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A SIMPLE THEORY OF JOINT VENTURE BREAK DOWN

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Abstract: This paper provides a theory of joint venture instability. It shows that initially a joint venture is formed between a multinational and a domestic firm to exploit synergistic advantages of each other; however, eventually break down occurs and the collaborating partners become 'friendly apart' as the other domestic firms catch up on the joint venture. The paper also determines the date of joint venture break down.

Key words: multinational, joint venture, licensing, imitation, break-down.
JEL classification numbers: F23; L13.

1. INTRODUCTION

In recent years we have witnessed a large accretion in the number of joint venture (JV) agreements between firms across borders. Theoretical works on cross-border JVs, however, has mostly focused on the strategic issues and incentives underlying formation of JVs between a multinational and a local firm (public or private).[1] However, a look at the business world reveals that JV relations are very fragile. Many of the JVs once formed are winding up their relations and hence the venture firms are typically short-lived. This instability in JV relationship has become, as if, a rule rather than an exception.

Evidence on the break down of JVs is well documented. Killing (1982) surveyed 37 international JVs and found that 36% of them performed unsatisfactorily. In Kogut (1989), out of a sample of 92 US based JVs, about half had terminated their relations by the sixth year. A recent study made by the Mckinsey consultancy firm of more than 200 alliances over the past few years shows that the median life span of a venture firm is only seven years, and in more than 80% of the cases it ends with one partner selling its stake to the other.[2]

Recently, project work conducted by Miller et al. (1996) under the International Finance Corporation provides a detailed analysis on the problems and sources of JV

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[1] See, for instance, Svejnar and Smith (1984), Kwoka (1992), Marjit (1990), Purkayastha (1993), Chao and Yu (1996), and Kabiraj and Chaudhuri (1997).

[2] See Bleake and Ernst (1995).

break down.[3] Sources lie both in the stage of negotiation and operation of JVs. It must be understood that a JV is not an once-for-all relation; it is a dynamic relation the basis of which can change considerably over time. The perspectives of players change with one side ultimately gain disproportionately. Sustaining comparative advantages or organizational complementaries between two or more corporate partners is the key factor to keep up the relations for long term.

Many factors are responsible for the break down of JV relations. Two crucially important factors as identified in the literature are the ownership of equity structure and control of the venture firm. Ownership determines profit share, control determines present and future policies of the venture firm. The other factors are also related to the question of equity shares and control. Partners fight each other on the question of introduction of new product or tehnology, extension and modernization, advertisement, dividend and investment policy. They differ in respect of resource use, sources of supply, government tax and trade policy, and also in respect of evaluation of performance, perspectives and contributions. It has also been noted that when two strong companies tie up in their core areas but compete in the downstream market, such alliances tend to be short-lived. This is the case, for instance, for the Lakeme–Lever JV on ponds, or Wig–Lever venture on kwality icecream in India. In case of a weak company tieing up with a strong one, typically the weaker company sells out and loses its identity. For example, General Electric (GE)–Apar had 50% stake of each, but Apar had been forced to sell out its entire holdings to GE. Even when two sides are equally poised initially, the balance of power shifts over time; eventually one partner sells out to the other. Recently, Proctor & Gamble and Godrej alliance (P & G–G) has been wound up. The tie-up between Escorts and New Ford Holland has been terminated on the issue of technology.[4]

Surprisingly, theoretical work on the break down of JVs is almost non-existent in the literature. In the present paper we make an attempt to explain one observed phenomenon of a cross-border JV which is initially profitable, but which eventually breakes down. Furthermore, here the JV is dissolved amicably. Skaggs–Albertson's which operated profitably, divided up their operation in 1977 after seven years of successful cooperation. A similar thing happened to the Dalco–Olson alliance. One recent example from India is the break down of the tie-up between Tata Sons and Unisys Corp of US. They agreed to a 'friendly' separation in their JV, Tata Unisys Ltd. Unisys is setting up a wholly-owned subsidiary in India after selling off its 40% holding in the venture firm to Tata Sons. In this paper we have constructed a model of three Cournot firms, where one is a multinational firm and the other two domestic firms. We concentrate on the situation where JV as a form of bilateral arrangement dominates licensing. Incentives of forming a JV between the multinational and a domestic firm comes via synergy effects on costs. Initially the JV becomes more efficient than the 'outside' domestic firm. The incentives for dissolving the JV arise because the 'outside' domestic

[3] Their study covered seventy JVs in six developing countries viz., Argentina, Brazil, India, Mexico, the Phillipines and Turkey.

