Trade cost reduction and foreign direct investment*

Arijit Mukherjee

University of Nottingham and The Leverhulme Centre for Research in Globalisation and Economic Policy, UK

and

Kullapat Suetrong

Office of policy and planning, Department of Business Development, Ministry of Commerce, Bangkok, Thailand

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Abstract: While the "proximity-concentration" theory suggests a positive relationship between trade cost and FDI, there is ample evidence showing a negative relationship between them. We show that both the positive and negative relationships between trade cost and FDI can occur in the case of a "home-country export platform FDI". In this respect, we show the implications of market demand and competition between asymmetric home and host-country firms.

Key Words: Export; FDI; Trade cost; Welfare

JEL Classifications: F12; F21; F23; L13; L24

Correspondence to: Arijit Mukherjee, School of Economics, University of Nottingham, University Park, Nottingham, NG7 2RD, UK.

E-mail: arijit.mukherjee@nottingham.ac.uk
Fax: +44-115-951 4159

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1. Introduction

What's the effect of trade cost reduction on foreign direct investment (FDI)? According to the well-established "proximity-concentration" theory, ceteris paribus, a lower trade cost (which may be the outcome of a better transportation technology, higher economic integration or trade liberalisation) reduces FDI (Markusen, 2002). While this theory is often consistent with empirical observations, there is ample evidence showing a negative relationship between trade cost and FDI.

Feinberg et al. (1998) test the relationship between trade cost and FDI at a disaggregate level by looking at the effects of USA-Canada tariff reduction on the behaviour of the multinationals and their affiliates. They do not support the prediction of the proximity-concentration theory and show that there is a negative relationship between tariff reduction and FDI. In this respect, idiosyncratic firm characteristics such as technologies play important roles.

There are other evidences showing a negative relationship between trade cost and FDI. For example, on one hand, UNCTAD (2004) reports "Trade reforms in developing countries over the past 10-to-15 years are reflected in the general decline in protection in these countries, often under World Bank/IMF programs. Chinese import tariffs, for example, dropped from 34.8% to 12.4% in year 1992 to 2001; Indian tariffs fell from 70.5% to 28.0% in year 1990 to 2001". On the other hand, UNCTAD (2002) shows that FDI inflows to China and India have increased respectively by almost double and four times between 1990 (annual average between 1990 and 1995) and 2001.

An explanation for this apparent puzzle of lowering trade cost and increasing FDI is that, along with lower trade costs, the host-country policies are facilitating investments from abroad by reducing the cost of undertaking FDI (Markusen and Venables, 1998). Though the host-country policies are creating more congenial environment for investment, thus reducing the cost of FDI, significant cost of FDI still remains. These costs may arise simply because the multinationals need to set up their plants and the distribution channels in the host countries. There may be significant amount of transaction costs related to FDI, which may arise due to poor infrastructural facilities and the so called "administrative barriers" such as corruption and policy discrepancy (Hines, 1995 and Bhuiyan, 2003).

We develop a simple model to show that even if the cost of FDI is unaffected, both the positive and negative relationships between trade cost and FDI can occur if the multinational firm uses the host-country as a platform for exporting back to its home country, which is often called "home-country export platform FDI".[1] In this respect, we identify two factors, viz., the demand conditions in the home and the host countries, and competition between asymmetric home and host-country firms, which may be responsible for the non-monotonic relationship between trade cost and FDI. Thus, we explain the FDI increasing and FDI reducing effects of trade cost in a single framework.

There are few existing theoretical works which show the non-monotonic relationship between FDI and trade cost between the home and the host countries. Smith (1987) shows that scale economies, which affect the entry decision of a host-country firm, may be responsible for the non-monotonic relationship.[2] Lommerud et

[1] We borrow this term from Ekholm et al. (2007), which provides the definitions for different types of export-platform FDI. Markusen and Maskus (2001 and 2002) provide data on the export platform FDI for the USA manufacturing affiliates.

[2] Focusing on a specific market demand function, Motta (1992) extends this line of research by introducing a cost of information acquisition by the multinational firm.

al. (2003) show that a non-monotonic relationship between FDI and trade cost may arise if the labour market is unionized. The former paper may be suitable for an infant host-country industry where intense competition from the multinational prevents entry of a host-country firm, while the latter paper shows the implication of input market imperfection. To show the effects of (i) demand conditions in the home and the host countries, and (ii) competition between asymmetric home and host-country firms, we abstract our analysis from these factors by assuming a given market structure and perfectly competitive input markets. Pontes (2007) shows a non-monotonic relationship between FDI and trade cost in a vertical FDI, while our focus is on horizontal FDI. Hence, our analysis complements the existing literature by providing new reasons for the non-monotonic relationship between trade cost and FDI.[3]

The remainder of the paper is organised as follows. Section 2 shows the implications of market size. Section 3 shows the effects of competition in the product market. Section 4 concludes.

