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

Firm productivity, foreign direct investment and the host-country welfare: trade cost vs. cheap labor

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Abstract

We show that the relationship between higher productivity of the foreign firm and host country welfare depends on the reason for foreign direct investment (FDI). If the reason for FDI is to get the advantage of cheap labor, higher productivity of the foreign firm may reduce host-country welfare. Higher productivity of the foreign firm always increases host-country welfare if the reason for FDI is to save transportation costs but may reduce it if trade costs consist of tariffs. Thus, the present paper complements the recent literature on international trade that explores the effects of foreign firms' productivities on the incentives for FDI.

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1. Introduction

Many developing countries are now liberalizing their economies and trying to attract foreign direct investment (FDI). Empirical evidence shows that multinationals account for a significant portion of international trade. For example, using data from 1999, Caves et al. (2002) have demonstrated that over 60% of multinational trade can be traced to a small set of developed countries and that 70% of FDI is hosted by industrial countries.[1]

Multinationals often face the important choice of export vs. FDI, and the recent literature shows that the productivity of the multinational may play an important role in this respect. Helpman et al. (2004) show that if the reason for FDI is to save trade costs, a relatively more productive firm undertakes FDI.[2] Head and Ries (2003) extend this line of research and show that if the reason for FDI is to get the advantage of a lower cost of production, whether the more productive firms do FDI is ambiguous. While both the papers show useful results about the foreign firms' equilibrium production strategies, they are silent about the effects of the foreign firms' productivities on the host country welfare, which may have important implications for FDI policies.

In a simple model we show that if the reason for FDI is to save trade costs, the incentive for FDI increases as the foreign firm becomes more productive, whereas, if the reason for FDI is to get the advantage of cheap labor, the incentive for FDI decreases with the foreign firm's productivity if the foreign firm is already very productive. Looking at the effects of the foreign firm's productivity on host country welfare, we find that if the reason for FDI is to save trade costs, and the trade cost consists of a transportation cost, higher productivity of the foreign firm always increases the host country welfare. If the trade cost consists of a tariff, higher productivity of the foreign firm may reduce the host country welfare. However, if the reason for FDI is to get the advantage of cheap labor, higher productivity of the foreign firm may reduce the host country welfare if higher productivity induces the foreign firm to shift its production strategy from FDI to export.

If there is no other benefit from FDI such as knowledge spillover (because of the strict patent system), which may help host country firms, it is not necessary that a host country will always be interested in attracting a foreign firm with higher productivity. Therefore, a competent FDI policy is required depending on the main reason for FDI. For example, if the main reason for FDI is to get the advantage of a lower wage rate, a host country may provide higher incentives for FDI to a more productive foreign firm, who otherwise prefers exporting than FDI. In contrast, if the main reason for FDI is to save trade costs, where the tariff rate is the main element of trade costs, a host country may prefer to prevent a more productive foreign firm, who otherwise does FDI, from doing so.

The present paper is related to an earlier literature, which shows that free trade (where the foreign firm exports) may reduce host country welfare in an imperfectly competitive market (se, e.g., Brander, 1981, Markusen, 1981). However, unlike those papers, the present paper considers both trade (i.e., export by the foreign firm) and FDI, and *our results depend on the relationship between the productivity of the foreign firm and its plant location choice*. Moreover, we show that higher

[1] One may refer to Pack and Saggi (1997) and Saggi (2002) for recent surveys on foreign direct investment.

[2] Helpman et al. (2004) extend the line of research conducted by Melitz (2003), which determines the relationship between firm productivity and the incentive for entering the export market.

productivity of the foreign firm may reduce host country welfare in an economy with foreign monopoly, which does not occur in the above-mentioned papers.

The remainder of the paper is organized as follows. The next section develops the model and provides the results. Section 3 concludes.

2. The model and results

Assume that there are two countries, a foreign country and a host country. There is a firm, called firm 1, in the foreign country who wants to sell its product to the host country either through exports or through FDI. In the case of exports, firm 1 produces in the foreign country and sells to the host country. In the case of FDI, firm 1 produces and sells in the host country. FDI requires a fixed sunk cost F. To understand the reasons for our results clearly, we will discuss separately FDI that saves trade costs and that saves wage costs. The implications of the combined effects follow easily from our analysis.

We assume that production requires only labor, and firm 1 has a constant returns to scale technology. Labor is assumed to be immobile between the countries. Assume that firm 1 needs $\frac{1}{\lambda}$ units of labor to produce one unit of output, where λ is the productivity parameter. Higher λ implies higher productivity of firm 1. We assume that the input markets in both countries are perfectly competitive. The wage rate in the home country is given by w.

Assume that the inverse market demand function in the host country is

$$P = a - q, \tag{1}$$

where P denotes price and q quantity.

