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Foreign Market Entry: a Theoretical Analysis[1]

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Abstract: This paper considers investment strategies of a foreign firm in a host country. The foreign firm apprehends that knowledge spillover will encourage entry in the host country. We show that foreign firm delays its investment for sufficiently lower threat of entry. If threat of entry is sufficiently strong, it invests at the beginning with its superior technology. For intermediate threat of entry, we find that foreign firm brings its relatively inferior technology initially and superior technology in future when threat of entry has been eliminated. If inferior technology of foreign firm too creates threat of entry, it reduces effectiveness of introducing technologies sequentially. Further, we show that there may be a conflict between foreign firm's optimal decision and welfare of the host country.

Keywords: Foreign investment, Knowledge spillover, Technology choice, Welfare

JEL Classifications: F21, F23

1. Introduction

Many developing countries view foreign direct investment as a vehicle of technology transfer. This encourages them to liberalize their economies and allowe multinational firms to open their subsidiaries in these countries in order to attract foreign investments. However, it is found empirically that foreign firms are very prudent about knowledge spillover, which creates threat of entry in the host-country (see, e.g., Mansfield, 1994).

Also, a concern to the developing countries is that foreign firms are not interested in bringing their latest technologies to the host-countries (see United Nations, 1992). In fact, empirical studies show that foreign firms prefer to bring their inferior technologies to the host-countries (Mansfield and Romeo, 1980).

This paper shows that if foreign firms apprehend knowledge spillover in the host-country, they strategically choose their timing of foreign investment and technologies to be used in the host-country. We show that foreign firms may prefer to delay investment[4] in the host-country to eliminate threat of entry due to knowledge spillover. If foreign firms have multiple technologies to produce their products, they might prefer to bring their inferior technologies to the host-country in earlier periods.

More specifically, we find that foreign firm delays its investment for sufficiently lower threat of entry. But, foreign firm invests initially with its superior technology for sufficiently strong threat of entry. For intermediate threat of entry, foreign firm brings its relatively inferior technology initially and its superior technology in the future when threat of entry has been eliminated. Effectiveness of introducing technologies sequentially reduces if inferior technology of foreign firm too creates threat of entry.

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[4] Capel (1992) and de Hek and Mukherjee (2003) also show possibility of delayed foreign investment when profits are uncertain.

We further show that if availability of multiple foreign technologies increases the welfare of the host country becomes ambiguous. If foreign firm has one technology only and delays (does not delay) investment, multiple foreign technologies increase (reduce) welfare of the host country.

Our results provide a rationale for different countries experiencing different amounts of foreign investments. For example, while in 1990 – 91 the number of foreign direct investment (FDI) from Japan to China was 165, FDI from Japan to India was only 7 for that period. In 1992 – 93 this number increased to 490 for China, while for India it increased to only 15 (Chawla, 1995). Also, the amount of foreign investment indicates significantly different trend for different industries.

The present paper is quite closely related to Horstmann and Markusen (1987). In their paper, Horstmann and Markusen (1987) argued that a foreign firm might prefer to invest in a host-country quickly if foreign investment pre-empts entry of domestic firm. In contrast to that, we show that foreign firm may prefer to delay its investment to eliminate threat of domestic-entry. Delayed investment by foreign firm reduces profit of the domestic firm and pre-empts domestic-entry when the discounted total profit of the domestic firm does not cover its cost of entry. Further, the possibility of multiple foreign technologies might induce foreign firm to introduce technologies sequentially in the host-country. So, contrary to Horstmann and Markusen (1987), we show that future benefits from foreign investment might dominate initial benefits.

Earlier, Buckley and Casson (1981) have argued how market size of the host-country can influence timing of foreign investment. In this paper we have included a new element, viz., knowledge spillover, which affects either timing of foreign investment or choice of technology to be used in the host-country.

