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FOREIGN MARKET ENTRY: PRODUCTION-RELATED STRATEGIES*

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This paper examines the profit to a firm of different production-related strategies for entering a foreign market. The entry strategies examined are foreign direct investment, exclusive licensing, multiple licensing, joint venture, and a combination of joint venture and licensing. It is shown that even though the entering firm is able to charge the optimal licensing fee, foreign direct investment generates the highest profit and is thus the dominant entry strategy in many contexts. This paper also suggests counter-strategies for responding to government restrictions on firms' entry.

(ENTRY STRATEGY; MULTINATIONAL ENTERPRISES; HOST GOVERNMENT)

1. Introduction

World markets provide opportunities for firms to exploit their comparative advantages through international horizontal integration strategies, by which they sell their existing products in foreign markets (Caves 1971; Teece 1985). Of crucial importance to a firm trying to establish itself internationally is its choice of strategy for entry into a foreign market. In addition, in pursuing this international expansion strategy, the firm must consider potential restrictions imposed by host governments. This paper will examine the impact of these restrictions on firms' profits and suggest ways in which firms can deal with them.

Due to the increasing importance of local production in foreign markets (United Nations Centre on Transnational Corporations 1983), we will focus on foreign production-related as opposed to home production-related strategies. The five foreign production-related entry strategies to be examined are:

(i) foreign direct investment, where an entering firm establishes a wholly-owned subsidiary;

(ii) exclusive licensing, where an entering firm licenses its know-how to a single local licensee;

(iii) multiple licensing, where an entering firm licenses its know-how to several local licensees;

(iv) a joint venture, where an entering firm shares the ownership of a local venture with a local partner and does not charge any fees for the use of the know-how;

(v) a combination of joint venture and licensing, where an entering firm forms a joint venture with a local partner and, at the same time, licenses its know-how to the local venture.

Among the five strategies listed above, multiple licensing and a hybrid strategy of combining a joint venture with licensing have received the least attention from researchers. In fact, much of the literature on the selection of entry strategies has concentrated on comparing three strategies: export, licensing, and foreign direct investment (Hirsch 1976; Mirus 1980; Buckley and Casson 1981; Rugman 1981; Teece 1983, 1985, 1986; Hill and Kim 1988). (See Caves 1982 and Root 1987 for an extensive discussion.) The dominant

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approach recently is the transaction costs approach, which focuses on the production and transaction costs associated with each governance structure. It is suggested that due to opportunism and the difficulty in enforcing contracts overseas, licensing entails the highest governance cost and is thus the least preferred governance structure for transferring *complex* technologies. Anderson and Gatignon (1986) broaden the scope of the transaction costs approach by considering a variety of governance structures and determinants of transactions costs.

However, as pointed out by Grosse (1985), unless revenues are the same for different governance structures, the optimal entry strategy determined by the cost minimization criterion is not necessarily the same as that determined by the profit maximization criterion. This suggests that previous research, which normally emphasizes the cost side of entry strategies, would be more revealing if it also addressed the revenue side. This paper adopts a revenue (net of production costs) maximization approach instead of a cost minimization approach to examine the preference for entry strategies.

In addition, host governments, while encouraging foreign firms' local production activities, usually restrict the strategic flexibility of entering firms. Therefore, entering firms need to formulate counter-strategies to these restrictions. In order to investigate the strategy preferences of entering firms and host governments, this paper will also study the interaction between them, an issue stressed by Doz and Prahalad (1981) and Contractor (1985a, b).

We organize the remaining four sections as follows. In §2 we derive the model to evaluate the profit potential of the five entry strategies. §3 discusses the strategic implications for entering firms and suggests counter-strategies to host governments restrictions. §4 discusses the results of the relaxation of some assumptions. The last section provides a conclusion.

2. The Model and the Static Analysis

The entry strategies under discussion are foreign direct investment (FDI), exclusive licensing (EL), multiple licensing (ML), joint venture (JV), and a strategy combining joint venture and licensing (JVL).[1] For the licensing cases, we will first derive the optimal output of licensee(s) given the unit royalty rate charged by the entering firm. Then we will analyze the optimal unit royalty rate given its potential impact on the licensee(s). For the case of FDI and JV, the entering firm designs a strategy to maximize its revenue based on the behavior of the local entity. The comparison of the profit yielded by different strategies gives the optimal entry strategy. We start with a general model which covers FDI, EL, and JV and then construct a model for ML.

The Hybrid Strategy: Joint Venture and Licensing

FDI, EL, and JV are special cases of JVL, the differences being the share of equity holdings of the local entity and the existence of a licensing agreement between the entering firm and the local entity. For example, under FDI, the entering firm holds 100% of the local entity and does not charge any licensing fees. In the case of JVL, the profit of the entering firm has two components, royalties and investment income from the local entity. Let α ($0 \leq \alpha \leq 1$) be the share of equity held by the entering firm and V be the profit of the local entity, then the equity income of the entering firm is $\alpha * V$. For royalties, we first assume that the entering firm charges a unit royalty rate, f, and then discuss how a two-part tariff, i.e., an initial fixed charge and a linear licensing fee for the use of know-

[1] Exporting is a special case in our model. A firm can export its products to its subsidiary or to an independent importer in the host country. If transportation costs are not considered, the former is equivalent to FDI and the latter is similar to EL.

how, affects the preferred strategy in §4. Let Q be the output of the local entity, then the entering firm's royalties are $f*Q$. A further consideration is the issue of control. Licensing agreements normally have a limited time span. It is possible that after signing a licensing agreement, over a period of time, the local licensee may become technologically independent. Thus, licensing payments may not last forever. On the other hand, if the entering firm holds equity interests in the local entity, it will receive its share of profit from local operations for an indefinite period of time. Assuming that after T years, the local entity becomes technologically independent, the net present value (Π) of the entering firm's revenue (net of production costs), termed profit in the following analysis, is

$$\Pi = \int_0^\infty (\alpha * V)e^{-rt}dt + \int_0^T (f * Q)e^{-rt}dt$$

where r is the discount rate. Given the local demand function, the entering firm chooses optimal α and f.

