A Theory of the Relationship between Foreign Direct Investment and Trade

by
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Abstract: Although empirical evidence shows that the relationship between foreign direct investment (FDI) and trade is complex, theories of international investment (both vertical and horizontal) present simple patterns of relation. By allowing for different locations of vertically-related stages of production and distinguishing between trade in finished goods and trade in intermediate goods, this paper introduces a nonmonotonic relationship between multinational firms and trade costs, which must be neither too high nor too low for FDI to arise. Exports and FDI behave as complements for high levels of trade costs and as substitutes otherwise.

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1 Introduction

Empirical studies such as those by PAIN and WAKELIN (1998) and PANTULU and POON (2003) show that the relationship between outward foreign direct investment (FDI) and exports is a complex one.[1] FDI and trade are neither substitutes nor complements: the nature of the relationship depends on the industry, the country and the time period concerned.

Moreover, the relationship between trade costs and FDI is not simple either. It is generally agreed that an important share of FDI is "tariff-jumping", i.e. it aims to bypass national or regional barriers to trade. However, the general increase of investment flows in relation to world production has been consistent with an overall decrease of trade costs in the world economy, namely through the formation of wide regional integration areas, such as NAFTA and the EU.

The standard theories of FDI do not agree with this complexity because they assume monotonic relationships between FDI and trade, on the one hand, and between FDI and trade costs, on the other hand.

The theory of vertical investment (HELPMAN, 1984) assumes that, with close to zero transport costs, FDI will take the form of a separation of headquarters and plant in order to make full use of international differences in production factor prices. FDI creates trade in the form of exports of capital goods and factor services from the headquarters to the plant, which in turn exports resource-based products to the home country.

The theory of horizontal investment (HORSTMANN and MARKUSEN, 1992, BRAINARD, 1993) assumes that the firm faces a trade-off between concentration and proximity to consumers. If economies of scale are high and trade costs are low, it is profitable for the firm to concentrate production in a single plant and to supply foreign markets through exports. Otherwise, if economies of scale in production are low and trade costs are high, it pays for the firm to supply each national market through a plant located in it. FDI substitutes trade and increases with the level of trade costs.

In this paper, we present a model of FDI that shows a nonmonotonic relationship between investment and trade creation and between investment and trade costs. The model combines features from horizontal and vertical theories and was first suggested by BRAINARD (1993), who sugggested decomposing the activity of the firm into "manufacturing" (or upstream production) and "distribution and sales" (or downstream production). Each of these vertically-related stages has its own economies of scale/trade costs trade-off. If both stages are decentralized across markets, FDI substitutes for trade. But if the upstream stage remains centralized while the downstream activity is decentralized, FDI creates trade in intermediate goods. In the following section, we attempt to model this intuition by means of a noncooperative game.

[1] *Inward* FDI usually promotes exports as a subsidiary of a mulinational corporation usually targets countries that are neighboring to the host country in the context of a regional integration area. On the other hand, inward investment is usually positively related with the the range of goods produced in the host economy, thus widening potential foreign markets.

2 The model

2.1 Assumptions

The spatial economy obeys the following assumptions:

1. There are two countries, Home (H) and Foreign (F), each with the same number n of consumers. By convention, the distance between H and F is 1 and the distance between two locations in the same country is 0.

2. There are two vertically-related firms, Upstream (U) and Downstream (D) that have headquarters in country H. U produces an intermediate good that is used by D in order to produce a consumer good. D uses α units of the input to produce one unit of the finished good.

3. Trade costs per unit of distance of the intermediate good and of the consumer good vary in proportion. Without loss of generality, we assume that they have a common rate t.

4. The transport costs of the goods are supported by the buyers, both intermediate and final.

5. The firms compete only through the choice of locations of plants. Prices of the intermediate good $\left(\overline{k}\right)$ and of the consumer good $(\overline{p})$ are parametric.

6. The production of the intermediate good has strong economies of scale that make it indivisible. Firm U can either run a single plant (at a constant unit production cost c_u) or stay out of the market.

7. The production of the consumer good has less important, but still significant, economies of scale. Firm D can choose between running one plant (in country H), running two plants (one in each country) or staying out of the market. The firm incurs a fixed cost G per plant besides a constant marginal cost c_D.

