

# Mode of foreign entry, technology transfer, and FDI policy

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## Abstract

Foreign direct investment (FDI) can take place either through the direct entry of foreign firms or the acquisition of existing domestic firms. The preferences of a foreign firm and a welfare-maximizing host country government over these two modes of FDI are examined in the presence of costly technology transfer. The trade-off between technology transfer and market competition emerges as a key determinant of preferences. The clash between the foreign firm's equilibrium choice and the local government's ranking of the two modes of entry can provide a rationale for some frequently observed FDI restrictions.

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## 1. Introduction

Host countries often associate inflows of foreign direct investment (FDI) with a wide variety of benefits, the most common of which are transfers of modern

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technologies and more competitive product markets. The extent to which a host country can secure these benefits of FDI is likely to depend upon the mode of entry of foreign firms. The goal of this paper is to shed light on the relationships between mode of entry, technology transfer, and market structure. To this end, we develop a simple model where a foreign firm can choose between two modes of entry: *direct entry* where in it establishes a new wholly owned subsidiary, or it can opt for *acquisition* of one of the existing domestic firms.<sup>3</sup>

In the model, the degree of technology transfer and the intensity of market competition depend upon the mode of entry chosen by the foreign firm. The competition enhancing effect of FDI is greater under direct entry. However, one mode does not unambiguously dominate the other in terms of the extent of technology transfer. On the one hand, the relatively larger market share that the foreign firm enjoys under acquisition increases its incentive for transferring costly technology (scale effect). On the other hand, strategic incentives to transfer technology in order to wrest market share away from domestic rivals can be stronger in more competitive environments (strategic effect).

Our results show that divergence between the foreign firm's choice and the welfare interest of the domestic economy can create a basis for policy intervention. More specifically, it is shown that for high costs of technology transfer, domestic welfare is generally higher under acquisition relative to direct entry, whereas the foreign firm chooses direct entry. Thus, restricting direct entry in order to induce acquisition can improve welfare, even in highly concentrated markets. On the other hand, if the cost of technology transfer is low then domestic welfare is higher under direct entry relative to acquisition whereas the foreign firm prefers acquisition to direct entry. As a result, a restriction on the acquisition of a domestic firm can help improve host country welfare by inducing direct entry by the foreign firm. Finally, for intermediate costs of technology transfer, both the government and the foreign firm prefer acquisition to direct entry.

Thus, according to our analysis the objective of frequently observed restrictions on FDI may not be to limit inflows of FDI, but rather to induce foreign firms to adopt the socially preferred mode of entry in the host country. More specifically, it is shown that restrictions on the degree of foreign ownership, even when applied symmetrically to both modes of entry (acquisition and direct entry), can induce the foreign firm to adopt the host country's preferred mode of entry.

Some of the issues addressed here have been studied separately before, but we know of no analytical study of the relationship between technology transfer and mode of entry by foreign firms (as in direct entry versus acquisition). The literature has tended to focus on licensing and direct entry where the foreign firm seeks to prevent the dissipation of its technological advantage (see Ethier and Markusen, 1996; Markusen, 2001; Saggi, 1996, 1999). Yu and Tang (1992) discuss several potential motivations for international acquisition of firms. These include the following: cost

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<sup>3</sup> Our model is most relevant to situations where cross-border delivery is either infeasible or not the most efficient mode of supply. For example, in many services, ranging from construction to local telecommunications, commercial presence of foreign firms via FDI is required in the host country.

reduction, risk sharing, and competition reduction (also a consideration in our framework).<sup>4</sup>

Lee and Shy (1992) demonstrate that restrictions on foreign ownership may adversely affect the quality of technology transferred by the foreign firm. However, they do not allow for direct entry.<sup>5</sup> In a duopoly model, Roy et al. (1999) identify the degree of cost asymmetry between the foreign and local firm and market structure as the crucial determinants of optimal domestic policy. However, they assume technology transfer be costless and do not examine the differing incentive to transfer technology under alternative market structures.

The literature on mergers and acquisitions in both the domestic and international context is also relevant to our paper. This literature implies that when firms are symmetric, a firm will always prefer direct entry to acquisition of an existing firm when there is more than one target firm in the market (see Salant et al., 1983; Kamien and Zang, 1990).<sup>6</sup> It turns out that this result does not hold in the presence of technology transfer, as shown later in this paper.<sup>7</sup> On the international side, there exists a large literature that is concerned with the relationships between trade and competition policy and the international effects of purely national mergers. For example, Head and Ries (1997) study incentives for national and supra-national merger regulations to authorize mergers in the presence of international trade whereas Horn and Levinsohn (2001) focus on the substitutability between trade policy and competition policy.<sup>8</sup> Neither of these papers is concerned with technology transfer.

The remainder of the paper is organized as follows. Section 2 presents the theoretical setup and describes the foreign firm's decisions regarding its mode of entry (acquisition versus direct entry) into the host country where the extent of technology transfer depends upon the entry mode. Section 3 focuses on welfare analysis and draws its implications for the host government incentives for policy intervention. Section 4 concludes.