We assume that the production function of the entering firm exhibits constant returns to scale and that the entering firm faces the following constant-elasticity demand function in the host country (Bardhan 1982):

$$Q = P^{-\theta}, \qquad \theta > 1$$

where Q is the output, P is the price and θ is the price elasticity of demand. Let c be the constant production cost, then the unit production cost of the local entity becomes $c + f$.

To illustrate the basic economic structure of the model, we first consider the perpetual licensing case. In this case, due to permanent patent protection, the entering firm is able to maintain control of its technology forever ($T \to \infty$). The net present value of the entering firm's profit is

$$\Pi = \int_0^\infty (\alpha * V)e^{-rt}dt + \int_0^\infty (f * Q)e^{-rt}dt = \frac{1}{r}(\alpha V + fQ).$$

Thus, under perpetual licensing, the above equation reduces to a timeless model, which is $\alpha V + fQ$.

The optimal output and the associated profit of the local entity are

$$Q = \left(\frac{\theta}{\theta - 1}(c + f)\right)^{-\theta}, \qquad V = (c + f)^{1-\theta}\theta^{-\theta}(\theta - 1)^{\theta-1}.$$

Consequently,

$$\pi = \alpha(c + f)^{1-\theta}\theta^{-\theta}(\theta - 1)^{\theta-1} + f * \left(\frac{\theta}{\theta - 1}(c + f)\right)^{-\theta} \tag{1}$$

where π is the profit of the entering firm in the static analysis. The objective of the entering firm is to maximize π. Equation (1) demonstrates that π is an increasing function of α, regardless of f. This means that no matter how much it charges the licensee, the entering firm will try to hold as much equity in the local entity as it can. Then the entering firm decides on the optimal unit royalty rate. A high f increases the cost of the local entity and reduces its output, and thus may increase or decrease licensing income, depending upon price elasticities. In addition, a high f reduces the profit of the local entity and thus reduces the equity income of the entering firm. The optimal f, therefore, depends on the trade-off between licensing income and equity income.

Differentiating equation (1) with respect to f and setting the result to zero we get

$$f = \frac{c(1 - \alpha)}{\theta + \alpha - 1}. \tag{2}$$

Equation (2) reveals that the ratio of optimal unit royalty rate to constant cost is determined by equity sharing and demand elasticity. A high share of equity leads to greater importance of equity income. As equity income becomes more important, a high royalty rate will decrease equity income more than the possible increase in licensing income. Consequently, a high share of equity of the entering firm reduces the royalty rate. The impact of demand elasticity is somewhat different. A higher demand elasticity indicates that, other things being equal, the firm has less power to raise prices. Consequently, when demand elasticities are high, a high royalty rate increases the cost of the licensee, reduces its output to a greater extent and thus reduces the licensing income for the entering firm. Therefore, the higher the demand price elasticity, the lower the unit royalty rate. We will further explore strategic implications of equation (2) in the next section.

Equations (1) and (2) can determine the profit of FDI, JV, EL, and JVL. For FDI, $\alpha = 1$ and from equation (2), $f = 0$. Thus, $\pi_{\text{FDI}} = c^{1-\theta}(\theta^{-\theta})(\theta - 1)^{\theta-1}$. For a joint venture, we assume that the entering firm's ownership is 50%, which is the maximum permissible foreign ownership in many developing countries (UNIDO 1978). Then, $\pi_{\text{JV}} = \frac{1}{2}c^{1-\theta}(\theta^{-\theta})(\theta - 1)^{\theta-1}$. If the entering firm licenses its know-how exclusively to a local firm, $\alpha = 0$, the optimal unit royalty rate is $f = c/(\theta - 1)$, and $\pi_{\text{EL}} = fQ = c^{1-\theta}\theta^{-2\theta}(\theta - 1)^{(2\theta-1)}$. If the entering firm adopts a JVL strategy, the unit royalty rate is a function of equity holdings as determined by equation (2). If $\alpha = 0.5$, then from equation (2), $f = c/(2\theta - 1)$. Consequently,

$$\pi_{\text{JVL}} = c^{1-\theta}\frac{1}{\theta - 1}\left(\frac{\theta}{\theta - 1}\right)^{1-\theta}\left(\frac{2\theta}{2\theta - 1}\right)^{-\theta}.$$

We have derived the profit of FDI, JV, EL, and JVL strategies. Next we derive the profit of the ML strategy.