The present paper also complements that of Wang and Blomstrom (1992) and Lin and Saggi (1999), where issue of foreign investment was addressed in presence of knowledge spillover in the host-country. While the former paper considered the strategy of a monopolist investor, the latter one focused on the strategies of two competing foreign firms. Unlike these two papers, the present paper focuses on competition between a foreign firm and a domestic firm. Further, we consider a product with finite lifetime. Finite lifetime of the product helps the foreign firm to adjust timing of investment and quality of technology so that it can eliminate threat of entry. Further, with a single foreign investor, the present paper does not consider any external benefits like Lin and Saggi (1999).

The remainder of the paper is organized as follows. Section 2 provides the basic model of foreign direct investment where foreign firm has single technology of production. Section 3 examines the role of multiple technologies in foreign direct investment. Section 4 discusses welfare implications. Section 5 summerizes the obtained results.

2. The basic model

Consider a country, called domestic or host country, that had protectionist policies so far and was restricting foreign investments in the country. The host country now opened up its economy to foreign investors and allowed foreign direct investment.

Assume that there is a foreign firm, called firm 1, who has know-how to produce a product and wants to invest in the host country. To focus on foreign investment strategy, we assume that due to the existence of tariff and/or the transportation cost, export is not a feasible option to firm 1. Assume that foreign firm needs to incur a cost, F_1, to make its technology, called x_1, usable in the host-country.[1] It may be because foreign technology needs some modifications before applying it to the host-country.

We assume that the product of firm 1 has a finite life from 0 to N. This assumption of finite lifetime implicitly assumes that firm 1 expects new products to come in the market after N, which will make the present product obsolete. While the assumption of finite lifetime simplifies

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[1] See, e.g., Teece (1976) and Kumar (1994) for discussions on costs of technology adoption by foreign firms.

our analysis, our results hold also for the products with infinite lifetime but with declining demand over time, as considered in Ghemawat and Nalebuff (1985).

Firm 1, however, apprehends that technological know-how will be diffused after time t_i since its investment in the host-country[1] and will encourage entry of a domestic firm, called firm 2. We further assume that the domestic firm also needs to incur cost I_2 as development cost (see, e.g., Mansfield et al., 1981 and Wang and Blomstrom, 1992).

Assume that if only one firm produces in the market, it yields a flow of profit M. If both firms produce the good with technology x_1, each of them gets a flow of profit $D < M$. The common discount rate is assumed to be r.

Therefore, if firm 1 invests at time 0, its discounted lifetime payoff is

$$\frac{M(1-e^{-rt_i})}{r} + \frac{D(e^{-rt_i} - e^{-rN})}{r} - F_1 . \tag{1}$$

Define t_e as the time period so that entry cost of firm 2 is equal to its discounted lifetime payoff starting from t_e. Therefore, at t_e

$$I_2 = \frac{D(1-e^{-r(N-t)})}{r} . \tag{2}$$

From (2), it is easy to find out that for $t = 0$, left hand side (LHS) of (2) < right hand side (RHS) of (2) (which is necessary for the profitable entry of firm 2), but for $t = N$, LHS of (2) > RHS of (2). This ensures the existence of t_e. Therefore, for $t_e < t_i$, firm 1 does not face any threat of entry from firm 2. We assume away this case and in the following analysis consider that $t_e > t_i$. It makes threat of entry of firm 2 credible.

Realizing threat of entry, firm 1, however, may choose its own way of investment timing so that it can eliminate threat of entry. It is clear from (2) that if firm 1 invests on or after time t_p, where $t_p = t_e - t_i$, there will be no entry. This possibility creates a value from waiting and may induce firm 1 to postpone its investment until t_p.[2]

The following proposition shows optimal entry strategy of firm 1.

Proposition 1: Assume that firm 1 apprehends credible threat of entry. If t_p is sufficiently (low) high, it is better for firm 1 to (delay investment) invest immediately.

