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Competition for Foreign Direct Investment:
the Role of Technology and Market Structure

By

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Abstract

We analyze the location choice of a multinational corporation (MNC) between two host countries connected via international trade. We do so when the host governments are passive as well as when they compete with each other for the MNC. In particular, we examine the role of relative production efficiencies of domestic firms, and of market structure, in the host countries, in the MNC's locational choice. We consider two scenarios: domestic firms export and they do not. Our findings include: (i) when the domestic firms export, the country with fewer firms always gets the MNC, but the MNC is indifferent between hosts with domestic firms that have different efficiency levels, (ii) when the domestic firms do not export, the country with more domestic firms gets the MNC if the domestic firms are sufficiently inefficient, and the MNC locates in the country with less efficient domestic firms.

Keywords: Foreign direct investment; Production efficiency; Market structure

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1 Introduction

The dramatic increase in foreign direct investment (FDI) by multinational corporations (MNC) in the past few decades justifies continued academic interest in studying location decisions by MNCs. Given high fixed costs associated with setting up of a physical plant in a foreign country, MNCs typically look for fundamentals and incentives in the shortlist of alternative locations, and choose a specific location (see, for example, Oman, 2000; Raff, 2004). Potential host countries compete with each other by offering fiscal and other incentives to attract the MNC within their borders (Davies, 2004; Barrols and Cabral, 2000; Raff, 2004). Besides seeking fiscal and other favors from host governments, MNCs also look for other characteristics of the competing host countries, and these include labor market conditions, infrastructure, local consumer demand , market environment, local competitions etc. (see, for example, Friedman, Gerlowski, and Silberman, 1992; Wheeler and Mody, 1992; Billington, 2000; Fumagalli, 2003; Ottaviano and Ypersele, 2005).

MNCs do not operate in isolation in host countries. Typically, there are other domestic firms who also produce similar goods. Further they need to compete with other firms, not located in the host country, in the international market. The extent of international competition depends, *inter alia*, on the level of transportation costs and on the extent firms take part in international trade. In recent years a theoretical and empirical literature has developed that try to explain why some firms export and some others do not. Greenaway and Kneller (2007) and Breau and Rigby (2006) find empirical evidence that on average the productivity of exporting firms is higher than that of non-exporting firms. Clerides, Lach and Tybout (1998), Melitz (2003) and Aw, Roberts and Winston (2007) argue that due to sunk cost associated with export market entry, the profitable and efficient firms are more likely to self-select into export markets. Helpman, Melitz and Yeaple (2003), Tomiura (2007) and Yasar and Paul (2007) go further and point out that the most productive firms engage in FDI, the next most productive ones export and the less productive firms produce only for

domestic markets.

There is also the literature on economic geography which focuses on the co-existence of economy of scale and transportation costs. This literature suggests that MNCs would want to locate in a place where there are already many other similar firms – the occurrence of agglomeration (see, for example, Head et al., 1995; Duranton and Puga, 2004).

In this paper we shall focus on the role fiscal incentives, market structure, and efficiency levels of competing domestic firms on an MNC's location decision. We shall do so in a two-country model of international trade where the two markets are segmented and firms from one country can export to the other after incurring some transportation costs. The two countries are potential hosts for the MNC and each has a number of domestic firms. In view of what we mentioned before and the fact that MNCs tend to be more efficient than their domestic competitors, we shall consider two scenarios in relation to international trade. In the first, we shall assume that domestic firms do not export, and in the second they do. We shall assume away increasing returns and therefore the usual forces that lead to agglomeration. However, as we shall see later on, agglomeration is still possible in our framework for different reasons.

There is a small sub-literature on tax competition for FDI that this paper belongs to. Haufler and Wooton (1999) is the starting point. In their model, there are no domestic firms in two host countries and they focus on the differences in market size between the host countries. Bjorvatn and Eckel (2006) allow for one domestic firm in one of the two countries in the Haufler and Wooton framework, i.e., the host countries are different in two dimensions: market size and number of domestic firms in them. Guariglia et al. (2006) on the hand allow for one domestic firm in each host country and they focus on differences in the efficiency levels of the domestic firms in the two countries. Zhong and Lahiri (2009) consider a different form of FDI, viz., international joint venture. There are two domestic firms - one in each host country and the MNC in their framework decides who to form the joint

venture with. The markets in the two countries are integrated in their framework. Whereas in Haufler and Wooton (1999) and Bjorvatn and Eckel (2006), the host governments are active in trying to attract the MNC through fiscal incentives, in Guariglia et al. (2006) the governments are passive. We consider both situations and compare how the role of governments changes the results. Bjorvatn and Eckel (2006) do not consider the case where the domestic firm does not export. In common with Guariglia et al. (2006) we consider both situations depending on if the domestic firms export or not, and compare the results. Unlike in Guariglia et al. (2006), but as in Bjorvatn and Eckel (2006), the number of domestic firms with different efficiency levels in the two countries are different. However, unlike Bjorvatn and Eckel (2006), we allow for the existence of domestic firms in both countries. Finally, by abstracting away from market size, we are able to focus on the role of the number of domestic firms in each country for the MNC's location decision. This allows us to obtain results that are qualitatively very different from that in Bjorvatn and Eckel (2006). For example, we find that when domestic firms exports, the MNC will locate in the country with fewer domestic firms. Under similar circumstances Bjorvatn and Eckel (2006) find that the MNC is more likely to locate in the country with a larger number of domestic firms.

The lay out of the paper is as follows. Section 2 describes the basic model. Sections 3 and 4 then consider the problem of the MNC's location choice. Whereas in section 3 we focus on differences in market structure between the host countries, section 4 considers differences in production efficiencies between the domestic firms in the two countries. Each of section 3 and 4 are subdivided to consider the cases of active and passive governments, and the cases where domestic firms export and they do not. Finally, some concluding remarks are made in section 5.