2. The implications of market size

Assume that there are two countries, called country 1 and country 2. There is a firm in country 1, called firm 1, who has already established its business in country 1 and wants to sell its product to both countries. Firm 1 has two production strategies available: (i) it can produce in country 1 (the home country) and sell to both markets, or (ii) it can relocate its plant to country 2 (the host country), called FDI, and sell to both markets from country 2. Appealing to Barros and Cabral (2000), Fumagalli (2003), Bjorvatn and Eckel (2006), and many others, we assume that it is not

[3] There is a related literature which considers the effect of trade cost reduction between the host countries on a multinational firm's incentive for undertaking FDI in one or more host countries (Norman and Motta, 1993, Motta and Norman, 1996 and Neary, 2002 and 2006). In contrast, we show the effects of trade cost reduction between the home and the host countries on the incentive for FDI.

profitable for firm 1 to operate two plants. This may be due to the diseconomies of scale created by the costs of managing and operating multiple plants. It is trivial that if firm 1 sets up one plant in each country to serve the respective market, the need for home-country export platform FDI does not arise, and the decision for FDI depends only on firm 1's profit generation in the host-country under exporting from the home-country and producing in the host-country. In this situation, the relationship between FDI and trade cost confirms the proximity-concentration theory.

If firm 1 wants to relocate its plant to the country 2, it needs to incur a fixed cost, F, for setting up its business in that country. However, exporting to and from country 2 involve the same and constant per-unit trade cost, t. The constant marginal cost of production of firm 1 is c_1, which is assumed to be zero, for simplicity.[4] It is needless to say that our qualitative results do not depend on this simplifying assumption of zero marginal cost in the home country.

Assume that the markets are segmented, and the inverse market demand functions in countries 1 and 2 are respectively

$$P_1 = a_1 - b_1 q_1 \tag{1}$$

$$P_2 = a_2 - b_2 q_2, \tag{2}$$

where $a_1 > 0$, $a_2 > 0$ and P_i and q_i show the price and output in country i, $i = 1,2$. These demand functions can be generated from the representative utility functions $U_i = a_i q_i - \frac{b_i q_i^{\,2}}{2} + \zeta$, $i = 1,2$, in countries 1 and 2, where ζ is the numeraire good, which is traded at a competitive world price. Therefore, $\frac{a_i}{b_i}$, which shows the value of

[4] Our assumption of constant marginal costs of production implicitly assumes that the factor prices are given in our analysis. In other words, the input supply curves are perfectly elastic in both the countries.

q_i at which the utilities are maximized (or the marginal utilities are zero), can be thought of as the measure of market size in these countries.

The game is as follows. At stage 1, firm 1 decides whether to undertake FDI or not. At stage 2, firm1 produce outputs and the profits are realised. We solve the game through backward induction.

2.1. Selling to both markets from the home country

Let us first consider the situation where firm 1 produces in country 1 and sell its product to both countries from country 1. In this situation, firm 1's total profit is

$$\pi_1^1 = (a_1 - b_1 q_1) q_1 + (a_2 - b_2 q_2 - t) q_2 . \tag{3}$$

The equilibrium outputs are

$$q_1 = \frac{a_1}{2b_1} \qquad \text{and} \qquad q_2 = \frac{a_2 - t}{2b_2} . \tag{4}$$

The second order conditions for profit maximization are satisfied. Note that the output of firm 1 is positive in both markets if $a_2 > t$, which is assumed to hold.

The total equilibrium profit of firm 1, if it produces in country 1, is

$$\pi_1^1 = \frac{{a_1}^2}{4b_1} + \frac{(a_2 - t)^2}{4b_2} . \tag{5}$$

2.2. Selling to both markets from the host-country

Now consider the situation where firm 1 produces in country 2, i.e., undertakes FDI, and sells to both countries from country 2. In this situation, firm 1's total profit is

$$\pi_2^1 = (a_1 - b_1 q_1 - t) q_1 + (a_2 - b_2 q_2) q_2 - F . \tag{6}$$

The equilibrium outputs are

$$q_1 = \frac{a_1 - t}{2b_1} \qquad \text{and} \qquad q_2 = \frac{a_2}{2b_2} . \tag{7}$$

The second order conditions for profit maximization are satisfied. Note that the output of firm 1 is positive in both markets if $a_1 > t$, which is assumed to hold.

The total equilibrium profit of firm 1 under FDI is

$$\pi_2^1 = \frac{(a_1 - t)^2}{4b_1} + \frac{a_2^{\,2}}{4b_2} - F . \tag{8}$$

2.3. *Plant location decision of firm 1*

Firm 1 undertakes FDI if $\pi_2^1 > \pi_1^1$

or $$F < \frac{t[b_1(2a_2 - t) - b_2(2a_1 - t)]}{4b_1 b_2} \equiv \overline{F} . \tag{9}$$

$\overline{F}$ shows the maximum willingness for FDI. Therefore, given that $F > 0$, FDI occurs only if $\overline{F} > 0$. It is immediate from (9) that FDI does not occur for *t = 0*, since, in this situation, $\overline{F} = 0$. If there is no trade barrier due to the transportation cost, it is trivial that there is incentive for FDI.