Multiple Licensing

The entering firm can license its technology to a number of local firms. It must decide on the number of local firms (n) it will license to and the unit royalty rate (f) it will charge. Let q_i be the output of local firm i, then the profit of the entering firm, π_{ML}, is $\int_0^T f \sum_{i=1}^n q_i e^{-rt}dt$. The cost of production for each local firm is $c + f$, and the profit of the local firm i is $V_i = Pq_i - (c + f)q_i$. Since $P = Q^{-1/\theta}$, the profit of the firm i is

$$V_i = ((\sum_{i=1}^{n} q_i)^{-1/\theta})q_i - (c + f)q_i.$$

We derive the profit of multiple licensing under both the Cournot and Bertrand equilibrium. In the Cournot equilibrium, $\partial q_i/\partial q_j = 0$ and $q_i = q_j = Q/n$. Thus,

$$q_i = \frac{1}{n}\left(\frac{c + f}{1 - (1/n\theta)}\right)^{-\theta}.$$

The licensing income of the entering firm is equal to nq_if and reaches the following maximum value when $f = c/(\theta - 1)$:

$$\pi_{\text{ML}} = \frac{c^{1-\theta}\theta^{-\theta}(\theta - 1)^{\theta-1}}{(1 - (1/n\theta))^{-\theta}}.$$

Since π_{ML} increases as n increases, the entering firm will try to license to as many licensees as it can find. The economic intuition behind this result is that as the number of licensees increases, the competition among them increases, which leads to a higher total output and thus higher licensing income. As $n \to \infty$, the profit of the entering firm is

$$c^{1-\theta}\frac{1}{\theta-1}\left(\frac{\theta}{\theta-1}\right)^{-\theta},$$

which is identical to the profit of FDI. This result indicates that multiple licensing can yield the same profit as FDI. The main reason for this is that under ML, the entering firm simply charges the profit margin under FDI as the unit royalty rate.

Similar results are obtained under the Bertrand equilibrium. As shown in Tirole (1988), two firms are sufficient to reach a competitive price under the Bertrand equilibrium. Thus, two licensees will charge a price equal to $c + f$ and divide the market equally. In this case, the optimal f for the entering firm is $f = c/(\theta - 1)$ and the profit is also equal to that of FDI. The main difference between the Cournot and Bertrand equilibrium is the number of licensees, which reaches infinity in the Cournot case and only two in the Bertrand case.

3. Strategic Implications

We first consider the strategic implications for the case of no host government restrictions. Under this scenario, the entering firm chooses the strategy which yields the highest profit. A comparison of the profits gives Proposition 1.

PROPOSITION 1. *The profits generated by entry strategies have the following characteristics*:

$$\pi_{\mathrm{FDI}} = \pi_{\mathrm{ML}} > \pi_{\mathrm{JVL}} > \pi_{\mathrm{JV}} > \pi_{\mathrm{EL}}.$$

PROOF. See Appendix 1.

Proposition 1 suggests that, without host government restrictions, the firm prefers FDI or ML to enter a foreign country. Only if these two strategies are prohibited by the host government will the entering firm seek other alternatives. We explain the economic rationale of this result below.

We first focus on FDI. The five strategies examined can be viewed as different governance structures. Under each governance structure, the rule of profit sharing, and thus firm behavior, is different. While under JV and JVL the entering firm shares its profit with a local partner, it keeps all the profit under FDI. Therefore, FDI is superior to JV and JVL. In addition, the transfer price under FDI is its marginal cost, and thus there is no distortion of resource allocation. The licensee under EL, on the other hand, incurs an additional cost (i.e., royalties) and must still earn a profit under this constraint. As transfer prices above marginal costs lead to inefficient decisions by the licensee, FDI is superior to EL.[2]

JV, like EL, is a rent sharing mechanism. Under JV, the entering firm shares the final profit with a local partner and under EL with the local licensee. Both governance structures reduce the profit of the entering firm. However, royalties, like taxes on the licensee, reduce the output level. This reduced level limits the profit potential of the EL strategy to a greater extent than do the profit sharing effects under the JV strategy, making joint venture preferable to exclusive licensing. However, the combination of joint venture and licensing provides the entering firm with an additional mechanism for extracting a profit and is thus more profitable than the pure joint venture strategy. In fact, it is the most profitable of all strategies after FDI and ML.

FDI and ML receive the same profit from local production. Consequently, the choice between the two is determined by factors not incorporated in the model such as governance and entry costs (Hennart 1982). As discussed later, ML incurs a lower entry cost but higher governance costs than FDI does. Therefore, if the benefits from a lower entry cost

[2] We are grateful to the Associate Editor for this insight.

exceed the disadvantages of higher governance costs, the entering firm will prefer ML over FDI.

Proposition 1 may provide a theoretical explanation of empirical results. Empirical studies, though conducted under different assumptions, usually reveal that FDI is the strategy most preferred by firms (Chang 1984). Davidson and McFetridge (1985) find that firms prefer to transfer know-how through FDI than through EL when there are no government restrictions on their entry. Franko (1989) points out that the prime cause of American multinational firms' move to minority ventures in the mid-1970's in less developed countries was due to ownership restrictions in these countries. Stopford and Wells (1972) also find that firms usually prefer FDI to licensing or to other strategies to serve foreign markets. However, we cannot infer from these studies that profit maximization is a firm's main motivation for engaging in FDI.

The popular belief that coalition activities, including licenses, joint ventures, and other types of contractual agreement between firms, have increased recently has been refuted by Ghemawat, Porter, and Rawlinson (1986). Likewise, Kobin (1988) does not support the conclusion that there has been a move away from wholly-owned subsidiaries in favor of joint ventures by U.S. manufacturing firms in developing countries. The recent trends of globalization of markets and global competition may in fact encourage a firm to adopt a wholly-owned structure to exploit global economies of scale. After reviewing the historical trends in joint venture use, Gomes-Casseres (1988) also predicts that FDI will prevail in industries where global competition is involved.