2 The general model

We consider a partial equilibrium model of a homogeneous good in which a foreign firm (labeled M), which we shall also refer to as the MNC (Multinational Corporation), wants to invest in one of two host countries, labeled A and B. There is a fixed cost F of setting up a plant in either country. This fixed cost is assumed to be sufficiently large to ensure that the MNC will not choose to operate plants in both countries. There are h_i number of identical domestic firms in each host country with constant marginal and average cost c_i ($i = A,\ B$). The unit variable and marginal costs of the MNC is c_M. We assume that the MNC is technologically superior to the domestic firms, i.e., $c_M < \min(c_A,\ c_B)$.

The market for the good in the two countries are assumed to be segmented. The inverse demand functions for the good in the two countries are given by

$$p_i = a - bD_i, \tag{1}$$

where p_i and D_i are respectively the price and the demand for the good in country i ($i = A,\ B$).[1]

The MNC is assumed to serve both markets, but whenever it exports a unit transportation cost t is incurred. But for the domestic firms, we shall consider two scenarios: (i) they only serve their respective domestic markets, and (ii) like the MNC they also serve both markets, incurring a unit transportation cost for exports. These two cases are now considered in turn.

2.1 Domestic firms do not export

We consider first the case where the MNC locates in country A. Putting a superscript A to all the variables (indication the location of the MNC), the market-clearing conditions in the

[1]Implicit in these inverse demands function are the assumptions of identical preferences and market sizes in the two host countries.

two markets are:

$$D_A^A = h_A q_A^A + q_M^A, \quad D_B^A = h_B q_B^A + q_M^{*A}, \tag{2}$$

where q_A^j is firm i's sales in the market of its location ($i = A,\ B,\ M$), and superscript $*$ denotes exports.

Substituting (2) into (1) yields

$$P_A^A = a - b(h_A q_A^A + q_M^A), \quad P_B^A = a - b(h_B q_B^A + q_M^{*A}). \tag{3}$$

Each firm's profit is:

$$\begin{aligned} \pi_A^A &= \left(P_A^A - c_A\right) q_A^A, \quad \pi_B^A = \left(P_B^A - c_B\right) q_B^A, \\ \pi_M^A &= \left(P_A^A - c_M\right) q_M^A + (P_B^A - c_M - t) q_M^{*A} - F + s_A, \end{aligned} \tag{4}$$

Each domestic firm's profit is simply the difference between revenue and variable costs. For the MNC, total profits consist of profits from the two markets, minus fixed costs F, and plus a lump-sum subsidy payment s_A received from the host country's government.

Assuming Cournot competition, the first-order profit-maximizing conditions are:

$$\begin{aligned} P_A^A - c_A &= b q_A^A, \quad P_B^A - c_B = b q_B^A, \\ P_A^A - c_M &= b q_M^A, \quad P_B^A - c_M - t_B = b q_M^{*A}. \end{aligned} \tag{5}$$

From (3) and (5), we solve the closed-form solutions as:

$$\begin{aligned} P_A^A &= \frac{a + h_A c_A + c_M}{h_A + 2}, \quad P_B^A = \frac{a + h_B c_B + c_M + t}{h_B + 2}, \\ q_A^A &= \frac{a - 2c_A + c_M}{b\,(h_A + 2)}, \quad q_M^A = \frac{a + h_A c_A - (h_A + 1) c_M}{b\,(h_A + 2)}, \\ q_B^A &= \frac{a - 2c_B + c_M + t}{b\,(h_B + 2)}, \quad q_M^{*A} = \frac{a + h_B c_B - (h_B + 1) c_M - (h_B + 1) t}{b\,(h_B + 2)}. \end{aligned} \tag{6}$$

When the MNC locates in Country B, the solutions can be analogously derived as:

$$\begin{aligned} P_A^B &= \frac{a+h_Ac_A+c_M+t}{h_A+2}, \quad P_B^B=\frac{a+h_Bc_B+c_M}{h_B+2}, \\ q_A^B &= \frac{a-2c_A+c_M+t}{b\left(h_A+2\right)}, \quad q_M^B=\frac{a+h_Bc_B-(h_B+1)c_M}{b\left(h_B+2\right)}, \\ q_B^B &= \frac{a-2c_B+c_M}{b\left(h_B+2\right)}, \quad q_M^{*B}=\frac{a+h_Ac_A-(h_A+1)c_M-(h_A+1)t}{b\left(h_A+2\right)}. \end{aligned} \tag{7}$$

To guarantee positive sales by domestic firms in the local market, we assume

Assumption 1. *$c_A < (a+c_M)/2$ and $c_B < (a+c_M)/2$.*

Substituting the first-order profit-maximizing conditions in the expressions for profits and then using (6) and (7), we find the solutions for profits for each firm under the two scenarios as:

$$\begin{aligned} \pi_A^A &= b\left(q_A^A\right)^2=\frac{(a-2c_A+c_M)^2}{b\left(h_A+2\right)^2}, \quad \pi_A^B=b\left(q_A^B\right)^2=\frac{(a-2c_A+c_M+t)^2}{b\left(h_A+2\right)^2}, \\ \pi_B^A &= b\left(q_B^A\right)^2=\frac{(a-2c_B+c_M+t)^2}{b\left(h_B+2\right)^2}, \quad \pi_B^B=b\left(q_B^B\right)^2=\frac{(a-2c_B+c_M)^2}{b\left(h_B+2\right)^2}. \end{aligned} \tag{8}$$

$$\begin{aligned} &\pi_M^A = b\left(q_M^A\right)^2+b\left(q_M^{*A}\right)^2-F+s_A \\ =\ &\frac{[a+h_Ac_A-(h_A+1)c_M]^2}{b\left(h_A+2\right)^2}+\frac{[a+h_Bc_B-(h_B+1)c_M-(h_B+1)t]^2}{b\left(h_B+2\right)^2}-F+s_A, \\ &\pi_M^B = b\left(q_M^B\right)^2+b\left(q_M^{*B}\right)^2-F+s_B. \\ =\ &\frac{[a+h_Bc_B-(h_B+1)c_M]^2}{b\left(h_B+2\right)^2}+\frac{[a+h_Ac_A-(h_A+1)c_M-(h_A+1)t]^2}{b\left(h_A+2\right)^2}-F+s_B. \end{aligned}$$