Proposition 1: *Suppose, t > 0.*

(i) If $b_1 = b_2$*, FDI can occur (i.e.,* $\overline{F} > 0$*) if* $a_1 < a_2$.

(ii) If $b_1 > b_2$*, FDI can occur if* $t < \bar{t} = \frac{2}{b_1 - b_2}(b_1 a_2 - b_2 a_1)$*, and it can happen only if*

$\frac{a_2}{b_2} > \frac{a_1}{b_1}$.

(iii) If $b_1 < b_2$*, FDI can occur if* $t > \bar{t}$.

Proof: It follows from (9) that $\overline{F} > 0$ if

$$2(b_1 a_2 - b_2 a_1) + t(b_2 - b_1) > 0 . \tag{10}$$

(i) If $b_1 = b_2$, (10) holds if $a_1 < a_2$.

(ii) If $b_1 > b_2$, (10) holds if $t < \bar{t} = \frac{2}{b_1 - b_2}(b_1 a_2 - b_2 a_1)$. Since $t > 0$, t can be less than $\bar{t}$ only if $\bar{t} > 0$, which happens if $\frac{a_2}{b_2} > \frac{a_1}{b_1}$.

(iii) If $b_1 < b_2$, (10) holds if $t > \bar{t}$. Q.E.D.

Let us now consider the effect of a change in the trade cost on the incentive for FDI.

Proposition 2: *The non-monotonic relationship between trade cost and the incentive for FDI occurs if* $b_1 > b_2$, $a_1 > a_2$ *and* $\frac{a_2}{b_2} > \frac{a_1}{b_1}$.

Proof: We get that $\frac{\partial \overline{F}}{\partial t} \gtreqless 0$ if

$$(b_1 a_2 - b_2 a_1) + t(b_2 - b_1) \gtreqless 0. \tag{11}$$

If $b_1 = b_2$, it follows from Proposition 1 that FDI can occur provided $a_1 < a_2$. In this situation, there exists a positive relationship between the trade cost and FDI. Hence, the non-monotonic relationship between trade cost and FDI occurs provided $b_1 \neq b_2$.

If $b_1 > b_2$, we get $\frac{\partial \overline{F}}{\partial t} \gtreqless 0$ if $t \lesseqgtr \frac{\bar{t}}{2}$. Since FDI can occur for $t < \bar{t}$ if $b_1 > b_2$ and $\frac{a_2}{b_2} > \frac{a_1}{b_1}$, it is possible to have $\frac{\partial \overline{F}}{\partial t} \gtreqless 0$ provided $\frac{\bar{t}}{2} < \min\{a_1, a_2\}$, which is required to satisfy positive outputs by firm 1. Since $\frac{\bar{t}}{2}$ is increasing in a_2 and it is equal to a_2 if $a_1 = a_2$, we get that $\frac{\partial \overline{F}}{\partial t}$ can be both positive and negative, i.e., $\frac{\bar{t}}{2}$ can be less than $\min\{a_1, a_2\}$, if $a_1 > a_2$.

If $b_1 < b_2$, we get $\frac{\partial \overline{F}}{\partial t} \gtreqless 0$ if $t \gtreqless \frac{\bar{t}}{2}$. However, it follows from Proposition 1 that FDI can occur for $t > \bar{t}$ if $b_1 < b_2$. Hence, the relationship between trade cost and FDI on the range where FDI can occur is given by $\frac{\partial \overline{F}}{\partial t} > 0$.

The above discussion shows that the non-monotonic relationship between trade cost and the incentive for FDI occurs if $b_1 > b_2$, $a_1 > a_2$ and $\frac{a_2}{b_2} > \frac{a_1}{b_1}$. Q.E.D.

Proposition 2 shows that the non-monotonic relationship between trade cost and the incentive for FDI occurs if the host-country market is larger than the home-country market and the host-country demand is more elastic than the home-country demand.[5]

If both the home and the host-country markets are important to the multinationals, a trade cost reduction has two opposing effects on the incentive for home-country export platform FDI. On one hand, like "proximity-concentration" theory, a lower trade cost reduces the incentive for FDI by increasing the profit from exporting to the host-country. On the other hand, a lower trade cost increases the incentive for FDI by reducing the cost of exporting back to the home country from the host country. The net effect depends on the strengths of these two opposing forces, which depend on the price sensitiveness of the demand functions.

