resulting $\left(\hat{t}^{A^*}, \hat{\tau}^{A^*}\right)$ can be an interior or a corner solution, or there may not even exist a profitable deviation for country A. This requires

For $c^A = c^B = c^C = c$,[6]

<u>Participation constraints</u>

[5] The hat variables like $\hat{t}^{A^*}$ denote variables of the deviating case.

[6] We show here only the binding conditions.

$$
\begin{aligned}
\hat{t}^{A*} &\leq \hat{\tau}^{A*} \\
& \quad \textit{and} \qquad\qquad\qquad\qquad \text{(PC1)} \\
\hat{t}^{A*} &\leq c^C - c^A = 0
\end{aligned}
$$

Country A has an incentive to deviate from $(A1, B1)$ to $(A2, B2)$ only when the resulting welfare is greater after deviation. We can find the marginal tax rate $\tilde{t}^A$ such that country A is indifferent between pre-deviation and post-deviation.

Incentive compatibility constraints

$$
\begin{aligned}
W_{2,2}^A\left(\tilde{t}^A; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right) &= CS\left(c^A + \tilde{t}^A\right) + \tilde{t}^A\left\{Y^A\left(c^A + \tilde{t}^A\right) + Y^B\left(c^A + \tilde{t}^A\right)\right\} \quad \text{(ICC1)} \\
&\geq W_{1,1}^{A*} = CS\left(c^C + \tau^{A*}\right) + \tau^{A*} Y^A\left(c^C + \tau^{A*}\right) = \frac{\left(\alpha - c^C\right)^2}{6\beta}
\end{aligned}
$$

where $W_{2,2}^A\left(\tilde{t}^A; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right)$ is national welfare of country A after its deviation from $(A1, B1)$ to $(A2, B2)$ given country B's original optimal tax/tariff rates $t_{1,1}^{B*}$ and $\tau_{1,1}^{B*}$ under $(A1, B1)$, $CS\left(c^A + \tilde{t}^A\right)$ is consumer surplus, $Y^A\left(c^A + \tilde{t}^A\right)$ and $Y^B\left(c^A + \tilde{t}^A\right)$ are consumptions of good y by countries A and B respectively when country A gets FDI and supply good y both to countries A and B at marginal production cost c^A and tax rate $\tilde{t}^A$. $W_{1,1}^{A*}$ denotes original optimal welfare of country A under $(A1, B1)$. For $c^A = c^B = c^C = c$, we also get[7]

$$
\begin{aligned}
\frac{\left(\alpha - c^C\right)^2}{6\beta} &< \frac{2\left(\alpha - c^A\right)^2}{9\beta} \\
& \textit{and} \\
-\frac{1}{3}\left(\alpha - c^C\right) &< \frac{7 - 4\sqrt{7}}{21}\left(\alpha - c\right) < 0
\end{aligned}
$$

[7] $\frac{\left(\alpha - c^C\right)^2}{6\beta}$ and $\frac{2\left(\alpha - c^A\right)^2}{9\beta}$ are maximized values of $W_{1,1}^A$ and $W_{2,2}^A\left(\tilde{t}^A; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right)$, and $-\frac{1}{3}\left(\alpha - c\right)$ and $\frac{7 - 4\sqrt{7}}{21}\left(\alpha - c\right)$ are left-hand side cut-off values of $W_{1,1}^A = 0$ and $W_{2,2}^A\left(\tilde{t}^A; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right) = 0$, respectively. Details are available from the author on request.

Then, we can draw the welfare functions $W_{1,1}^{A}$ and $W_{2,2}^{A}\left(\tilde{t}^{A}; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right)$ as in Figure 2 for $c^{A} = c^{B} = c^{C} = c$. Note here that the two curves intersect on the y-axis at $t^{A} = 0$. The maximum of the two curves obtains at the same point $\hat{t}^{A*} = \frac{1}{3}(\alpha - c)$ due to the unchanged country B optimal tax/tariff rates.[8]