Though FDI is preferred by entering firms, host governments may impose some restrictions to increase the local share of the benefits created by such entry. Therefore, the entering firm has to formulate counter-strategies to maximize its profit in the host market.

The host government prefers the foreign entry strategy which generates the highest level of social welfare, which is defined as the sum of consumer surplus and local producer surplus. The consumer surplus of the host country is

$$\int_0^{Q^*} (P(Q) - P(Q^*))dQ$$

where Q^* is the equilibrium output under different entry strategies. The local producer surplus is zero for FDI and ML, and is

$$(1 - \alpha)(c + f)^{1-\theta} \frac{1}{\theta - 1} \left(\frac{\theta}{\theta - 1} \right)^{-\theta}$$

for JV and JVL.

It is shown in Appendix 2 that the relationship of social welfare (W) under different entry strategies is

$$W_{\text{JV}} > W_{\text{FDI}} = W_{\text{ML}} > W_{\text{JVL}} > W_{\text{EL}}.$$

Comparing Proposition 1 to the above equation, it is obvious that the interest of the host government conflicts with that of the entering firm. The host government prefers a joint venture while the entering firm prefers FDI or ML. Hence, it is understandable for the host government to put some restrictions on foreign firms' entry, especially on foreign ownership. Korea, Brazil, and India, for example, all have local ownership requirements for foreign subsidiaries.

The entering firm can formulate counter-strategies to respond to host government restrictions. If the host government bans FDI, the entering firm can choose the ML strategy. Host governments usually regard the exclusivity of licensing agreements as a matter of negotiation between entering firms and local firms and thus do not intervene in the multiple licensing strategy (UNIDO 1978). Two special cases are Japan and India,

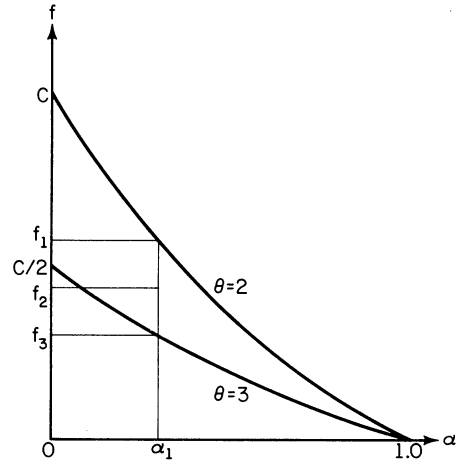

FIGURE 1. Relationship between Equity Holding (α) and Unit Royalty Rate (f) with $\theta = 2$ and $\theta = 3$.

with the former discouraging multiple licensing and the latter encouraging it (Contractor 1985b; UNIDO 1978).

If multiple licensing is not feasible, the entering firm can adopt the JVI strategy. In this case, equation (2) can determine the optimal unit royalty rate for given equity holdings. Figure 1 depicts equation (2) for $\theta = 2$ and $\theta = 3$ and can generate counter-strategies. If foreign firms are forced to hold no more than α_1 equity, the entering firm should respond by charging f_1 as the unit royalty rate when θ is 2. However, the host government may also set a royalty rate ceiling (f_2). In this case, since the profit of the entering firm is an increasing function of equity holdings, the entering firm will hold the maximum allowable equity share (α_1) and will charge f_2 as the unit royalty rate if $\theta = 2$. Sometimes the restrictions on royalty rates may not be binding. For example, when $\theta = 3$, the optimal royalty rate is f_3, which is lower than the royalty rate ceiling. These counter-strategies are applicable in host countries with limitations on foreign ownership only (e.g., Mexico), or in countries with restrictions on foreign ownership and royalty rates (e.g., Argentina), but are not applicable in countries which prohibit royalty payments from affiliates to foreign parents (e.g., Colombia).

Thus, it appears that FDI is the dominant entry strategy if the host government allows it. However, faced with host government restrictions, the entering firm can choose ML or JVL to extract more profits. Exclusive licensing, under the assumptions of this model, seems to be the least preferable strategy for the entering firm.

The above conclusions are reached under stringent assumptions of perpetual licensing, no governance or entry costs, and a linear licensing fee. We will relax these assumptions in turn and discuss the results.

4. Model Extensions

Limited Licensing Period

The above analysis assumes perpetual licensing. However, perpetual licensing may not be feasible for three reasons. First, since incomplete patent protection is the norm rather than the exception (Lieberman and Montgomery 1988), entering firms are unable to control their technologies indefinitely. Second, host governments may restrict the period of licensing and may not permit the renewal of licensing agreements (UNIDO 1978). And third, local licensees may be able to gain control of the technology and thus will be unwilling to renew the agreements. Let T be the number of years a licensing

agreement is effective. Then, after T years, the entering firm will no longer receive royalty payments from the licensee. Under this scenario, the optimal strategy may be different from the one identified in the previous static analysis.