If the trade cost increases, it reduces firm 1's output and profit under exporting to and from the host-country. However, the loss of profit is higher in that situation where the output of firm 1 is higher. That is, if the output of firm 1 is higher under exporting to the host-country than under exporting from the host-country, firm 1's

[5] It is shown in Nieswiadomy (1986) that a demand curve is more elastic than the other if the price intercept of the former is lower than the latter.

loss of profit due to a higher trade cost is higher under the former than the latter. The opposite occurs if the firm 1's output is higher under exporting from the host-country than under exporting to the host-country.

If the price intercept of the host-country demand, which is a_2, is lower than the price intercept of the home-country demand, which is a_1, and the market size is higher in the host-country than in the home-country, i.e., $\frac{a_2}{b_2} > \frac{a_1}{b_1}$, these two demand curves intersect at the price $\frac{b_1 a_2 - b_2 a_1}{b_1 - b_2}$, which is nothing but $\frac{\bar{t}}{2}$. Therefore, if $t < \frac{\bar{t}}{2}$, the output of firm 1 is higher under exporting to the host-country than under exporting from the host-country. In this situation, a higher trade cost increases the loss of profit under the former than the latter, thus increasing the incentive for FDI. On the other hand, if $t > \frac{\bar{t}}{2}$, firm 1' profit loss due to a higher trade cost is higher under exporting from the host-country than under exporting to the host-country, thus increasing the incentive for FDI.

3. The implications of competition in the product market

The previous section shows the importance of demand conditions in the home and the host countries in determining the non-monotonic relationship between trade cost and FDI. The purpose of this section is to show the implications of competition in the product market.

We modify the model of section 2 by considering a firm in the host-country, called firm 2, which competes with firm 1 in the host-country like a Cournot duopolist with a homogeneous product. We assume that the constant marginal cost of production of firm 2 is $c_2 > 0$. Further, to show the implications of competition, we

assume that the demand functions in both the markets are same, and are given by $P = a - q$.

There could be several justifications for our assumption of no exporting by firm 2 to the home country. As pointed out by Greaney (2003) and the evidences therein, a buyer-seller network may be important for both international trade and investment, and asymmetric network effects may generate different production strategies for the firms. In our framework, a higher network cost of firm 2 may prevent it from selling the product to the home country. Moreover, transportation technology available to the firms may be different, and may create prohibitive trade cost for firm 2, thus restricting firm 2 from selling in the foreign country. As an alternative justification, financial constraint may prevent it from selling the product in the home country. Different patent systems in these countries may also justify why firm 2 is selling the product only in the host-country. Assuming firm 1 as the innovator of this product, while product patent (or a strong process patent) in the home country can ensure firm 1's monopoly in that country, the lack of product patent (or a weak process patent) in the host-country can create the threat of competition in the host-country.[6] However, we show the implications of export by firm 2 in the *Appendix*.

We consider the following game in this section. At stage 1, firm 1 decides whether to undertake FDI or not. At stage 2, the firms produce simultaneously and the profits are realised. We solve the game through backward induction.

[6] Product patent implies that no other firm except the original innovator can produce similar products through imitation, thus ensuring monopoly to the original innovator. Though process patent allows non-infringing imitation, the novelty requirement for the imitated product or large patent breadth helps to reduce the threat of imitation.

3.1. Selling to both markets from the home country

Let us first consider the profit of firm 1 when it decides to produce in the home country and serves the host-country through export. In this situation, firm 1's profit is

$$\pi_1^1 = \left(a - q_1^1\right)q_1^1 + \left(a - q_1^2 - q_2 - t\right)q_1^2, \tag{12}$$

where q_1^1 and q_1^2 denote the outputs of firm 1 in the home and the host countries respectively, and q_2 is the output of firm 2.

If firm 1 produces in its home country, the profit of firm 2 is

$$\pi_2^1 = \left(a - q_1^2 - q_2 - c_2\right)q_2. \tag{13}$$

The equilibrium outputs are

$$q_1^1 = \frac{a}{2},\ q_1^2 = \frac{a - 2t + c_2}{3} \text{ and } q_2 = \frac{a - 2c_2 + t}{3}. \tag{14}$$

The second order conditions for profit maximisation are satisfied. The equilibrium output of firm 2 is positive for any trade cost if $c_2 < \frac{a}{2}$, and the equilibrium output of firm 1 under export is always positive if $t < \frac{a}{2}$. We assume that these conditions hold.