2.2 Domestic firms export

When all firms can sell in both markets, the model is essentially the reciprocal dumping model of Brander & Krugman (1983). In this case, the market-clearing conditions are:

$$\begin{aligned} D_A^A &= h_Aq_A^A+q_M^A+h_Bq_B^{*A}, \\ D_B^A &= h_Bq_B^A+q_M^{*A}+h_Aq_A^{*A}. \end{aligned} \tag{9}$$

Substituting the above equations into demand function (1), we get:

$$p_A^A = a - b\left(h_A q_A^A + q_M^A + h_B q_B^{*A}\right),\ p_B^A = a - b\left(h_B q_B^A + q_M^{*A} + h_A q_A^{*A}\right). \tag{10}$$

Profit of each firm is

$$\pi_A^A = \left(P_A^A - c_A\right) q_A^A + \left(P_B^A - c_A - t\right) q_A^{*A},\quad \pi_B^A = \left(P_B^A - c_B\right) q_B^A + \left(P_A^A - c_B - t\right) q_B^{*A},$$
$$\pi_M^A = \left(P_A^A - c_M\right) q_M^A + (P_B^A - c_M - t) q_M^{*A} - F + s_A. \tag{11}$$

Assuming Cournot behavior, the first-order profit-maximizing conditions are:

$$P_A^A - c_A = b q_A^A,\quad P_B^A - c_A - t = b q_A^{*A},\quad P_B^A - c_B = b q_B^A,$$
$$P_A^A - c_B - t = b q_B^{*A},\quad P_A^A - c_M = b q_M^A,\quad P_B^A - c_M - t = b q_M^{*A}. \tag{12}$$

The closed-form solutions from the above equations are:

$$P_A^A = \frac{a + h_A c_A + h_B c_B + c_M + h_B t}{h_A + h_B + 2},\quad P_B^A = \frac{a + h_A c_A + h_B c_B + c_M + (h_A + 1)\, t}{h_A + h_B + 2},$$
$$q_A^A = \frac{a - (h_B + 2)\, c_A + h_B c_B + c_M + h_B t}{b\,(h_A + h_B + 2)},$$
$$q_A^{*A} = \frac{a - (h_B + 2)\, c_A + h_B c_B + c_M - (h_B + 1)\, t}{b\,(h_A + h_B + 2)},$$
$$q_B^A = \frac{a + h_A c_A - (h_A + 2)\, c_B + c_M + (h_A + 1)\, t}{b\,(h_A + h_B + 2)},$$
$$q_B^{*A} = \frac{a + h_A c_A - (h_A + 2)\, c_B + c_M - (h_A + 2)\, t}{b(h_A + h_B + 2)},$$
$$q_M^A = \frac{a + h_A c_A + h_B c_B - (h_A + h_B + 1) c_M + h_B t}{b\,(h_A + h_B + 2)},$$
$$q_M^{*A} = \frac{a + h_A c_A + h_B c_B - (h_A + h_B + 1) c_M - (h_B + 1) t}{b\,(h_A + h_B + 2)}.$$

When the MNC locates in Country B, the closed-form solutions are analogously de-

rived as:

$$
\begin{aligned}
P_B^B &= \frac{a + h_A c_A + h_B c_B + c_M + h_A t}{h_A + h_B + 2}, \quad P_A^B = \frac{a + h_A c_A + h_B c_B + c_M + (h_B + 1)\, t}{h_A + h_B + 2}, \\
q_A^B &= \frac{a - (h_B + 2)\, c_A + h_B c_B + c_M + (h_B + 1)\, t}{b\,(h_A + h_B + 2)}, \\
q_A^{*B} &= \frac{a - (h_B + 2)\, c_A + h_B c_B + c_M - (h_B + 2)\, t}{b\,(h_A + h_B + 2)}, \\
q_B^B &= \frac{a + h_A c_A - (h_A + 2)\, c_B + c_M + h_A t}{b\,(h_A + h_B + 2)}, \\
q_B^{*B} &= \frac{a + h_A c_A - (h_A + 2)\, c_B + c_M - (h_A + 1)\, t}{b\,(h_A + h_B + 2)}, \\
q_M^B &= \frac{a + h_A c_A + h_B c_B - (h_A + h_B + 1)\, c_M + h_A t}{b\,(h_A + h_B + 2)}, \\
q_M^{*B} &= \frac{a + h_A c_A + h_B c_B - (h_A + h_B + 1)\, c_M - (h_A + 1)\, t}{b\,(h_A + h_B + 2)}.
\end{aligned}
$$