## 2. Model

There are two goods ( $z$  and  $y$ ) and preferences in the domestic economy over these two goods are quasi-linear:  $U(z,y)=u(z)+y$ . Good  $y$  serves as a numeraire good and it is produced under perfect competition with constant returns to scale technology. Let  $p(q)$  be

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<sup>4</sup> Svejnar and Smith (1984) focus on the interaction between transfer pricing and local policy in an international joint venture whereas Al-Saadon and Das (1996) construct a model of in which the ownership shares of joint venture partners are endogenously determined as the outcome of a bargaining game. Neither of these papers allow for technology transfer and direct entry.

<sup>5</sup> Mutinelli and Piscitello (1998) argue that foreign firms may prefer joint ventures rather than full ownership in uncertain environments and provide evidence for Italian firms investing abroad.

<sup>6</sup> Although the formal games these papers analyze differ significantly from ours, the mechanism underlying this result also exists in our model.

<sup>7</sup> See also Perry and Porter (1985) where, at any given average cost, a merged firm can produce more output than either of the two independent firms because of the intangible asset it acquires from its two partners.

<sup>8</sup> Other models of mergers that deal with international issues include Barros and Cabral (1994), Cowan (1989), Das and Sengupta (2001), and Richardson (1999).

the inverse demand function for good  $z$  generated by consumer maximization, where  $q$  is total consumption of good  $z$ . For simplicity, assume that  $u(z)$  is quadratic so that  $p(q) = a - q$ .

There are  $n - 1$  denote domestic firms that can produce good  $z$  at constant marginal cost  $c$ . A foreign firm has two options for entering the domestic market. It can either acquire a domestic firm or it can set up a wholly owned subsidiary that directly competes with domestic firms. Thus, under acquisition the total number of firms in the market equals  $n - 1$  whereas under direct entry it equals  $n$ .

The game proceeds as follows. In the first stage, the foreign firm chooses its mode of entry ( $E$  denotes direct entry and  $A$  denotes acquisition).<sup>9</sup> If it wants to acquire a domestic firm, it makes a take-it-or-leave-it offer to the target firm which specifies a fixed transaction price ( $v$ ). If the target firm accepts the offer, they form a new firm that is owned by the foreign firm. If the foreign firm's offer is refused by the domestic firm, the foreign firm can enter the market by establishing its own subsidiary or by acquiring some other domestic firm.

After selecting its mode of entry, the foreign firm chooses the quality of technology it wishes to transfer to its subsidiary. Technology transfer lowers the marginal cost of production but is a costly process. By incurring the cost  $C(x)$ , the foreign firm can lower the cost of production of its subsidiary in the domestic economy to  $c - x$ . In other words, if it opts to transfer no technology, the marginal cost of its subsidiary equals that of the domestic firm. In the last stage, firms compete in a Cournot–Nash fashion. The perfect equilibrium of this game is found by solving backwards.

### 2.1. Product market

In the last stage of the game, domestic and foreign firms simultaneously choose their output levels. Firm  $i$ 's profit function at the output stage is given by:

$$\pi_i(q_i, q_{-i}) = (p(q) - c_i)q_i = (a - q_{-i} - q_i - c_i)q_i \quad (1)$$

where  $c_h = c$  is the marginal cost of a typical home firm ( $h$ ),  $c_f = c - x$  the marginal cost of the foreign firm ( $f$ ),  $q_{-i}$  is the sum of outputs of all firms other than firm  $i$ , and  $q$  is total output (or domestic consumption).

Let the cost function for technology transfer be  $C(x) = \tau x^2/2$  where  $\tau = \partial^2 C / \partial x^2$  determines the convexity of this function. As  $\tau$  increases, the cost function for technology transfer shifts up while at the same time incremental technology transfer also becomes more costly. Thus, with an increase in  $\tau$ , both the total cost and the marginal cost of technology transfer increase.

Solving for the optimal output levels under Cournot competition is straightforward. These are given in the appendix for domestic and foreign firms under both entry and acquisition (see Appendix A.1).

<sup>9</sup> Later in the paper, when analyzing local policy we allow for a partial acquisition on the part of the foreign firm. In the absence of any policy restrictions, full acquisition is optimal from the foreign firm's perspective.

### 2.2. Technology transfer

In the second stage of the game, given the mode of entry, the foreign firm chooses the level of technology transfer. Here, we describe the foreign firm’s incentives for technology transfer under the two modes of entry.

Under direct entry, the foreign firm’s first-order condition for technology transfer can be written as

$$\frac{\partial \pi_f^E}{\partial q_f} \frac{dq_f^E}{dx} + (n - 1) \frac{\partial \pi_f^E}{\partial q_h} \frac{dq_h^E}{dx} + \frac{\partial \pi_f^E}{\partial x} - \frac{dC(x)}{dx} = 0 \tag{2}$$

where  $q_h^E$  denotes the output of a typical domestic competitor and is reported in Appendix A.1.

