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E C O N O M I C S   B U L L E T I N

FDI may help rival firms

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Abstract

This paper presents a two−country model of duopolistic market with vertical relations which leads to a paradoxical result: when upstream firms possess sufficient bargaining power, cost−reducing FDI may actually enhance the rival firm's profit.

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1 Introduction

In standard Cournot models of oligopoly with no external effect, a firm engaging in cost-reducing investment is always a threat to other rival firms. The same conclusion applies for multicountry models of international oligopoly where firms potentially undertake foreign direct investment (hereafter, FDI). In this context, FDI plays exactly the same role as cost-reducing investment in the foreign market as it allows the firm to save transport costs including tariffs and various non-tariff trade barriers. With the firm gaining more efficiency in the foreign market through FDI, rival firms are inevitably made worse off since they are now able to make less profit in the foreign market.

In this paper we construct a two-country model of duopoly with vertical relations and show that this seemingly robust conclusion can be overturned once strategic price-setting behavior of upstream firms is explicitly taken into account. Suppose that a firm undertakes FDI and becomes more efficient in the foreign market. While this fact itself is certainly detrimental to the rival firm, the story does not end here when profit-maximizing upstream input suppliers have sufficient bargaining power. Facing more intense competition, there arises an incentive for the upstream input supplier of the rival firm to lower input prices in order to compete in the foreign market. As we will see shortly, this strategic reduction in input prices is sometimes large enough to compensate for the loss arising from more intense competition in the foreign market.

There are now several papers which examine the relationship between unionization and FDI.[1] In those previous studies, however, the effect of FDI on its domestic rival firms has not been investigated. In the sense that strategic price-setting behavior of upstream input suppliers leads to a paradoxical result in an otherwise standard model of oligopolistic market, the result obtained here is also related to Naylor (2002) who shows that industry profits can increase with the number of firms in the market. In this paper we take a different route and present a situation where cost-reducing FDI can actually increase its rival firm' profits without any external effect assumed explicitly.

2 The model

The model is a slightly modified version of Lommerud et al. (2003). We consider two countries, countries H (home) and F (foreign), and two downstream producers, firms A and B. Initially, each firm has a plant located in country H.[2] To export to country F, a firm must incur a per unit transport

[1]See, for instance, Bughin and Vannini (1995), Zhao (1995), Leahy and Montagna (2000), Skaksen and Sørensen (2001), Naylor and Santoni (2003), and Lommerud et al. (2003).

[2]This is a difference from Lommerud et al. (2003) where one firm is initially located in country H while the other is in country F.

cost, denoted by $t \geq 0$.[3] To avoid the corner solution, we assume that the transport cost is sufficiently small:

$$t \leq \bar{t} \equiv \frac{160(31 - 15\sqrt{2})(1 - \bar{w})}{3577} \simeq 0.4378(1 - \bar{w}). \tag{1}$$

This condition assures that the firms choose nonnegative quantities to export in equilibrium. Within this setup, we look at a situation where FDI is potentially undertaken by firm A: more precisely, firm A may set up another plant in country F, which allows it to avoid the transport cost. Since our interest lies in the external effect of FDI, we do not consider its fixed cost, at least for a moment.

There is only one factor of production, which we refer to as the input. Each firm procures its input from its own (plant-specific) upstream input supplier and produces a homogenous final good in a constant-returns-to-scale process where one unit of the input is turned into one unit of the final good. If firm A chooses to set up a plant in country F, it must procure its input from a foreign input supplier: that is, the number of input suppliers varies depending on firm A's FDI decision.[4] Let z_i^j denote the amount of the input supplied by the input supplier of firm i located in country j. Each input supplier sets a wholesale price w_i^j to maximize its profit function:

$$U_i^j = (w_i^j - \bar{w})z_i^j, \; i = A, B, \; j = H, F, \tag{2}$$

where $\bar{w} < 1$ is the marginal cost of producing a unit of the input, which is identical for all input suppliers.[5]

We assume that competition between the two firms is Cournot and adopt the segmented market hypothesis: both firms thus choose separate quantities for the two markets. Now let x_i^j denote i's sales in country j. The inverse demand function in the two countries is symmetric and given by

$$p^j \quad = \quad 1 - (x_A^j + x_B^j), \; j = H, F, \tag{3}$$

where p^j is the price of the final good in country j.