Proof: If firm 1 invests in the host country at time t_p, its discounted lifetime payoff is

$$\frac{M(e^{-rt_p} - e^{-rN})}{r} - e^{-rt_p} F_1 . \tag{3}$$

However, investing in the host-country at time t_p is profitable to firm 1 provided its future benefits are greater than initial losses, i.e.,

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[1] One can think that t_i shows time necessary for the domestic firm to adopt foreign technology economically.

[2] It is easy to check that if foreign firm does not enter immediately, it will enter at time t_p.

$$e^{-rt_i}\frac{(M-D)(1-e^{-r(N-t_i)})}{r}+F_1(1-e^{-rt_p})>\frac{M(1-e^{-rt_p})}{r}. \tag{4}$$

It is easy to check that LHS of (4) is greater than RHS of (4) at $t_p = 0$ but LHS of (4) is less than RHS of (4) if t_p is sufficiently large, say $t_p = N$.[1] Since, LHS and RHS of (4) are continuous in t_p, it implies that condition (4) holds (does not hold) for sufficiently low (high) t_p, which proves the result. Q.E.D.

LHS of (4) shows the premium that firm 1 earns in future periods if it invests at time t_p. RHS of (4) shows cost of postponing investment up to time t_p. Therefore, value from waiting exists provided condition (4) holds.

If t_p is sufficiently low, firm 1 needs to wait for sufficiently short time periods to eliminate threat of entry. The above proposition shows that, in this situation, it is optimal for firm 1 to delay its investment. In other words, if firm 1 faces credible threat of entry which is not strong enough, it is better for firm 1 to delay its investment since it can get rid of this threat of entry by waiting for short time period. But, in case of stronger threat of entry, firm 1 needs to wait for long time periods to eliminate threat of entry and hence, waiting does not pay firm 1. Therefore, under strong threat of entry, it is better for firm 1 to invest immediately and to accommodate firm 2 later.

3. Multiple technologies

So far, we have assumed that firm 1 has single technology to produce its product. Now, we relax this assumption and assume that firm 1 has multiple technologies.[2] For simplicity, we assume that firm 1 has another technology, called x_1' along with the technology x_1, which was considered in section 2, and that x_1' is inferior to x_1. Assume that x_1' yields $M' < M$, if only one firm produces the product with x_1' and yields $D' < D$, if both firms use x_1'. Consider that firm 1 incurs cost F_1' to use technology x_1' in the host-country and that $F_1' < F_1$. For simplicity, we further assume that the technologies of firm 1 are drastic in nature, i.e., the optimal output of a firm is zero if it produces with inferior technology and its competitor produces with superior technology.[3]

We also assume that knowledge spillover of x_1' technology is instantaneous. The introduction of a lag in knowledge spillover for x_1' does not change our basic conclusions. We further assume that firm 2 incurs costs I_2 and I_2' to adopt the technologies x_1 and x_1' respectively with $I_2 > I_2'$.

In our analysis below, we assume that the following condition holds:

$$\frac{(M-M')\left(1-e^{-r(N-t_p)}\right)}{r}>F_1. \tag{5}$$

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[1] It is possible to have $t_p = N$, if $t_i = 0$ and I_2 is such that $t_e = N$.

[2] Different technologies may also be interpreted as different models of the product.

[3] Our qualitative results will hold even if foreign technologies are non-drastic.

Assumption (5) shows that it is better for firm 1 to produce with its superior technology x_1 at t_p when it produces with $x_1^{'}$ initially.[1]

Since $x_1^{'}$ yields less profit to a firm, then, given the development cost and the time of knowledge spillover, it decreases threat of entry. If $x_1^{'}$ is less complicated, firm 2 may adopt it more easily and incur lower cost to adopt it. This possibility increases threat of entry. As a result, technology $x_1^{'}$ creates either higher or lower threat of entry.