The above equation is interpreted as follows. From the first-order condition at the output stage, the first term of the above equation equals zero (i.e.  $\partial \pi_f^E / \partial q_f = 0$ ). The second term captures the *strategic effect* of technology transfer: an increase in  $x$  lowers the output of the domestic firms thereby increasing the foreign firm’s profits (see Brander and Spencer, 1983). The third term captures the stand-alone incentive for technology transfer. We call this the *scale effect* because the higher the output of the foreign firm, the stronger its incentive for technology transfer. The last term simply denotes the marginal cost of technology transfer. Using Eq. (1) to obtain the derivatives of profits with respect to their arguments, we can rewrite Eq. (2) as:

$$(n - 1)(-q_f^E) \frac{dq_h^E}{dx} + q_f^E - \tau x = 0 \text{ where } \frac{dq_h^E}{dx} = -\frac{1}{n + 1} < 0. \tag{3}$$

It is straightforward to show that under acquisition Eq. (3) becomes:<sup>10</sup>

$$\frac{n - 2}{n} q_f^A + q_f^A - \tau x = 0 \tag{4}$$

as there are only  $n - 2$  domestic firms in the market.

Replacing  $q_f^A$  and  $q_f^E$  from Appendix A.1 into the first terms in Eqs. (3) and (4), it is easy to show that the strategic effect is concave in  $n$ : it increases with  $n$  if  $n < n^c$  and decreases with  $n$  if  $n > n^c$ .<sup>11</sup> In other words, the strategic effect increases with the number of existing domestic firms only if the domestic market is not too competitive. By contrast, in a relatively competitive market, the presence of an extra firm in the domestic market actually decreases the strategic incentive to transfer technology. The intuition for this is that as the market gets more competitive, the scope for strategic interactions among firms decreases and the foreign firm’s choice regarding technology transfer has a small impact on their

<sup>10</sup> Here we report the case of full acquisition of the domestic firm, as in equilibrium the foreign firm does not choose partial acquisition (see Section 2.3).

<sup>11</sup> We show in the appendix that

$$n^c = \frac{\tau - 2 + \sqrt{2} \sqrt{(\tau - 2)(2\tau - 1)}}{\tau - 2}.$$

output levels. Since the number of firms in the market is greater under direct entry ( $n$ ) than under acquisition ( $n - 1$ ), for  $n < n^c$ , the strategic incentive for technology transfer is higher under direct entry than under acquisition and vice versa. This result helps explain why in environments that are not very competitive one may observe greater technology transfer under direct entry.

Solving Eqs. (3) and (4) for  $x$  yields the extent of technology transferred to the subsidiary under the two modes:

$$x^E = \frac{2n(a - c)}{(\tau - 2)n^2 + (2n + 1)\tau} \text{ and } x^A = \frac{2(n - 1)(a - c)}{(4n - 2) + (\tau - 2)n^2} \quad (5)$$

The equilibrium technology transfers have reasonable properties: under both direct entry and acquisition, technology transfer diminishes with  $n$  as well as with the cost parameter  $\tau$ .

**Proposition 1.** *The foreign firm transfers less technology under acquisition than under direct entry iff  $\tau < \tau_t(n)$  where*

$$\tau_t(n) = \frac{2n(n - 1)}{n^2 - n - 1} \quad (6)$$

*Furthermore,  $\tau_t(n)$  is decreasing in  $n$  and it approaches 2 as  $n$  approaches infinity.*

Thus, direct entry may yield more technology transfer if  $\tau$  and  $n$  are sufficiently small. In general, the strategic effect is strong when  $\tau$  is small because it is proportional to the foreign firm's output and that declines with  $\tau$ . Furthermore, as was noted above, the strategic effect is concave in  $n$ . As a result, for small  $n$ , the strategic effect is stronger under direct entry than under acquisition whereas for large  $n$ , both the scale effect and the strategic effect are stronger under acquisition. The fact that  $\tau_t(n)$  approaches 2 when  $n$  approaches infinity implies that when the domestic market is extremely competitive, acquisition necessarily delivers greater technology transfer ( $\tau$  cannot be less than 2 for the second-order condition in the choice of technology transfer to hold).

### 2.3. Foreign firm's preferred mode of entry

In the first stage of the game, the foreign firm chooses whether to enter through acquisition or direct entry. Since the foreign firm has all the bargaining power under acquisition, we must have  $v = \pi_h^A(x^A)$ . In other words, a target domestic firm accepts an offer that leaves it with a payoff equal to that it makes as a competitor when some other domestic firm is acquired. The foreign firm opts for acquisition iff it is more profitable than direct entry:

$$\Delta\Pi \equiv \pi_f^A(x^A) - C(x^A) - \pi_h^A(x^A) - [\pi_f^E(x^E) - C(x^E)] > 0$$

As might be expected, the expression for  $\Delta\Pi$  is quite cumbersome and non-linear in  $\tau$  and  $n$  (see Appendix A.3). However, dividing  $\Delta\Pi$  by  $(a - c)^2$  permits us a convenient graphical analysis in the  $(n, \tau)$  space. Fig. 1 plots the contours of three different functions in the  $(n, \tau)$  space. The  $TT$  curve is the contour of the function  $\Delta X / (a - c)^2$  where  $\Delta X \equiv$