For FDI, the entering firm maintains effective control over the local market and receives payments from the local entity indefinitely. The net present value of the profit of this strategy is

$$\Pi_{\text{FDI}} = \int_0^{\infty} \pi_{\text{FDI}} e^{-rt} dt = \frac{1}{r} \frac{c^{1-\theta}}{\theta - 1} \left(\frac{\theta}{\theta - 1} \right)^{-\theta}$$

where r is the discount rate. For EL, the entering firm receives royalties up until T and the net present value of the profit is

$$\Pi_{\text{EL}} = \int_0^{T} \pi_{\text{EL}} e^{-rT} dt = \frac{c^{1-\theta}}{\theta - 1} \left(\frac{\theta}{\theta - 1} \right)^{-2\theta} \left(\frac{1}{r} - \frac{e^{-rT}}{r} \right).$$

Similarly, the net present value of the profit of the ML strategy is

$$\Pi_{\text{ML}} = \int_0^{T} \pi_{\text{ML}} e^{-rt} dt = \frac{c^{1-\theta}}{\theta - 1} \left(\frac{\theta}{\theta - 1} \right)^{-\theta} \left(\frac{1}{r} - \frac{e^{-rT}}{r} \right).$$

For the JV and JVL strategies, we assume that the entering firm controls 50% of the equity and keeps its share for an unlimited time. The net present values of the profit of JV and JVL are[3]

$$\Pi_{\text{JV}} = \frac{1}{2r} \left(\frac{c^{1-\theta}}{\theta - 1} \right) \left(\frac{\theta}{\theta - 1} \right)^{-\theta} \quad \text{and}$$

$$\Pi_{\text{JVL}} = \int_0^{\infty} \pi_{\text{JVL}} e^{-rt} dt = \frac{1}{2r} \frac{c^{1-\theta}}{\theta - 1} \left(\frac{\theta}{\theta - 1} \right)^{-\theta} \left(\frac{2\theta}{2\theta - 1} \right)^{-\theta}.$$

Appendix 3 compares the net present value of the profits of different entry strategies when licensing agreements last for a limited period of time and provides the following two propositions.

PROPOSITION 2. *In the long run, FDI yields the highest discounted profit, and EL results in the lowest discounted profit.*

PROPOSITION 3. *Superiority among ML, JV, and JVL in the long run depends on rT and θ.*

(i) *If* $rT > -\ln(1 - (2\theta/(2\theta - 1))^{-\theta})$, *then* $\Pi_{ML} > \Pi_{JVL} > \Pi_{JV}$.

(ii) *If* $-\ln(1 - (2\theta/(2\theta - 1))^{-\theta}) > rT > \ln 2$, *then* $\Pi_{JVL} > \Pi_{ML} > \Pi_{JV}$.

(iii) *If* $\ln 2 > rT$, *then* $\Pi_{JVL} > \Pi_{JV} > \Pi_{ML}$.

The rationale behind these results is as follows. rT represents the product of the cost of capital and the licensing period. Other things being equal, the lower the T, the less time it takes the licensee to acquire the technology; consequently, the least attractive strategies are multiple and exclusive licensing. Similarly, the higher the discount rate, the lower the present value of the profit after T, making licensing more attractive. Therefore, the higher rT is, the more discounted profit results from licensing.

The preference of the host government for particular entry strategies in the case of a limited period of licensing is too involved for analysis, and can only be determined through simulation. However, because FDI is not the preferred strategy from the host government's point of view, the entering firm faces potential conflict with the host gov-

[3] In the case of JVL, because the entering firm holds 50% of the equity, we assume that it receives royalty payments indefinitely.

ernment. Furthermore, since a limited licensing period increases the social welfare of the country, the host government may place restrictions on the term of licensing agreements as well as on ownership and royalties. The Indian government, for example, restricts the period of a licensing agreement to five years. Confronted with these possible restrictions, the entering firm has to formulate counter strategies, which depend on r, T, and θ. For example, if the discount rate is 0.12, T is limited to 6 years, and θ is greater than 1.1, then it follows from Proposition 3 that the entering firm would prefer JVL over ML and JV. If the host government bans the simultaneous use of licensing and joint venture, the entering firm will choose ML over JV.

Governance Costs

A firm must incur some costs, such as contractual and monitoring costs, when it transfers technology overseas. From the transaction costs perspective, Teece (1986) argues that contractual and transfer problems increase with the complexity of the technology. Thus, the average governance costs of licensing for a complex technology are greater than those for a less complex one. On the other hand, the average governance costs of transferring technology through FDI are invariant to the complexity of technology. Hence, the comparison of governance costs for licensing and FDI depends on the technology involved. This implies that the average governance costs of FDI are lower than those of licensing when transferring complex technologies abroad. Extending Teece's argument, since a joint venture also controls the local entity, its average governance costs fall between those of FDI and licensing. Because of the experience gained in dealing with several licensees, the average governance costs of multiple licensing should not be greater than those of exclusive licensing. The average governance costs of a joint venture combined with a licensing agreement should be between those of licensing and joint venture. Therefore, when transferring a complex technology abroad, the average governance costs of different entry strategies are in the following sequence:

$$GC_{EL} \geq GC_{ML} > GC_{JVL} > GC_{JV} > GC_{FDI} \tag{3}$$

where GC stands for governance costs.

The average governance costs can be viewed as an additional unit cost on top of c. Since FDI enjoys the highest margin and the lowest average governance costs, other things being equal, FDI is still the best strategy for entering a foreign market when the entering firm owns a complex technology. Similarly, since EL incurs the highest average governance costs and yields the lowest profit, it is still the least preferable strategy. The comparison between other pairs of strategies is not conclusive, because the results depend on the relative amount of governance costs to profits.

For less complicated technologies, the average governance costs of licensing are lower than those of FDI (Teece 1986). Since FDI generates a high profit but incurs a high level of governance costs, the comparison between FDI and licensing is not clear. This also applies to the other three entry strategies. Thus, unlike the case of transferring complex technologies, FDI may not be the dominant strategy when less complicated technologies are transferred abroad.