Once again, the expressions of profits of each firm under the two scenarios are:

$$
\begin{aligned}
\pi_A^A = b\left(q_A^A\right)^2 + b\left(q_A^{*A}\right)^2 &= \frac{\left[a - (h_B + 2)\, c_A + h_B c_B + c_M + h_B t\right]^2}{b\,(h_A + h_B + 2)^2} \\
&+ \frac{\left[a - (h_B + 2)\, c_A + h_B c_B + c_M - (h_B + 1)\, t\right]^2}{b\,(h_A + h_B + 2)^2}, \\
\pi_A^B = b\left(q_A^B\right)^2 + b\left(q_A^{*B}\right)^2 &= \frac{\left[a - (h_B + 2)\, c_A + h_B c_B + c_M + (h_B + 1)\, t\right]^2}{b\,(h_A + h_B + 2)^2} \\
&+ \frac{\left[a - (h_B + 2)\, c_A + h_B c_B + c_M - (h_B + 2)\, t\right]^2}{b\,(h_A + h_B + 2)^2}, \\
\pi_B^A = b\left(q_B^A\right)^2 + b\left(q_B^{*A}\right)^2 &= \frac{\left[a + h_A c_A - (h_A + 2)\, c_B + c_M + (h_A + 1)\, t\right]^2}{b\,(h_A + h_B + 2)^2} \\
&+ \frac{\left[a + h_A c_A - (h_A + 2)\, c_B + c_M - (h_A + 2)\, t\right]^2}{b(h_A + h_B + 2)^2},
\end{aligned}
$$

$$\pi_B^B = b\left(q_B^B\right)^2 + b\left(q_B^{*B}\right)^2 = \frac{\left[a + h_A c_A - (h_A + 2)\, c_B + c_M + h_A t\right]^2}{b\left(h_A + h_B + 2\right)^2}$$

$$+\frac{\left[a + h_A c_A - (h_A + 2)\, c_B + c_M - (h_A + 1)\, t\right]^2}{b\left(h_A + h_B + 2\right)^2}. \tag{13}$$

$$\pi_M^A = b\left(q_M^A\right)^2 + b\left(q_M^{*A}\right)^2 - F + s_A = \frac{\left[a + h_A c_A + h_B c_B - (h_A + h_B + 1) c_M + h_B t\right]^2}{b\left(h_A + h_B + 2\right)^2}$$

$$+\frac{\left[a + h_A c_A + h_B c_B - (h_A + h_B + 1) c_M - (h_B + 1) t\right]^2}{b\left(h_A + h_B + 2\right)^2} - F + s_A,$$

$$\pi_M^B = b\left(q_M^B\right)^2 + b\left(q_M^{*B}\right)^2 - F + s_B = \frac{\left[a + h_A c_A + h_B c_B - (h_A + h_B + 1)\, c_M + h_A t\right]^2}{b\left(h_A + h_B + 2\right)^2}$$

$$+\frac{\left[a + h_A c_A + h_B c_B - (h_A + h_B + 1)\, c_M - (h_A + 1)\, t\right]^2}{b\left(h_A + h_B + 2\right)^2} - F + s_B.$$

Having analyzed the basic model and the determination of profits under two alternative locational choices by the MNC, we shall now examine the determination of the MNC's location. In doing so, we shall focus on two differences between the two host countries. The first difference is in market structure, viz., in the number of domestic firms in the industry. The second difference would be in the production efficiency of the domestic firms. These two cases are taken up in turn in the following two section.

3 The role of market structure

In this section, we examine the role of market structure in the two host countries for the MNC's choice of location. In order to focus on the role of market structure, we shall assume away any other differences between the two host countries. In particular, we assume that the domestic firms in the two host countries are all identical in their efficiency levels. For simplicity, but without any loss of generality, we shall also assume that there is only one domestic firm in country B. These are formally stated as:

$$h_A > 1, h_B = 1, \quad c_A = c_B = c. \tag{14}$$

We now consider two cases depending on whether or not the domestic firms export.

3.1 Domestic firms do not export

Substituting (14) into the foreign firm's profit function (8) we find:

$$\begin{aligned}\pi_M^A &= \frac{\left[a + h_A c - (h_A + 1)\, c_M\right]^2}{b\,(h_A + 2)^2} + \frac{(a + c - 2c_M - 2t)^2}{9b} - F - s_A \\ \pi_M^B &= \frac{(a + c - 2c_M)^2}{9b} + \frac{\left[a + h_A c - (h_A + 1)\, c_M - (h_A + 1)t\right]^2}{b\,(h_A + 2)^2} - F - s_B \end{aligned} \tag{15}$$

We now consider two further sub-cases based on the roles of the host governments.

3.1.1 Passive governments

In the absence of any government policy or when the two governments offer the same amount of fiscal incentives to the MNC, the difference between the MNC profits under two alternative location decisions is:

$$\pi_M^A - \pi_M^B = \frac{-t\,(h_A - 1)}{9b\,(h_A + 2)^2}\left[2a\,(2h_A + 1) - 2c\,(7h_A + 8) + 2c_M\,(5h_A + 7) + t\,(5h_A + 7)\right].$$

The following proposition follows directly from the above equation.

Proposition 1. *When the host governments are passive and the domestic firms do not export, there exists a critical value of c, $\bar{c}$, such that the MNC will choose to locate in country A (B) if $c > \bar{c}$ ($c < \bar{c}$) where*

$$\bar{c} = \frac{2a\,(2h_A + 1) + 2c_M\,(5h_A + 7) + t\,(5h_A + 7)}{2\,(7h_A + 8)}.$$

The critical $\bar{c}$ is an increasing function of the transportation cost t.

When domestic firms do not export and in the presence of transportation costs, the MNC would prefer to locate in the country with fewer domestic firms. However, the fear of

more competition from domestic firms in country A is less intense when the domestic firms are not very efficient. In this case agglomeration will occur in the sense that the MNC will locate in the country which has a larger number of firms. As transportation costs increase, the benefit from locating in the country with fewer domestic firms increase.

3.1.2 Tax competition

We now consider the sub-case where the host governments are not passive, but actively try to persuade the MNC locate in their respective countries with the carrots of lump-sum subsidies. Of course, in doing so they try to maximize social welfare in their countries. There can of course be one winner, and loser would not find it worthwhile to subsidize beyond a certain level.