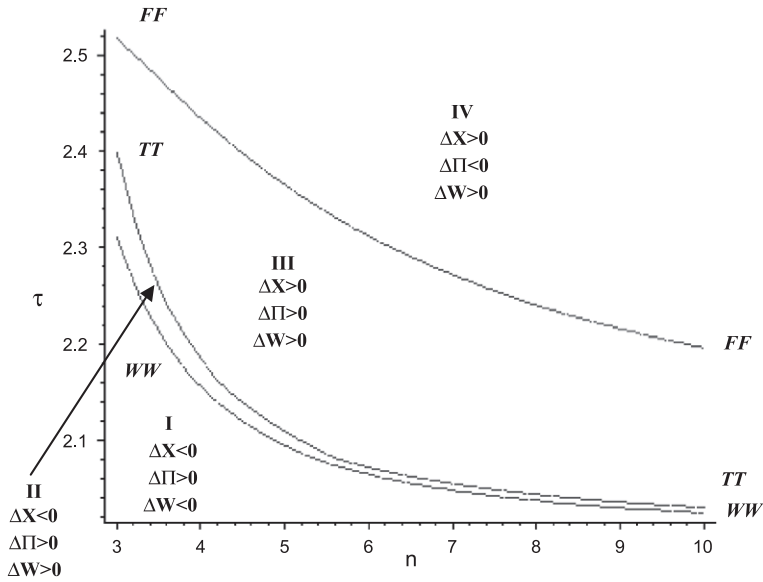


Fig. 1. Mode of entry, technology transfer and policy intervention.

$x^A - x^E = 0$ . Along this function (given by Eq. (6)), acquisition and direct entry deliver the same amount of technology transfer. The *FF* curve is the contour of the  $\Delta\Pi/(a - c)^2 = 0$  function along which the foreign firm is indifferent between acquisition and direct entry; the *WW* curve is the contour of the function  $\Delta W/(a - c)^2 = 0$ , where  $\Delta W = (W^A - W^E)$  and  $W^j$  denotes aggregate domestic welfare under mode  $j = A, E$ . Along the *WW* curve, aggregate domestic welfare under the two modes is the same (see the next subsection for greater details on domestic welfare). To focus on the equilibrium mode of entry chosen by the foreign firm, restrict attention to the *TT* and *FF* curves.

The parameter space in Fig. 1 can be divided into four regions: I, II, III, and IV. In regions I and II, direct entry leads to more technology transfer whereas the foreign firm prefers acquisition. In region III, acquisition leads to more technology transfer and is indeed preferred by the foreign firm. Finally, in region IV, direct entry is chosen by the foreign firm whereas acquisition leads to more technology transfer.

To see the intuition behind the equilibrium mode choice, consider region IV. In this region,  $\tau$  is large and technology transfer is of marginal importance (due to its high cost). As a result, the buy-out price of the local firm ( $\pi_b^A(x^A)$ ) is relatively high. Under this scenario, the considerations studied in Salant et al. (1983) and Kamien and Zang (1990) become important, making acquisition less profitable than direct entry.<sup>12</sup> In all other regions, the foreign firm prefers acquisition over direct entry. The reason for this is as follows. Acquisition lowers the degree of competition in the market relative to direct entry but the foreign firm has to buy-out a local firm to achieve that competition reduction.

<sup>12</sup> See Mattoo et al. (2001) for a demonstration of the Kamien and Zang (1990) result in our model without technology transfer.

Thus, the foreign firm has to weigh the price at which acquisition occurs (i.e.  $\pi_h^A(x^A)$ ) against the gain competition reduction brings. As long as the *absolute* level of technology transfer under acquisition is sufficiently high (even though it may be lower than under direct entry), the buy-out price  $\pi_h^A(x^A)$  is small and acquisition is more attractive to the foreign firm relative to direct entry.

It is worth emphasizing the crucial role technology transfer plays in our model. If technology transfer were infeasible, all firms would be symmetric in the model. In such a situation, the existing literature (Salant et al., 1983; Kamien and Zang, 1990) has shown that acquisition cannot occur in equilibrium when there are more than two firms in the market. Briefly put, the argument is as follows. An acquiring firm has to offer the target firm a payoff equal to what it collects if it is not acquired. If firms are symmetric, this condition fails to hold because the profits of a single firm with  $n - 2$  competitors are lower than the *total* profits of two independent firms with  $n - 1$  firms in the market. As noted above, the foreign firm may find acquisition more profitable than direct entry if it transfers sufficient technology to the new enterprise.<sup>13</sup> This result relates well to Perry and Porter's (1985) model of mergers where a merged unit has a greater stock of an indivisible asset relative to other firms in the industry (thereby creating asymmetry between merging firms and others).

### 3. Host country welfare

We prove the following result in Appendix A.4:

**Proposition 2.** *In the host country, consumers are better off under direct entry than under acquisition ( $p^E < p^A$ ) whereas a typical domestic producer is better off under acquisition ( $\pi_h^A > \pi_h^E$ ).<sup>14</sup>*

Thus, we have a conflict between the interests of domestic producers and consumers. Given this conflict, the main question is whether total domestic welfare (defined as the sum of consumer surplus and producer surplus) is higher under direct entry or acquisition. It is straightforward to show that:

$$\Delta W \equiv W^A - W^E = \left[ a - \frac{p^E + p^A}{2} \right] [p^E - p^A] + (n - 1) [\pi_h^A - \pi_h^E] \quad (7)$$

As noted earlier, the  $WW$  curve in Fig. 1 plots the contours of the  $\Delta W/(a - c)^2$  function in the  $(n, \tau)$  space. In each of the regions in Fig. 1, the preferences in terms of the mode of entry of the government and the foreign firm are denoted by indicating whether  $\Delta W$  is larger or smaller than zero in the different regions.