Entry Costs

In addition to governance costs, the various entry strategies incur different entry costs. FDI, JV, JVL entail administrative, learning, and start-up costs and an irreversible fixed investment cost, while EL and ML do not. These entry costs reduce the attractiveness of investment in equity, especially for investment in countries with substantial political risks where the entering firm may not recuperate the fixed investment. Since a joint venture shares these costs with a local partner, FDI has the highest entry cost. Let I_i be the entry cost of strategy i, then, $I_{FDI} > I_{JV} > I_{EL}$. Subtracting these entry costs from Π_i

obtains the net present value of strategy i. It can be shown that the preferred strategy is not conclusively determined, but depends on I_i relative to Π_i. It is possible that the dominance of FDI gives way to other entry strategies after taking into account the entry costs.

A Two-Part Tariff of Licensing

We assume a linear licensing fee in the above analysis. However, entering firms can get lump-sum fees and royalties from licensing agreements. Though comprehensive statistics are not available, Contractor (1981) and the United Nations Centre on Transactional Corporations (1987) show that over 50% of the sampled agreements require the licensees to pay lump-sum fees. Root (1981) also finds that about a third of the companies examined seek alternative channels of revenue, such as lump-sum fees, when host governments impose royalty rate ceilings. We need to modify the linear licensing fee assumption.

If the entering firm charges a two-part tariff, the maximum amount of the fixed charge is the profit of the licensees. In the case of multiple licensing, since the licensees earn no abnormal profit, a two-part tariff is not feasible. For exclusive licensing, it is easy to adapt the above analysis to accommodate a two-part tariff. The initial fixed charge can be viewed as a fixed percentage of the licensee's profit, and the fixed charge is thus equivalent to the equity income for the entering firm. The two-part tariff case is thereby simplified to the JVL case, and the conclusions derived for JVL apply. As shown above, the most profitable strategy is FDI. Thus, without host government regulations, the entering firm will charge π_{FDI} as the initial fixed fee and a zero unit royalty rate. Only in this extreme case is a two-part tariff equivalent to FDI. If an entering firm is able to set up such an agreement, the trade off between governance costs and entry costs may demonstrate the superiority of licensing to FDI.

In practice we rarely observe that the payment to the licensor is based on a onetime initial fee. This fact can be attributed to the uncertainty involved in the sale of technology and the moral hazard on the side of the licensor, which are not included in the model. From the licensee's point of view, the technology is unknown to the firm and the licensor may transfer an obsolete technology to it. Therefore, the licensee may require an outcome-based contract, paying the licensor on the units sold rather than a maximum initial fee. In addition, many host governments regulate rates of royalty payments and lump-sum fees for technological know-how (United Nations Centre on Transnational Corporations 1983). This may explain the difficulty faced by licensors who charge enormous amounts of lump-sum fees in licensing agreements.

In summary, as long as the entering firm allows the licensee to make an economic profit or charge any royalty fees, EL, even under a two-part tariff, is no better than FDI.

5. Conclusions

This paper adopts a revenue (net of production costs) maximization approach to explore foreign production-related entry strategies under different assumptions. Because of a higher level of economic profit and the ability to control the know-how indefinitely, other things being equal, a wholly-owned subsidiary is shown to be the optimal strategy. The high profit of FDI is mainly due to the fact that transfer prices in other entry strategies are higher than marginal costs, making downstream operations inefficient. In addition, FDI enables an entering firm to integrate and coordinate its global operations better, which, in turn, enhances the competitiveness of a wholly-owned subsidiary in a host country. Due to concern for social welfare, however, host governments usually impose some restrictions on foreign firms' entry. These restrictions, such as those on foreign ownership and periods of licensing, tend to reduce foreign firms' operating profit in host

markets. In responding to these restrictions, entering firms can adopt other strategies to increase their profits, such as multiple licensing or a strategy of combining joint venture with licensing.

The profitability of strategies other than FDI is different in the perpetual licensing and limited licensing contexts. For example, while in the case of perpetual licensing the multiple licensing strategy is preferable to a joint venture combined with licensing, the latter is more profitable when the length of the licensing agreement is short or the discount rate is low.

This paper also extends the basic model to evaluate the impact of governance costs, entry costs, and a two-part tariff for licensees on entry strategies. This analysis indicates that: (1) FDI is still the dominant strategy for transferring complex technologies abroad, (2) the difference in entry costs may reduce the attractiveness of FDI, and (3) as long as entering firms allow licensees to make an economic profit, FDI is still the most preferred strategy.

The model studied here could be extended in several directions. The demand in the host country could be modeled by other functions. The production function could be modified to include economies of scale, or the host market could contain another strong competitor. The switch from one entry strategy to another due to environmental changes could also be examined. These complications need further investigation.[4]

[4] Helpful comments from the Associate Editor and two referees are gratefully acknowledged.

Appendix 1. Proof of Proposition 1

In comparing the profit of different strategies, we will show that the ratio of the profit of two strategies is greater or less than one, and thus the profit of the numerator strategy is higher or less than that of the denominator strategy. We first examine the profit of FDI and ML.

Since $\pi_{FDI}/\pi_{EL} = (1-(1/\theta))^{-\theta}$ and since $\theta > 1$, $\pi_{FDI}/\pi_{EL} > 1$, then $\pi_{FDI} > \pi_{EL}$. Similarly, because $\pi_{FDI}/\pi_{JVL} = (1-(1/2\theta))^{-\theta} > 1$ as long as $\theta > 1$, $\pi_{FDI} > \pi_{JVL}$. Since $\pi_{FDI} = \pi_{ML}$, which is greater than the profit of any other strategies, both FDI and ML are dominant strategies.

