Economics Bulletin

Volume 29, Issue 1

Firm productivity and foreign direct investment: a non-monotonic relationship

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Abstract

The theoretical prediction of Head and Ries (‘Heterogeneity and the FDI versus export decision of Japanese manufacturers', 2003, Journal of the Japanese and International Economies, 17: 448-67) is that if the foreign plant is not used to serve the home market, the exporters can be more productive than the foreign direct investors only if the host-country wage is lower than the home-country wage. With unionized labor markets, we show that there always exist situations where the exporters are more productive than the foreign investors even if the host-country wage is higher than the home-country wage. Given the cost of FDI, a higher trade cost and higher bargaining powers of the labor unions make this result more likely.

Citation: Arijit Mukherjee and Sugata Marjit, (2009) "Firm productivity and foreign direct investment: a non-monotonic relationship", *Economics Bulletin*, Vol. 29 no.1 pp. 230-237.
Submitted: Nov 18 2008. **Published:** March 02, 2009.

1. Introduction

Dominance of foreign direct investment (FDI) over international trade (UNCTAD, 2006) has generated a vast theoretical and empirical literature on FDI.[1] However, the literature is paying attention to the effects of firm-productivity on FDI only in recent years. Helpman et al. (2004) show that the more productive firms do FDI if the reason for FDI is to save trade costs. Head and Ries (2003) show that the more productive firms may prefer export to FDI if the reason for FDI is to get the advantage of a lower wage.[2] More specifically, their theoretical prediction is that if the foreign plant is not used to serve the home market, the exporters can be more productive than the foreign direct investors *only if* the host-country wage is lower than the home-country wage. We show that this is not necessarily the case if the labor markets are unionized, which create imperfectly competitive input markets.

It is well known that the behavior of the labor unions' affects firms' performance (Flanagan, 1999) and there is an existing literature considering the effects of labor unions on firms' decisions on FDIs (see, Lommerud et al., 2003 and Mukherjee, 2008, for some recent works and the references therein). However, that literature did not focus on the impacts of firm-productivity on FDI. We take up this issue in this paper.

In a simple model of FDI with unionized labor markets, we show that there always exist situations where the exporters are more productive than the foreign direct investors even if the host-country wage is higher than the home-country wage. Using symmetric union powers between the countries, we show that, ceteris paribus, a higher trade cost or higher bargaining powers of the unions increase this possibility. Hence, the possibility of higher productivities of the exporters than the foreign investors is more than what demonstrated by Head and Ries (2003), and more empirical works are needed to show the effects of labor market institutions in determining the relationship between firm-productivity and FDI.

The remainder of the paper is organized as follows. Section 2 describes the model and shows the results. Section 3 concludes.

2. The model and the results

Assume that there is a monopolist foreign firm, which wants to sell a product in a country, called the host country. We assume that the firm can serve the host country either through export or through FDI. If the firm exports, it incurs a transportation cost, t. However, the firm incurs a fixed cost F under FDI.

The inverse market demand function for the product is

$$P = A - q, \qquad A > 0, \tag{1}$$

where P is price and q is the total output.

We consider that labor is the only factor of production, and it is immobile between the countries. Assume that the firm needs λ workers to produce one unit of output. λ is the inverse of labor productivity. A lower λ implies higher labor productivity.

[1] See Saggi (2002) for a recent survey on FDI.

[2] The empirical evidence on the relationship between firm-productivity and is mixed. Helpman et al. (2004), which is based on a cross-section of the US manufacturing firms, show that foreign investors are more productive than the exporters. Using English individual data, Girma et al. (2005) broadly confirm the finding of Helpman et al. (2004). Considering listed Japanese firms, Head and Ries (2003) show that low productivity firms are most attracted to do FDI in low-cost host countries, thus in contrast to Helpman et al. (2004). Using data on Slovenian firms, Damijan et al. (2004) show that, in general, the Slovenian firms that invest abroad do not have on average higher labor productivity. They support the finding of Helpman et al. (2004), but only for Slovenian FDI in the high-wage countries. Using the same data set, Damijan et al. (2007) found some support that the firms investing in low-income countries have lower average productivity. Greenaway and Kneller (2003) provide a survey of the recent literature on FDI and firm heterogeneity.