In region IV, the foreign firm prefers direct entry whereas the government prefers acquisition (and the extent of technology transfer is higher under full acquisition). In

<sup>13</sup> We thank an anonymous referee for helping us improve the exposition of this result.

<sup>14</sup> The difference between prices under full acquisition and direct entry declines as the number of firms increases. At the limit, when  $n$  approaches infinity, this difference tends to zero.



region I, for low levels of  $\tau$ , the opposite is true whereas in region III for intermediate values of  $\tau$ , both the government and the foreign firm prefer full acquisition to direct entry. Finally, in region II, the firm prefers acquisition while welfare is higher under acquisition even though there is more technology transfer under direct entry.

The logic for these results is as follows. From Proposition 2, we know that consumers always prefer direct entry whereas local firms always prefer acquisition since direct entry has a stronger profit shifting effect. For domestic welfare to be higher under direct entry relative to acquisition, it is necessary that direct entry leads to more technology transfer than acquisition but it is not sufficient. In region I, welfare is higher under direct entry because it leads to sufficiently more technology transfer than acquisition. By contrast, in the vicinity of the  $TT$  locus, the government prefers acquisition even though it leads to less technology transfer because direct entry hurts local profits too much and the level of technology transfer under the two modes is not significantly different. In regions III and IV, technology transfer under direct entry is lower than that under acquisition so that direct entry is never preferred from a welfare perspective.

In general, in regions I and IV there is room for government intervention. In region I, policy measures that induce direct entry and/or discourage full acquisition can improve domestic welfare. Similarly, in region IV, restricting direct entry and/or encouraging acquisition by the foreign firm can improve domestic welfare. Finally, in regions II and III, there is harmony between local welfare and the equilibrium entry mode chosen by the foreign firm: acquisition is the preferred mode from both points of view.

Introducing political economy considerations into the analysis does not change the qualitative results in any significant way. From Proposition 2 we know that domestic firms prefer acquisition to direct entry. Thus, if domestic firms could influence local policy they would want to lobby for restrictions on direct foreign entry. Further, if under lobbying pressure the government puts a higher weight to domestic firms' profits than on consumer welfare, then the  $WW$  curve in Fig. 1 will shift downwards thereby making it more likely that the government prefers acquisition to direct entry. This in turn implies that the likelihood of observing restrictions on acquisition of domestic firms would be lower. On the other hand, the incentives to restrict entry when this is the preferred mode by the foreign firm would remain the same (i.e. region IV does not change) despite lobbying by domestic firms.

Finally, it is possible that under direct entry, sunk costs are higher than under acquisition (e.g. cost of hiring new qualified employees). In this case, the  $FF$  locus will shift outwards towards the northeast. This will obviously make direct entry relatively less attractive and therefore will reduce the likelihood of observing restrictions on direct entry (i.e. region IV becomes smaller).

### 3.1. Equity restrictions on foreign ownership

Thus far we have allowed full foreign ownership and noted that local welfare considerations might motivate FDI restrictions on acquisition and/or direct entry by foreign firms. However, FDI restrictions frequently limit the degree of foreign ownership. In this section, we analyze such restrictions and show that they can be used to induce a foreign firm to adopt the socially preferred mode of entry.

An equity restriction on the degree of foreign ownership can be implemented in one of two ways. First, it might be applied *symmetrically* in that policy restricts the degree of foreign ownership of both an acquired firm as well as that of a newly established subsidiary of the foreign firm. Alternatively, it might be *asymmetric* in nature wherein policy restricts the degree of foreign ownership of an acquired firm but not that of a newly established foreign subsidiary. There are numerous examples of symmetric restrictions: e.g. in life insurance services, India limits foreign ownership in existing and new firms to 26% and China to 50%; in basic telecommunications, both countries have imposed limits of 49%. Asymmetric restrictions are less frequently observed, but there are some prominent examples: in Japan and Korea, foreign ownership of incumbent telecommunications companies was limited (to 20% in NTT and KDD in Japan, and 20% in Korea Telecom) but there were either no or much weaker restrictions on foreign equity in new firms. The quite common presence of public monopolies in the service sector, which make acquisition by foreign firms a complex political decision, also tends to lead to a de facto discrimination between foreign equity participation in existing domestic firms (public firms) and new firms in the sector (when these are allowed). In what follows, we show that both symmetric and asymmetric equity restrictions may be used to induce foreign firms to adopt a different mode of entry into the host country.