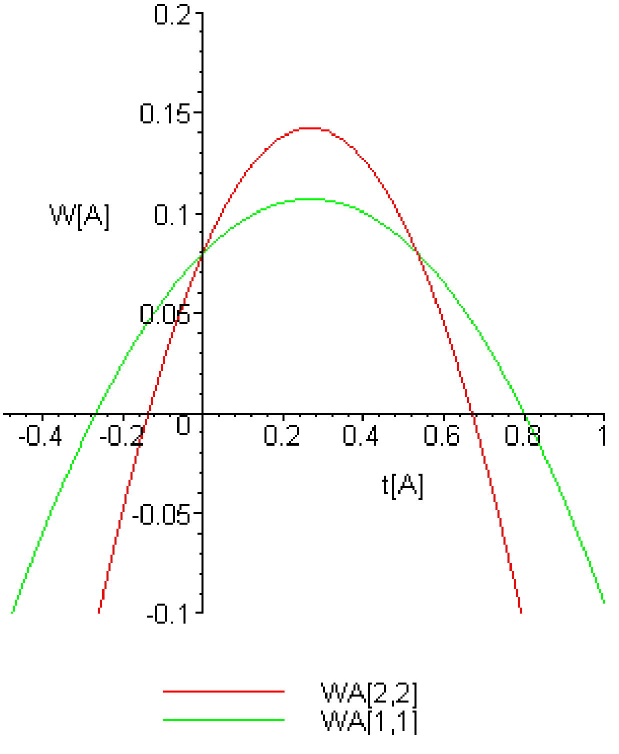

FIG. 2 National welfare $W_{1,1}^{A}$ under $(A1, B1)$ and $W_{2,2}^{A}\left(\tilde{t}^{A}; t_{1,1}^{B^*}, \tau_{1,1}^{B^*}\right)$ after deviation from $(A1, B1)$ to $(A2, B2)$ by country A when $c^{A} = c^{B} = c^{C} = c$. The more concave curve is for the latter.

We can see in Figure 2 that there is no profitable deviation for country A for $t^{A} \leq 0$, which is a necessary condition (PC1) for any deviation from $(A1, B1)$ to $(A2, B2)$ to be feasible. Hence, there is no feasible domain of t^{A} for a profitable deviation for country A. There is no profitable deviation for country B from $(A1, B1)$ to $(A3, B3)$ by symmetry.

Secondly for $(A1 = \textit{export from } C, B3 = \textit{FDI in } B)$, suppose again country A undercuts its tax rate below $t^{B*} = \frac{1}{3}\left(\alpha - c^{B}\right)$ to achieve higher national

[8]Note that the maximum of $W_{2,2}^{A}$ obtains normally at $t^{A^*} = \frac{7}{19}\left(\alpha - c^{A}\right)$.

welfare by inducing inward FDI. We need to solve

$$W_{2,2}^{A}\left(\tilde{t}^{A};t_{1,3}^{B^*},\tau_{1,3}^{B^*}\right) \;=\; W_{1,3}^{A^*} \;=\; \frac{\left(\alpha-c^{C}\right)^2}{6\beta} \tag{21}$$

This identity is qualitatively equivalent to (ICC1) with equality and we can also check that $\tilde{t}^{A}$ has to satisfy conditions (PC1) for any incentive to deviate for country A from $(A1, B3)$ to $(A2, B2)$ to be feasible. We get the same welfare diagram as Figure 2, hence there is no profitable way to deviate for country A. The same is true for country B.

Thirdly, the potential Nash equilibrium $(A2 = FDI\ in\ A, B1 = export\ from\ C)$ is a symmetric case to $(A1 = export\ from\ C, B3 = FDI\ in\ B)$ and we can check that there is no incentive to deviate for either country A or country B.

