Export performance requirements under international duopoly*

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Abstract

This article shows the resource allocation effects of export performance requirements (EPRs) on the foreign multi-national firm and the welfare in the host country when the market in the host country is under duopoly. To verify how EPRs affect the foreign multi-national firm, we find that difference in the marginal cost between the foreign and the host country is crucial in the without-EPRs equilibrium. With respect to the host country's welfare, we derive a necessary condition for the host country to improve its welfare by imposing EPRs at the without-EPRs equilibrium. Moreover, if outputs are strategic complements, the multi-national firm might be better-off, while the host country necessarily loses.

Keywords: Export performance requirements; oligopoly; Trade policy Trade-related investment measures JEL Classification Numbers: F12, F13

1 Introduction

In the last decades, the foreign direct investment has significantly emerged throughout the world. Some of the host countries, however, imposed numerous restrictions on it to protect domestic industries. Some of these investment measures violate the National Treatment Agreement (Article III of GATT 1994) or the agreements on the quantitative restrictions (Article XI of GATT 1994). Therefore, they are prohibited by the Agreement on Trade-Related Investment Measures (TRIMs Agreement hereafter), which contains statements prohibiting any TRIMs that are inconsistent with the provisions of the GATT Articles. An example of these restrictions on foreign direct investment is the export performance requirements, which violate the Article XI of GATT. Export performance

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requirements require that a specified percentage of total production volume of foreign subsidiary be exported¹⁾.

There is few literature that directly analyzes export performance requirements, despite a large literature on the local content requirements, which are also restrictions on foreign direct investment and require that certain components be domestically manufactured. A seminal work on the export performance requirements is Rodrik (1987) which develops the general equilibrium model of export performance requirements, and investigates the resource allocation effects and welfare effects of the restrictions. Davidson *et al.* (1987) also provides the partial equilibrium analysis of performance standards for foreign direct investment including local content protection and export performance requirements under two country oligopoly model.

This paper investigates export performance requirements in the three country model when markets are imperfectly competitive. The purpose of this paper is twofold. The first purpose is to verify whether export performance requirements are protecting measures, and to clarify on what conditions it depends. We also argue the effectiveness of export performance requirements. The second purpose is to investigate an welfare implication of introducing export performance requirements. With respect to these aims, Rodrik (1987) and Davidson *et al.* (1987) show that, in a certain case, export performance requirements decrease the total profits of foreign multi-national, and increase the host country's welfare.

These results in the literature, however, critically depend on the following two assumptions. First, in those models, the marginal cost in foreign country is always assumed to be lower than that in the host country. There is no reason why they have to exclude the case where the foreign marginal cost is higher than that of subsidiary. Empirically speaking, the cost difference between host country and source country is one of the major sources for foreign direct investment as well as well-known tariff-jumping motive. Thus, the case that is omitted in a literature might be more realistic. Second, they specifically assume that outputs are strategic substitutes. In recent years, the analyses on the strategic trade policies have focused on the case of strategic complements as well as strategic substitutes.

Contrary to those models, we consider possible situations where the marginal cost in foreign country can be lower or higher than that in host country, and outputs can be strategic substitutes or complements. We focus not only an equilibrium under export performance requirements but also an equilibrium without EPRs as a benchmark. We show that the cost difference between foreign and host country is crucial in the without-EPRs equilibrium. However, we also show that the cost difference is no longer needed to deliver conditions for when the host country's welfare gets better-off, and for when the foreign multi-nationals gets worse-off, and so on. Strategic substitutes among goods is

For the other examples of TRIMs and the relations between TRIMs Agreement and the GATT/WTO system, see Greenaway (1991) and Mutti (1994).

necessary for welfare improving of host country. It should be noted that strategic relations among goods plays more important role than the cost difference for welfare improvement.