[4] Ghosh (1996) and Bhandari (1996–97) provide many such examples drawn from India.

firm catches up on the JV. Then becoming 'friendly apart' and competing independently at the market place become optimal for each. Our analysis exploits results from Salant et al. (1983), who show that under certain conditions, the sum of payoffs of two firms in an n-firm Cournot oligopoly industry is larger than the profit of one firm in an $(n-1)$-firm oligopoly industry.

The paper is organized as follows. The second section presents the model and results. The third section determines the date of JV break down. The fourth section discusses related possible scenarios, and the last section concludes the paper.

2. MODEL AND RESULTS

Consider a domestic market for a homogeneous product. The market is to be served by three firms—one foreign firm and two domestic firms. We call these as firm 1, 2 and 3 respectively. The per unit cost of supplying the output is constant and same for all firms, i.e.,

$$c_i = c > 0 \quad \forall i \tag{1}$$

However, c_i has two components, i.e.,

$$c_i = a_i + b_i \tag{1a}$$

where a_i is technology- or production-specific cost per unit, and b_i is the per unit distribution and marketing cost. We assume that

$$a_1 < a_2 = a_3 \quad \text{but} \quad b_1 > b_2 = b_3 . \tag{1b}$$

This means that the foreign firm has superior production knowledge compared to each of the domestic firms; however, the domestic firms have cost advantage in distributing and marketing the products. The market demand for the product is assumed to be linear and is given by

$$P = \alpha - \sum_i q_i, \quad \alpha > c \tag{2}$$

where P is the price of the product and q_i is demand for the i-th firm's produce.

We assume that firms believe in Cournot conjectures and compete in quantities. The game is played repeatedly at every instant of time. Then under non-cooperative situation in equlibrium the i-th firm's instanteneous flow of profit is

$$\pi_i(c_1, c_2, c_3) = \pi_i(c, c, c) = (\alpha - c)^2/16, \quad i = 1, 2, 3.$$

Consider now two possibe cross-border (bilateral) arrangements, viz., the JV formation and 'friendly' cross-licensing. Below, we find conditions under which initially JV formation dominates licensing in terms of profitability. Without loss of generality we consider each of the arrangements between firm 1 and 2. It may be recalled that the foreign firm has technological superiority and the domestic firm has marketing superiority. Hence these firms may form a JV and exploit the synergistic advantages, or alter-

natively, they can think of a friendly licensing contract, where the collaborating firms cross-license their superior knowledge to each other[5]—the foreign firm allows the domestic firm to use the superior technology (a_1) and in turn the domestic firm allows the foreign firm to use the local distribution and marketing channel (b_2).

Define

$$c' = a_1 + b_2, \quad 0 < c' < c. \tag{3}$$

Then under JV the venture firm's per unit cost of output supply becomes c'. Similarly, under licensing each of firm 1 and 2 will have c' cost per unit of supply. Assume that formation of JV involves a setting up cost $F>0$ as sunk cost.

It follows immediately that there always exists a profitable licensing contract between 1 and 2, because

$$\Omega(c', c', c) > \sum_{1}^{2} \pi_j(c, c, c) \tag{4}$$

where $\Omega(\cdot, \cdot, \cdot)$ is the sum of collaborating firms' payoffs under licensing, and the RHS of (4) is the sum of their payoffs under no-agreement situation. We have

$$\Omega(c', c', c) = \sum_{1}^{2} \pi_j(c', c', c) = \begin{cases} 2(\alpha - 2c' + c)^2/16 & \text{if } c' \geq (3c - \alpha)/2 \equiv \bar{c} \\ 2(\alpha - c')^2/9 & \text{if } c' < \bar{c} \end{cases} \tag{5}$$

(5) follows from the fact that if $c'<\bar{c}$, $q_3(c', c', c)=0$, that is, if synergistic effect is strong enough, the inefficient third firm will cease to operate under non-cooperative competition.