Finally for $(A2 = FDI\ in\ A, B3 = FDI\ in\ B)$, we have optimal tax/tariff rates $t^{A^*} = \frac{1}{3}\left(\alpha - c^{A}\right)$, $t^{B^*} = \frac{1}{3}\left(\alpha - c^{B}\right)$, $\tau^{A^*} \;\geq\; 0$, $\tau^{A^*} \;\geq\; \frac{1}{3}\left(\alpha + 2c^{A} - 3c^{C}\right)$, $\tau^{B^*} \;\geq\; 0$ and $\tau^{B^*} \;\geq\; \frac{1}{3}\left(\alpha + 2c^{B} - 3c^{C}\right)$. Is there any incentive to deviate? Let's suppose country A lowers its tax rate by a small amount. As before, country A has to optimize over t^{A} and τ^{A} taking country B's optimal tax/tariff rates t^{B^*} and τ^{B^*} under $(A2, B3)$ as given. Necessary conditions for $c^{A} \;=\; c^{B} \;=\; c^{C} \;=\; c$ are the same as (PC1). Country A has to solve the identity

$$W_{2,2}^{A}\left(\tilde{t}^{A};t_{2,3}^{B^*},\tau_{2,3}^{B^*}\right) \;=\; W_{2,3}^{A^*} \;=\; \frac{\left(\alpha-c^{A}\right)^2}{6\beta} \tag{22}$$

We get again the same welfare diagram as Figure 2, hence there is no feasible way of profitable deviation for either country A or country B.

Overall, there is no incentive to deviate for $c^{A} \;=\; c^{B} \;=\; c^{C} \;=\; c$ and we can confirm the 4 Nash equilibria $(A1, B1)$, $(A1, B3)$, $(A2, B1)$ and $(A2, B3)$ with national welfare pair $\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$.

Corresponding profit of the MNC is obtained from equation (4). For Nash equilibrium $(A1 = export\ from\ C, B1 = export\ from\ C)$, we get $\tilde{c}^{A} \;=\; c^{C} + \tau^{A^*} \;=\; \frac{1}{3}\left(\alpha + 2c\right)$ and $\tilde{c}^{B} \;=\; c^{C} + \tau^{B^*} \;=\; \frac{1}{3}\left(\alpha + 2c\right)$ using equations (5), (6) and (19). Hence, the profit becomes

$$\Pi^* = \frac{2(\alpha - c)^2}{9\beta} - F \tag{23}$$

Profits for other Nash equilibria turn out to be the same as this using appropriate optimal tax/tariff rates.

6.2. Case 2; $c^C > c^A = c^B = c$

National welfare becomes as in Table 3.

Table 3. Equilibrium national welfare when $c^C > c^A = c^B = c$

	$B1$	$B2$	$B3$
$A1$	$\left(\frac{(\alpha-c^C)^2}{6\beta}, \frac{(\alpha-c^C)^2}{6\beta}\right)$	$(0,0)$	$\left(\frac{(\alpha-c^C)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$
$A2$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c^C)^2}{6\beta}\right)$	$\left(\frac{88(\alpha-c)^2}{19^2\beta}, \frac{24(\alpha-c)^2}{19^2\beta}\right)$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$
$A3$	$(0,0)$	$(0,0)$	$\left(\frac{24(\alpha-c)^2}{19^2\beta}, \frac{88(\alpha-c)^2}{19^2\beta}\right)$

Here, country A's dominant strategy is $A2$ and country B's dominant strategy is $B3$. Hence, we get a unique potential Nash equilibrium $(A2, B3)$ with national welfare $\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$. This is reasonable for the relatively high marginal cost of home country C.

Can this be a Nash equilibrium? For the deviation from $(A2, B3)$ to $(A2, B2)$ by country A to be feasible we need to satisfy the following conditions using (14), (17) and (18). For $c^C > c^A = c^B = c$,

Participation constraints

$$\begin{aligned}
\hat{t}^{A^*} &\leq \hat{\tau}^{A^*} + t^{B^*} = \hat{\tau}^{A^*} + \frac{1}{3}(\alpha - c) \\
\hat{t}^{A^*} &\leq \hat{\tau}^{A^*} + c^C - c \\
&\quad and \\
\hat{t}^{A^*} &< t^{B^*} - \tau^{B^*} \leq \min\left(t^{A^*}, c^C - c\right) = \min\left(\frac{1}{3}(\alpha - c), c^C - c\right)
\end{aligned} \tag{PC2}$$

We can also get by solving (22) the welfare diagrams same as Figure 2 except $W^A_{1,1}$ is replaced by $W^A_{2,3}$. For $c^C > c^A = c^B = c$, we have