The rest of the paper is organized as follows. Section 2 provides the basic model without any restrictions on exports. We characterize the without EPRs equilibrium in this section as a benchmark. We introduce export performance requirements by the host country, and examine the effects of the protection for both cases where marginal cost of producing in foreign country is higher and lower than that in host country in section 3. Section 4 provides concluding remarks.

2 Basic model without EPRs

We consider three country model including source country S, host country H and rest of the world W. There is a multi-national firm (parent firm A) in country S which has a subsidiary (firm B) in country H to supply homogeneous goods to country H and rest of the world. The foreign subsidiary competes in quantities against a domestic local firm (firm d) in the host country with a Cournot conjecture. We treat foreign direct investment as exogenously given, and we do not consider the parent firm's choice between exporting and direct investment for supplying goods to country H. Multi-national firm can supply goods to the rest of world from the parent firm or the subsidiary with no transportation cost. We denote the total amount of multi-national firm's total supply to the rest of world by $X^* \equiv X^4 + X^B$, where X^A and X^B are supply from parent and subsidiary to the rest of world, respectively. The demand in the rest of world is given by the following inverse-demand function:

$$P_{w} = P_{w}(X^{*}), \ P^{w}(X^{*}) < 0, \tag{1}$$

where P_w is the consumer price in the rest of the world. The inverse-demand function in the country H is given by

$$P_{H} = P_{H}(x^{h}), \ P_{H}(x^{h}) < 0,$$
 (2)

where P_H and $x^h \equiv x^b + x^d$ are the consumer price and total demand in the country H, respectively. x^i (i=b, d) are firm *i*'s output. The inverse-demand functions are assumed to be twice continuously differentiable.

Production technologies of firms are assumed to vary according to the location of production. Technologies are characterized by constant marginal costs c_j (j=H, S); c_s for the parent, and c_H for the subsidiary and the domestic local firm. Total profit of foreign multi-national firm is given by

$$\Pi^{*}(X^{A}, X^{B}, x^{b}, x^{d}) = P_{w}(X^{*}) X^{*} - X^{A}c_{S} + P_{H}(x^{h}) x^{b} - (x^{b} + X^{B}) c_{H}.$$
(3)

Thus, the profit of foreign multi-national firm consists of total revenue minus total costs. The profit of domestic local firm in the host country is given by

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$$\pi^{d}(x^{d}, x^{b}) = P_{H}(x^{h}) x^{d} - c_{H} x^{d}.$$
(4)

We assume that the profit functions are strictly concave in quantities for fixed other quantities. The first-order conditions under Cournot conjectures are

$$\frac{\partial \Pi^*}{\partial X^A} = P^{w'} \cdot (X^A + X^B) + P_w - c_s = 0, \tag{5}$$

$$\frac{\partial \Pi^*}{\partial x^b} = P^{h'} x^b + P_H - c_H = 0, \tag{6}$$

$$\frac{\partial \Pi^*}{\partial X^B} = P^{w'} \cdot (X^A + X^B) + P_w - c_H = 0, \tag{7}$$

$$\frac{\partial \pi^d}{\partial x^d} = P^{h} \dot{x}^d + P_H - c_H = 0.$$
(8)

We have five variables: X^* , X^A , X^B , x^b and x^d , and four equations. Noting that $X^* = X^A + X^B$, four independent variables exist in this economy. From (6) and (8), we can obtain the reaction functions of $x^i = x^i(x^j)$ where i = d, f and $i \neq j$. From (5) and (7), we can arrange the first-order conditions with respect to X^A and X^B as follows:

$$X^{A}(X^{B}) = \frac{P_{w} - c_{S}}{-P_{w}'} - X^{B}, \quad X^{B}(X^{A}) = \frac{P_{w} - c_{H}}{-P_{w}'} - X^{A},$$

where $P_w' \equiv (\partial P_w / \partial X^*)$. If the production technology of foreign (resp. host) country is superior to that of host (resp. foreign) country, the outputs at the equilibrium are $X^A = X^*$ and $X^B = 0$ (resp. $X^B = X^*$ and $X^A = 0$). We define the export ratio of the subsidiary by $\underline{\alpha} \equiv [X^B/(x^b + X^B)]$. It should be noted that in the case of $c_S < c_H$, where the firm p has more efficient technology than the firm s, $\underline{\alpha} = 0$, while $\underline{\alpha} = [X^*/x^b(x^d) + X^*] < 1$ in the case of $c_S > c_H$, where the firm s has more efficient technology. Thus, the following lemma is strait-forward:

Lemma 1. If the parent (resp. subsidiary) firm has more efficient technology and lower marginal cost, then the subsidiary (resp. parent) firm does not supply good to the rest of world, which implies that $\underline{\alpha} = 0$ (resp. $0 < \underline{\alpha} < 1$).

$$\begin{cases} \underline{\alpha} = 0 \\ 0 < \underline{\alpha} < 1 \end{cases} \text{ holds when } \begin{cases} c_s < c_H \\ c_s > c_H \end{cases} \text{ respectively.}$$

Lemma 1 intuitively states that the more efficient firm should supply the good to the rest of world market as possible.

3 Export performance requirements

In the previous section, we proposed the relations between $\underline{\alpha}$ and cost differences under the

equilibrium without EPRs. In this section, we introduce export performance requirements by host country on foreign subsidiary which require that a certain percentage of total production volume of foreign subsidiary must be exported. We define the percentage of exports accounting for total production of foreign subsidiary as

$$\alpha \leq \frac{X^B}{x^b + X^B}$$
, such that $\alpha \in (0, 1)$

We exclude the case of $\alpha < \underline{\alpha}$ because if government imposes export performance requirements below $\underline{\alpha}$, this requirement is over-bound and has no restrictive effects on the supply of the subsidiary to the market in the host country. We also exclude the case of $\underline{\alpha} = 1$, where x^b is zero under without-EPRs equilibrium. We focus on the equilibrium where the requirement is relatively more restrictive than that under without-EPRs equilibrium. Thus, we assume that the requirement is just binding in equilibrium.

The objective of the host country's government is to improve its welfare by introducing export performance requirements under without-EPRs equilibrium. Thus, the conditions in our results do not have to hold globally. We suppose that they hold at least in the neighborhood of the without-EPRs equilibrium. The welfare measure we adopt is the standard total surplus function. Thus, welfare of country H consists of consumers' surplus and profits of the domestic local firm:

$$W^{h}(x^{d}, x^{b}) = CS^{h} + \pi^{d}(x^{d}, x^{b}).$$
(9)

The profits of multi-national firm under EPRs is given by:

$$\Pi^{*}(X^{A}, x^{b}; \alpha) = P_{w}(X^{*})X^{*} - X^{A}c_{S} + P(x^{b})x^{b} - (X^{B} + x^{b})c_{H}$$
where
$$X^{*} = X^{A} + X^{B},$$
(10a)

$$X^{B} \ge \frac{\alpha}{(1-\alpha)} x^{b}.$$
(10b)

Although there are four foreign variables X^* , X^A , X^B and x^b , we are sure from (10a) and (10b) that there exists only two variables (X^p and x^b , for example) which are independent among them. The determination of x^b leads to X^B through the binding export performance requirements. X^* is derived by X^A and X^B . The first-order conditions for the foreign multi-national firm are given by partially differentiating Π^* with respect to X^A and x^b :

$$\frac{\partial \Pi^*}{\partial X^4} = P'_w X^* + (P_w - c_S) \le 0, \text{ with equality if } X^4 > 0,$$

$$\frac{\partial \Pi^*}{\partial x^b} = \left(\frac{\alpha}{1-\alpha}\right) (P'_w X^* + P_w - c_H) + (P'_H x^b + P_H - c_H) = 0.$$
(12)