3.1. No entry with the inferior technology

In this subsection we assume that if firm 1 produces with $x_1^{'}$ technology from the beginning, it is not optimal for firm 2 to enter in the market with this technology. Therefore, if both firms produce with $x_1^{'}$, the lifetime payoff of firm 2 does not cover the cost of adoption, i.e.,

$$I_2{}' > \frac{D'(1-e^{-rN})}{r} \,. \tag{6}$$

Condition (6) guarantees that firm 1 does not face any threat of entry from firm 2 if it uses $x_1^{'}$ technology in the host-country whereas the assumption of $t_e > t_i$ ensures that firm 1 faces threat of entry if it uses x_1 before time t_p.[2]

Proposition 2: Suppose condition (5) holds.

(*a*) *Firm 1 has incentive to introduce its inferior technology only if* $\dfrac{M'(1-e^{-rt_p})}{r} > F_1^{'}$.

(b) Suppose condition (4) holds. Given $F_1^{'} > 0$, *if* t_p *is very small, firm 1 does not bring its inferior technology but invests at* t_p *with its superior technology.*

(c) Suppose condition (4) does not hold.

(i) If t_p *is not sufficiently large, firm 1 will invest at the beginning with its superior technology.*

(ii) If t_p *is sufficiently large, firm 1 may invest with its inferior technology at the beginning and introduce its superior technology at* t_p.

Proof:

(a) Given condition (5), it is always optimal for firm 1 to introduce its superior technology x_1 at time t_p. If only firm 1 produces the product, it has the incentive to introduce its inferior

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[1] If foreign firm uses superior technology before t_p then it encourages competition from the domestic firm and, hence, it eliminates the benefits from waiting. Therefore, if foreign firm decides to wait to introduce x_1 then it is optimal to wait until t_p.

[2] With a lag in knowledge spillover, condition (6) becomes $I_2{}' > \frac{D'(1-e^{-r(N-t_k)})}{r}$, where t_k shows the lag.

technology $x_1^{'}$ only if its discounted payoff from $x_1^{'}$ over $[0, t_p]$ is greater than its cost of adopting $x_1^{'}$, i.e., $\frac{M'(1-e^{-rt_p})}{r} > F_1^{'}$.

(b) Assume that condition (4) holds, which is possible for small values of t_p, as shown in Proposition 1. So, firm 1 has incentive for immediate investment with its inferior technology $x_1^{'}$ if and only if

$$\frac{M'(1-e^{-rt_p})}{r} > F_1^{'}. \tag{7}$$

Given $F_1^{'} > 0$, if t_p is sufficiently small, condition (7) does not hold. Hence, in this situation, firm 1 does not bring its inferior technology and invest directly at t_p with its superior technology.

(c) If condition (4) does not hold, we have

$$e^{-rt_i}(M-D)(1-e^{-r(N-t_i)}) + rF_1(1-e^{-rt_p}) < M(1-e^{-rt_p}). \tag{8}$$

It implies that if firm 1 has only x_1 technology, it will invest in the host-country initially and its discounted lifetime payoff will be

$$\frac{M(1-e^{-rt_i})}{r} + e^{-rt_i}\frac{D(1-e^{-r(N-t_i)})}{r} - F_1. \tag{9}$$

Since firm 1 has also $x_1^{'}$ technology, it can use $x_1^{'}$ at the beginning (since it does not create threat of entry) and introduce its x_1 technology at time t_p.

(i) Firm 1 will introduce its inferior technology only if condition (7) holds. Given $F_1^{'} > 0$, (7) does not hold if t_p is not sufficiently large. So, if t_p is not sufficiently large, firm 1 invests in the host country from the beginning with its superior technology.

