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Working Paper

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Cardiff Economics Working Papers, No. E2010/4

Provided in Cooperation with:

Cardiff Business School, Cardiff University

Suggested Citation: Collie, David R. (2010) : Multilateral trade liberalisation, foreign direct investment and the volume of world trade, Cardiff Economics Working Papers, No. E2010/4, Cardiff University, Cardiff Business School, Cardiff

This Version is available at:

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**Cardiff Economics
Working Papers**

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*Multilateral Trade Liberalisation, Foreign Direct Investment
and the Volume of World Trade*

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ISSN 1749-6101
June 2010

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Multilateral Trade Liberalisation, Foreign Direct Investment and the Volume of World Trade

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June 2010

Abstract

A paradox in international trade is that multilateral trade liberalisation has resulted in increases in both the volume of world trade and the amount of foreign direct investment (FDI). This note presents a Cournot duopoly model with two regions, each consisting of two countries, and with an inter-regional transport cost. It is shown that multilateral trade liberalisation may lead firms to switch from exporting to undertaking export-platform FDI when the inter-regional transport cost is high. Also, when the inter-regional transport cost is high, the switch to FDI leads to an increase in the volume of world trade in this industry.

Keywords: Trade Liberalisation, Foreign Direct Investment, Cournot Oligopoly.

JEL Classification: F12, F13, F23.

1. Introduction

Multilateral trade liberalisation since the formation of the General Agreement on Tariffs and Trade (GATT) has led to an increase in the volume of world trade and an increase in the amount of foreign direct investment (FDI) with many industries experiencing increases in both intra-industry trade and intra-industry FDI.¹ The increase in FDI as a result of trade liberalisation is a paradox as the standard theoretical model (the proximity-concentration trade-off model) suggests that a reduction in trade costs would reduce the amount of horizontal FDI.² Recently, Neary (2009) has discussed this paradox and considered possible explanations to resolve the paradox. One explanation is that economic integration by trade blocs has reduced intra-bloc trade costs and led to an increase in export-platform FDI where firms undertake FDI in one country to supply all the countries in the trade bloc.³ However, this approach does not really explain how multilateral trade liberalisation may lead to an increase in FDI, and does not address the effect on the volume of world trade.

This note will present a model that explains how multilateral trade liberalisation (albeit in the presence of an inter-regional transport cost) can lead firms to shift from supplying markets by exporting to supplying markets by undertaking export-platform FDI when the inter-regional transport cost is high. Also, it is shown that this shift from exporting to undertaking export-platform FDI leads to an increase in the volume of world trade in this industry when the inter-regional transport cost is high. Therefore, when the inter-regional transport cost is high, this model can explain why multilateral trade liberalisation has led to an increase in FDI and an increase in the volume of world trade.

¹ Stylised facts on FDI are presented in Markusen (2002, chapter 1) and Barba Navaretti and Venables (2004, chapter 1).

² Notable articles among the first strategic models of FDI are: Horstmann and Markusen (1992), Motta (1992) and Rowthorn (1992).

³ See, *inter alia*, Norman and Motta (1993), Motta and Norman (1996) and Neary (2002).

2. The Model

In this symmetric model, the world consists of two regions labelled A and B with two countries in each of the regions. The countries in region A are labelled one and two while the countries in region B are labelled three and four. There is a single firm based in each region that has incurred a sunk cost to build a factory in one of the countries in the region. Firm A , the firm in region A , has a factory in country one and firm B , the firm in region B , has a factory in country three. The firms produce a homogeneous product and compete as Cournot duopolists in the four markets that are assumed to be segmented. The firms each have constant marginal cost c , there is an inter-regional transport cost k , and each country has a specific import tariff t . In the i th country ($i=1,2,3,4$) the inverse demand function for the homogeneous product is $P_i = \alpha - \beta(x_{Ai} + x_{Bi})$, where P_i is the price, x_{Ai} is the sales of firm A and x_{Bi} is the sales of firm B . The firms can supply the markets either by exporting from their existing factories thereby incurring the import tariff on all exports and the inter-regional transport cost on inter-regional exports, or they can undertake FDI by building a factory in another country thereby incurring a sunk cost of FDI: G .