$\min\left(\frac{1}{3}(\alpha - c), c^C - c\right) > 0$, and hence country A can now reduce its tax rate t^A down to $\hat{t}^A \in \left(0, \min\left(\frac{1}{3}(\alpha - c), c^C - c\right)\right)$ to get a double tax revenue. By symmetry, country B has the same incentive to reduce its tax rate down to $\hat{t}^{B*} = 0$ for the same reason. I.e., we get a non-cooperative tax rate competition between countries A and B. As a result, we get a Nash equilibrium $(A2 = FDI\ in\ A, B3 = FDI\ in\ B)$ with optimal tax/tariff rates

$$
\begin{aligned}
\hat{t}^{A*} &= \hat{t}^{B*} = 0 \\
\hat{\tau}^{A*} &\geq \max\left(-\frac{1}{3}(\alpha - c), -\left(c^C - c\right)\right) \\
\hat{\tau}^{B*} &\geq \max\left(-\frac{1}{3}(\alpha - c), -\left(c^C - c\right)\right)
\end{aligned}
\tag{24}
$$

and national welfare

$$
\begin{aligned}
\hat{W}^{A*} &= \hat{W}^{B*} \\
&= \frac{\beta}{2}\left(\frac{\alpha - c - \hat{t}^{A*}}{2\beta}\right)^2 + \hat{t}^{A*}\left(\frac{\alpha - c - \hat{t}^{A*}}{2\beta}\right) \\
&= \frac{(\alpha - c)^2}{8\beta}
\end{aligned}
\tag{25}
$$

MNC's profit is obtained from (4) using (2), (3), (5), (6) and relevant tax rates (24).

$$
\Pi^* = \frac{(\alpha - c)^2}{2\beta} - F \tag{26}
$$

6.3. Case 3; $c^C < c^A = c^B = c$

National welfare is identical as in Table 3 except the condition $c^C < c^A = c^B = c$. Here, $A3$ and $B2$ are strictly dominated by $A2$ and $B3$, respectively. Then, by iterated strict dominance, $A1$ becomes a strictly dominant strategy subset of country A and $B1$ becomes a strictly dominant strategy subset of country B, respectively. Hence, we get a unique potential Nash equilibrium ($A1 = export\ from\ C, B1 = export\ from\ C$) with national welfare $\left(\frac{(\alpha - c^C)^2}{6\beta}, \frac{(\alpha - c^C)^2}{6\beta}\right)$. This is again reasonable for the relatively low marginal cost of home country C.

We check the incentive to deviate as before. First of all, we can compare the welfare $W_{2,2}^{A}\left(\tilde{t}^{A}; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right)$ of country A after deviation from $(A1, B1)$ to $(A2, B2)$ given country B's optimal tax/tariff rates $t_{1,1}^{B*}$ and $\tau_{1,1}^{B*} = \frac{1}{3}\left(\alpha - c^C\right)$ under $(A1, B1)$ with $W_{1,1}^{A*} = \frac{(\alpha - c^C)^2}{6\beta}$. For $c^C < c^A = c^B = c$, we get[9]

$$
\begin{aligned}
W_{1,1}^{A*} &> W_{2,2}^{A*}\left(\tilde{t}^{A}; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right) \\
if\ c^A &> \alpha - \frac{\sqrt{2961} - 9}{40}\left(\alpha - c^A\right) > c^C \\
& \quad and \\
W_{1,1}^{A*} &< W_{2,2}^{A*}\left(\tilde{t}^{A}; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right) \\
if\ c^A &> c^C > \alpha - \frac{\sqrt{2961} - 9}{40}\left(\alpha - c^A\right)
\end{aligned}
$$