(ii) If (7) holds, i.e., t_p is sufficiently large, firm 1 may have incentive to bring its inferior technology at the beginning and its superior technology at time t_p. Discounted payoff of firm 1 under this strategy is

$$\frac{M'(1-e^{-rt_p})}{r} + \frac{M(e^{-rt_p} - e^{-rN})}{r} - (F_1^{'} + e^{-rt_p}F_1). \tag{10}$$

From (9) and (10) we find that firm 1 prefers to bring in the technologies sequentially rather than producing with x_1 technology from the beginning provided

$$M'(1-e^{-rt_p}) + e^{-rt_i}(M-D)(1-e^{-r(N-t_i)}) + rF_1(1-e^{-rt_p}) - rF_1^{'} > M(1-e^{-rt_p}). \tag{11}$$

If condition (7) holds, it is possible that conditions (8) and (11) also hold simultaneously. In that case, firm 1 invests at the beginning with its inferior technology and introduces its superior technology at t_p. Q.E.D.

The reason for the above proposition is as follows. Condition (5) implies that firm 1 will certainly switch to superior technology at t_p even if it introduces inferior technology at the beginning. Since, inferior technology does not create threat of entry, firm 1 has incentive to introduce the inferior technology only if its discounted monopoly payoff over $[0, t_p]$ is greater than the cost of adopting the inferior technology, i.e., $\frac{M'(1-e^{-rt_p})}{r} > F_1^{'}$.

If entry of firm 2 is sufficiently costly, it creates little threat of entry. This implies that firm 1 needs to wait for short periods if it wants to delay its investment, i.e., t_p is very small. Due to this small waiting period, introduction of inferior technology may not be beneficial to firm 1 (i.e., condition (7) does not hold). These things together induce firm 1 to delay investment when threat of entry is sufficiently low.

If threat of entry is sufficiently stronger firm 1 needs to wait for longer periods to deter entry. However, if waiting period is not long enough, i.e., t_p is not very large, it is not profitable for firm 1 to introduce its inferior technology, i.e., (7) does not hold. So, here neither waiting period up to t_p nor introduction of inferior technology is beneficial to firm 1 and encourages it to invest immediately with superior technology.

If t_p is very large, then sufficiently longer waiting period makes introduction of inferior technology profitable. Therefore, if threat of entry is sufficiently strong, it is more likely that firm 1 invests with its inferior technology initially and brings its superior technology at time t_p.[1]

The above proposition explains the phenomenon that often foreign firms do not prefer to bring their superior technologies at the time of entering a host country. Foreign firm may prefer to bring its technologies sequentially to the host country even if it can introduce the superior technology initially. These findings imply that opening up of an economy does not necessarily mean immediate inflow of foreign investments. It depends on other things like the possibility of entry of domestic firms and availability of various technologies to foreign firms. Our results suggest that liberalized economies may experience lower amount of foreign direct investments or foreign direct investments with relatively inferior technologies in earlier periods.

Patent protection of a country and/or complexity of technologies may have negative relationship with knowledge spillover. Above findings show that if patent protection of a country is sufficiently strong but not perfect and/or technologies are very complex to create sufficiently low knowledge spillover, foreign firms may delay investment in that country. On the other hand, with weak patent protection and/or with relatively simpler technologies, foreign firms may prefer to invest at the beginning but with relatively inferior technologies.

Before, concluding this subsection, we want to briefly examine the implication of condition (5). If condition (5) does not hold, it implies that firm 1 does not introduce its superior technology at time t_p when it has already introduced its inferior technology. In other words, this implies that if firm 1 introduces the inferior technology, it produces with this technology in all future periods.

The next proposition shows that if condition (5) does not hold, it may be optimal for firm 1 to always use its inferior technology.

Proposition 3: *Suppose condition (5) is not satisfied but condition (4) holds. It may be optimal for firm 1 to use its inferior technology always.*

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[1] If monopoly profit from the inferior technology is higher than duopoly profit of a firm producing with the superior technology then this outcome is more likely when condition (7) holds. Otherwise, foreign firm brings its superior technology initially.