Consider first the case when both firms supply all the markets by exporting from their existing factories thereby incurring the import tariff on all exports and the transport cost on inter-regional exports. In country one, firm A has marginal cost c and firm B has marginal cost $c+k+t$ while in country three the situation is reversed. In country two, firm A has marginal cost $c+t$ and firm B has marginal cost $c+k+t$ while in country four the situation is reversed. Assuming an interior solution where all firms sell positive quantities in all markets, it is straightforward to show that the Cournot duopoly equilibrium outputs in the four markets are:

$$\begin{aligned}
x_{A1}^E = x_{B3}^E &= \frac{\alpha - c + k + t}{3\beta}, & x_{B1}^E = x_{A3}^E &= \frac{\alpha - c - 2k - 2t}{3\beta} \\
x_{A2}^E = x_{B4}^E &= \frac{\alpha - c + k - t}{3\beta}, & x_{B2}^E = x_{A4}^E &= \frac{\alpha - c - 2k - t}{3\beta}
\end{aligned} \tag{1}$$

The output exported by firm A (B) to country three (one) will be positive if the sum of the import tariff and inter-regional transport cost $k+t < (\alpha-c)/2$ so the prohibitive tariff in countries one and three is $\bar{t} \equiv (\alpha-c-2k)/2$, which will be positive if it is assumed that $k < (\alpha-c)/2$. It will be assumed that the import tariff is less than the prohibitive tariff, $t < \bar{t}$, as then both firms will sell positive quantities in all markets. For future reference, when comparing the volume of world trade, note that the total exports of firm A and, by symmetry, firm B are:

$$X_A^E = x_{A2}^E + x_{A3}^E + x_{A4}^E = \frac{3(\alpha - c - k) - 4t}{3\beta} = x_{B1}^E + x_{B2}^E + x_{B4}^E = X_B^E \tag{2}$$

Using the Cournot duopoly equilibrium outputs (1) to solve for the profits of the two firms in the four markets yields:

$$\begin{aligned}
\pi_{A1}^E = \pi_{B3}^E &= \frac{(\alpha - c + k + t)^2}{9\beta}, & \pi_{B1}^E = \pi_{A3}^E &= \frac{(\alpha - c - 2k - 2t)^2}{9\beta} \\
\pi_{A2}^E = \pi_{B4}^E &= \frac{(\alpha - c + k - t)^2}{9\beta}, & \pi_{B2}^E = \pi_{A4}^E &= \frac{(\alpha - c - 2k - t)^2}{9\beta}
\end{aligned} \tag{3}$$

Since it is assumed that $k+t < (\alpha-c)/2$, both firms sell positive quantities in all markets and the profits of the firms are positive in all markets.

3. Foreign Direct Investment

Now consider the possibility that the firms undertake FDI by building a factory (incurring a sunk cost, G) in one (or more) other countries thereby avoiding the import tariff and, in the case of inter-regional trade, avoiding the inter-regional transport cost. There are a

number of possible outcomes that need to be considered: firms may engage in intra-regional FDI where firm A (B) undertakes FDI in country two (four); firms may engage in inter-regional FDI where firm A (B) undertakes FDI in country three (one), country four (two), or countries three and four (one and two). However, as shown in the appendix, it turns out that if the sunk cost of undertaking FDI is sufficiently large then the only possible outcome will be for the firms to undertake inter-regional export-platform FDI where firm A (B) undertakes FDI in country four (two) and supplies country three (one) from this factory. Each firm undertakes FDI in the country in the other region where its competitor does not have its factory.

If both firms undertake inter-regional export-platform FDI, where firm A undertakes FDI in country four and firm B undertakes FDI in country two, then firm A (B) will have marginal cost c in countries one and four (two and three) where it has a factory, and it will have marginal cost $c+t$ in countries two and three (one and four) where the product is exported from the factory in the other country in the region. It is straightforward to show that the Cournot duopoly equilibrium outputs are:

$$x_{A1}^F = x_{A4}^F = x_{B3}^F = x_{B2}^F = \frac{\alpha - c + t}{3\beta}, \quad x_{A2}^F = x_{A3}^F = x_{B1}^F = x_{B4}^F = \frac{\alpha - c - 2t}{3\beta} \quad (4)$$

For future reference, when comparing the volume of world trade, note that the total exports of firm A from its factories in countries one and four (and, by symmetry, the total exports of firm B from its factories in countries two and three) are:

$$X_A^F \equiv x_{A2}^F + x_{A3}^F = \frac{2(\alpha - c - 2t)}{3\beta} = x_{B1}^F + x_{B4}^F \equiv X_B^F \quad (5)$$

Using the Cournot duopoly equilibrium outputs (4) to solve for the gross profits (before the sunk cost, G) of the two firms in the four markets yields:

$$\pi_{A1}^F = \pi_{A4}^F = \pi_{B2}^F = \pi_{B3}^F = \frac{(\alpha - c + t)^2}{9\beta}, \quad \pi_{A2}^F = \pi_{A3}^F = \pi_{B1}^F = \pi_{B4}^F = \frac{(\alpha - c - 2t)^2}{9\beta} \quad (6)$$

