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Relationship between FDI, foreign ownership restrictions, and technology transfer in the resources sector: A derivation approach

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ABSTRACT

In various industries, multinational companies are the dominant players while local firms play a less prominent role. We consider such an industry and develop a model in which foreign multinationals strategically interact in technology transfer and compete in the product market stage. Furthermore, we analyze the welfare implications of often observed FDI policy measures. We find that the cost of technology transfer provides a possible rationale for why in practice FDI crowding out effects are often smaller in less developed countries.We also find that foreign ownership restrictions may reduce FDI crowding-out effects. However, the net effect of these restrictions on host country welfare will be negative. Finally, we find that, in industries with low levels of product market competition (e.g. the natural resources sector), the government may improve welfare by taking away the joint venture equity share of the domestic firm.

1. Introduction

Due to a lack of financial and technological resources many (developing) countries depend on Foreign Direct Investment (FDI) to extract and export their natural resources. An often imposed restriction on FDI in the natural resources sector is mandatory joint ownership with local firms. Joint Ventures (JVs) between foreign multinationals and local (state-owned) firms are widely used by governments in order to capture economic rents from their natural resources. Abu Dhabi's state-owned firm ADNOC, for example, has a 60% share in the Emirate's oil and gas operations, while, 40% is owned by international oil companies. Recently, Iran also decided to move more towards a JV structure in order to attract foreign investment into the energy sector. In Botswana and Namibia local state-owned firms have formed 50-50 JVs with De Beers in the diamond extraction industry. In contrast, governments may also restrict foreign ownership directly instead of imposing mandatory joint ventures. The government may, for example, manage equity stakes in foreign operated projects through a ministry or through a separate agency. A similar measure was taken in Norway's oil and gas sector in the 1980s when the government took away significant ownership shares of the national oil company Statoil and put them under direct control of the government through the so called States Direct Financial Interest (SDFI) portfolio. In Nigeria the Oil and Gas Reform Implementation Committee (OGIC) proposed a similar framework for Nigeria's oil & gas sector. The committee recommended that the National Petroleum Asset Management Agency (NPAMA) should oversee investments by the state, while The National Petroleum Corporation (NNPC) would be active as a commercial company (see (Thurber and Istad, 2010)).[1] We develop a simple model where a host country government either directly restricts the equity share of foreign firms or it imposes mandatory joint ventures with a domestic firm. Furthermore, the foreign firms transfer technology to their subsidiaries in the host country. The goal of this model is to shed light on the relationships between foreign ownership restrictions, technology transfer, and market structure.

We find that in sectors with high cost of technology transfer and low levels of product market competition (e.g. in the natural resources sector), the government may improve host country welfare by taking away the local firm's equity shares in joint ventures. As a result of this policy measure the domestic firm will become active in the market. This

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[1] The policy recommendations of the OGIC have, however, not been implemented.

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increases the level of product market competition and improves host country welfare. Furthermore, we find that crowding-out effects of FDI will be stronger in case of lower cost of technology transfer. The rationale behind this result is that due to higher cost of technology transfer, multinational corporations will transfer less technology to their affiliates. This weakens the competitive position of multinational affiliates and improves the competitive position of the local firm.

The literature on technology transfer and foreign ownership restrictions is closely related to the current study. Lee and Shy (1992) show that foreign ownership restrictions reduce the quality of technology transfer by multinational firms. Asiedu and Esfahani (2001) show that in resource-based industries foreign firms prefer shared ownership in order to gain access to raw material sources. Javorcik and Saggi (2010) show that a foreign investor with higher quality technology is less likely to form a joint venture and more likely to enter directly. In contrast, Karabay (2010) shows that by imposing mandatory joint ventures a host country government may alleviate its informational constraints. Furthermore, Karabay (2010) shows that ownership restrictions should only decrease as the size of the multinational's firm-specific advantage increases. This stream of research, however, does not study an endogenously determined level of technology transfer which is an important focus of the current paper. The existing theoretical literature on technology transfer by multinational firms, mainly considers the entry mode of a foreign firm in a market dominated by domestic companies (see e.g. Ethier and Markusen (1996); Markusen (2001); Mattoo et al. (2004); Saggi, (1996, 1999)). However, numerous industries such as automobile, electronics, extractive and chemical industries, are dominated by foreign multinational companies and national firms play a less prominent role. Similar point is made by Markusen and Venables (1998). Multinational companies in these industries not only compete in the product market but they also strategically interact in technology transfer. We take this strategic interaction between multinational firms into account. Furthermore, the aforementioned papers do not consider crowding out effects of FDI. The crowding out effect of FDI has been analyzed separately from technology transfer in a small number of theoretical studies. Driffield and Hughes (2003) study the possibility of FDI crowding out local firms in the domestic capital market. Barry et al. (2005) analyze crowding out effects in the labor market. Similar to our analyzes Markusen and Venables (1999) consider crowding out effects in the product market. However, Markusen and Venables (1999) do not consider an endogenously determined level of technology transfer.