Proof: If condition (5) does not hold but condition (4) holds, firm 1 has two options: (i) to use its superior technology from t_p or, (ii) to use its inferior technology from the beginning. Firm 1 will prefer to use its inferior technology provided

$$\frac{M'(1-e^{-rt_p})}{r} - (F_1' - e^{-rt_p} F_1) > \frac{(M-M')(e^{-rt_p} - e^{-rN})}{r}. \tag{12}$$

It is easy to check that both conditions (4) and (12) may hold simultaneously, which proves the result. Q.E.D.

Condition (12) interprets that lower monopoly profits in all periods may be greater than higher monopoly profits over the time period $[t_p, N]$. Therefore, to safeguard it from domestic competition, firm 1 may never bring its state-of-the-art technology to the host country. Even if conditions (4) and (5) do not hold, it can be shown that, given the values of D, M and M', firm 1 may find it optimal to use its inferior technology in all periods.

3.2. Entry with the inferior technology

This subsection briefly discusses the situation where firm 1's inferior technology also creates threat of entry, i.e.,

$$I_2' < \frac{D'(1-e^{-rN})}{r}, \tag{13}$$

and shows that this possibility reduces incentive for sequential introduction of the technologies. Condition (13) says that if firm 1 brings its inferior technology at the beginning and produces with this technology throughout the lifetime, it creates a credible threat of entry.

Like the above analysis, we assume that knowledge spillover about firm 1's inferior technology is instantaneous and condition (5) holds.

Proposition 4: *Suppose the technologies of firm 1 are drastic and condition (5) holds.*

(a) Assume that condition (4) holds.

(i) If $I_2' > \frac{D'(1-e^{-rt_p})}{r}$, result of Proposition 2(b) holds.

(ii) If $I_2' < \frac{D'(1-e^{-rt_p})}{r}$, incentive for introducing inferior technology initially reduces.

(b) Assume that condition (4) does not hold.

(i) If $I_2' > \frac{D'(1-e^{-rt_p})}{r}$, results of Proposition 2(c) hold.

(ii) If $I_2' < \frac{D'(1-e^{-rt_p})}{r}$, incentive for introducing inferior technology reduces compared to the situation when there is no threat of entry with inferior technology.

Proof:

(a) Suppose, condition (4) holds, i.e., without inferior technology, firm 1 introduces its superior technology at time t_p.

(i) Now, assume that firm 1 introduces its inferior technology initially and the superior technology at time t_p. Introduction of inferior technology initially does not encourage entry of firm 2 if the following condition holds:

$$I_2^{'} > \frac{D'(1-e^{-rt_p})}{r}. \tag{14}$$

Therefore, if condition (14) holds, there is no credible threat of entry from firm 2 and result of Proposition 2(b) holds.

(ii) But, if (14) does not hold, introduction of inferior technology initially creates credible threat of entry from firm 2. In this situation, firm 1 always introduces the inferior technology before t_p when

$$\frac{D'(1-e^{-rt_p})}{r} > F_1^{'}, \tag{15}$$

which is stronger requirement than (7).

Even if condition (15) holds, firm 1 may not prefer to introduce inferior technology initially. Following the logic of Proposition 1 we may say that firm 1 may introduce $x_1^{'}$ at a time between 0 and t_p if delayed introduction of the inferior technology increases firm 1's profit over $[0,t_p]$. This proves that the incentive for introducing inferior technology initially reduces.

(b) Assume that condition (4) does not hold.

(i) If (14) holds then effectively inferior technology creates no threat of entry and the result of the Proposition 2(c) holds.

(ii) If condition (14) does not hold, firm 1 faces threat of entry over the interval $[0,t_p]$. However, if condition (15) holds, which is stronger requirement than (7), firm 1 may have incentive to introduce its inferior technology between $[0,t_p]$. If it introduces inferior technology at the beginning, it earns duopoly profits over $[0,t_p]$. On the other hand, if firm 1 introduces inferior technology between $[0,t_p]$, it gets zero payoffs in the initial periods but monopoly profits between the time of introduction and t_p, since it is delaying the introduction of inferior technology to eliminate threat of entry with it. However, whether firm 1 introduces the inferior technology at the beginning or between $[0,t_p]$, its discounted payoff over $[0,t_p]$ is less than its discounted monopoly payoffs from this technology over this period, which it receives when the inferior technology does not create threat of entry. This proves that possibility of entry with the inferior technology reduces incentive to introduce it. Q.E.D.