Each firm decides how to supply the other region by comparing the profits from exporting with the profits from undertaking FDI (including the sunk cost, G). The decision of each firm is unaffected by the decision of its competitor since the assumptions of segmented markets and constant marginal cost imply that the profits in the region where the firm is based are independent of whether the other region is supplied by exporting or undertaking FDI. For firm A (B), supplying region B (A) by undertaking FDI is more profitable than exporting if $\pi_{A3}^F + \pi_{A4}^F - G > \pi_{A3}^E + \pi_{A4}^E$ ($\pi_{B1}^F + \pi_{B2}^F - G > \pi_{B1}^E + \pi_{B2}^E$). Hence, each firm will undertake FDI if the sunk cost of FDI is less than the critical value:

$$G < \bar{G} \equiv \frac{1}{9\beta} [8k(\alpha - c - k - t) + 4t(\alpha - c - k)] > 0 \quad (7)$$

If $G < \bar{G}$ then undertaking FDI is a dominant strategy for both firms and both firms will undertake FDI in the subgame perfect Nash equilibrium of the game. To determine how multilateral trade liberalisation affects the critical value of the sunk cost, differentiate \bar{G} in (7) with respect to the import tariff, t :

$$\frac{\partial \bar{G}}{\partial t} = \frac{4}{9\beta} [(\alpha - c) - 3k] \quad (8)$$

This is positive if the inter-regional transport cost is low, $k < k^* \equiv (\alpha - c)/3$, and negative if the inter-regional transport cost is high, $k > k^*$. Hence, multilateral trade liberalisation (a reduction in t) may lead to a switch from undertaking FDI to exporting when the inter-regional transport cost is low, as shown in figure 1a, whereas it may lead to a switch from exporting to undertaking FDI when the inter-regional transport cost is high, as shown in figure 1b. This latter case may explain why multilateral trade liberalisation has led to an

increase in FDI. The effect of the switch from exporting to undertaking FDI on the volume of world trade in this industry can be seen by subtracting the volume of world trade when firms export, $X_A^E + X_B^E$ as in (2), from the volume of world trade when firms undertake FDI, $X_A^F + X_B^F$ as in (5), which yields:

$$\left(X_A^F + X_B^F\right) - \left(X_A^E + X_B^E\right) = \frac{2}{3\beta} \left[3k - (\alpha - c)\right] > 0 \quad (9)$$

Since the firms shift from exporting to undertaking FDI when the inter-regional transport cost is high, $k > k^*$, this is positive so there is an increase in the volume of world trade in this industry. This leads to the following proposition:

Proposition: *If the inter-regional trade cost $k > k^*$ then the critical value of the fixed cost \bar{G} is decreasing in the import tariff, $\partial \bar{G} / \partial t < 0$. Hence, multilateral trade liberalisation may lead firms to switch from exporting to undertaking FDI and increase the volume of world trade in this industry.*

4. Conclusions

It has been shown that multilateral trade liberalisation may lead firms to shift from exporting to undertaking export-platform FDI when the inter-regional transport cost is high as it increases the profitability of undertaking FDI. This inter-regional FDI eliminates inter-regional trade, but leads to an increase in intra-regional, intra-industry trade. The net result, when the inter-regional transport cost is high, is that the volume of world trade in this industry increases. Therefore, this model can explain why multilateral trade liberalisation has led to an increase in FDI and an increase in the volume of world trade.

Appendix

This appendix shows that the pattern of inter-regional FDI described above is the only possibility if the sunk cost of FDI is sufficiently large.

With intra-regional FDI, firm A could supply country two by undertaking FDI rather than exporting from country one. The profits from exporting to country two from its factory in country one are: π_{A2}^E in (3) whereas the profits from supplying country two by undertaking FDI in country two are: $\pi_{A2}^I = (\alpha - c + k + t)^2 / 9\beta$. Hence, firm A will undertake FDI if the sunk cost of FDI is less than the critical value: $G_I = 4t(\alpha - c + k) / 9\beta$, which is increasing in the import tariff and has a maximum value: $G_I^{Max} = 2(\alpha - c + k)(\alpha - c - 2k) / 9\beta$ at $t = \bar{t}$.

With inter-regional FDI, firm A can either build a factory in country three, where its competitor has a factory, or in country four, where its competitor does not have a factory. The profits in country three and four for firm A from undertaking FDI in country three are: $\pi_{A3}^C = (\alpha - c - 2t)^2 / 9\beta$ and $\pi_{A4}^C = (\alpha - c + t)^2 / 9\beta$. The profits for firm A from undertaking FDI in country four are $\pi_{A3}^F + \pi_{A4}^F$ given by (6). It can be shown that $(\pi_{A3}^F + \pi_{A4}^F) - (\pi_{A3}^C + \pi_{A4}^C) = 4t^2 / 9\beta > 0$ so it is always more profitable to undertake FDI in country four rather than country three. Also, firm A could undertake inter-regional FDI by building a factory in country three as well as country four. When deciding whether to invest in a second factory in region B , it would compare the profits from exporting to country three from its factory in country four, π_{A3}^F in (6), with the profits from undertaking FDI in country three: $\pi_{A3}^{II} = (\alpha - c)^2 / 9\beta$. It will invest in a second factory if the sunk cost of FDI is less than: $G_{II} = 4t(\alpha - c - t) / 9\beta$, which has a maximum value of $G_{II}^{Max} = [(\alpha - c)^2 - 4k^2] / 9\beta$ at $t = \bar{t}$.