First consider an asymmetric equity restriction that limits the degree of foreign ownership of an existing domestic firm to  $\theta \leq 1$  but not that of a newly established subsidiary. How does such a restriction affect the foreign firm's choice between the two modes of entry? We first show that, under an acquisition *the foreign firm chooses the maximum permitted degree of ownership* (i.e.  $\theta^* = \bar{\theta}$ ). Let the pair  $(\theta, v)$  denote an arbitrary offer by the foreign firm to a target domestic firm under the restriction  $\bar{\theta}$  where  $v$  denotes the transaction price offered in return for the equity share  $\theta$ . Since there is one foreign firm and several domestic firms, we assume that a domestic firm is willing to accept any offer that leaves it with a net payoff equal to that which it makes if some other domestic firm is acquired.<sup>15</sup> Thus, any offer  $(\theta, v)$  that satisfies the following constraint is acceptable to any domestic firm:

$$(1 - \theta)\pi_f^A(x^A(\theta)) + v \geq \pi_h^A(x^A) \quad (8)$$

where  $\pi_h^A(x^A)$  denotes the profits of a non-acquired domestic firm under acquisition and  $x^A(\theta) \equiv \arg \max \theta \pi_f^A(x) - C(x)$  denotes technology transfer when the foreign firm's equity share equals  $\theta$  (the expression for  $x^A(\theta)$  is reported in Appendix A.5). Since the foreign firm has all the bargaining power, the above constraint binds in equilibrium so that  $v = \pi_h^A(x^A) - (1 - \theta)\pi_f^A(x(\theta))$ . As a result, the problem facing the foreign firm becomes:

$$\max_{\theta} \pi_f^A(x^A(\theta)) - C(x^A(\theta)) - \pi_h^A(x^A(\theta)) \text{ subject to } \theta \leq \bar{\theta}$$

<sup>15</sup> A second reasonable candidate for the acquisition price is  $\pi_h^E(x^E)$ : the profits of a typical domestic firm under direct entry. The advantage of using  $\pi_h^A(x^A)$  is that a domestic firm that agrees to sell out to the foreign firm fares no worse than those that compete with the new enterprise. In any case, our qualitative results do not depend upon which acquisition price is used.

Differentiating the objective function above gives:

$$\left[ \frac{\partial \pi_f^A}{\partial x} - \frac{\partial C}{\partial x} - \frac{\partial \pi_h^A(x^A)}{\partial x} \right] \frac{dx^A(\theta)}{d\theta} \quad (9)$$

Since  $x^A$  is chosen by the foreign firm to maximize  $\theta \pi_f^A(x^A) - C(x^A)$ , the following first-order condition must hold:

$$\theta \frac{\partial \pi_f^A}{\partial x} = \frac{\partial C}{\partial x}$$

Using the above equation, the first-order condition in Eq. (9) can be rewritten as:

$$\left[ (1 - \theta) \frac{\partial \pi_f^A}{\partial x} - \frac{\partial \pi_h^A(x^A)}{\partial x} \right] \frac{dx^A(\theta)}{d\theta} > 0 \quad (10)$$

The above first-order condition with respect to  $\theta$  is always positive (note that  $\partial \pi_h^A(x^A)/\partial x < 0$ ), implying that the foreign firm chooses the maximum permitted degree of ownership, i.e.  $\theta^* = \bar{\theta}$ .

Eq. (10) shows that there are two reasons why the foreign firm opts for full acquisition. First, since  $x$  is chosen optimally at a later date by the foreign firm,  $\pi_f^A(\cdot)$  is strictly increasing in  $\theta$  and the foreign firm fully acquires the domestic firm to internalize the benefits of technology transfer. Second,  $\pi_h^A(x^A(\theta))$  is decreasing in  $\theta$ : the higher the degree of technology transfer the lower the profits of a non-acquired firm. As a result, through its choice of technology transfer, the foreign firm can make it less attractive for a domestic firm to be a competitor thereby lowering the price at which acquisition occurs.

How does an asymmetric restriction  $\theta$  affect the foreign firm's choice between acquisition and direct entry? First note that such a restriction has no first-order effect on the payoff of the foreign firm. The reason is as follows. Under an asymmetric equity restriction  $\theta$ , the transaction price  $v$  offered by the foreign firm under a (partial) acquisition equals  $v = \pi_h^A(x^A(\bar{\theta})) - (1 - \bar{\theta})\pi_f^A(x^A(\bar{\theta}))$ . At this acquisition price, the foreign firm's payoff equals  $\pi_f^A(x^A(\bar{\theta})) - C(x^A(\bar{\theta}))$  whereas under no equity restrictions it equals  $\pi_f^A(x^A) - C(x^A)$ . In other words, since the foreign firm can lower the transaction price offered to the local firm to offset the payoff the latter receives via the equity restriction (which is  $(1 - \bar{\theta})\pi_f^A(x^A(\bar{\theta}))$ ), the equity restriction affects the foreign firm's profits only because  $x^A(\theta)$  increases in  $\theta$  (so that  $x^A(\bar{\theta}) < x^A$  and  $\pi_f^A(x^A(\bar{\theta})) - C(x^A(\bar{\theta})) < \pi_f^A(x^A) - C(x^A)$ ).<sup>16</sup> Thus, an asymmetric equity restriction makes acquisition less attractive to the foreign firm because it hampers its incentives for technology transfer. As a result, relative to the case of no restrictions, an asymmetric equity restriction makes direct entry relatively more attractive to the foreign firm and a sufficiently stringent equity restriction (i.e.  $\bar{\theta}$  small enough) can induce direct entry by the foreign firm. On the other hand, if the restriction is relatively lax, i.e.  $\bar{\theta}$  is

<sup>16</sup> It is straightforward to show that the extent of technology transfer  $x^A(\theta)$  increases with  $\theta$ ; see Appendix A.5.

close to 1, the foreign firm still prefers (partial) acquisition to direct entry and the only effect of the restriction is that it results in less technology transfer to the local economy.