To summarize, we model the game structure as follows:

1. Firm A decides whether to set up a plant in country F;
2. Each upstream input supplier sets its wholesale price;
3. Given this, each firm simultaneously chooses quantities.

[3] Among other things, the transport cost is meant to capture tariffs and non-tariff trade barriers.

[4] It should be noted, however, that it is not critical how firm A procures its input in country F. The same result can be obtained if the firm procures its input at the competitive price, as assumed in Lommerud et al. (2003).

[5] If the input supplier is a labor union, $\bar{w}$ can be considered as the competitive (non-union) wage level.

3 Analysis

Notice that the model has fairly standard features: (i) the firms produce a homogenous final good (perfect substitute); (ii) the production technology is independent between the firms (no productive externality). Under this setup, since FDI makes firm A more efficient in country F, it appears that FDI undertaken by firm A can only be detrimental to its rival, firm B. We now show that, quite contrary to this intuition, this is not necessarily the case and the external effect of FDI can actually be positive under certain conditions.

3.1 No FDI

Suppose first that firm A chooses to remain entirely in country H. In this case, there are two input suppliers to be considered, both located in country H. Given the wholesale prices (w_A^H and w_B^H) set by each of the two input suppliers, each firm maximizes

$$x_i^H, x_i^F \quad = \quad \arg\max_{x_i^H, x_i^F} [(1-(x_i^H + x_{-i}^H) - w_i^H)x_i^H + (1-(x_i^F + x_{-i}^F) - w_i^H - t)x_i^F], \; i \neq -i. \quad (4)$$

Solving the first-order conditions, we obtain

$$x_i^H = \frac{1 - 2w_i^H + w_{-i}^H}{3}, \; x_i^F = \frac{1 - 2w_i^H + w_{-i}^H - t}{3}. \quad (5)$$

When t is in the appropriate range, the optimal input price is obtained as a solution to the following problem:[6]

$$\max_{w_i^H} \quad U_i^H = (w_i^H - \bar{w})(x_i^H + x_i^F) = \frac{(w_i^H - \bar{w})(2 - 4w_i^H + 2w_{-i}^H - t)}{3}. \quad (6)$$

The first-order condition then implies

$$\frac{\partial U_i^H}{\partial w_i^H} = 0 \quad \Leftrightarrow \quad \frac{2 + 4\bar{w} - t - 8w_i^H + 2w_{-i}^H}{3} = 0, \quad (7)$$

which leads to

$$w_i^H = \frac{2 + 4\bar{w} - t}{6}. \quad (8)$$

In equilibrium, therefore, each firm chooses

$$x_i^H = \frac{4(1-\bar{w}) + t}{18}, \; x_i^F = \frac{4(1-\bar{w}) - 5t}{18}. \quad (9)$$

Finally, the equilibrium profit with no FDI, π_{iN}, is computed as

$$\pi_{iN} = \frac{16(1-\bar{w})^2 - 16(1-\bar{w})t + 13t^2}{162}. \quad (10)$$

[6] We can show that the solution to this problem indeed maximizes the union's utility. The proof is available upon request.

3.2 FDI

Now suppose that firm A chooses to set up a new plant in country F to avoid the transport cost. In this case, there are three input suppliers to be considered, two in country H and one in country F. Given the wholesale prices (w_A^H, w_B^H and w_A^F) set by each of the three input suppliers, each firm maximizes

$$\begin{aligned} x_A^H, x_A^F &= \arg\max_{x_A^H, x_A^F} [(1-(x_A^H+x_B^H)-w_A^H)x_A^H + (1-(x_A^F+x_B^F)-w_A^F)x_A^F], && (11) \\ x_B^H, x_B^F &= \arg\max_{x_B^H, x_B^F} [(1-(x_A^H+x_B^H)-w_B^H)x_B^H + (1-(x_A^F+x_B^F)-w_B^H-t)x_B^F]. && (12) \end{aligned}$$