Our setup is similar to the single-industry case of Head and Ries (2003). Replicating this industry n times will not change our qualitative results. It is worth mentioning that higher entry costs, patent protection and significant product differentiation may be the reasons for creating a foreign monopoly. We will discuss the implications of the existence of host-country firms in the concluding section.

2.1. FDI to save trade cost

In this subsection we assume that the wage rates in both countries are w and the reason for FDI is to save trade costs. If firm 1 exports, it needs to incur a trade cost t per-unit of output, which can be saved by undertaking FDI.

Trade cost may involve both a transportation cost and a tariff. However, the interpretations of the trade costs have different implications for the host country welfare. If the trade cost implies a tariff, the tariff revenue becomes a part of the host country welfare and makes the host country welfare different from the situation where the trade cost implies a transportation cost.

In our analysis, we will consider the trade cost as a transportation cost or an exogenous tariff rate, which is determined outside of this model. Mukherjee (2007), which is the working paper version of this paper, shows that our qualitative results hold for an endogenous tariff rate, which maximizes the host country welfare. Hence, it also confirms that the predictions of Head and Ries (2003) and Helpman et al. (2004) about the relationships between FDI and productivity, which are based on exogenous trade costs, hold even with endogenous trade costs.

If firm 1 exports, it maximizes the following expression:

$$\underset{q}{Max}(a - q - \frac{w}{\lambda} - t)q. \tag{2}$$

We find that the equilibrium output and profit of firm 1 under export are respectively $q_x = \frac{1}{2}(a - \frac{w}{\lambda} - t)$ and $\pi_x = \frac{1}{4}(a - \frac{w}{\lambda} - t)^2$. The second-order condition for profit maximization is satisfied. For simplicity, we assume that the parameter values are such that the output under export is positive.

If firm 1 undertakes FDI, it maximizes the following expression:

$$\underset{q}{Max}(a - q - \frac{w}{\lambda})q - F \ . \tag{3}$$

We find that the equilibrium output and profit of firm 1 under export are respectively $q_f = \frac{1}{2}(a - \frac{w}{\lambda})$ and $\pi_f = \frac{1}{4}(a - \frac{w}{\lambda})^2 - F$. The second-order condition for maximization is satisfied. For simplicity, we assume that the parameter values are such that the output under FDI is positive.

Firm 1 undertakes FDI if $\pi_f = \frac{1}{4}(a - \frac{w}{\lambda})^2 - F > \frac{1}{4}(a - \frac{w}{\lambda} - t)^2 = \pi_x$

or $$F < \frac{1}{4}(2a - \frac{2w}{\lambda} - t)t \equiv F_1 . \tag{4}$$

Proposition 1: *Firm 1's incentive for FDI increases with higher* λ.

Proof: It follows from (4) that $\frac{\partial F_1}{\partial \lambda} = \frac{wt}{2\lambda^2} > 0$. That is, the range of F over which firm 1 undertakes FDI increases. Q.E.D.

The above proposition shows that if firm 1 becomes more productive, it has a higher incentive for FDI. Since FDI saves the trade cost, the productivity of firm 1 does not affect the incentive for FDI directly, but it affects the incentive for FDI indirectly by affecting the equilibrium output. As firm 1 becomes more productive, it increases firm 1's output, and therefore FDI saves more trade costs, which are tq_f, thus increasing firm 1's incentive for FDI.

The above discussion suggests that there are two effects of higher productivity of firm 1: (1) technological effect (increasing λ) and (2) location effect (changing the production strategy). The technological effect increases firm 1's output. However, since firm 1 may shift its production from export to FDI when it becomes more productive, the location effect may further increase output by saving the trade cost. Hence, if the reason for FDI is to save trade cost, both the effects go in the same direction to increase the output of firm 1.

If the trade cost implies an *exogenous* tariff rate, the location effect, by shifting production from export to FDI, generates lower tariff revenue for the host country, thus creating a negative impact on host-country welfare.[3] It is easy to see that if higher productivity of the foreign firm does not create a location effect, the host country welfare is always higher with the higher productivity of the foreign firm under an exogenous tariff rate. If the tariff is exogenous, higher productivity of the

[3] Host country welfare is the sum of consumer surplus and tariff revenue. Since, we implicitly assume that there is no unemployment in our analysis, and since, the wage rates of the host country workers are the same in this industry and in the alternative jobs, a change in the labor income in this industry following the productivity change of the foreign firm does not affect the host country welfare. The implication of unemployment can be derived easily from our analysis.

foreign firm increases its output, which increases consumer surplus and tariff revenue, thus increasing the host-country welfare.