Now consider a symmetric equity restriction  $\bar{\theta} \leq 1$  that applies to both entry modes. When facing a symmetric equity restriction, under direct entry the foreign firm forms a new enterprise and collects  $\theta$  of its total profit (with the rest accruing to the domestic economy). There are two points worth noting about a symmetric equity restriction. First, such an equity restriction makes direct entry less attractive to the foreign firm even though it applies to both modes of entry. The reason is that the foreign firm suffers a first-order loss in profits only under direct entry where it essentially pays a fee of  $(1 - \bar{\theta})\pi_f^E(x^E(\bar{\theta}))$  to enter the market. As noted above, under a (partial) acquisition, the foreign firm can ensure itself a payoff of  $\pi_f^A(x^A(\bar{\theta})) - C(x^A(\bar{\theta}))$  by manipulating the transaction price  $v$ . Second, despite the fact that the equity restriction applies across both modes, the level of technology transfer differs across modes because market structure depends upon the mode of entry (see Appendix A.5). However, the first-order effect of a symmetric restriction makes direct entry less attractive to the foreign firm. The following proposition summarizes the results of this section.

**Proposition 3.** *While an asymmetric equity restriction makes acquisition less attractive to the foreign firm, a symmetric equity restriction makes direct entry less attractive.*

Thus, in terms of Fig. 1, the introduction of an asymmetric equity restriction shifts the foreign firm's  $FF$  contour outwards, whereas a symmetric equity restriction shifts it inwards.

One final point is worth noting: equity restrictions are not the only means of inducing the foreign firm to adopt a different mode of entry. Fiscal and financial incentives (such as the frequently witnessed tax breaks and subsidies to FDI) can also be used to induce direct entry. Of course, such concessions impose budgetary costs on the government that equity restrictions do not.

#### 4. Conclusion and discussion

This paper has explored a foreign firm's choice between acquisition and direct entry when the degree of technology transfer is endogenously determined. Our analysis indicates that a foreign firm can find acquisition of an existing domestic firm profitable under oligopoly when it is accompanied by technology transfer and that conflict between the foreign firm's objective and the preferences of a welfare maximizing government can serve a basis for policy intervention in such markets. Existing literature has noted that national security concerns the appropriation of domestic rents by foreigners, and purely nationalistic views over domestic ownership as potential explanations behind the existence of FDI restrictions (see, for example, Neven and Siotis, 1996). This paper shows that a purely welfare-maximizing government might use FDI restrictions in order to influence the foreign firm's choice between different modes of entry.

The costs of technology transfer play a major role in our analysis. While the modeling of factors that determine the magnitude of such costs is beyond the scope of

this paper, it is useful to reflect on our results in light of existing empirical evidence. For example, several micro-level studies have shown that costs of technology transfer for FDI projects stem from knowledge gaps between the parties involved.<sup>17</sup> At the aggregate level, technology differentials between countries can be proxied by national differences in stocks of R&D expenditures (see, for example, [Coe and Helpman, 1995](#)). Following this interpretation, a prominent stylized fact regarding the global patterns of FDI fits well with our results. For example, during 1994–1999, on average about 93% of the total FDI inflows to OECD countries took the form of mergers and acquisitions. Given that OECD countries are unlikely to be far behind the technology frontier even in industries in which they host FDI, costs of technology transfer involved in FDI into such countries are likely to be low, making mergers and acquisitions more attractive relative to direct entry. In contrast, costs of technology transfer to developing countries are likely to be high, making direct entry the preferred mode for firms, whereas social welfare is likely to be higher with acquisition. It is therefore not surprising that where policy restrictions still exist in developing countries, they typically take the form of restrictions on new entry (e.g. in financial services in countries ranging from Brazil to Malaysia) and symmetric equity restrictions, which make direct entry less attractive (Proposition 3).

Several other stylized facts deserve mention. First, the rapid increase in the relative importance of worldwide acquisitions in the late 1990s has coincided with the development of new information and communication technologies. Such technological change should, in principle, have lowered the cost for cross-border technology transfer. Furthermore, while the share of foreign acquisitions in total FDI flows was constant between 1988 and 1993, it doubled by the year 1999 (see [OECD, 2001, p. 47](#)). Thus, firm preferences over modes of entry into foreign markets seem to have shifted towards acquisition with a decline in the cost of cross-border technology transfer. Second, a recent [OECD \(2001\)](#) study finds that foreign acquisitions are more likely to occur in host countries with low levels of competition. This fact is also consistent with our theoretical results.

The policy implications of our analysis should, nevertheless, be treated with caution. We have developed our results in a simple model under some special assumptions. For example, our analysis does not extend to a monopolistic competitive setting, where rents are dissipated by domestic or foreign entry into the host country. In such a setup, the case for policy intervention vanishes as, in the long-run equilibrium, the foreign firm and the government would be indifferent between the two modes of entry.<sup>18</sup> One may be tempted to further note that indeed FDI restrictions are more common in services (telecommunications, utilities, banking, etc.) than in manufacturing, where barriers to entry are generally lower, and for which most countries offer incentives to FDI, rather than try to restrict it.