The value of the critical value of the sunk cost of FDI, \bar{G} from (7), at the prohibitive import tariff, $t = \bar{t}$, is $\bar{G}_{t=\bar{t}} = 2[(\alpha - c)^2 - k(\alpha - c - 2k)] / 9\beta$, which is its minimum value if $k > k^*$. It can be shown that: $G_I^{Max} - G_{II}^{Max} = (\alpha - c)(\alpha - c - 2k) / 9\beta > 0$, and also that:

$\bar{G}_{t=i} - G_I^{Max} = 8k^2/9\beta > 0$. Hence, if the sunk cost of FDI is sufficiently large, $G > G_I^{Max} > G_{II}^{Max}$, then the pattern of inter-regional FDI described in the text is the only possibility.

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Figure 1a: Exporting versus FDI with low Inter-Regional Transport Cost

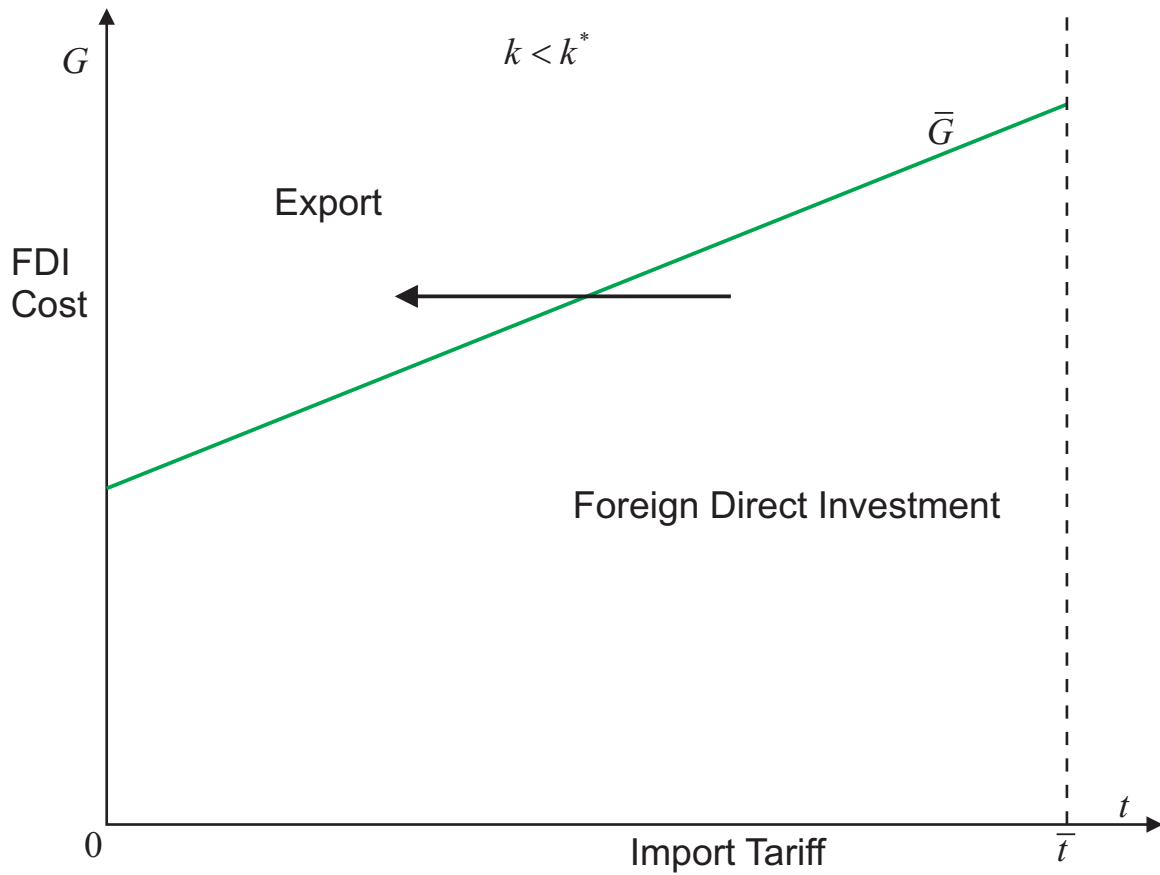


Figure 1b: Exporting versus FDI with high Inter-Regional Transport Cost