We first suppose that $X^4 > 0$. Then, (11) is satisfied with equality, which implies that the determination

of X^* is independent from α . Using (11) with equality, we can rearrange (12) as

$$P'_H x^b + P_H - \frac{c_H - \alpha c_S}{1 - \alpha} = 0.$$

It should be noted that "the effective marginal cost" for the subsidiary's supply in the host country's market is as follows:

$$\theta \equiv \frac{c_H - \alpha c_S}{1 - \alpha} = c_S + \frac{c_H - c_S}{1 - \alpha}.$$
(13)

It is obvious from (13) that whether θ is increasing in α depends on the sign of $(c_H - c_S)$. To verify this, we must know that when X^A takes positive values. When $c_S < c_H$, it is intuitive to consider that X^A is positive, because we already know that, at the without-EPRs equilibrium, $X^A = X^*$ and $\underline{\alpha} = 0$. If the country H imposes α slightly higher than $\underline{\alpha} = 0$, then it is unlikely that X^A becomes zero as long as the market size of the rest of the world is not so small. When $c_S > c_H$ on the other, we can show that X^A = 0 in the EPRs equilibrium with following steps. Suppose $X^A > 0$ holds with $c_S > c_H$. Then, from (13), $\theta'(\alpha) < 0$ and $(dx^b / d\alpha) > 0$. Recalling that $X^A = X^*(c_S) - X^B$,

$$\frac{dX^{A}}{d\alpha} = -\left(\frac{dX^{B}}{d\alpha}\right) = -\frac{x^{b}}{(1-\alpha)^{2}} - \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{dx^{b}}{d\alpha}\right) < 0.$$

We should note that, when we evaluate $(dX^4 / d\alpha)$ at the neighborhood of without-EPRs equilibrium, $(dX^4 / d\alpha)|_{\alpha = \underline{\alpha}} < 0$ implies that X^4 takes a negative value, which contradicts $X^4 > 0$.

Thus, we immediately obtain following lemma with respect to X^{A} .

Lemma 2. Suppose country H imposes export performance requirements such as $\alpha > \underline{\alpha}$ and α is just binding. Then $X^{4} \ge 0$ if $c_{s} < c_{H}$ and $X^{4} = 0$ if $c_{s} > c_{H}$.

From Lemma 2, when the marginal cost of parent firm is lower than that of subsidiary, we can confirm from (13) that an increase in α from the without-EPRs equilibrium level causes the effective marginal cost for the subsidiary θ higher. Thus, foreign subsidiary decreases supply for the host country's market x^b if c_s is less than c_H . To determine the effects of an increase of export performance requirements on the profit of multi-national firm in this case, we differentiate Π^* with respect to α and obtain

$$\frac{d\Pi^*}{d\alpha} = P'_H x^b \frac{dx^d}{dx^b} \frac{dx^b}{d\alpha} - \frac{c_H - c_S}{(1 - \alpha)^2} \cdot x^b.$$
(14)

The first term in (14) indicates the effects of an increasing in α through the strategic interaction between x^b and x^d . We should note that $(dx^d / dx^b) < 0$ (resp. $(dx^d / dx^b) > 0$) holds if outputs are strategic substitutes (SS hereafter) (resp. complements, SC). The second term shows the loss from relatively inefficient production. Thus, when $c_S < c_H$, the total profit of the multi-national firm decreases if outputs are strategic substitutes, but might increases only if outputs are strategic complements.

When the marginal cost of parent firm is higher than that of subsidiary, $X^{4} = 0$ implies that (11) does

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not hold with equality. Noting that $X^* = X^B$ when $c_S > c_H$, we arrange (12) as follows:

$$\left[\left(\frac{\alpha}{1-\alpha}\right)\left\{\left(\frac{\alpha}{1-\alpha}\right)P'_{w}x^{b}+P_{w}-c_{H}\right\}\right]+\left[P'_{H}x^{b}+P_{H}-c_{H}\right]=0,$$
(15)

where we assume $x^b > 0$. First bracket in (15) shows that the marginal profitability in the rest of world market, and the second bracket shows that the marginal profitability in the host country market. To clarify the effect of increasing α on the x^b , we provide following two examples. First, if we assume that the multi-national firm does not change x^b , then X^B must be raised at the EPRs equilibrium. The profits in the rest of world market falls, however the profits in the market of country H remains constant. Thus, the multi-national firm never gains at the EPRs equilibrium as far as x^b remains constant.