The utility function implicit behind the demand function is a quasi-linear one of the form $u(D) = aD - bD^2/2 + Z$ where D and Z are the domestic consumption of the oligopoly good and the numeraire good respectively. With this utility function, the indirect utility function can easily be derived as $u = (a-p)^2/(2b) + I$ where I is the sum of labor income and domestic firms' profits, minus any lump-sum payment to the MNC. Substituting for the solution for price and domestic profits obtained before into this indirect utility function, we derive the levels of social welfare in country A when the MNC locates in country A and B respectively as:

$$\begin{aligned} U_A^A &= \frac{[(h_A+1)a - h_A c - c_M]^2}{2b(h_A+2)^2} + \frac{h_A\,(a-2c+c_M)^2}{b(h_A+2)^2} - s_A + \bar{I}_A, \\ U_A^B &= \frac{[(h_A+1)a - h_A c - c_M - t]^2}{2b(h_A+2)^2} + \frac{h_A\,(a-2c+c_M+t)^2}{b(h_A+2)^2} + \bar{I}_A, \end{aligned} \tag{16}$$

where $\bar{I}_A$ and $\bar{I}_B$ are the levels of labor income in the two countries. The first term is the consumer surplus, and the second term is the producer surplus in both equations.

Equating $U_A^A = U_A^B$, we solve for the critical subsidy level $\widetilde{s_A}$ at which government of

the country A is indifferent between whether the MNC locates in country A or B:

$$\widetilde{s_A} = \frac{-2ta(h_A - 1) + 6th_Ac - 2tc_M(2h_A + 1) - t^2(2h_A + 1)}{2b\left(h_A + 2\right)^2}.$$

Clearly, the government of country A would not be willing to offer any subsidy that is higher than the above critical value.

Similarly, for the government in country B the critical subsidy level can be obtained as:

$$\widetilde{s_B} = \frac{t\left(2c - 2c_M - t\right)}{6b}.$$

From the above two equations, we find:

$$\widetilde{s_A} - \widetilde{s_B} = \frac{t\left(h_A - 1\right)}{6b\left(h_A + 2\right)^2}\left[-6a - 2c\left(h_A - 4\right) + 2c_M\left(h_A - 1\right) + t\left(h_A - 1\right)\right] < 0.$$

That is, the government in country B will always be willing to pay a higher subsidy level than that in country A. But will country B win the competition for the MNC? It will if $c < \bar{c}$. This is because when $c < \bar{c}$, we know from proposition 1 that the MNC would make a bigger profit (not counting any subsidy) by locating itself in Country B rather than in Country A; and, as we find out, country B will be able to seal the deal by offering a higher subsidy. However, when $c > \bar{c}$ it is not clear which country is able to deliver a higher profits (counting subsidy). It can be derived that if $c > \tilde{c}$ ($c < \tilde{c}$) country A (B)will win the competition for the MNC, where

$$\tilde{c} = \frac{\left(8h_A + 22\right)a + 2c_M\left(13h_A + 11\right) + t\left(13h_A + 11\right)}{2\left(11h_A + 28\right)}.$$

In fact to attract the MNC country A (or B) does not have to pay subsidy as high as $\widetilde{s_A}$ (or) $\widetilde{s_B}$, as in Haufler and Wooton (2000), Kind et al. (2000) and Bjorvatn and Eckel (2006). By offering a subsidy $\widehat{s_A}$ or $\widehat{s_B}$, country A (or B) is able to appropriate the entire location rent without inducing relocation, where $\widehat{s_A} = \widetilde{s_B} + \pi_M^A - \pi_M^B$ (or $\widehat{s_B} = \widetilde{s_A} + \pi_M^A - \pi_M^B$). The above results are stated formally in the following proposition.

Proposition 2. *Consider the case where the governments of the host countries are active and the domestic firms do not export. Country B will win the competition for the MNC if* $c < \bar{c}$. *If* $c > \bar{c}$, *country B will still win the competition if* $\bar{c} < c < \tilde{c}$. *Country A will win the competition if* $c > \tilde{c}$.

Compared to the case of passive host governments, here the MNC is more likely to locate in country B (the country with fewer domestic firms, since country B is always willing to offer more generous subsidy to the MNC than country A.

3.2 Domestic firms export

In this case, substituting (14) into (13) we can find the MNC's profits under alternative locational choice as:

$$\begin{aligned}
\pi_M^A &= \frac{\left[a + (h_A + 1)\, c - (h_A + 2)\, c_M + t\right]^2}{b\,(h_A + 3)^2} \\
&\quad + \frac{\left[a + (h_A + 1)\, c - (h_A + 2)\, c_M - 2t\right]^2}{b\,(h_A + 3)^2} - F - s_A, \\
\pi_M^B &= \frac{\left[a + (h_A + 1)\, c - (h_A + 2)\, c_M + h_A t\right]^2}{b\,(h_A + 3)^2} \\
&\quad + \frac{\left[a + (h_A + 1)\, c - (h_A + 2)\, c_M - (h_A + 1)\, t\right]^2}{b\,(h_A + 3)^2} - F - s_B. \qquad (17)
\end{aligned}$$

Once again we consider two cases depending on the host governments' behavior.

3.2.1 Passive government

We assume two host governments are either passive or offer the same amount of fiscal incentives to FDI, the difference between π_M^A and π_M^B is computed from (17) as:

$$\pi_M^A - \pi_M^B = \frac{t^2(1 - h_A)(2h_A + 4)}{b(h_A + 3)^2} < 0, \qquad (18)$$

from which the following proposition immediately follows.