If all the outputs in (14) are positive, the respective equilibrium profits of firms 1 and 2 are

$$\pi_1^1 = \left(\frac{a}{2}\right)^2 + \left(\frac{a - 2t + c_2}{3}\right)^2 \tag{15}$$

$$\pi_2^1 = \left(\frac{a - 2c_2 + t}{3}\right)^2. \tag{16}$$

3.2. Selling to both markets from the host-country

Next, consider the situation where firm 1 undertakes FDI and sells the product to both markets from the host-country. In this situation, the profit of firm 1 is

$$\pi_1^2 = \left(a - q_1^1 - t\right)q_1^1 - F + \left(a - q_1^2 - q_2\right)q_1^2. \tag{17}$$

If firm undertakes FDI, the profit of firm 2 is

$$\pi_2^2 = \left(a - q_1^2 - q_2 - c_2\right)q_2. \tag{18}$$

The equilibrium outputs are

$$q_1^1 = \frac{a-t}{2},\ q_1^2 = \frac{a+c_2}{3} \text{ and } q_2 = \frac{a-2c_2}{3}. \tag{19}$$

The second order conditions for profit maximisation are satisfied. Given our assumptions of $c_2 < \frac{a}{2}$ and $t < \frac{a}{2}$, the equilibrium outputs of both firms are positive under FDI by firm 1.

If all the outputs in (19) are positive, the respective equilibrium profits of firms 1 and 2 are

$$\pi_1^2 = \left(\frac{a-t}{2}\right)^2 + \left(\frac{a+c_2}{3}\right)^2 - F \tag{20}$$

$$\pi_2^2 = \left(\frac{a-2c_2}{3}\right)^2. \tag{21}$$

3.3. Plant location decision of the home firm

Now we are in position to consider the plant location decision of firm 1. Comparison of (15) and (20) shows that $\pi_1^1 \underset{<}{\geq} \pi_1^2$ provided

$$\left(\frac{a}{2}\right)^2 + \left(\frac{a-2t+c_2}{3}\right)^2 \underset{<}{\geq} \left(\frac{a-t}{2}\right)^2 + \left(\frac{a+c_2}{3}\right)^2 - F, \tag{22}$$

which boils down to

$$F \underset{<}{\geq} \frac{t(-2a-7t+16c_2)}{36} \equiv F^*. \tag{23}$$

F^* shows firm 1's maximum benefit from (or maximum willingness for) FDI. We find that $F^* > 0$ provided $t < \frac{2(8c_2 - a)}{7} \equiv \hat{t}$. However, $\hat{t} > 0$ if $c_2 > \frac{a}{8} \equiv \overline{c_2}$, and $\hat{t} < \frac{a}{2}$ if $c_2 < \frac{11a}{32} \equiv \overline{\overline{c_2}}$.

Hence, the following result is immediate.

Proposition 3: *Assume that* $c_2 \in (0, \frac{a}{2})$ *and* $t \in (0, \frac{a}{2})$. *Firm 1 undertakes FDI provided the marginal cost of firm 2 is sufficiently high (i.e.,* $c_2 \in (\overline{c_2}, \frac{a}{2})$*), trade cost is sufficiently low (i.e.,* $t \in (0, \hat{t})$*), and firm 1's maximum benefit from FDI is greater than the fixed cost of FDI (i.e.,* $F < F^*$*).*

Proposition 3 shows that FDI occurs *only if* c_2 is sufficiently high and t is sufficiently low so that $F^* > 0$. Otherwise, firm 1 has no incentive to relocate its plant to the host-country.

The above result can be explained as follows. Let us imagine a situation with no host-country firm. Hence, firm 1 is a monopolist under both export and FDI. In this situation, firm 1 never prefers FDI since its gross profit from undertaking FDI and exporting back to the home country is equal to its gross profit from serving both the markets from the home country. However, under competition in the host-country, the incentive for FDI may arise, since FDI helps firm 1 to capture higher market share in the host-country compared to exporting from the home-country. Further, firm 1's benefit from FDI increases with higher cost of the host-country firm. However, since firm 1 serves both the markets either from the home-country or from the host-country, FDI provides a negative impact on firm 1's total profit by reducing its profit in the

home-country due to the presence of a trade cost. This negative impact of FDI on firm 1's total profit is increasing with the trade cost. Hence, firm 1's incentive for FDI arises if the positive effect of FDI dominates the negative effect of FDI, and it happens if the marginal cost of the host-country firm is sufficiently high and the trade cost is sufficiently low. However, since FDI involves a fixed cost, FDI occurs if the fixed cost of FDI is sufficiently low along with a lower trade cost and a higher marginal cost of the host-country firm.

Let us now see the relationship between trade cost and the incentive for FDI. It follows from (23) that if $c_2 \leq \frac{a}{8} \equiv \overline{\overline{c_2}}$, we get $F^* < 0$ for any $t > 0$. Hence, FDI is never be an equilibrium for $c_2 \leq \frac{a}{8}$. Thus, to show the effects of trade cost reduction on the incentive for FDI, we restrict our attention to $c_2 > \overline{\overline{c_2}}$.