The next section outlines the model. Section 3 solves the model in case of direct foreign ownership restrictions and analyses the crowding-out effects of FDI. Section 4 solves the model in case of mandatory joint ventures and analyses the optimal type of foreign ownership restrictions. The final section concludes.

2. Model

We analyze a local firm (l) that competes with $n-1$ multinational affiliates (m).[2] The firms interact over two periods, where first technology investment is chosen and afterwards firms compete in the product market. In the first stage the multinational firms transfer technology, x_m, to their affiliates in the host country which reduces marginal cost of production from c to $c_m = c - x_m$.[3] Technology transfer is costly and the cost function of technology transfer has the standard quadratic form $C(x_m) = \tau x_m^2/2$. This form implies diminishing returns to technology transfer. Total and marginal cost of technology transfer both increase with τ. Thus, the cost function for technology transfer shifts up as τ increases and τ can be related to the level of the cost of technology transfer (see (Mattoo et al., 2004)). The second stage quantity competition is between $n-1$ multinational affiliates and one local company.

The linear inverse demand function for the product is given by $p = a - (\sum_{m=1}^{n-1} q_m + q_l)$. Where, p is the market price, $a > 0$, $Q_m = \sum_{m=1}^{n-1} q_m$ is total output of all the foreign firms operating in the host country and q_l is the output of the local firm. Hence, $Q = Q_m + q_l$ denotes total output.

The foreign firms do not have full ownership. The government can either directly restrict foreign ownership or it may require foreign firms to establish a joint venture with the local firm. The share of foreign ownership is θ with $0 < \theta < 1$. We proceed by deriving equilibrium levels of output and technology transfer as well as welfare implications under these two regimes.

3. Direct foreign ownership restrictions

Under the first regime the profit of a representative foreign firm, net of technology transfer cost, and that of the local firm are given by (1) and (2), respectively:

$$\pi_m^R(q_m, q_{-m}, q_l) = \theta(a - q_m - q_{-m} - q_l - c_m)q_m, \quad m \in \{1, \ldots, n-1\} \tag{1}$$

$$\pi_l^R(q_l, q_m, q_{-m}) = \left(a - q_l - \sum_{m=1}^{n-1} q_m - c\right)q_l. \tag{2}$$

where, R stands for foreign ownership restrictions regime and q_{-m} is the sum of outputs of all multinational affiliates other than firm m. Using the standard two-stage approach adopted in the literature on the economics of R & D[4] we can derive equilibrium outputs of the foreign firms and the local firm equilibrium output. They are given by:

$$q_m^R = \frac{a-c+2(n-1)x_m - 2\sum_{j=1,j\neq m}^{n-1} x_j}{n+1}, \; m \in \{1, \ldots, n-1\}$$
$$\text{and } q_l^R = \frac{a-c-\sum_{m=1}^{n-1} x_m}{n+1}. \tag{3}$$

Output of a foreign firm increases with its own technology transfer and decreases with technology transfer of competing firms. Output of the local firm goes down when technology transfer by foreign multinationals increases as it enhances the competitiveness of the subsidiaries.

The equilibrium level of technology transfer by a representative multinational is given by

$$x_m^R(\theta) = \frac{4\theta(n-1)(a-c)}{\tau(n+1)^2 - 8\theta(n-1)} \tag{4}$$

Consequently, total transfer of technology is given by $(n-1)x_m^R(\theta)$. In line with previous research (see e.g. Mattoo et al. (2004)) we impose certain restrictions on parameter τ, i.e. $\tau > 2$.[5] As expected, technology transfer decreases with the cost of technology transfer (τ) and increases with the share of foreign ownership (θ).

3.1. Welfare

Producer surplus is equal to the profit of the local firm. By substituting the equilibrium level of technology transfer (i.e. $x_m^R(\theta)$) into the function for local firm output in (3) we obtain the local firm's equilibrium level of output:[6]

[2] Similar to Wang and Blomström (1992) we abstain from looking at the mode of entry choice of foreign firms. We assume all foreign firms have entered the country directly.

[3] Note $0 \leq c \leq a$.

[4] See e.g. Brander and Spencer (1983), d'Aspremont and Jacquemin (1988), Kamien et al. (1992), Kamien and Zang (2000), and Leahy and Neary (1997).

[5] This restriction ensures non-negative solutions for equilibrium levels of technology transfer under all relevant regimes.

[6] See Appendix A for the derivations under direct foreign ownership restrictions.