I.e., if c^C is sufficiently smaller than c^A, then country A has no incentive to deviate from $(A1, B1)$ to $(A2, B2)$ for whatever tax rate. In contrast, if the difference between c^C and c^A is small ($c^A - c^C > 0$ but small), then country A has an incentive to lower its tax rate to get a higher tax revenue and consequently higher welfare level. National welfare $W_{2,2}^{A}\left(\tilde{t}^{A}; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right)$ is maximized at $0 < \tilde{t}^{A*} = \frac{9(\alpha - c^A) - 2(\alpha - c^C)}{21} < \tau_{1,1}^{B*} = \frac{1}{3}\left(\alpha - c^C\right)$ for $c^A > c^C$.[10] We can also check that the welfare of country A at $\tau^A = 0$ under $(A1, B1)$ is greater than that at $t^A = 0$ under $(A2, B2)$ after deviation, $W_{1,1}^{A}\left(\tau^A = 0\right) = \frac{(\alpha - c^C)^2}{8\beta} > \frac{(\alpha - c^A)^2}{8\beta} = W_{2,2}^{A}\left(t^A = 0; t_{1,1}^{B*}, \tau_{1,1}^{B*}\right)$ for $c^C < c^A$. Hence, we can draw a typical welfare diagram as in Figure 3 for $\alpha - \frac{\sqrt{2961} - 9}{40}\left(\alpha - c^A\right) < c^C < c^A = c^B = c$.

Furthermore, for the deviation from $(A1, B1)$ to $(A2, B2)$ by country A to

[9] Details are available from the author on request.

[10] Details are available from the author on request.

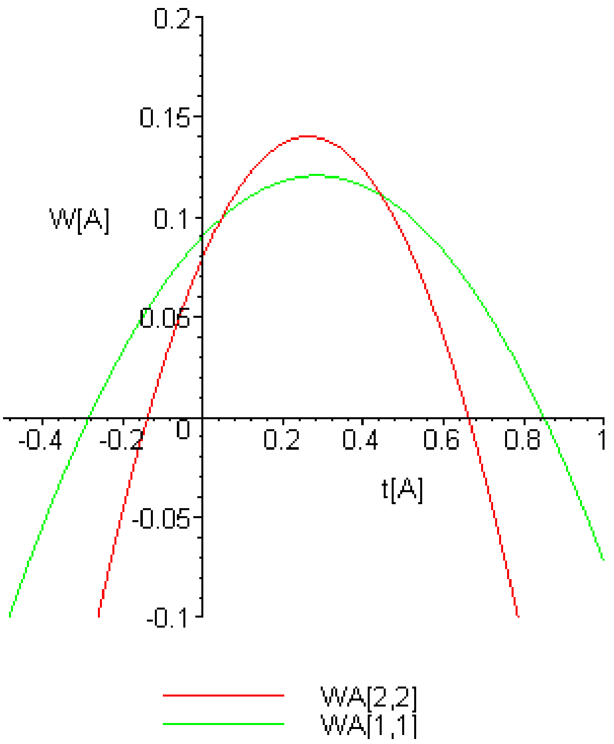

FIG. 3 National welfare $W^A_{1,1}$ under $(A1, B1)$ and $W^A_{2,2}\left(\tilde{t}^A; t^{B^*}_{1,1}, \tau^{B^*}_{1,1}\right)$ after deviation from $(A1, B1)$ to $(A2, B2)$ of country A when $c^C < c^A = c^B = c$. The more concave curve is for the latter.

be feasible we need to satisfy the following conditions using (13), (14), (16) and (17). For $c^C < c^A = c^B = c$,

Participation constraints

$$\begin{aligned} \hat{t}^{A^*} &\leq \hat{\tau}^{A^*} + t^{B^*} \\ \hat{t}^{A^*} &\leq \hat{\tau}^{A^*} + c^C - c \\ \hat{t}^{A^*} &< t^{B^*} - \tau^{B^*} \\ &\quad \textit{and} \\ \hat{t}^{A^*} &\leq c^C - c < 0 \end{aligned} \tag{PC3}$$