Proposition 4: Assume $t \in (0, \frac{a}{2})$ *and* $c_2 \in (\overline{\overline{c_2}}, \frac{a}{2})$. *There is a non-monotonic relationship between trade cost and the incentive for FDI.*

Proof: Differentiating F^* with respect to t, we find that $\frac{\partial F^*}{\partial t} \gtreqless 0$ if

$$(16c_2 - 7t - 2a) - 7t \gtreqless 0 \qquad \text{or} \qquad t \lesseqgtr \frac{8c_2 - a}{7} \equiv \bar{\bar{t}}, \tag{24}$$

where $0 < \bar{\bar{t}} < \frac{a}{2}$ for $c_2 \in (\overline{\overline{c_2}}, \frac{a}{2})$. Q.E.D.

Figure 1, which shows the relationship between t and F^*, for a given c_2, is a graphical representation of Proposition 4.

Figure 1

We plot five curves (*A*, *B*, *C*, *D* and *E*) in Figure 1. As c_2 increases, we move upward between the curves. Curves *A* and *B* correspond to the situations where $c_2 > \frac{11a}{32}$ (i.e., $\hat{t} > \frac{a}{2}$) and $c_2 = \frac{11a}{32}$ (i.e., $\hat{t} = \frac{a}{2}$). Therefore, these curves represent the situations where $F^* > 0$ for $t \in (0, \frac{a}{2})$. Curves *D* and *E* correspond to the situations where $c_2 = \frac{a}{8}$ (i.e., $\hat{t} = 0$) and $c_2 < \frac{a}{8}$ (i.e., $\hat{t} < 0$). Hence, these situations represent the cases of $F^* < 0$ for $t \in (0, \frac{a}{2})$. Curve *C* corresponds to the situation where $c_2 \in (\frac{a}{8}, \frac{11a}{32})$. Hence, this situation represents the case where $F^* > 0$ for $t < \frac{2(8c_2 - a)}{7} \equiv \hat{t}$ but $F^* < 0$ for $t > \hat{t}$.

Figure 1 provides the following information. First, it shows that a non-monotonic relationship occurs between trade cost and FDI if c_2 is sufficiently high. For example, curve *A* shows that if trade cost is sufficiently high, a reduction in trade cost increases the incentive for FDI, but, if the trade cost goes below $\overline{\overline{t_a}}$, the incentive for FDI decreases with further reduction of the trade cost. Second, it shows that if c_2 is sufficiently small (refers to curves *D* and *E*), FDI never occurs, since $F^* < 0$ in these situations. Lastly, it shows that as c_2 increases, the possibility of higher FDI following a trade cost reduction falls. This is represented by a rightward move of the maximum points of the curves.

Proposition 4 can be explained as follows. If the trade cost reduces, it increases firm 1's profit from exporting irrespective of its plant location strategy. If

firm 1 produces in the home country, lower trade cost increases its profit in the host country. On the other hand, if firm 1 undertakes FDI, lower trade cost increases its profit in the home country. The net effect depends on the relative strengths of these effects.

The reason for FDI under competition in the host-country market arises from firm 1's incentive for (near) monopolizing the host-country market, and this happens if the marginal cost of the host-country firm is sufficiently high. As the marginal cost of the host-country firm (i.e., c_2) increases, it makes it easier for firm 1 to near monopolize the host-country market following a trade cost reduction. Hence, if the marginal cost of the host-country firm is very high, a trade cost reduction increases firm 1's incentive for FDI by reducing the cost of exporting back to the home country. However, if the host-country firm is not very much cost inefficient compared to firm 1, FDI does not help firm 1 to gain significant market share in the host-country market. In this situation, the effect of a trade cost reduction on firm 1's profit from exporting to the host-country becomes the important factor in determining the relationship between trade cost and FDI. Hence, if the marginal cost of the host-country firm is not very high, a trade cost reduction reduces firm 1's incentive for FDI by increasing firm 1's profit from exporting to the host-country.

For a given trade cost, as the cost of the host-country firm increases, it increases firm 1's competitive advantage against firm 2, thus reducing firm 1's incentive for FDI for getting a higher competitive advantage in the host-country market. Hence, as c_2 increases, it increases the range of trade costs over which a lower trade cost reduces the incentive for FDI.

So far, we have assumed that firm 2 serves only the host-country market. However, if firm 2 can export to the home-country and faces the trade cost t, like

firm 1, we get that *FDI occurs only for those higher trade costs where firm 2 does not find it profitable to export to the home-country. However, there exists a non-monotonic relationship between trade cost and the incentive for FDI, in the presence of exporting by firm 2.* To avoid repetition, we skip the analysis here. However, interested readers can see the *Appendix* for details.

4. Conclusion

While the well established proximity-concentration theory suggests that, ceteris paribus, a lower trade cost reduces FDI, there is ample evidence showing a negative relationship between trade cost and FDI. We show that both the positive and negative relationships between trade cost and FDI can occur in the case of a home-country export platform FDI. In an economy with perfectly competitive input market and constant returns to scale technologies, we show the implications of demand conditions and competition between the asymmetric home and host-country firms. Thus, our paper complements the previous works explaining a non-monotonic relationship between trade cost and the incentive for FDI in the presence of either input market imperfection or scale economies.