Second, we assume that the multi-national firm does not alter exports X^{B} , then x^{b} must be decreased at the EPRs equilibrium. The profits in the market of country H rises or falls depending on the strategic substitutability, however the profits in the rest of world market remains constant. The effects of change in x^{b} on the profits in the country H is:

$$\frac{d\Pi_H^*}{dx^b} = P'_H x^b \Big(\frac{dx^d}{dx^b} \Big).$$

Thus, Π_H^* rises (resp. falls) with a decrease in x^b when the output in the country H is strategic complements (resp. substitutes). In the case of the strategic complements, the multi-national firm can gain from EPRs.

Next, we consider the case where the multi-national firm changes both x^b and X^B . Using the implicit function theorem, equation (15) leads to a change in x^d with respect to α .

$$\frac{dx^{d}}{d\alpha} = -\frac{(\partial^{2}\Pi^{*}/\partial\alpha\partial x^{b})}{(\partial^{2}\Pi^{*}/\partial x^{b^{2}})}$$

Second-order condition implies that $(dx^b / d\alpha) < 0$. Thus, foreign subsidiary decreases supply for the host country's market regardless of cost differences between c_s and c_{H} . To determine the effects of an increase in α on the total profit of multi-national firm, we differentiate Π^* with respect to α and obtain

$$\frac{d\Pi^*}{d\alpha} = P'_H x^b \frac{dx^d}{dx^b} \frac{dx^b}{d\alpha} - \frac{c_H}{(1-\alpha)^2} \cdot x^b.$$
(16)

The effect of α on profits in equation (16) seems similar to (14) with a slight difference in the second term.

Thus, we obtain following lemmas with respect to x^b and the profits of the multi-national firm Π^* .

Lemma 3. Suppose country H imposes EPRs such as $\alpha > \underline{\alpha}$ and α is just binding. Then the supply of the subsidiary to the host country x^{b} always falls regardless of cost difference. The total profit of the multinational firm always falls if outputs in the local market are strategic substitutes, but might rise when

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outputs are strategic complements.

Next, we show some comparative statics. The effects of a change in α on outputs are given by

$$\frac{dX^{B}}{d\alpha} = \frac{1}{\left(1-\alpha\right)^{2}} x^{b} + \frac{\alpha}{1-\alpha} \cdot \frac{dx^{b}}{d\alpha},$$
(17)

$$\frac{dx^{d}}{d\alpha} = \left(\frac{dx^{d}}{dx^{b}}\right) \cdot \left(\frac{dx^{b}}{d\alpha}\right),\tag{18}$$

$$\frac{d(x^b+x^d)}{d\alpha} = \left(1 + \frac{dx^d}{dx^b}\right) \cdot \left(\frac{dx^b}{d\alpha}\right).$$
(19)

From (17) and Lemma 3, in the case of $c_S < c_H$, we evaluate $(dX^B/d\alpha)$ at $\alpha = 0$ and obtain $(dX^B/d\alpha) > 0$. In the case of $c_S < c_H$, however, the sign of $(dX^B/d\alpha)$ is generally ambiguous. Noting that α takes $0 < \alpha < 1$ and that $(1/(1-\alpha)^2)$ becomes greater with larger α , $(dX^B/d\alpha)|_{\alpha>0}$ likely to be positive. Thus, following lemma is obvious with respect to X^B .