We consider the following game. At stage 1, the firm decides whether to export or to undertake FDI. If the firm exports (undertakes FDI), then at stage 2, the firm and the home (host) country labor union bargain for the wage rate. At stage 3, production takes place and the profits are realized. We solve the game through backward induction.

We consider the right-to-manage model of labor union.[3] Assume that the reservation wage rates of the workers in the home and the host countries are respectively $\overline{w}$ and $\overline{w}^*$, with $\overline{w} > \overline{w}^*$. The other case, where $\overline{w} \leq \overline{w}^*$, follows easily from our analysis.

Under exporting, given the home-country wage rate, w_x, the equilibrium output and the profit of the firm are respectively

$$q_x = \frac{A - \lambda w_x - t}{2} \qquad \text{and} \qquad \pi_x = \frac{(A - \lambda w_x - t)^2}{4}. \tag{2}$$

The labor demand faced by the home-country labor union is $L_x = \frac{\lambda(A - \lambda w_x - t)}{2}$. The wage rate in the home country is determined through a generalized Nash bargaining process that maximizes the following expression:

$$\underset{w_x}{Max} \left(\frac{(w_x - \overline{w})\lambda(A - \lambda w_x - t)}{2} \right)^{\alpha} \left(\frac{A - \lambda w_x - t}{2} \right)^{2(1-\alpha)}, \tag{3}$$

where α and $(1-\alpha)$ are the respective bargaining power of the home-country labor union and the firm, and $\alpha \in [0,1]$.

The equilibrium wage rate is

$$w_x = \frac{\alpha(A - t) + \lambda\overline{w}(2 - \alpha)}{2\lambda}. \tag{4}$$

The equilibrium output and the profit of the firm under exporting are respectively

$$q_x = \frac{(A - \lambda\overline{w} - t)(2 - \alpha)}{4} \qquad \text{and} \qquad \pi_x = \frac{(A - \lambda\overline{w} - t)^2(2 - \alpha)^2}{16}. \tag{5}$$

We assume that $\lambda < \frac{A - t}{\overline{w}} \equiv \lambda^{\max}$, which ensures positive output under exporting.

Next, consider the case under FDI. If the firm undertakes FDI, given the host-country wage rate, w_f, the equilibrium output and the profit of the firm is

$$q_f = \frac{A - \lambda w_f}{2} \qquad \text{and} \qquad \pi_f = \frac{(A - \lambda w_f)^2}{4} - F. \tag{6}$$

The labor demand faced by the host-country labor union is $L_f = \frac{\lambda(A - \lambda w_f)}{2}$. The wage rate in the host country is determined through a generalized Nash bargaining process that maximizes the following expression:

$$\underset{w_f}{Max} \left(\frac{(w_f - \overline{w}^*)\lambda(A - \lambda w_f)}{2} \right)^{\alpha} \left(\frac{A - \lambda w_f}{2} \right)^{2(1-\alpha)}, \tag{7}$$

[3] See Lommerud et al. (2003), López and Naylor (2004) and Mukherjee (2008), to name a few, for the recent works with the right-to-manage model of labor union. The 'efficient bargaining' model, which stipulates that the firms and unions bargain over wages and employment, is an alternative to the right-to-manage model. See, Layard et al. (1991) for arguments in favor of right-to-manage models.

where α and $(1-\alpha)$ are the respective bargaining power of the host-country labor union and the firm, and $\alpha \in [0,1]$.

We are considering symmetric union power between the countries. The reason for this is to ensure that our results are not driven by the different bargaining powers of the unions.

The equilibrium wage rate under FDI is

$$w_f = \frac{A\alpha + \lambda \overline{w}^* (2-\alpha)}{2\lambda}. \tag{8}$$

The equilibrium output and the profit of the firm under FDI are respectively

$$q_f = \frac{(A-\lambda \overline{w}^*)(2-\alpha)}{4} \qquad \text{and} \qquad \pi_f = \frac{(A-\lambda \overline{w}^*)^2 (2-\alpha)^2}{16} - F. \tag{9}$$

The output of the firm is positive under FDI if $\lambda < \frac{A}{\overline{w}^*} \equiv \overline{\lambda}$, and this is always satisfied for $\lambda < \lambda^{\max}$.