When firms 1 and 2 form a JV, the instanteneous flow of profit of the JV is

$$\pi_{12}^0(c', c) = \begin{cases} (\alpha - 2c' + c)^2/9 & \text{if } c' \geq (2c - \alpha) \equiv \underline{c} \\ (\alpha - c')^2/4 & \text{if } c' < \underline{c} \end{cases} \tag{6}$$

and that of firm 3 is

$$\pi_3^0(c', c) = \begin{cases} (\alpha - 2c + c')^2/9 & \text{if } c' \geq \underline{c} \\ 0 & \text{if } c' < \underline{c} \end{cases} \tag{7}$$

(6) and (7) are derived on the assumption that when synergistic effect is 'too' strong, firm 3, in case of JV formation between firm 1 and 2, cannot operate at a positive output level, and so its equilibrium quantity of production will be zero, i.e., if $c'<\underline{c}$, $q_3^0(c', c)=0$ and the JV emerges as monopoly. Quite naturally, we have $\underline{c}<\bar{c}$.

Define

$$B = \pi_{12}^0(c', c) - \Omega(c', c', c). \tag{8}$$

Here B measures the incentive of forming JV between firm 1 and 2 over a licensing contract. Then we can easily get the following result.

[5] In our structure b_i cannot be transferred directly. So by 'friendly licensing' we mean that collaborating firms make a binding contract so that each of them can use the same (superior) production technology and marketing network. See Fershtman and Kamien (1992), in particular, on the issue of cross-licensing.

LEMMA 1. $\exists c^*, 0<c^*<c \mid B>0$ *iff* $c'<c^*$.

We have assumed that both mutual licensing and joint venture between two firms (here firm 1 and 2) create a synergistic (marginal) cost reducing effect. Then Lemma 1 shows that if this cost reducing effect is large enough, it turns out that momentary profit of joint venture between firm 1 and 2 dominates that of mutual licensing between those two firms. Then c^* exists, because both $\pi^0_{12}(c', c)$ and $\Omega(c', c', c)$ are monotonically falling in c', with the former being everywhere steeper than the latter over the relevant range of c'. Also for a very small c' the first term in the expression of B becomes close to monopoly payoff with low cost, whereas the second term becomes symmetric duopoly industry payoff. And for a very high c', the first term is dominated by the logic of Salant *et al.* (1983). The result is shown in Fig. 1. The curves Ω and π^0_{12} have kink at $\bar{c}$ and $\underline{c}$ respectively, the former intersecting the latter from below at a point corresponding to $c=c^*$. Given the demand function (2), we have $c^*=\{c-(\sqrt{2}-1)\alpha\}/(2-\sqrt{2})=1.707c-0.707\alpha$ (approximately).

Let us now suppose that firm 3 is capable of imitating (or innovating) a_1 at date $\tau>0$ by investing a sunk cost $I>0$ at the beginning. In this section we assume that τ and I are independent. In the next section we determine τ optimally. Hence after the date τ, firm 3 will also have c' cost per unit. But whenever firm 3 comes up with c', the JV partners would find that by retaining the JV structure their payoff would fall to