Proposition 3. *With passive host governments and when domestic firms do not export, the MNC will always locate in the country with fewer domestic firms.*

Once domestic firms export, all firms participate in both markets, and the MNC's profits are related to transportation costs and the number of firms that are located in the same country as the MNC. When the MNC locates in country B, it competes with one domestic firm and h_A number of firms' exports from country A. In contrast, when the MNC is located in country A, it competes with h_A number of domestic firms and one firm's export from country B. Because of the existence of transportation costs and productivity symmetry among all domestic firms, country A's market is more competitive. Thus, the MNC always locates in country B.

3.2.2 Tax competition

When all firms (including the domestic firms) export, the levels of social welfare in country A is calculated as before (in the case of no domestic exports) under the two alternative location choice for the MNC:

$$\begin{aligned} U_A^A &= \frac{\left[\left(h_A+2\right)a-\left(h_A+1\right)c-c_M-t\right]^2}{2b\left(h_A+3\right)^2}+\frac{h_A\left(a-2c+c_M+t\right)^2}{b\left(h_A+3\right)^2} \\ &\quad +\frac{h_A\left(a-2c+c_M-2t\right)^2}{b\left(h_A+3\right)^2}+\bar{I}_A-s_A, \\ U_A^B &= \frac{\left[\left(h_A+2\right)a-\left(h_A+1\right)c-c_M-2t\right]^2}{2b\left(h_A+3\right)^2}+\frac{h_A\left(a-2c+c_M+2t\right)^2}{b\left(h_A+3\right)^2} \\ &\quad +\frac{h_A\left(a-2c+c_M-3t\right)^2}{b\left(h_A+3\right)^2}+\bar{I}_A. \end{aligned} \tag{19}$$

In both utility functions, the first term is consumer surplus, the second term is the producer surplus from the domestic market, and the third term is the producer surplus from exports.

Equating U_A^A and U_A^B, we calculate the maximum level of the subsidy the government in country A will be willing to offer, $\widetilde{s_A}$:

$$\widetilde{s_A} = \frac{2t\left(h_A+2\right)a - 2t\left(h_A+1\right)c - 2tc_M - t^2(16h_A+3)}{2b(h_A+3)^2}. \tag{20}$$

Similarly, for country B, the maximum subsidy level is:

$$\widetilde{s_B} = \frac{2t\left(h_A+2\right)a - 2t\left(h_A+1\right)c - 2tc_M - t^2(10h_A+9)}{2b(h_A+3)^2}. \tag{21}$$

From the above two equation we find:

$$\Delta = \widetilde{s_A} - \widetilde{s_B} = \frac{-3t^2\left(h_A-1\right)}{b(h_A+3)^2} < 0. \tag{22}$$

Country B is always able to out-compete country A in attracting the MNC. Since the MNC also makes a higher profit (without any subsidy) by locating in country B (proposition 3), there is no doubt that country B always wins the competition for the MNC.

Proposition 4. *Suppose that the host governments are active and all firms can export. The MNC will always locate in the country with fewer domestic firms.*

When all firms participate in both markets, two markets are very interconnected, and neither country is able to maintain its domestic firms' market power in their own countries. In this case, the importance of consumer surplus becomes more important in social welfare. However, with the MNC locating there, country A's consumers' surplus would not increase as much as country B's consumers' surplus, since its domestic market is relatively more competitive in country A. Thus, country A cannot offer the MNC more subsidy than country B.

The model of the present subsection (the case of active governments and exports by domestic firms) has some common elements with that in Bjorvatn and Eckel (2006) who consider one domestic firm in one host country and none in the other. The country with

the domestic firm is also larger than the other country in their framework. They find that the larger country is more likely to win competition for the MNC. In contrast, by focusing on differences in the number of domestic firms in the two host countries, we obtain a very different result, viz., the country with fewer domestic firms will always win the competition.

4 The Role of production efficiency of domestic firms

To focus on the role of differences in production efficiencies of the domestic firms in the two countries, we assume that the two countries are identical except for the marginal cost of production of the domestic firms in each country. For simplicity and without loss of generality, it is assumed that both countries have only one domestic firm each and the domestic firm in country A is more efficient than that in country B, i.e.,

$$h_A = h_B = 1, \quad c_M < c_A < c_B. \tag{23}$$

As in the previous section, we consider two situations with regard to the domestic firms: they export and they do not.

4.1 Domestic firms do not export

Substituting (23) into the expression of MNC's profits (8) we derive this under two alternatives for its locations:

$$\begin{aligned} \pi_M^A &= \frac{(a + c_A - 2c_M)^2}{9b} + \frac{(a + c_B - 2c_M - 2t)^2}{9b} - F + s_A, \\ \pi_M^B &= \frac{(a + c_B - 2c_M)^2}{9b} + \frac{(a + c_A - 2c_M - 2t)^2}{9b} - F + s_B. \end{aligned} \tag{24}$$

We now consider two sub-cases depending on the behavior of the host governments.

4.1.1 Passive governments

When the host governments are passive or apply the same subsidy levels, from (24) we find:

$$\pi_M^A - \pi_M^B = \frac{4t}{9b}(c_A - c_B) < 0,$$

from which the following proposition follows.

Proposition 5. *When the host governments are passive and the domestic firms do not export, the MNC would locate in the country with a more inefficient domestic firm.*

Intuitively, the location decision in the absence of policy competition is determined by market competition. In country B, which has a less efficient domestic firm, the MNC would make more profits by capturing a bigger market share there than in country A. Consequently, the MNC would locate in country B. In the extreme case where transportation cost is zero, location is unimportant as the MNC can serve both markets with equal ease and therefore it will be indifferent between the two locations.

It should be noted that the model of this sub-section (passive government and no exports by domestic firms) and the result are the same as in Guariglia et al. (2006).

4.1.2 Tax competition

Now we include the host country's fiscal policy into the model. Each government compares its welfare between hosting the MNC and not hosting it.