The comparison of (4) and (8) gives the following result immediately.

Lemma 1: *If the union power is symmetric between the countries, the host-country wage is higher than the home-country wage if* $\lambda < \frac{\alpha t}{(2-\alpha)(\overline{w} - \overline{w}^*)} \equiv \hat{\lambda}$.

It follows from Lemma 1 that $\frac{\partial \hat{\lambda}}{\partial \alpha} > 0$, i.e., higher bargaining powers of both the symmetric labor unions increase the possibility of higher host-country wage compared to the home-country wage. Further, we get that $\hat{\lambda}$ at $\alpha = 1$ is lower than $\lambda^{\max}$ if $\overline{w}^* < \frac{\overline{w}(A-2t)}{A-t}$. Assume that this condition holds.[4] We also get that, ceteris paribus, a higher trade cost increases $\hat{\lambda}$.

It may worth mentioning that Lemma 1 is not due to the assumption of symmetric union powers but $\frac{\partial \hat{\lambda}}{\partial \alpha} > 0$ is due to the same changes in the bargaining powers of the symmetric unions. If the bargaining power of only the home-country (host-country) union increases, it reduces (increases) the possibility of a lower home-country wage compared to the host-country wage. However, it must be noted that even if the union powers differ between countries, the home-country wage can be lower than the host-country wage, and it happens if $\lambda < \frac{A(\alpha_f - \alpha_x) + t\alpha_x}{\overline{w}(2-\alpha_x) - \overline{w}^* (2-\alpha_f)}$, where $\alpha_x (\alpha_f)$ is the bargaining power of the home-country (host-country) union.

Now find out the condition under which FDI is the equilibrium production strategy of the firm. It is immediate from (5) and (9) that FDI occurs if

$$\frac{(A-\lambda \overline{w}^*)^2 (2-\alpha)^2}{16} - \frac{(A-\lambda \overline{w} - t)^2 (2-\alpha)^2}{16} \equiv \overline{F} > F, \tag{10}$$

i.e., the firm undertakes FDI if its gross benefit from FDI compared to exporting, which is given by $\overline{F}$, is higher than the cost of FDI. $\overline{F} > 0$ whenever $\overline{w} > \overline{w}^*$, which is assumed here.

[4] It follows from (4) and (8) that if the countries are similar in reservation wages, the equilibrium wage differential exists, which is due to the presence of labor union. This may be consistent with Gittleman and Wolff (1993), which suggests that unionization is a significant factor in creating cross-country wage differences in the OECD countries.

Proposition 1: *If* $a(\bar{w}-\bar{w}^*)>t\bar{w}$, $\frac{\partial \bar{F}}{\partial \lambda} \gtreqless 0$ *for* $\lambda \lesseqgtr \lambda^*$, *where* $\lambda^* = \frac{A(\bar{w}-\bar{w}^*)+t\bar{w}}{(\bar{w}^2-\bar{w}^{*2})}$.

Proof: Differentiating $\bar{F}$ with respect to λ and rearranging terms, we find that

$$\frac{\partial \bar{F}}{\partial \lambda} \gtreqless 0 \text{ for } \frac{\bar{w}(A-\lambda\bar{w}-t)}{\bar{w}^*(A-\lambda\bar{w}^*)} \gtreqless 1. \tag{11}$$

If $A(\bar{w}-\bar{w}^*)>t\bar{w}$, we get that $\frac{\bar{w}(A-\lambda\bar{w}-t)}{\bar{w}^*(A-\lambda\bar{w}^*)}$ is greater than 1 at $\lambda=0$ and it is negatively related to λ. Further, for $\lambda = \frac{(A-t)}{\bar{w}} \equiv \lambda^{\max}$, we get that $\frac{\bar{w}(A-\lambda\bar{w}-t)}{\bar{w}^*(A-\lambda\bar{w}^*)}=0$. Since λ is continuous over $[0,\lambda^{\max}]$, we get that $\frac{\bar{w}(A-\lambda\bar{w}-t)}{\bar{w}^*(A-\lambda\bar{w}^*)} \gtreqless 1$ for $\lambda \lesseqgtr \frac{A(\bar{w}-\bar{w}^*)+t\bar{w}}{(\bar{w}^2-\bar{w}^{*2})} \equiv \lambda^*$. Hence, the result follows. Q.E.D.