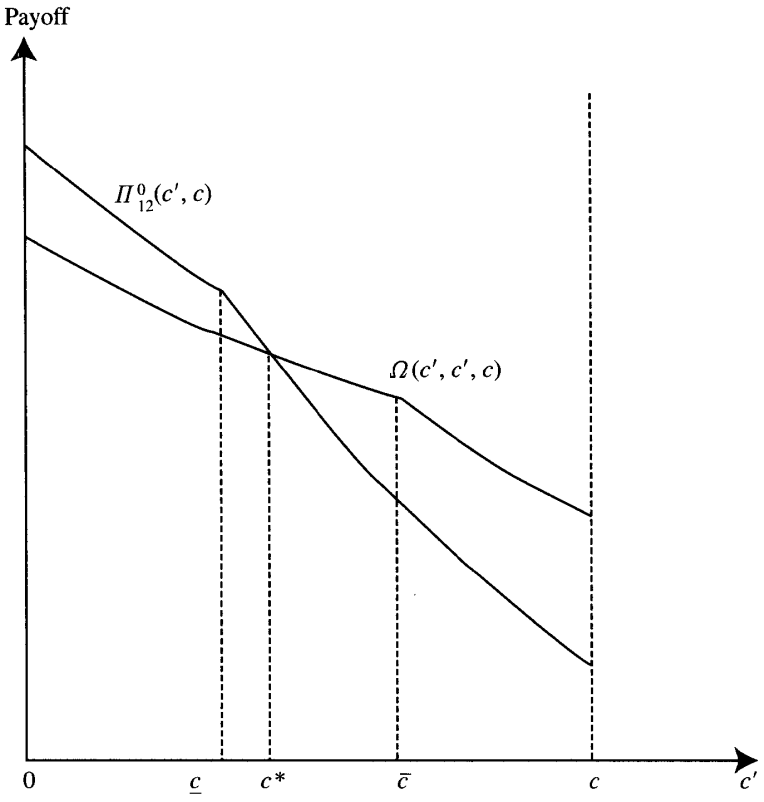

Fig. 1.

$\pi^0_{12}(c',c')<\pi^0_{12}(c',c)$, whereas if they dismantle the JV structure and be friendly apart to operate independently each with c' cost per unit (through a licensing contract), they will gain because $\Omega(c',c',c')>\pi^0_{12}(c',c')$. Then although $\pi^0_3(c',c')>\pi^0_3(c',c)$, firm 3 by imitating c′ can expect a profit flow $\pi_3(c',c',c')$ and not $\pi^0_3(c',c')$. Therefore, for imitation to occur it is necessary that $\pi_3(c',c',c')>\pi^0_3(c',c)$.

Let us define the instanteneous gain through imitation as:

$$G = \pi_3(c', c', c') - \pi^0_3(c', c). \tag{9}$$

Without giving the proof we can write the following Lemma.

LEMMA 2. $\exists c^{**}, 0<c^{**}<c \mid G>0$ *iff* $c'<c^{**}$.

Given a situation where JV between firm 1 and 2 prevails, and if firm 3 can reduce its marginal cost via imitation, then the profits from mutual licensing dominate JV. Lemma 2 shows that if cost reducing effect of imitation by firm 3 is large enough, there actually is a gain for firm 3 in pursuing imitation. In our case it is easy to calculate $c^{**}=1.14c-0.14\alpha$.

Define

$$\tilde{c} = \min(c^*, c^{**}). \tag{10}$$

Therefore, B and G will be both positive iff

$$c' < \tilde{c}. \tag{11}$$

Then given (11) and the JV setup cost, $F>0$, a JV between firm 1 and 2 will be formed iff

$$\begin{gathered} \int_0^\tau Be^{-rt}dt > F \\ \text{i.e., } \tau > (1/r)\log\left(\frac{B}{B-rF}\right) \equiv \tau_{\min} \end{gathered} \tag{12}$$

where r is the market rate of interest. (12) tells that for the JV to occur it is necessary that the JV must operate at least for a minimum length of period so that the setup cost is recovered.

Similarly, given (11) and the imitation cost, $I>0$, imitation of c' will occur iff

$$\begin{gathered} \int_\tau^\infty Ge^{-rt}dt > I \\ \text{i.e.,} \tau < (1/r)\log\left(\frac{G}{rI}\right) \equiv \tau_{\max}. \end{gathered} \tag{13}$$

It states that if imitation is costly, imitation will have to occur at a sufficiently early date.

From (12) and (13) we have

$$\tau_{\max} > \tau_{\min} \Longrightarrow r\left(\frac{F}{B} + \frac{I}{G}\right) < 1.$$

PROPOSITION 1. *Assume $c' < \tilde{c}$ and $r(F/B + I/G) < 1$. Then $\exists \tau$ such that initially formation of JV and eventually break down of the JV will follow an optimal decision path.*

Proof. Given Lemma 1 and 2, B and G are both positive as $c' < \tilde{c}$. Then from (12) a profitable JV will occur iff $\tau > \tau_{\min}$. Now if imitation of c' actually occurs at τ, it is optimal for the JV firms to be 'apart' at that instant and be involved in a licensing contract. Then given $G > 0$, imitation at τ will occur iff (13) holds, i.e., $\tau < \tau_{\max}$. Therefore, given $c' < \tilde{c}$, the formation and eventually break down of JV at τ will occur iff $\tau_{\min} < \tau < \tau_{\max} \Rightarrow r(F/G + I/G) < 1$. QED