Solving the first-order conditions, we obtain

$$x_A^H = \frac{1-2w_A^H+w_B^H}{3},\ x_A^F = \frac{1-2w_A^F+w_B^H+t}{3}, \quad (13)$$

$$x_B^H = \frac{1+w_A^H-2w_B^H}{3},\ x_B^F = \frac{1-2(w_B^H+t)+w_A^F}{3}. \quad (14)$$

Given this, each input supplier maximizes

$$\begin{aligned} U_A^H &= (w_A^H-\bar{w})x_A^H = \frac{(w_A^H-\bar{w})(1-2w_A^H+w_B^H)}{3}, && (15) \\ U_B^H &= (w_B^H-\bar{w})(x_B^H+x_B^F) = \frac{(w_B^H-\bar{w})(2+w_A^H-4w_B^H-2t+w_A^F)}{3}, && (16) \\ U_A^F &= (w_A^F-\bar{w})x_A^F = \frac{(w_A^F-\bar{w})(1-2w_A^F+w_B^H+t)}{3}. && (17) \end{aligned}$$

The first-order conditions then imply

$$\frac{\partial U_A^H}{\partial w_A^H} = 0 \quad \Leftrightarrow \quad \frac{1+2\bar{w}-4w_A^H+w_B^H}{3} = 0, \quad (18)$$

$$\frac{\partial U_B^H}{\partial w_B^H} = 0 \quad \Leftrightarrow \quad \frac{2+4\bar{w}-2t+w_A^H-8w_B^H+w_A^F}{3} = 0, \quad (19)$$

$$\frac{\partial U_A^F}{\partial w_A^F} = 0 \quad \Leftrightarrow \quad \frac{1+2\bar{w}+t+w_B^H-4w_A^F}{3} = 0, \quad (20)$$

which lead to

$$w_A^H = \frac{40+80\bar{w}-7t}{120},\quad w_B^H = \frac{10+20\bar{w}-7t}{30},\quad w_A^F = \frac{40+80\bar{w}+23t}{120}. \quad (21)$$

In equilibrium, therefore, each firm chooses

$$x_A^H = \frac{40(1-\bar{w})-7t}{180},\ x_A^F = \frac{40(1-\bar{w})+23t}{180}, \quad (22)$$

$$x_B^H = \frac{80(1-\bar{w})+49t}{360},\ x_B^F = \frac{80(1-\bar{w})-161t}{360}. \quad (23)$$

Finally, the equilibrium profit with FDI, π_{iF}, is computed as

$$\pi_{AF} = \frac{1600(1-\bar{w})^2+640(1-\bar{w})t+289t^2}{16200},\quad \pi_{BF} = \frac{6400(1-\bar{w})^2-8960(1-\bar{w})t+14161t^2}{64800}. \quad (24)$$

3.3 External effects of FDI

We are now ready to examine how firm B's profit is affected by firm A's FDI. To this end, define

$$\Delta\pi(t) \equiv \pi_{BF} - \pi_{BN} = \frac{-t(2560(1-\bar{w}) - 8961t)}{64800}. \tag{25}$$

Then, FDI undertaken by firm A benefits firm B if $\Delta\pi(t) > 0$. We can now state the following result.

Proposition 1 *There exists some nonempty interval $T \equiv (\underline{t}, \overline{t}]$ such that $\Delta\pi(t) > 0$ for all $t \in T$.*

PROOF: We can show this by simple algebra. It directly follows from (25) that $\Delta\pi(t) > 0$ if and only if

$$t > \frac{2560(1-\bar{w})}{8961} \equiv \underline{t}. \tag{26}$$

Given this it is immediate to verify $\underline{t} < \overline{t}$.

Q.E.D.