The levels of social welfare in country A under two alternative location choices of the MNC are:

$$\begin{aligned} U_A^A &= \frac{(2a - c_A - c_M)^2}{18b} + \frac{(a - 2c_A + c_M)^2}{9b} - s_A + \bar{I}_A, \\ U_A^B &= \frac{(2a - c_A - c_M - t)^2}{18b} + \frac{(a - 2c_A + c_M + t)^2}{9b} + \bar{I}_A. \end{aligned}$$

In both utility functions, the first term is consumer surplus, and the second term is producer surplus.

The government of country A will be indifferent between hosting and not hosting the MNC when $U_A^A = U_A^B$. This equality determines the maximum subsidy that country A is willing to offer in order to attract the MNC. The solution of this subsidy, $\widetilde{s_A}$, is:

$$\widetilde{s_A} = \frac{t(2c_A - 2c_M - t)}{6b}.$$

Similarly for country B we get:

$$\widetilde{s_B} = \frac{t(2c_B - 2c_M - t)}{6b},$$

comparing $\widetilde{s_A}$ and $\widetilde{s_B}$, we get:

$$\widetilde{s_A} - \widetilde{s_B} = \frac{t(2c_A - 2c_B)}{6b} < 0.$$

Since the MNC's profits are higher when it chooses to locate in country B than in A when two host governments are passive (proposition 5), and the government in country B is always willing to offer a more generous subsidy to the MNC, there is no way that country A can win the competition for the MNC. Formally,

Proposition 6. *Suppose that the host governments are active and the domestic firms cannot export. The MNC will always locate in the country with a less efficient domestic firm.*

Comparing proposition 6 with proposition 5, we find that the introduction of competition does not make any difference to the MNC's locational choice. However, social welfare in country B is lower under tax competition if it has to pay a subsidy which it did not need to when both governments are passive. However, it is possible in this case that the host country actually taxes the MNC, and in that case the tax competition actually improves the welfare in country B. The actual subsidy paid by country B is:

$$\widehat{s}_B = \widetilde{s}_B + \pi_M^A - \pi_M^B = \frac{t(14c_A - 8c_B - 6c_M - 3t)}{18b}.$$

If, for example, $c_A \simeq c_M \simeq 0$, the MNC will indeed be taxed.

4.2 Domestic firms export

We now allow the domestic firms to participate in the international trade by exporting.

4.2.1 Passive governments

When the host governments are passive or apply the same subsidy levels, substituting (23) into the MNC's profit expressions (13) under two different location decisions, we get:

$$\pi_M^A = \pi_M^B = \frac{(a + c_A + c_B - 3c_M + t)^2 + (a + c_A + c_B - 3c_M - 2t)^2}{16b} - F - s,$$

and therefore, we obtain:

Proposition 7. *When the host governments are passive and the domestic firms can export, the MNC is indifferent between locating in country A and B.*

Intuitively, no matter where the MNC locates, it competes with both domestic firms in both countries. The market structures in the two host countries are also same. Thus MNC earns the same amount of profit by investing in either country. Comparing this result with the result for the case when domestic firms do not export (proposition 5), we find that the chance of the MNC locating in country A (which has a more efficient domestic firm) has improved here. Once domestic firms start to export, two regional markets are more connected and therefore cost advantages are no longer important. We note that this result is similar to the one in Guariglia et al. (2006).

4.2.2 Tax Competition

The levels of social welfare in country A under two alternative location decisions by the MNC in this case are:

$$\begin{aligned} U_A^A &= \frac{(3a - c_A - c_B - c_M - t)^2}{32b} + \frac{(a - 3c_A + c_B + c_M + t)^2}{16b} \\ &\quad + \frac{(a - 3c_A + c_B + c_M - 2t)^2}{16b} + \bar{I}_A - s_A, \\ U_A^B &= \frac{(3a - c_A - c_B - c_M - 2t)^2}{32b} + \frac{(a - 3c_A + c_B + c_M + 2t)^2}{16b} \\ &\quad + \frac{(a - 3c_A + c_B + c_M - 3t)^2}{16b} + \bar{I}_A. \end{aligned} \tag{25}$$

In both utility functions, the first term is consumer surplus, the second term is the producer surplus from domestic sales, and the third term is the producer surplus from exports.

Equating $U_A^A = U_A^B$, we can obtain the maximum subsidy (minimum tax) that the government of country A is willing to offer to the MNC:

$$\widetilde{s_A} = \frac{t(6a - 2c_A - 2c_B - 2c_M - 19t)}{32b}. \tag{26}$$

Similarly, for country B:

$$\widetilde{s_B} = \frac{t(6a - 2c_A - 2c_B - 2c_M - 19t)}{32b}.$$

As we can see from the above two expressions the two countries offer the same maximum subsidy to the MNC. This together with proposition 7 gives us the following result.

Proposition 8. *With active host governments and domestic firms exporting, the MNC is indifferent between investing in country A and Country B.*

Comparing proposition 7 and 8, we note that tax competition does not change the MNC's location choice. However, whichever country happens to host the MNC will be worse

(better) off than the case of passive governments if the actual subsidy payment is positive (negative). The actual subsidy payment in fact is given by (26), which is negative if, for example, the transportation cots t is sufficiently large.

5 Conclusion

Foreign direct investments (FDI) in emerging economies by multi-national corporations (MNC) from developed countries are pervasive and has been growing much faster than some other aspects of the globalization. FDI can take different forms, but greenfield FDI has been gaining in currency in recent years. However, due to high fixed costs associated with such investments, the MNC often have to choose between locations. Do what factors determine this choice? This question is at the heart of the present paper.

There are of course many factors that are important determinants of an MNC's locational choice. In this paper we focus on technological differences between domestic firms, and on differences in market structure, in alternative host countries. It is also observed that host governments often compete with each other for the MNCs using financial incentives for the latter. We therefore consider two scenarios depending on whether host governments compete with each other or not. In most cases, the MNCs have to compete with domestic firms in host countries, and in many cases some of these domestic firms could be outward looking and export a part of their outputs. We therefore consider two situations depending on whether the domestic firms take part in international trade or not.