The explanation of the result is the following. If there is a long enough time before firm 3's imitation occurs (if imitation occurs after time $\tau_{\min}$), there is an incentive for firm 1 and 2 to form JV by a paying fixed cost, F. Moreover if the time of imitation by firm 3 is soon enough (if imitation occurs before time $\tau_{\max}$), there is an incentive for firm 3 to imitate by paying a fixed imitation cost, I (i.e., there occurs friendly break down of joint venture). If these fixed costs are small enough, then there is a timing of imitation where incentives for forming joint venture between firm 1 and 2 exist and imitation by firm 3 pays.

For the validity of Proposition 1 we, in fact, further need to ensure that firm 1 and 2 cannot, by making a licensing contract instead of forming a JV, prevent firm 3's imitation and that firm 2 has no more incentive to be an outsider rather than an insider in the JV. We discuss these issues in Section 4.

COROLLARY. *Given any $\tau > 0$, if $F = 0$ and $I = 0$, then $c' < \tilde{c}$ is both necessary and sufficient condition for formation and subsequently break down of the JV.*

3. THE OPTIMAL DATE OF IMITATION

Let us define

$$I = I(\tau) \tag{14}$$

with

$$I'(\tau) < 0, \quad I''(\tau) > 0, \quad I(0) = \infty, \quad I(\infty) = 0$$

that is, we assume that imitation costs are inversely related to the date of imitation; imitation costs increase at an increasing rate as τ falls; also imitation at date $\tau = 0$ is impossible and imitation always involves a positive cost. These restrictions are quite innocuous and general. The I-function is convex and downward sloping throughout, and it never intersects any axis.

Define

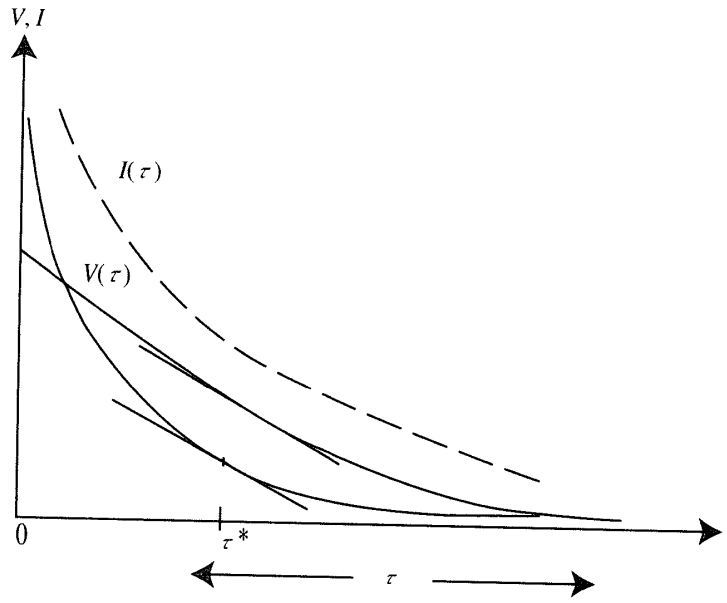

Fig. 2.

$$V(\tau) = G\int_{\tau}^{\infty} e^{-rt}dt = (G/r)e^{-r\tau}. \tag{15}$$

$V(\tau)$ is also falling and convex, with $V(\tau)=(G/r)$ at $\tau=0$ and $V(\tau)=0$ as $\tau \to \infty$.