Examining Figure 3, there is no profitable deviation for country A that satisfies the necessary condition (PC3) for deviation for $c^C < c^A = c^B = c$. Hence, we can confirm the unique Nash equilibrium $(A1, B1)$ with optimal tax/tariff rates

$$\begin{aligned} t^{A^*} &> \frac{1}{3}\left(\alpha - 3c^A + 2c^C\right) \\ t^{B^*} &> \frac{1}{3}\left(\alpha - 3c^B + 2c^C\right) \\ \tau^{A^*} &= \tau^{B^*} = \frac{1}{3}\left(\alpha - c^C\right) \end{aligned} \tag{27}$$

and national welfare

$$W^{A^*} = W^{B^*} = \frac{\left(\alpha - c^C\right)^2}{6\beta} \tag{28}$$

For Nash equilibrium $(A1, B1)$, we get $\tilde{c}^A = \tilde{c}^B = \frac{1}{3}\left(\alpha + 2c^C\right)$ and the MNC profit becomes

$$\Pi^* = \frac{2\left(\alpha - c^C\right)^2}{9\beta} - F \tag{29}$$

We can see from (23), (26) and (29) that the MNC profit is positively related to the intercept α of the inverse demand function, and negatively related to marginal cost c or c^C, steepness β of the inverse demand function and fixed cost F.

Summarizing the results of Cases 1 $\sim$ 3, we get the following Nash equilibria and corresponding national welfare.

Table 4. Nash equilibria[11]

[11] We show only the binding tax/tariff rates.

	$Nash\ eq.$
$c^A = c^B = c^C = c$	$\left\{ \begin{array}{c} \begin{pmatrix} A1 = export\ from\ C, B1 = export\ from\ C \\ with\ \tau^{A^*} = \tau^{B^*} = \frac{1}{3}\left(\alpha - c^C\right) \end{pmatrix} \\ \begin{pmatrix} A1 = export\ from\ C, B3 = FDI\ in\ B \\ with\ \tau^{A^*} = \frac{1}{3}\left(\alpha - c^C\right),\ t^{B^*} = \frac{1}{3}\left(\alpha - c^B\right) \end{pmatrix} \\ \begin{pmatrix} A2 = FDI\ in\ A, B1 = export\ from\ C \\ with\ t^{A^*} = \frac{1}{3}\left(\alpha - c^A\right),\ \tau^{B^*} = \frac{1}{3}\left(\alpha - c^C\right) \end{pmatrix} \\ \begin{pmatrix} A2 = FDI\ in\ A, B3 = FDI\ in\ B \\ with\ t^{A^*} = \frac{1}{3}\left(\alpha - c^A\right),\ t^{B^*} = \frac{1}{3}\left(\alpha - c^B\right) \end{pmatrix} \end{array} \right\}$
$c^C > c^A = c^B = c$	$\begin{pmatrix} A2 = FDI\ in\ A, B3 = FDI\ in\ B \\ with\ t^{A^*} = t^{B^*} = 0 \end{pmatrix}$
$c^C < c^A = c^B = c$	$\begin{pmatrix} A1 = export\ from\ C, B1 = export\ from\ C \\ with\ \tau^{A^*} = \tau^{B^*} = \frac{1}{3}\left(\alpha - c^C\right) \end{pmatrix}$

Table 5. National welfare and the MNC profit

	$National\ welfare\ \left(W^{A^*}, W^{B^*}\right)$	$MNC\ profit,\ \Pi^*$
$c^A = c^B = c^C = c$	$\left(\frac{(\alpha-c)^2}{6\beta}, \frac{(\alpha-c)^2}{6\beta}\right)$	$\frac{2(\alpha-c)^2}{9\beta} - F$
$c^C > c^A = c^B = c$	$\left(\frac{(\alpha-c)^2}{8\beta}, \frac{(\alpha-c)^2}{8\beta}\right)$	$\frac{(\alpha-c)^2}{2\beta} - F$
$c^C < c^A = c^B = c$	$\left(\frac{\left(\alpha-c^C\right)^2}{6\beta}, \frac{\left(\alpha-c^C\right)^2}{6\beta}\right)$	$\frac{2\left(\alpha-c^C\right)^2}{9\beta} - F$

7. CONCLUSION

We have studied the effects of tax and tariff rates of the host countries on the optimal choice of production location and output level of a monopolist MNC and the corresponding trade pattern and welfare. When the marginal costs are identical across the three countries, $c^A = c^B = c^C$, we get multiple Nash equilibria $(A1, B1)$, $(A1, B3)$, $(A2, B1)$ and $(A2, B3)$. When the home country marginal production cost c^C is higher than those of consumer countries A and B, i.e. $c^C > c^A = c^B$, we get a unique Nash equilibrium $(A2, B3)$ and when $c^C < c^A = c^B$ we get a unique Nash equilibrium $(A1, B1)$. Hence, we always achieve a productive efficiency, i.e. good y is produced in the lowest marginal cost country.