We develop a two-country partial equilibrium model for an oligopolistic industry, the market for which is internationally segmented. There are some existing domestic firms in each country and an MNC locates in one of the two countries. The MNC and/or the domestic firms can serve the country of their location and also the other country via exports, after incurring some transportation costs.

When the domestic firms in the two host countries do not export, we find that MNC

would locate in the host country that has less efficient firms relative to the other host country. It will also locate in the country with fewer (more) domestic firms if the domestic firms are sufficiently efficient (inefficient). Tax competition tilts the location choice in favor of the host country with fewer domestic firms.

When the domestic firms export, the differences between the host countries become less important as an MNC have to compete with all the domestic firms from both countries, no matter where it locates itself. In this case, the MNC would be indifferent between the host countries with technologically different domestic firms, irrespective of whether there is tax competition or not. The MNC will always locate in the country with fewer domestic firms, irrespective of whether there is tax competition or not. Therefore, when domestic firms export, the presence of tax competition do not seem to have any impact on the MNC's choice. However, tax competition can make the winning host country worse off or better off because of the subsidy payments. In particular, tax competition may not always be welfare reducing.

Our model simplifies many aspects of the real world and conducts the analysis with specific functional forms of demand and cost functions. However, the results are suggestive and further research needs to be carried out to test the robustness of the results.

References

[1] Aw, B. Y., Roberts, M.J. and T. Winston, 2007, Export market participation, investments in R&D and worker training, and the evolution of firm productivity, *The World Economy*, 30(1), 83 - 104.

[2] Barros, P. and L. Cabral, 2000, Competing for foreign direct investment, *Review of International Economics*, 8(2), 360-371.

[3] Billington, N., 1999, The location of foreign direct investment: an empirical analysis, *Applied Economics*, 31(1), 65-76.

[4] Bjorvatn, K. and C. Eckel, 2006, Policy competition for foreigndirect investment between asymmetric countries, *European Economic Review*, 50(7), 1891-1907.

[5] Brander, J. A. and P. R. Krugman, 1983, A 'reciprocal dumping' model of international trade, *NBER Working Paper*.

[6] Breau, S. and D. Rigby, 2006, Participation in export markets and plant productivity in Los Angeles, 1987-1997, *Working Paper*.

[7] Clerides, S. K., Lach, S and J. R. Tybout, 1998, Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco, *Quarterly Journal of Economics*, 113(3), 903-947.

[8] Davies, R. B., 2004, Tax treaties and foreign direct investment: potential versus performance, *International Tax and Public Finance*, 11(6), 775-802.

[9] Duranton, Gilles and Puga, Diego, 2004, Micro-foundations of urban agglomeration economies, in: J. V. Henderson & J. F. Thisse (ed.), *Handbook of Regional and Urban Economics*, edition 1, volume 4, chapter 48, pp. 2063-2117.

[10] Friedman, J., Gerlowski, D. A. and J. Silberman, 1992, What attracts foreign multinational corporations? Evidence from branch plant location in the United States, *Journal of Regional Science*, 32(4), 403-418.

[11] Fumagalli, C., 2003, On the welfare effects of competition for foreign direct investments, *Euoropean Economic Review*, 47(6), 963-983.

[12] Greenaway, D. and R. Kneller, 2007, Firm heterogeneity, exporting and foreign direct investment, *The Economic Journal*, 117(517), 134 - 161.

[13] Guariglia, A., Mukherjee, A. and K. Suetrong, 2006, Technological asymmetries and strategic plant location: the case of export-platform foreign direct investment, *NBER Working Paper*.

[14] Haufler, A. and I. Wooton, 1999, Country size and tax competition for foreign direct investment, *Journal of Public Economics*, 71(1), 121-139.

[15] Head, K., Ries, J. and D. Sweson, 1995, Agglomeration benefits and location choice: evidence from Japanese manufacturing investments in the United States, *Journal of International Economics*, 1995, 38(3-4), 223-247.

[16] Helpman, E., Melitz, M. J. and S. R. Yeaple, 2004, Export versus FDI with heterogeneous firms, *American Economic Review*, 94(1), 300-316.

[17] Kind, H. J., Knarvik, K. H. M. and G. Schjelderup, 2000, Competing for capital in a lumpy world, *Journal of Public Economics*, 78(3), 253-274.

[18] Melitz, M. J., 2003, The impact of trade on intra-industry reallocations and aggregate industry productivity, *Econometrica*, 71(6), 1695 - 1725.

[19] Oman, C. P., 1999, Competition for foreign direct investment: A Study of competition among governments to attract FDI, *OECD Publication*.

[20] Ottaviano, G. I. P. and T. Ypersele, 2005, Market size and tax competition, *Journal of International Economics*, 67(1), 25-46.

[21] Raff, H., 2004, Preferential trade agreements and tax competition for foreign direct investment, *Journal of Public Economics*, 88(12), 2745-2763.

[22] Tomiura, E., 2007, Foreign outsourcing, exporting, and FDI: A productivity comparison at the firm level, *Journal of International Economics*, 72(1), 113-127.

[23] Wheeler, D. and A. Mody, 1992, International investment location decisions: the case of U.S. firms, *Journal of International Economics*, 33(1-2), 57-76.

[24] Yasar, M. and C. J. M. Paul, 2007, International linkages and productivity at the plant level: Foreign direct investment, exports, imports and licensing, *Journal of International Economics*, 71(2), 373-388.

[25] Zhong, L. and S. Lahiri, 2009, International joint ventures and tax competition in an integrated market, *International Review of Economics and Finance*, 18 (1), 38-44.