Appendix

The implications of export by firm 2 on the relationship between trade cost and FDI: Assume that firm 2 faces the trade cost t and can export to the home-country. We also assume that $c_2 < \frac{a}{2}$ and $t < \frac{a}{2}$, which ensure positive outputs by firm 1 in both markets and positive output by firm 2 in the host-country market. However, these assumptions may not ensure that firm 2 always exports to the home-country.

It may worth noting that we restrict firm 2 from undertaking FDI in the home-country. Since the possibility of FDI by firm 2 will have further strategic effect on the investment decision of firm 1, we restrict firm 2 from investing in the home-country in order to show the effect of the home-country export platform FDI. This assumption of no FDI by firm 2 may be justified by considering firm 2 as a capital constrained firm (see, e.g., Norman and Motta, 1993, for similar assumption in a different context).

If firm 1 exports, the profits of firms 1 and 2 are respectively

$$\pi_1^1 = \left(a - q_1^1 - q_2^1\right)q_1^1 + \left(a - q_1^2 - q_2^2 - t\right)q_1^2 \qquad \text{(A1)}$$

and $$\pi_2^1 = \left(a - q_1^1 - q_2^1 - c_2 - t\right)q_2^1 + \left(a - q_1^2 - q_2^2 - c_2\right)q_2^2, \qquad \text{(A2)}$$

where q_1^1 and q_1^2 (respectively q_2^1 and q_2^2) denote the outputs of firm 1 (respectively firm 2) in the home and the host countries respectively.

The equilibrium outputs are

$$q_1^1 = \frac{a + c_2 + t}{3},\ q_1^2 = \frac{a - 2t + c_2}{3},\ q_2^1 = \frac{a - 2c_2 - 2t}{3} \text{ and } q_2^2 = \frac{a - 2c_2 + t}{3}.$$

Note that firm 2 exports to the home country if and only if $t < \frac{a - 2c_2}{2}$. The profits of firms 1 and 2 are respectively

$$\pi_1^1 = \left(\frac{a + c_2 + t}{3}\right)^2 + \left(\frac{a - 2t + c_2}{3}\right)^2, \qquad \text{for } t < \frac{a - 2c_2}{2} \tag{A3}$$

and $$\pi_2^1 = \left(\frac{a - 2c_2 - 2t}{3}\right)^2 + \left(\frac{a - 2c_2 + t}{3}\right)^2, \qquad \text{for } t < \frac{a - 2c_2}{2}. \tag{A4}$$

If $t > \frac{a - 2c_2}{2}$, the profits of firms 1 and 2 are respectively given by (15) and (16) in the text.

If firm 1 undertakes FDI, the profits of firms 1 and 2 are respectively

$$\pi_1^2 = \left(a - q_1^1 - q_2^1 - t\right)q_1^1 + \left(a - q_1^2 - q_2^2\right)q_1^2 - F \tag{A5}$$

and $$\pi_2^2 = \left(a - q_1^1 - q_2^1 - c_2 - t\right)q_2^1 + \left(a - q_1^2 - q_2^2 - c_2\right)q_2^2. \tag{A6}$$

The equilibrium outputs are

$$q_1^1 = \frac{a - t + c_2}{3},\ q_1^2 = \frac{a + c_2}{3},\ q_2^1 = \frac{a - 2c_2 - t}{3},\ q_2^2 = \frac{a - 2c_2}{3}.$$

It is clear from the equilibrium outputs that firm 2 exports to the home country if and only if $t < a - 2c_2$. Hence, the equilibrium profits of firms 1 and 2 are respectively

$$\pi_1^2 = \left(\frac{a - t + c_2}{3}\right)^2 + \left(\frac{a + c_2}{3}\right)^2 - F, \qquad \text{for } t < a - 2c_2 \tag{A7}$$

and $$\pi_2^2 = \left(\frac{a - 2c_2 - t}{3}\right)^2 + \left(\frac{a - 2c_2}{3}\right)^2, \qquad \text{for } t < a - 2c_2. \tag{A8}$$

If $t > a - 2c_2$, the profits of firms 1 and 2 are respectively given by (20) and (21) in the text.

The following three intervals need to be considered to determine the investment decision of firm 1: (i) $t \in \left(0, \frac{a - 2c_2}{2}\right)$, (ii) $t \in \left(\frac{a - 2c_2}{2}, a - 2c_2\right)$, and (iii) $t \in \left(a - 2c_2, \frac{a}{2}\right)$. The interval $\left(a - 2c_2, \frac{a}{2}\right)$ is non-empty if $c_2 > \frac{a}{4}$.

If $t \in \left(0, \frac{a-2c_2}{2}\right)$, firm 2 exports irrespective of firm 1's decision on exporting and FDI. Hence, we need to compare (A3) and (A7) to determine the production strategy of firm 1. The comparison of these expressions shows that firm 1 prefers exporting than FDI.