Lemma 4. Suppose country H imposes export performance requirement such as $\alpha > \underline{\alpha}$ and α is just binding. Then exports from foreign subsidiary to the rest of world X^{B} unambiguously increases.

From (18), the effect of α on x^d depends on the strategic substitutability between x^d and x^b . From (18) and Lemma 3, we obtain following lemma with respect to x^d .

Lemma 5. Suppose country H imposes export performance requirement such as $\alpha > \alpha$ and α is just binding. Then output of the domestic local firm x^{d} increases (resp. decreases) if and only if outputs in the local market are strategic substitutes (resp. complements).

From(19), it should be noted that a change in aggregate supply in the host country's market $x^{h} = x^{b} + x^{d}$ has one-to-one relation with a change in price P_{H} . Noting that $-1 < (dx^{d}/dx^{b}) < 1$ holds, we obtain following lemma on the effect of α on price P_{H} .

Lemma 6. Suppose country H imposes export performance requirements such as $\alpha > \underline{\alpha}$ and α is just binding. Then the price in the host country P_H always rises regardless of strategic relationship and cost difference.

Finally, we investigate the effect on welfare of a change in the rate of export performance requirements. We totally differentiate (9) with respect to α and evaluate it at the without EPRs equilibrium level $\underline{\alpha}$.

$$\left.\frac{dW^{h}}{d\alpha}\right|_{\alpha=\underline{\alpha}} = -x^{b}\left(\frac{dP_{H}}{d\alpha}\right) + (P_{H} - c_{H})\left(\frac{dx^{d}}{d\alpha}\right)$$

 $(dW^{h}/d\alpha)|_{\alpha=\alpha} > 0$ implies that a small increase in α raises the host country's welfare.

Combining Lemma 5 and 6, the analysis in this section leads to the following proposition.

Proposition 1. Suppose country H imposes export performance requirements such as $\alpha > \underline{\alpha}$ and α is just binding. Then following statements on the profit and welfare are derived.

- (i) The foreign subsidiary always decreases supply for the domestic local market regardless of cost differences among countries.
- (ii) When outputs in the host country's market are strategic substitutes, the change in the host country's welfare is ambiguous, while the domestic local firm always gets better-off and the foreign multi-national firm always loses.
- (iii) When outputs are strategic complements, the profit of the multi-national firm might increase, while the host country always suffers from EPRs.

We should note that the host country's welfare increases by EPRs only if outputs are strategic substitutes. It should be also noted that when outputs are strategic complements, the host country's government cannot raise its welfare by introducing export performance requirements.

4 Concluding Remarks

In a three-country model, we have shown how export performance requirements affect the profit of multi-national firm and the host country's welfare when the market in the host country is under duopoly. We draw two main conclusions from this analysis.

First, we have examined that whether and when the export performance requirements protect domestic local firm. Introducing export performance requirements at the without-EPRs equilibrium always decreases the market share of the foreign subsidiary. Thus, whether the export performance requirements are protecting measures depends not on the cost difference among countries but also on the strategic substitutabilities.

Second, we have investigated the welfare implication of introducing export performance requirements at the without-EPRs equilibrium. In general, the effect of export performance requirements on the host country's welfare depends not on cost difference among countries but also on the strategic substitutability of goods. We found what condition is required for welfare to improve by imposing export performance requirements. Strategic substitutes among goods are necessary for welfare improvement of host country. On the other hand, when outputs are strategic complements, host country cannot raise its welfare by imposing EPRs.

Moreover, we have obtained some interesting results in certain cases. When outputs are strategic complements, introducing export performance requirements might raise the profits of multi-national firm, while the host country's welfare necessarily falls.

As a final remark, we emphasize that this paper in no way to support the strait-from-the-shoulder use of export performance requirements. There is no possibility for the case where both multi-national firm and the host country's welfare gain from introducing export performance requirements. All of

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results in lemmas and proposition do not require the condition on cost difference among countries, whereas we need the condition on the strategic relationaship among goods.

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