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<sup>17</sup> For example, [Teece \(1977\)](#) and [Ramachandran \(1993\)](#) have shown that variables such as the age of the technology, the number of previous applications of the technology and the experience of the transferee all affect the costs of technology transfer in an expected manner.

<sup>18</sup> As a referee noted, this implies that FDI restrictions should be more commonly observed in markets where there are high barriers to entry.

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## Appendix A

Here, we provide all analytical derivations that underlie the results contained in the body of the paper.

### A.1. Cournot competition

We directly report the output levels of all firms:

$$q^A = \frac{a + (n-1)x - c}{n} \quad \text{and} \quad q_h^A = \frac{a - c - x}{n} \quad \text{for } h = 1 \dots n-2.$$

Similarly, in case of direct entry, we have

$$q_f^E = \frac{a + nx - c}{n+1} \quad \text{and} \quad q_h^E = \frac{a - c - x}{n+1} \quad \text{for } h = 1 \dots n-1.$$

### A.2. The strategic incentive for technology transfer

The strategic incentive for technology transfer is given by

$$S(n, \tau) \equiv - (n-1) q_f^E \frac{dq_h^E}{dx}$$

It is easy to show that  $S(n, \tau)$  decreases with  $\tau$ :

$$\frac{dS(n, \tau)}{d\tau} = \frac{-2(n-1)(a-c)n^2}{(-2n^2 + \tau n^2 + 2\tau n + \tau)^2} < 0$$

Furthermore,

$$\frac{dS(n, \tau)}{dn} = \frac{-(a-c)(-2n^2 + \tau n^2 - 2\tau n - 3\tau + 4n)\tau}{(-2n^2 + \tau n^2 + 2\tau n + \tau)^2}$$

which implies that

$$n^c(\tau) = \frac{\tau - 2 + \sqrt{2}\sqrt{(\tau-2)(2\tau-1)}}{\tau-2}$$

A.3. Mode of entry

Profit levels gross of costs of technology transfer and the buy-out price under acquisition are

$$\pi_f^A = \frac{(a - c)^2}{2n(2 - n) + \tau n^2} \quad \text{and} \quad \pi_h^A = \left[ \frac{(a - c)(\tau n + 2 - 2n)}{2n(2 - n) + \tau n^2} \right]^2. \quad (11)$$

Under direct entry, we have:

$$\pi_f^E = \frac{(a - c)^2 \tau}{2n(\tau - n) + \tau(n^2 + 1)} \quad \text{and} \quad \pi_h^E = \left[ \frac{(a - c)(n\tau - 2n + \tau)}{2n(\tau - n) + \tau(n^2 + 1)} \right]^2 \quad (12)$$

A.4. Proof of Proposition 2

We have

$$P^A - P^E = \frac{(a - c) \left[ n^2(\tau - 2)^2 + n(\tau^2 - 4) + 4\tau \right]}{((\tau - 2)n^2 + \tau(2n + 1))((\tau - 2)n^2 + 2(2n - 1))} \quad (13)$$

Since  $\tau > 2$ , the above expression is positive. Domestic firms prefer acquisition to direct entry iff  $\pi_h^A > \pi_h^E$ . Using Eqs. (11) and (12), we have:

$$\begin{aligned} \pi_h^A - \pi_h^E &= (a - c)^2 n(n\tau + \tau + 2 - 2n)(2n\tau + \tau - 4n + 2) \\ &\quad \times (4n^2 - 4n^2\tau + n^2\tau^2 + n\tau^2 - 4n + 4\tau) / (n^2\tau - 2n^2 + 2n\tau + \tau)^2 \\ &\quad \times (4n - 2n^2 - 2 + n^2\tau)^2 \end{aligned} \quad (14)$$

Again, since  $\tau > 2$ , the above expression is also positive.

A.5. Symmetric equity restriction

It is easy to solve for the level of technology transfer under the two entry modes:

$$x^A(\theta) = \frac{2\theta(n - 1)(a - c)}{(4n - 2) + (\tau - 2\theta)n^2} \quad \text{and} \quad x^E(\theta) = \frac{2\theta n(a - c)}{\tau(2n + 1) + (\tau - 2\theta)n^2}. \quad (15)$$

It follows from above that

$$x^A(\theta) - x^E(\theta) = \frac{2\theta(a - c)[(\tau - 2\theta) + 2\theta n - \tau n - \tau]}{[(\tau - 2\theta)n^2 + 2\theta(2n - 1)](\tau - 2\theta)n^2 + 2\tau(n + 1)}$$

which implies that under a symmetric equity restriction, direct entry results in more technology transfer than acquisition iff

$$\tau < \frac{2\theta n(n-1)}{(n^2 - n - 1)}$$

Note that technology transfer under both modes is increasing in the foreign firm's equity share:

$$\frac{dx^A(\theta)}{d\theta} = \frac{\tau n^2 [x^A(\theta)]^2}{2(a-c)(n-1)\theta^2} > 0$$

and

$$\frac{dx^E(\theta)}{d\theta} = \frac{\tau(n+1)^2 [x^E(\theta)]^2}{2(a-c)n\theta^2} > 0.$$

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