If $t \in \left(\frac{a-2c_2}{2}, a-2c_2\right)$, firm 2 exports if firm 1 undertakes FDI in the host-country, but firm 2 does not export if firm 1 produces in the home country (i.e., exporting). Hence, (15) and (A7) are the relevant expressions to be compared in order to determine the investment decision of firm 1**.** The comparison shows that firm 1 prefers exporting to FDI.

Lastly, consider the situation where $t \in \left(a-2c_2, \frac{a}{2}\right)$. Recall that this situation can occur provided $c_2 > \frac{a}{4}$. In this situation, firm 2 does not export, irrespective of the investment decision of firm 1, and the analysis is similar to subsection 3.3, where exporting by firm 2 is not allowed. Here, firm 1 undertakes FDI if $F < \frac{t(-2a-7t+16c_2)}{36} \equiv F^*$, where $F^* > 0$ provided $t < \frac{2(8c_2-a)}{7} \equiv \hat{t}$. Since we have $c_2 > \frac{a}{4}$, it implies that $\hat{t} > 0$. However, $\hat{t} < \frac{a}{2}$ if $c_2 < \frac{11a}{32} \equiv \overline{\overline{c_2}}$. We further obtain that $\hat{t} > a-2c_2$ if $c_2 > \frac{3a}{10}$.

Therefore, if $\frac{a}{4} < c_2 < \frac{3a}{10}$, i.e., $0 < \hat{t} < a-2c_2$, firm 1 exports if $t \in \left(a-2c_2, \frac{a}{2}\right)$. In this situation, a trade cost reduction while satisfying $t \in \left(a-2c_2, \frac{a}{2}\right)$ has no impact on firm 1's production strategy.

But, if $c_2 > \frac{3a}{10}$, i.e., $\hat{t} > a - 2c_2$, firm 1 undertakes FDI if $t \in (a - 2c_2, \hat{t})$ and $F < F^*$. Hence, if $t > \hat{t}$, thus making $F^* < 0$, firm 1 does not undertake FDI for a positive cost of FDI. However, if the trade cost reduces in a way that the lower trade cost lies between $(a - 2c_2)$ and $\hat{t}$, thus making $F^* > 0$, firm 1 prefers to undertake FDI if $F < F^*$. Therefore, in this situation, lower trade cost increases the incentive for FDI.

If $t \in (a - 2c_2, \hat{t})$, firm 1 undertakes FDI if $F < F^*$. We get that $\frac{\partial F^*}{\partial t} \gtreqless 0$ if $t \lessgtr \frac{8c_2 - a}{7}$, where $\frac{8c_2 - a}{7} \gtreqless a - 2c_2$ for $c_2 \gtreqless \frac{4a}{11}$. Therefore, a lower trade cost increases the incentive for FDI if either $c_2 \in (\frac{3a}{10}, \frac{4a}{11})$ or $c_2 \in (\frac{4a}{11}, \frac{a}{2})$ and $t > \frac{8c_2 - a}{7}$. But, if $c_2 \in (\frac{4a}{11}, \frac{a}{2})$ and $t < \frac{8c_2 - a}{7}$, a lower trade cost reduces the incentive for FDI.

The above discussion implies that a non-monotonic relationship between trade cost and FDI remains in the presence of exporting by firm 2.

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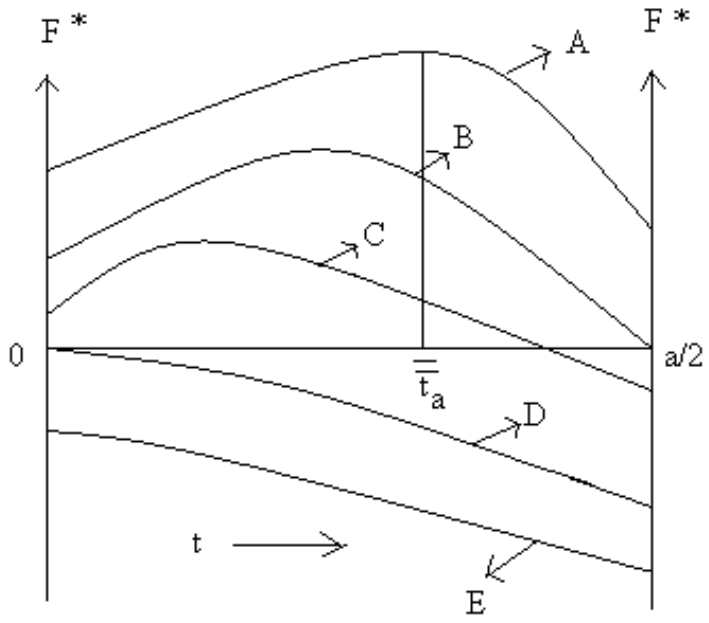

Figure 1: The relationship between trade cost and the incentive for FDI