Let us now see how higher productivity of the foreign firm affects the host-country welfare under an exogenous tariff when there is a location effect. If firm 1's labor co-efficient increases from λ_0 to λ_1, which shifts firm 1's production from export to FDI, the host country welfare under λ_0 and under λ_1 are respectively $\frac{1}{8}(a-\frac{w}{\lambda_0}-t)^2+\frac{1}{2}t(a-\frac{w}{\lambda_0}-t)$ and $\frac{1}{8}(a-\frac{w}{\lambda_1})^2$. Note that the second term in the host-country welfare under λ_0 is due to the tariff revenue, which is zero if the trade cost consists of a transport cost. Comparing the welfare of the host country under λ_0 and under λ_1, we get that that higher productivity of the foreign firm increases the host country welfare if

$$(a-\frac{w}{\lambda_1})^2-(a-\frac{w}{\lambda_0})^2>t(2a-\frac{2w}{\lambda_0}-3t). \quad (5)$$

The following proposition is immediate from the above discussion.

Proposition 2: *Suppose the reason for FDI is to save trade costs.*
(a) If the trade cost consists of a transportation cost, higher productivity of firm 1 always increases the host country welfare.
(b) If the trade cost consists of a (exogenous) tariff, higher productivity of firm 1 increases the host-country welfare if the higher productivity of firm 1 either (i) creates no location effect or (ii) creates a location effect but satisfies condition (5).

2.2. FDI to get the advantage of cheap labor

Let us now consider that there is no trade cost under export, i.e., $t=0$, but the wage rate in the host country is lower by α compared to the wage rate in the foreign country, where $\alpha\in(0,w]$. Therefore, the wage rate under export and FDI are respectively w and $(w-\alpha)$.

If firm 1 does export, it maximizes the following expression:

$$\underset{q}{Max}(a-q-\frac{w}{\lambda})q. \quad (6)$$

We get that the equilibrium output and profit of firm 1 under export are respectively $q_x=\frac{1}{2}(a-\frac{w}{\lambda})$ and $\pi_x=\frac{1}{4}(a-\frac{w}{\lambda})^2$. The second-order condition for maximization is satisfied.

If firm 1 undertakes FDI, it maximizes the following expression:

$$\underset{q}{Max}(a-q-\frac{(w-\alpha)}{\lambda})q-F. \quad (7)$$

We get that the equilibrium output and profit of firm 1 under export are respectively $q_f=\frac{1}{2}(a-\frac{w-\alpha}{\lambda})$ and $\pi_f=\frac{1}{4}(a-\frac{w-\alpha}{\lambda})^2-F$. The second-order condition for maximization is satisfied.

Firm 1 undertakes FDI if $\pi_f=\frac{1}{4}(a-\frac{w-\alpha}{\lambda})^2-F>\frac{1}{4}(a-\frac{w}{\lambda})^2=\pi_x$

or $$F < \frac{1}{4}(2a - \frac{2w-\alpha}{\lambda})\frac{\alpha}{\lambda} \equiv F_2 . \quad (8)$$

Proposition 3: *Firm 1's incentive for FDI increases with higher* λ *if* $\frac{1}{\lambda} \in (\frac{1}{\lambda^*}, \frac{a}{w})$, *where* $\frac{1}{\lambda^*} = \frac{a}{2w-\alpha}$, *but, its incentive for FDI decreases with higher* λ *for* $\frac{1}{\lambda} < \frac{1}{\lambda^*}$.

Proof: Differentiating F_2 with respect to λ, we find that $\frac{\partial F_2}{\partial \lambda} = \frac{-\alpha(a\lambda - 2w + \alpha)}{2\lambda^3}$. So, $\frac{\partial F_2}{\partial \lambda} \gtreqless 0$ if $\frac{1}{\lambda} \gtreqless \frac{a}{2w-\alpha} \equiv \frac{1}{\lambda^*}$. Since the profit of firm 1 under export is always positive, it provides an upper bound on $\frac{1}{\lambda}$, which is $\frac{a}{w}$. We get that $\frac{1}{\lambda^*} < \frac{a}{w}$ for $\alpha < w$. Therefore, $\frac{\partial F_2}{\partial \lambda} > 0$ for $\frac{1}{\lambda} \in (\frac{1}{\lambda^*}, \frac{a}{w})$. In this situation, firm 1's incentive for FDI increases with higher λ. However, $\frac{\partial F_2}{\partial \lambda} < 0$ for $\frac{1}{\lambda} < \frac{1}{\lambda^*}$. In this situation, firm 1's incentive for FDI decrease with higher λ. Q.E.D.