To evaluate the JVL strategy, we compare its profit to that of the EL and JV strategies. The ratio of the profit of JVL and EL is

$$\frac{\pi_{JVL}}{\pi_{EL}} = \left(\frac{2\theta-1}{2\theta}\right)^{\theta}\left(\frac{\theta}{\theta-1}\right)^{1+\theta}.$$

Since

$$\left(\frac{2\theta-1}{2\theta}\right)^{\theta} = \left(1-\frac{1}{2\theta}\right)^{\theta} > \left(1-\frac{1}{\theta}\right)^{\theta} = \left(\frac{\theta}{\theta-1}\right)^{-\theta},$$

$$\frac{\pi_{JVL}}{\pi_{EL}} > \left(\frac{\theta}{\theta-1}\right)^{-\theta}\left(\frac{\theta}{\theta-1}\right)^{1+\theta} = \frac{\theta}{\theta-1},$$

which is greater than 1. Therefore, π_{JVL} is greater than π_{EL}. The profit ratio of JVL to JV is $\pi_{JVL}/\pi_{JV} = 2(1-(1/2\theta))^{\theta}$. Since $\theta > 1$, $1-(1/2\theta) > \frac{1}{2}$ and $(1-(1/2\theta))^{\theta} > \frac{1}{2}$, then $\pi_{JVL}/\pi_{JV} > 1$. Therefore, the JVL strategy is more profitable than the JV and the EL strategies.

It remains to compare the EL and JV strategies. The profit ratio is

$$\frac{\pi_{JV}}{\pi_{EL}} = \frac{1}{2}\left(\frac{\theta}{\theta-1}\right)^{\theta}.$$

Now we want to show that $(\theta/(\theta-1))^{\theta} > 2$. Let $(\theta/(\theta-1))^{\theta} = \phi$. Taking logarithms of both sides and using Taylor's series expansion, we get

$$\theta\left(\ln\theta - \ln\theta + \frac{1}{\theta} + \frac{1}{2\theta^2} + \frac{1}{3\theta^3} + \cdots + \frac{1}{n\theta^n}\right) = 1 + \frac{1}{2\theta} + \frac{1}{3\theta^2} + \cdots + \frac{1}{n\theta^{n-1}} = \ln\phi.$$

Thus, $\ln\phi > 1$, $\phi > e$, $(\theta/(1-\theta))^{\theta} > 2$, and $\pi_{JV} > \pi_{EL}$. Therefore, $\pi_{FDI} = \pi_{ML} > \pi_{JVL} > \pi_{JV} > \pi_{EL}$.

Appendix 2. Comparisons of Social Welfare

This appendix compares the social welfare of the host country created by different entry strategies. The social welfare of the host country is consumer surplus plus local producer surplus. The consumer surplus (CS) of the host country is

$$\int_0^{Q^*} (P(Q) - P(Q^*))dQ$$

where Q^* is the equilibrium output under different entry strategies. Under JVL,

$$Q^* = \left(\frac{\theta}{\theta - 1}(c + f)\right)^{-\theta}.$$

Thus,

$$\text{CS} = \frac{1}{\theta - 1}\left(\frac{\theta}{\theta - 1}(c + f)\right)^{1-\theta}.$$

The local producer surplus (PS) is zero for FDI and ML and is

$$(1 - \alpha)(c + f)^{1-\theta}\frac{1}{\theta - 1}\left(\frac{\theta}{\theta - 1}\right)^{-\theta}$$

for the JV and JVL strategies. From equation (2), $f = c(1 - \alpha)/(\theta + \alpha - 1)$. Consequently, the social welfare (W) is

$$W = \text{CS} + \text{PS} = \frac{1}{\theta - 1}\left(\frac{\theta c}{\theta - 1}\right)^{1-\theta}\left(1 + (1 - \alpha)\frac{\theta - 1}{\theta}\right)\left(\frac{\theta}{\theta + \alpha - 1}\right)^{1-\theta}.$$

For notation simplification, define

$$\Phi = \frac{1}{\theta - 1}\left(\frac{\theta c}{\theta - 1}\right)^{1-\theta}.$$

Assuming $\alpha = 0.5$, then the social welfare for four of the strategies is:

$$W_{\text{FDI}} = \Phi, \qquad W_{\text{EL}} = \Phi\left(\frac{\theta}{\theta - 1}\right)^{-\theta}\left(\frac{2\theta - 1}{\theta - 1}\right),$$

$$W_{\text{JV}} = \Phi\frac{3\theta - 1}{2\theta}, \qquad \text{and} \qquad W_{\text{JVL}} = \Phi\frac{3\theta - 1}{2\theta}\left(\frac{2\theta}{2\theta - 1}\right)^{1-\theta}.$$

Under multiple licensing, $P = c + f$, $f = c/(\theta - 1)$, PS = 0, and thus $W_{\text{ML}} = \Phi$.

Next we compare social welfare under different entry strategies.

First, $W_{\text{JV}}/W_{\text{FDI}} = (3\theta - 1)/2\theta > 1$. Second, Bardhan (1982) shows that $W_{\text{FDI}} > W_{\text{EL}}$. Thus, $W_{\text{JV}} > W_{\text{FDI}} = W_{\text{ML}} > W_{\text{EL}}$. The question that remains is whether $W_{\text{JVL}} > W_{\text{FDI}}$, and if not, whether $W_{\text{JVL}} > W_{\text{EL}}$.