Ironically, host countries A and B engage in *a non-cooperative tax reduction competition* to induce inward FDI only when they have an absolute cost advantage against the home country C, i.e. when $c^C > c^A = c^B$, and yet this works adversely to reduce their welfare and benefits the monopolist MNC. Nevertheless, we get optimal tax rates $t^{A^*} = t^{B^*} = 0$ and therefore achieve a Pareto optimality apart from the monopoly inefficiency. When the marginal costs are identical across the three countries, $c^A = c^B = c^C$, because the internal tariff between countries A and B acts as a deterrent to deviation by countries A or B, so we do not get a tax competition and the resulting tax rates are strictly positive, $t^{A^*} = t^{B^*} = \frac{1}{3}(\alpha - c) > 0$. Consequently, we get a loss of efficiency due to suboptimally low output level. Similarly, when home country C has a cost advantage, $c^C < c^A = c^B$, we do not get any tax competition between countries A and B because there is no profitable deviation for either country.

Secondly, the cost function (1) implies economies of scale at firm-level for the monopolist MNC while the governments of countries A and B cannot create a monopsony power on the consumer agents' side with the fixed linear demand even if they cooperate fully.[12]

[12]ref. Feldstein and Hartman (1979, p.619) for monopsony power implementation through a heavier tax on foreign investmnet.

REFERENCES

[1] Brander, James A. and Barbara J. Spencer (1984a). "Tariff Protection and Imperfect Competition," in Henryk Kierzkowski (ed.), *Monopolistic Competition and International Trade*, Oxford, Clarendon Press, pp.194-206.

[2] ——— (1984b). "Trade Warfare: Tariffs and Cartels," *Journal of International Economics* 16, pp.227-242.

[3] ——— (1985). "Export Subsidies and International Market Share Rivalry," *Journal of International Economics* 18, pp.83-100.

[4] ——— (1987). "Foreign Direct Investment with Unemployment and Endogenous Taxes and Tariffs," *Journal of International Economics* 22, pp.257-279.

[5] Brecher, Richard A. (1974). "Optimal Commercial Policy for a Minimum-wage Economy," *Journal of International Economics* 4, pp.139-149.

[6] Dixit, Avinash (1984). "International Trade Policy for Oligopolistic Industries," *Economic Journal*, pp.1-16.

[7] Feenstra, Robert C. (2004). *Advanced International Trade*, Princeton, Princeton University Press.

[8] Feldstein, Martin and David Hartman (1979). "The Optimal Taxation of Foreign Source Investment Income," *Quarterly Journal of Economics*, November, pp.613-629.

[9] Fudenberg, Drew and Jean Tirole (1991). *Game Theory*, Cambridge, Massachusetts, MIT Press.

[10] Helpman, Elhanan, Marc J. Melitz and Stephen R. Yeaple (2004). "Export Versus FDI with Heterogeneous Firms," *American Economic Review*, March, Vol.94, No.1, pp.300-316.

[11] Janeba, Eckhardt (1998). "Tax Competition in Imperfectly Competitive Markets," *Journal of International Economics* 44, pp.135-153.

[12] Krugman, Paul R. (1979). "Increasing Returns, Monopolistic Competition, and International Trade," *Journal of International Economics* 9, pp.469-479.

[13] Lipsey, Robert E. (2002). "Home and Host Country Effects of FDI," *NBER Working Paper No.9293*, National Bureau of Economic Research, Cambridge, pp.1-76.

[14] Markusen, James R. (1984). "Multinationals, Multi-plant Economies, and the Gains from Trade," *Journal of International Economics* 16, pp.205-226.

[15] ——— (2002). *Multinational Firms and the Theory of International Trade*, Cambridge, Massachusetts, MIT Press.