Recall that a higher λ implies lower labor productivity. Proposition 1 suggests an "inverted U" relationship between the gross benefit from FDI (given by $\bar{F}$) and the labor productivity of the firm (given by λ). This is shown in Figure 1.

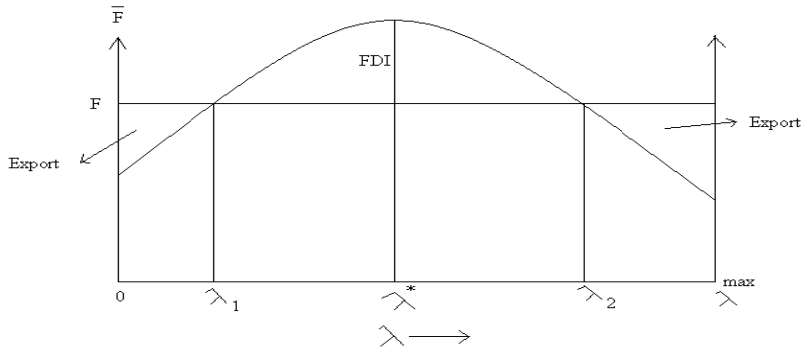

Figure 1: The decision on FDI and exporting depending on λ.

If the actual cost of FDI, F, is greater than both $\bar{F}(\lambda=0)$ and $\bar{F}(\lambda=\lambda^{\max})$ but lower than $\bar{F}(\lambda=\lambda^*)$, Figure 1 shows that the firm undertakes FDI for $\lambda \in (\lambda_1,\lambda_2)$ while it exports for $\lambda \in [0,\lambda_1]$ and $\lambda \in [\lambda_2,\lambda^{\max}]$. That is, the firm with a very high or a very low labor productivity exports, and the firm with an intermediate productivity undertakes FDI. It is trivial that if $F > \bar{F}(\lambda=\lambda^*)$ (F is lower than both $\bar{F}(\lambda=0)$ and $\bar{F}(\lambda=\lambda^{\max})$), FDI is never (always) be the equilibrium outcome.[5]

[5] Whether $\bar{F}(0)$ is greater than or less than $\bar{F}(\lambda^{\max})$ depends on the parameter values. For example, $\bar{F}(0)$ is greater than $\bar{F}(\lambda^{\max})$ for $\bar{w} \to \bar{w}^*$, while a lower *t* can make $\bar{F}(0)$ lower than $\bar{F}(\lambda^{\max})$.

The "inverted U relationship" shown in Figure 1 can be explained in the following way. A higher labor productivity of the firm increases the profits under both exporting and FDI. However, the total effects of a higher productivity of the firm can be decomposed into two separate effects. First, given the output of the firm, a higher productivity of the firm increases the profit by reducing the cost of production. This effect is directly related to the wage level. Second, a higher productivity of the firm increases the output, thus increasing the profit. However, the effect on the output is higher under FDI than under exporting due to the transportation cost of exporting.

If the firm's productivity is very high, a further productivity improvement has negligible impact on the output, while a productivity improvement helps to increase the firm's profit by reducing the cost of production. Hence, if the production under exporting is sufficiently costlier than under FDI, which occurs if the reservation wage in the home-country is sufficiently higher than that in the host-country such that $A(\bar{w}-\bar{w}^*)>t\bar{w}$,[6] the cost saving under exporting compared to FDI is sufficiently large to outweigh the output effect of the productivity improvement. In this situation, the firm's gain in profits is higher under exports than under FDI, thus reducing the incentive for FDI.

Now consider the situation where productivity of the firm is very low so that the output under exporting is negligible. In this situation, both the output and the cost saving effects of a productivity improvement are negligible under export. However, a lower cost of production under FDI compared to export induces the firm to produce a relatively large amount under FDI, and creates significant output and cost saving effects under FDI. Hence, a productivity improvement increases the profit more under FDI than under exports, and increases the incentive for FDI.