8. Consumers have a $0-1$ demand function with a reservation price v. The consumer buys one unit of the finished good if the delivered price (mill price plus transport cost) does not exceed the reservation price.

2.2 The game in normal form

The economy can be modelled as a static noncooperative game with two players U and D. Firm U has two pure strategies: exit the market (strategy "stay out") or set up one indivisible plant (strategy "1"). Firm D has three pure strategies: exit the market (strategy "stay out"), set up one plant in country H (strategy "1") or set up two plants in countries H and F (strategy "2"). The

game matrix has the form

$$\begin{array}{cccc} & & D & \\ & & \text{Stay Out} & 1 & 2 \\ U & \text{Stay Out} & (1) & (2) & (3) \\ & 1 & (4) & (5) & (6) \end{array} \tag{1}$$

The payoffs are:
(1)
P_U (Stay Out, Stay Out) $= 0$
P_D (Stay Out, Stay Out) $= 0$
(2)
P_U (Stay Out, 1) $= 0$
P_D (Stay Out, 1) $= -G$
(3)
P_U (Stay Out, 2) $= 0$
P_D (Stay Out, 2) $= -2G$
(4)
P_U (1, Stay Out) $= 0$
P_U (1, Stay Out) $= 0$

In order to assess the payoffs in cells (5) and (6) of matrix 1, it is necessary to make a distinction between two cases.

In the first case, trade costs are low ($\overline{p} + t \leq v$), so that a plant of firm D in the home country can export to consumers in the foreign country. In this case, the demand addressed to firm D is $2n$. Hence, we have:
(5)
$P_U(1,1) = 2n\alpha\left(\overline{k} - c_U\right)$
$P_D(1,1) = 2n\left(\overline{p} - c_D - \alpha\overline{k}\right) - G$
(6)
$P_U(1,2) = 2n\alpha\left(\overline{k} - c_U\right)$
$P_D(1,2) = 2n\left(\overline{p} - c_D - \alpha\overline{k}\right) - \alpha nt - 2G$

where αnt is the trade cost of the intermediate good to the plant of firm D in the foreign country.

In the second case, trade costs are high ($\overline{p} + t > v$), so that a plant of firm D located in the home country cannot sell to consumers in the foreign country. In this case, payoffs become:
(5)
$P_U(1,1) = n\alpha\left(\overline{k} - c_U\right)$
$P_D(1,1) = n\left(\overline{p} - c_D - \alpha\overline{k}\right) - G$
(6)
$P_U(1,2) = 2n\alpha\left(\overline{k} - c_U\right)$
$P_U(1,2) = 2n\left(\overline{p} - c_D - \alpha\overline{k}\right) - \alpha nt - 2G$

Without loss of generality, we make the following parameter specifications:

$$\begin{aligned} \overline{k} &= \overline{p} = 1 \\ c_D &= c_U = 0 \\ G &= 1 \\ \alpha &= \frac{1}{2} \\ v &= \frac{3}{2} \end{aligned}$$

We are left with two general parameters: market size n and trade cost t. The payoff matrix in the two cases becomes:

Case $t \leq \frac{1}{2}$

		D		
		Stay Out	1	2
U	Stay Out	$0, 0$	$0, -1$	$0, -2$
	1	$0, 0$	$n, n-1$	$n, n\left(1 - \frac{t}{2}\right) - 2$

Case $t > \frac{1}{2}$

		D		
		Stay Out	1	2
U	Stay Out	$0, 0$	$0, -1$	$0, -2$
	1	$0, 0$	$\frac{n}{2}, \frac{n}{2} - 1$	$n, n\left(1 - \frac{t}{2}\right) - 2$

(Stay Out, Stay Out) is a Nash equilibrium for any values of n and t. But it is not a reasonable solution. It is a nonstrict and dominated equilibrium, as "Stay Out" is a weakly dominated strategy for firm U, which implies that the productive activity in the economy is nonexistent.

We tried to find other Nash equilibria with positive production. The set of such equilibria in the space of parameters (t, n) is plotted in Figure 1.