The social welfare ratio is

$$\frac{W_{\text{JVL}}}{W_{\text{FDI}}} = \frac{3\theta - 1}{2\theta}\left(\frac{2\theta - 1}{2\theta}\right)^{\theta-1}.$$

We use Cauchy-Schwarz inequality to show that $W_{\text{JVL}}/W_{\text{FDI}} < 1$. Cauchy-Schwarz inequality states that if a_1, $a_2, \ldots, \alpha_n$ are positive numbers, then

$$\sqrt[n]{a_1a_2a_3 \cdots a_n} \le \frac{a_1 + a_2 + \cdots + a_n}{n}.$$

Let $\theta = n/m$, $n > m$, then

$$(3\theta - 1)\frac{(2\theta - 1)^{\theta-1}}{(2\theta)^{\theta}} = \left(\frac{(3\theta - 1)^m(2\theta - 1)^{n-m}}{(2\theta)^n}\right)^{1/m}.$$

Let $a_i = (3\theta - 1)/2\theta$ for $1 \le i \le m$, and $a_j = (2\theta - 1)/2\theta$ for $m + 1 \le j \le n$, then

$$(3\theta - 1)\frac{(2\theta - 1)^{\theta-1}}{(2\theta)^{\theta}} \le \left(\frac{(3\theta - 1)m + (2\theta - 1)(n - m)}{2\theta n}\right)^n$$

$$= \left(\frac{\left(3\frac{n}{m} - 1\right)m + \left(2\frac{n}{m} - 1\right)(n-m)}{2\frac{n^2}{m}} \right)^n$$

$$= 1.$$

Thus, $W_{FDI} > W_{JVL}$. Similarly, it can be shown that $W_{JVL} > W_{EL}$. Therefore,

$$W_{JV} > W_{FDI} = W_{ML} > W_{JVL} > W_{EL}.$$

Appendix 3. Entry Strategies Under Limited Licensing Period

This appendix compares discounted profit generated by different entry strategies when licensing is not perpetual. First, we will show that FDI is the dominant strategy. Since $1 - e^{-rT} < 1$, $\Pi_{FDI}/\Pi_{ML} > 1$, and $\Pi_{FDI}/\Pi_{EL} = (1 - (1/\theta))^{-\theta}(1 - e^{-rT})^{-1} > 1$. Also, $\Pi_{FDI}/\Pi_{JV} = 2$ and $\Pi_{FDI}/\Pi_{JVL} = (1 - (1/2\theta))^{-\theta} > 1$. Thus, FDI is the dominant strategy in the long run.

Next, we show that $\Pi_{JVL} > \Pi_{JV} > \Pi_{EL}$. As shown before, $\pi_{JVL} > \pi_{JV}$, thus, $\Pi_{JVL} = \pi_{JVL}/r > \Pi_{JV} = \pi_{JV}/r$. Since $\pi_{EL} < \pi_{JV}$,

$$\Pi_{EL} = \pi_{EL}\left(\frac{1}{r} - \frac{e^{-rT}}{r}\right) < \frac{\pi_{EL}}{r} < \frac{\pi_{JV}}{r} = \Pi_{JV}.$$

Similarly, $\Pi_{JVL} > \Pi_{EL}$. Thus, $\Pi_{FDI} > \Pi_{JVL} > \Pi_{JV} > \Pi_{EL}$. The next question is the order of Π_{ML} relative to the discounted profit of other strategies.

We first compare the discounted profit of ML to that of JVL. The profit ratio is

$$\frac{\Pi_{ML}}{\Pi_{JVL}} = \left(\frac{2\theta}{2\theta - 1}\right)^{\theta}(1 - e^{-rT}).$$

If $\Pi_{ML} > \Pi_{JVL}$, then $(1 - e^{-rT}) > (2\theta/(2\theta - 1))^{-\theta}$, which is equivalent to $rT > -\ln(1 - (2\theta/(2\theta - 1))^{-\theta})$. Thus, if $rT > -\ln(1 - (2\theta/(2\theta - 1))^{-\theta})$, $\Pi_{FDI} > \Pi_{ML} > \Pi_{JVL} > \Pi_{JV} > \Pi_{EL}$.

If $rT < -\ln(1 - (2\theta/(2\theta - 1))^{-\theta})$, we need to compare Π_{ML} to Π_{JV}. The profit ratio is $\Pi_{ML}/\Pi_{JV} = 2(1 - e^{-rT})$. Obviously, if $rT > \ln 2$, $\Pi_{ML} > \Pi_{JV}$. Thus, if $-\ln(1 - (2\theta/(2\theta - 1))^{-\theta}) > rT > \ln 2$, $\Pi_{FDI} > \Pi_{JVL} > \Pi_{ML} > \Pi_{JV} > \Pi_{EL}$.

Since $\Pi_{ML} > \Pi_{EL}$ and if $rT < \ln 2$, $\Pi_{FDI} > \Pi_{JVL} > \Pi_{JV} > \Pi_{ML} > \Pi_{EL}$. In conclusion, FDI is the dominant entry strategy. The order of preference of the rest of the strategies depends on rT as compared to $\ln 2$ and $-\ln(1 - (2\theta/(2\theta - 1))^{-\theta})$. In any case, EL generates the lowest discounted profit.

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