4. Welfare implications

It is easy to understand that when firm 1 has only x_1 technology and delays investment, it reduces welfare of the host country compared to the situation where firm 1 invests at the beginning. If firm 1 does not invest immediately, there are no productions in the early periods and it will become a monopolist over the period t_p to N. If firm 1 invests immediately, there will be positive productions in all periods and after some periods (i.e., after time t_i) the market will be characterized by a duopoly. While delayed investment is better for firm 1, welfare of the host-country is higher if it invests immediately compared to the situation where it delays investment.

Now, we examine whether more foreign technologies are beneficial for the host country. For this purpose we will concentrate only on the situation where inferior technology does not create threat of entry. However, the qualitative result will be similar even if we consider the situation where inferior technology creates threat of entry. To avoid repetition, we will not analyze the situation where inferior technology creates threat of entry.

Let us first consider the situation where condition (4) is satisfied. If condition (7) holds, it is optimal for firm 1 to use $x_1^{'}$ technology initially and x_1 technology from t_p. On the other hand, if firm 1 has only x_1 technology then it invests at time t_p since condition (4) holds. So, in this situation, there will be no production before t_p. Hence, it implies that welfare of the host country is higher when firm 1 has both technologies compared to the situation where firm 1 has only x_1 technology.

Next, consider the situation where condition (4) is not satisfied. If firm 1 has only x_1 technology, it uses this technology from the beginning. Therefore, there will be foreign monopoly up to t_i and duopoly afterwards. But, if firm 1 has both the technologies and conditions (7) and (11) hold, it uses the inferior technology $x_1^{\prime}$ initially and brings its superior technology x_1 at t_p. This strategy of firm 1 creates foreign monopoly in all periods. Up to t_p, it is foreign monopoly with the inferior technology $x_1^{\prime}$ but after that it is foreign monopoly with the superior technology x_1. Hence, industry output and consumer surplus are lower under sequential use of foreign technologies compared to the situation where firm 1 has only the superior technology x_1. So, welfare of the host country is lower with more foreign technologies if condition (4) does not hold.

The following proposition summarizes the discussion on welfare implications.

Proposition 5:

(a) Welfare of the host country is lower under delayed investment of firm 1 compared to no delay in investment.

(b) Whether presence of more foreign technologies increases welfare of the host country is ambiguous.

5. Conclusion

Researchers working on international economics have addressed various issues related to foreign direct investment. However, theoretical literature has paid little attention to the importance of the timing of foreign investment as well as the use of the quality of the technologies to be used in the host country. This paper focuses on these issues.

We show that if a foreign firm apprehends knowledge spillover in the host country, which may create threat of entry, then it may prefer to delay foreign investment. Delayed investment helps to eliminate threat of entry by making entry unattractive to the domestic firm. While under this strategy foreign firm sacrifices earlier profits, this strategy increases its profits in the future. If the latter effect dominates the former, it is optimal for foreign firm to delay its investment in the host country. However, delayed foreign investment reduces welfare of the host country compared to the situation where foreign firm invests at the beginning.

If foreign firm has multiple technologies, it may prefer to bring its inferior technology at the beginning and the superior technology in future. This strategy helps foreign firm to earn positive profits in earlier periods and also to eliminate threat of entry. Effectiveness of this strategy reduces when inferior technology of the foreign firm creates threat of entry too. We also show that there are situations where foreign firm prefers to use the inferior technology always and does not introduce the superior technology at all. The effect of more foreign technologies on welfare of the host country is ambiguous.

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