(Figure 1, Page 8)

2.3 Interpretation of the results

In Figure 1, if market size n is too low for firm D to break even, the only equilibrium is the one where the upstream and downstream firms exit the market and production does not exist.

If trade costs are low ($t \leq \frac{1}{2}$), there can be trade in finished goods which otherwise cannot exist.

FDI by the consumer goods firm occurs for high values of market size n, because the establishment of a plant in the foreign country entails a fixed cost that must be met by a sufficient local demand. This is a usual result (see ROWTHORN, 1993).

It is less usual from the viewpoint of the theory of horizontal investment that the multinational firm should arise for *medium* rather than high trade costs. The relationship between FDI and trade costs is nonmonotonic. In order for firm D to become multi-plant, trade costs cannot be too low. Otherwise it would be more profitable for firm D to concentrate production in the home country and export finished goods to the foreign country. But trade costs cannot be too high either. Otherwise the supply of intermediate goods by firm U placed in the home country to the decentralized plant of firm D in the foreign country would not be feasible.

Considering in more detail the region of the parameter space where market size is high enough ($n > 4$), so that multi-plant production is feasible, let it be assumed that trade costs fall from an initial high level. Then, there are two successive transitions. Firstly, we have $(1, 1) \Rightarrow (1, 2)$: a decrease in trade costs creates FDI *and* trade by making exports of intermediate goods feasible. FDI and trade are complements. Secondly, we have $(1, 2) \Rightarrow (1, 1)$: the fall in trade costs removes FDI and the trade in intermediate goods and it creates a trade in finished goods. Because the trade in consumer goods exceeds the volume of trade in intermediate goods, on balance the fall of trade costs in this case enhances trade and lowers FDI. Hence FDI and trade behave as substitutes.

3 Conclusions

The distinction between trade in intermediate and trade in finished goods enabled us to establish nonmonotonic relationships between FDI and trade, and FDI and trade costs. This analysis can be extended in two ways. A first extension would be to assume that the demand for the consumer good is continuously elastic. A second extension would be to allow firms to select prices endogenously. However, it is likely that these generalizations would not qualitatively change the conclusions of this paper.

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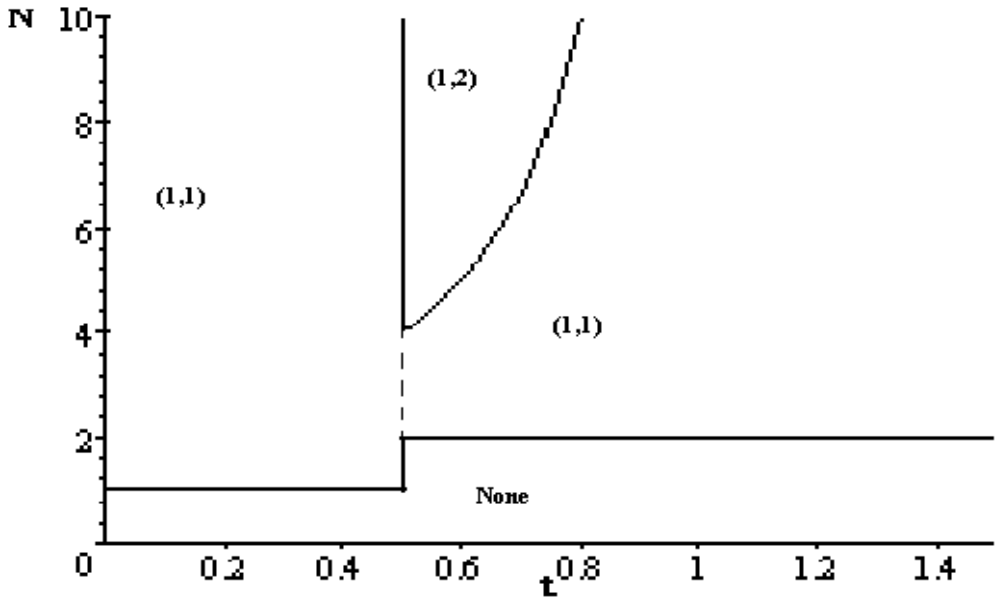

Figure 1: Equilibria with positive production in space (t, n)