By setting up a new plant in country F, firm A can save the transport cost and becomes more efficient by this margin. The proposition suggests that this cost-reducing FDI can actually be beneficial for the rival firm when the transport cost is sufficiently large. This result is counterintuitive in two respects: first, cost-reducing investment may actually help its rival firm; second, this positive external effect is more likely to occur when FDI is more effective.[7]

The logic behind this result is as follows. In standard Cournot models of oligopolistic market, the presence of a more efficient firm is always detrimental to other rival firms. Besides this conventional effect, however, FDI undertaken by firm A also gives rise to effects that work in favor of firm B. To see this, figure 1 depicts how firm A's FDI affects the wholesale prices that prevail in country H as the transport cost increases. When firm A undertakes FDI, the input supplier of firm B is put under pressure to lower the wholesale price in order to export. This downward pressure on the wholesale price is naturally stronger when the transport cost is larger. An increase in the transport cost thus leads to a downward shift in the reaction function of w_B^H (the arrow in the figure indicates an increase in t). There are two points to be noted as to what this shift brings about. First, the wholesale price in country H, w_B^H, is monotonically decreasing in the transport cost, which certainly benefits firm B. Second, it should also be noted that the reaction function of w_A^H is totally independent of the transport cost, because firm A does not export. This asymmetry virtually puts firm B in an advantageous position in country H as it faces a lower wholesale price than its rival, i.e., $w_B^H < w_A^H$ when $t > 0$. The proposition

[7] Note that in the current setup, the marginal value of FDI is equivalent to the transport cost.

states that the gain from this downward pressure on the wholesale prices eventually dominates the loss arising from facing more intense competition in the foreign market as the transport cost becomes larger.

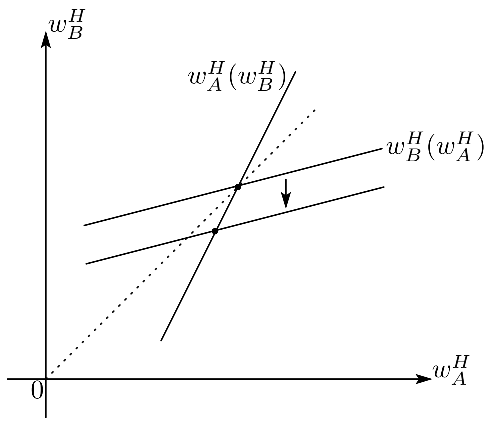

Figure 1: Reaction functions under FDI (upstream firms)

This rather paradoxical result also leads to a paradoxical implication. Suppose that FDI now involves some fixed cost: let C_i denote the fixed cost of FDI by firm i. Suppose further that $\pi_{AF} - \pi_{AN} \geq C_A$ while C_B is prohibitively large so that firm B never undertakes FDI. In this case, the unique equilibrium outcome is that only firm A undertakes FDI. Given this, if $\Delta\pi(t) > 0$, there may arise a case where

$$\pi_{BF} > \pi_{AF} - C_A \geq \pi_{AN} = \pi_{BN}. \tag{27}$$

When this condition holds, the more efficient firm actually ends up with less profit in this unique equilibrium outcome.

4 Conclusion

This paper presents a two-country model of duopoly with vertical relations and examines how FDI undertaken by a firm affects for its rival firm. We have shown that, contrary to the conventional wisdom, cost-reducing FDI can actually benefit the rival firm through its effect on input prices when upstream firms possess sufficient bargaining power.

References

Bughin, J., Vannini, S., 1995, Strategic direct investment under unionized oligopoly, International Journal of Industrial Organization 13, 127-45.

Leahy, D., Montagna, C., 2000, Unionisation and foreign direct investment: challenging conventional wisdom? Economic Journal 110, C80-C92.

Lommerud, K.E., Meland, F., Sørgard, L., 2003. Unionized oligopoly, trade liberalization and location choice, Economic Journal 113, 782-800.

Naylor, R.A., 2002. Industry profits and competition under bilateral oligopoly, Economics Letters 77, 169-75.

Naylor, R.A., Santoni, M., 2003, Foreign direct investment and wage bargaining, Journal of International Trade and Economic Development 12, 1-18.

Skaksen, M.Y., Sørensen, J.R., 2001, Should trade unions appreciate foreign direct investment, Journal of International Economics 55, 379-90.

Zhao, L., 1995. Cross-hauling direct foreign investment and unionized oligopoly, European Economic Review 39, 1237-53.