Now we are in position to show the main point of this paper, i.e., the labor productivities of the exporters may be higher than the foreign direct investors even if the host-country wage is higher than the home-country wage. The comparison between $\hat{\lambda}$ and λ^* shows that $\hat{\lambda}<\lambda^*$ if

$$\alpha<\underline{\alpha}\equiv\frac{2(A(\bar{w}-\bar{w}^*)+t\bar{w})}{A(\bar{w}-\bar{w}^*)+2t\bar{w}+t\bar{w}^*}. \tag{12}$$

Condition (12) holds always since $\underline{\alpha}>1$ because $\bar{w}^*<\frac{\bar{w}(A-2t)}{A-t}\left(<\frac{A\bar{w}}{A+t}\right)$. Therefore, if $\lambda\in(\hat{\lambda},\lambda^*)$, the exporters are more productive than the foreign investors and the host-country wage is lower than the home-country wage. This result is in line with Head and Ries (2003).

Now consider the case of $\lambda\in(\lambda_1,\hat{\lambda})$. Note that this case does not arise if the bargaining powers of the labor unions are *0* (i.e., $\alpha=0$), since $\hat{\lambda}=0$ in this situation. Since the equilibrium wages are equal to the reservation wages if the bargaining powers of the labor unions are *0*, it implies that, in a perfectly competitive labor market (as in Head and Ries, 2003), the exporters can have higher productivities than the foreign investors only if the host-country wage is lower than the home-country wage. However, if $\alpha>0$ and *t > 0*, we get that $\hat{\lambda}>0$. Further, λ_1 reduces as *F* falls, and can take the minimum value *0* if $F\le\bar{F}(\lambda=0)$. Hence, for a given $\alpha>0$ and *t > 0*, there always exists *F* such that the interval $(\lambda_1,\hat{\lambda})$ is non-empty. In this situation, the productivities of the exporters are higher than the foreign investors, while the host-country wage is higher than the home-country wage. Given the symmetric union powers between the countries, ceteris paribus, a higher trade cost (i.e., *t*) or higher bargaining powers of the unions (i.e., α) increase the possibility of this result by increasing $\hat{\lambda}$.

[6] If $t=0$, this is true for a higher reservation wage rate in the home country than in the host country.

We have done our analysis with $\bar{w} > \bar{w}^*$. However, if $\bar{w} \leq \bar{w}^*$, it is immediate from (11) that $\frac{\bar{w}(A-\lambda\bar{w}-t)}{\bar{w}^*(A-\lambda\bar{w}^*)} < 1$, which implies that $\frac{\partial \bar{F}}{\partial \lambda} < 0$. Therefore, if $\bar{w} \leq \bar{w}^*$, a higher productivity of the firm increases the incentive for FDI compared to exporting, and the foreign investors are more productive than the exporters. Hence, higher productivities of the exporters and higher host-country wages can hold together only if $\bar{w} > \bar{w}^*$.

3. Conclusion

So far, the existing literature shows that exporters can be more productive than the foreign investors only if the host-country wage is lower than the home-country wage. We show that this is not necessarily the case with unionized labor markets. With unionized labor markets in both the home and the host-countries, we show that there always exist situations where the exporters are more productive than the foreign investors even if the host-country wage is higher than the home-country wage. For a given cost of FDI, higher bargaining powers of the labor unions and a higher trade cost increase the possibility of this result. It is important to note that a higher reservation wage in the home-country than in the host-country is necessary for our result.

We show that in an industry with a very low productivity, foreign investors are expected to have a higher productivity than the exporters. However, the foreign investors may have lower productivity than the exporters if the industry under consideration has a high productivity. Thus, our analysis may help to reconcile the mixed findings on firm-productivity and FDI in the sense that whether the relationship will be positive or negative may depend on the initial productivity of the concerned industry. However, there is a caveat. Our firm-level analysis may not be fully consistent with the somewhat aggregated data used in some empirical analyses mentioned in footnote 2. A more disaggregated firm-level analysis may be required. We have also abstracted from other factors such as product market competition and strategic FDI decisions of the competing foreign firm, which may affect the productivity and FDI relationship.

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