The above proposition shows that if the reason for FDI is to get the advantage of cheap labor, the relationship between the incentive for FDI and productivity is ambiguous. If FDI is due to cheap labor, higher productivity of firm 1 has both direct and indirect effects. Since higher productivity of firm 1 increases λ, it makes export relatively less costly and directly creates lower advantage of FDI. However, higher λ increases the incentive for FDI indirectly by affecting the equilibrium output, which is higher under FDI. If $\frac{1}{\lambda}$ is sufficiently small, i.e., productivity is very high, the difference between the equilibrium outputs under FDI and export is not large. Hence, in this situation, the advantage from higher output under FDI is not sufficiently large and is dominated by the direct effect of the relatively lower cost of export. Hence, if $\frac{1}{\lambda}$ is sufficiently small, higher productivity of firm 1 reduces the incentive for FDI. However, the opposite occurs if $\frac{1}{\lambda}$ is sufficiently high, i.e., productivity is very low. In this situation, the effect of a higher λ through higher equilibrium output under FDI dominates the direct effect of lower relative cost of export, thus making FDI more attractive.

Unlike the previous subsection, where the reason for FDI is to save trade costs, the above proposition suggests that there may be conflicting effects on host-country welfare if firm 1's productivity increases. If firm 1's productivity increases, the technological effect creates positive impact on host-country welfare. However, if $\frac{1}{\lambda} < \frac{1}{\lambda^*}$, higher productivity may induce firm 1 to shift its production strategy from FDI to export. Hence, the location effect is opposite to the previous subsection and creates a negative impact on host-country welfare by shifting firm 1's production from the low-wage country to the high-wage country, thus reducing firm 1's output.

Let us now consider the situation where firm 1's productivity increases from λ_0 to λ_1, which shifts firm 1's production from FDI to export. The consumer surplus of the host country, which is also equal to the host country welfare, under export and FDI by firm 1 is $\frac{1}{8}(a-\frac{w}{\lambda_1})^2$ and $\frac{1}{8}(a-\frac{w-\alpha}{\lambda_0})^2$ respectively. Comparison of the consumer surplus shows that it is higher under export compared to FDI if

$$\alpha > \lambda_0 w(\frac{1}{\lambda_0}-\frac{1}{\lambda_1}). \quad (9)$$

If the wage rate in the host country is sufficiently low compared to the foreign country, higher productivity of firm 1 may reduce host-country welfare by shifting frm1's production from FDI to export.

But, if $\frac{1}{\lambda} \in (\frac{1}{\lambda^*}, \frac{a}{w})$, Proposition 3 shows that the location effect shifts firm 1's production strategy from export to FDI, which creates a positive effect on the host country welfare by shifting firm 1' production from a high wage country to a low wage country.

The above discussion is summarized in the following proposition.

Proposition 4: *Suppose the reason for FDI is to get the advantage of cheap labor.*

(a) If $\frac{1}{\lambda} < \frac{1}{\lambda^*}$*, higher productivity of firm 1 reduces the host country welfare if it shifts firm 1's production strategy from FDI to export and condition (9) holds.*

(b) If $\frac{1}{\lambda} \in (\frac{1}{\lambda^*}, \frac{a}{w})$*, higher productivity of firm 1 always increases the host country welfare.*

3. Conclusion

Two important reasons for FDI are to save trade costs and to get the benefit of cheap labor. We show that these incentives for FDI may affect the host country welfare differently. Hence, while designing FDI polices, the governments need to be careful about the main reason for FDI.

The relationship between productivity and FDI is positive if the reason for FDI is to save trade costs. In this situation, higher productivity of the foreign firm always increases host-country welfare if trade costs consist of a transportation cost. If trade costs consist of a tariff, host-country welfare may even fall with higher productivity of the foreign firm.

If the reason for FDI is to get the advantage of cheap labor, the incentive for FDI increases (decreases) with the foreign firm's productivity if the initial technology of the foreign firm is sufficiently inferior (superior). In this situation, higher productivity of the foreign firm may reduce host country welfare.

We have focused on the effects of a monopoly foreign firm's productivity on its production strategy, thus ignoring the effects of FDI and exporting on the profitability of host-country firms. However, it should be immediately obvious that, since the marginal cost of the foreign firm is lower under FDI (irrespective of the reason for FDI) compared to export, if higher productivity of the foreign firm increases the incentive for FDI, it increases the possibility of lower host-country welfare by reducing the profits of host-country firms. But, if higher productivity of

the foreign firm reduces the incentive for FDI, it helps to increase host-country welfare by increasing the profits of host-country firms.

Another line of research following this paper will be to consider the strategic FDI decisions of multiple foreign firms. If the productivity of a foreign firm increases, it not only affects that firm's production strategy, but may also affect the production strategy of the competing foreign firms, which may have significant implications for the profits of host-country firms and for host-country welfare. In this respect, the endogenous productivity improvement by the foreign firms may have important implications for the equilibrium production strategies and host-country welfare. We leave these issues for future research.

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