Then firm 3's problem can be written as:

$$\max_{\tau}[V(\tau) - I(\tau)] \quad s.t. \quad V(\tau) - I(\tau) \geq 0. \tag{16}$$

Hence τ^* (*i.e.*, the optimal τ) must satisfy following conditions:

$$V'(\tau^*) = I'(\tau^*), \quad V''(\tau^*) < I''(\tau^*), \quad V(\tau^*) > I(\tau^*), \quad \text{and} \quad \tau^* \geq 0$$

or

$$V'(0) < I'(0), \quad V''(0) < I''(0), \quad V(\tau) < I(\tau) \quad \forall \tau \geq 0, \quad \text{and} \quad \tau^* = 0.$$

Look at Fig. 2. If $I(\tau)$ is always above $V(\tau)$, imitation will never occur. We are more interested in an interior solution. This occurs when $I(\tau)$ intersects $V(\tau)$. Then given the restrictions on the functions, the optimal timing of imitation by firm 3 is τ^*. Such a τ^*, whenever exists, is unique. Hence τ^* is also the optimal date of break-down. We, of course, need that τ^* must satisfy (12), otherwise there will be no JV. One can also note that as synergic advantages accrued to the collaborating firms grow larger, the break down of JV occurs earlier (see Appendix).

4. RELATED ISSUES

We have so far considered formation and eventually break down of JV between two firms, 1 and 2, and checked the incentive for firm 3 to imitate after appearance of JV

between firm 1 and 2. But within our structure there might be other possible scenarios, and we show that even under these alternative scenarios our result as given in Proposition 1 will go through.

One possible scenario to examine is whether it is beneficial for firm 2 to just having mutual licensing with firm 1 instead of forming JV in order to prevent firm 3's imitation. It is basically to examine whether under mutual licensing between firm 1 and 2, firm 3 has larger incentive for imitating. In this context it may not be unreasonable to assume that firm 3 is equally capable to imitate the foreign firm's production knowledge when instead of a JV agreement firm 1 and 2 make a licensing contract. But given that the licensing contract had been signed between firm 1 and 2, firm 3 would get a flow of payoff $\pi_3(c', c', c) < \pi_3^0(c', c)$. This means, firm 3 has larger incentive (G) to imitate under licensing as compared to the scenario of JV between 1 and 2, because

$$\pi_3(c', c', c') - \pi_3(c', c', c) > \pi_3(c', c', c') - \pi_3^0(c', c).$$

Since $d\tau^*/dG < 0$, firm 3, under the licensing scenario, will imitate at an earlier date. So given our assumption, $c' < \tilde{c}$, the JV formation will strictly dominate the licensing contract from the perspective of firm 1 and 2. Thus JV will be the outcome although it eventually breaks down.

The second possible scenario to examine is whether it is beneficial for firm 2 to be a JV partner instead of becoming an imitator after letting firm 3 to form JV with firm 1. If we assume that the foreign firm brings the offer of JV formation to a randomly chosen local firm, say firm 2, and if the offer be only once-for-all, firm 2 will accept such an offer if it is not worse off (in fact, firm 2 must gain after τ^*). But in our structure we have the case of 'one-seller-two-buyers', and then the assumption of once-for-all offer is not sensible enough.

One may avoid analyzing the situation by assuming that only firm 3 can imitate. Then of course question will arise regarding whether it will still be optimal for firm 1 to form JV with firm 2 which cannot imitate. We do not, however, need to address this question in this paper, because if formation of JV occurs between firm 1 and 3 in equilibrium, then we don't have any scope of analyzing the break down of JV at the same time. Therefore, more interesting case should be the one where each local firm is capable of imitating as an outsider to the JV.

Let us follow the following notations for the remaining part of the analysis. Let $\pi_J(c', c)$ and $\pi_0(c', c)$ denote the payoffs of the JV and the outsider respectively. We also denote $\pi(\cdot, \cdot, \cdot)$ as the symmetric payoff of one firm under non-cooperative competition of all (three) firms. Let us now think of an offer that the foreign firm brings to a randomly chosen local firm (insider) and is accepted by the local firm. Supposing that the JV agreement is signed between one foreign firm and a local firm, the maximum that a local firm would get as an outsider is:

$$A \equiv \int_0^{\tau^*} \pi_0(c', c) e^{-rt} dt + \int_{\tau^*}^{\infty} \pi(c', c', c') e^{-rt} dt - I$$

Note that τ^* is independent of the local firm's identity and distribution of JV profits.

The total profit that accrues to the JV partners (after formation and break down of JV) is:

$$T \equiv \int_0^{\tau^*} \pi_J(c', c)e^{-rt}dt + \int_{\tau^*}^{\infty} 2\pi(c', c', c')e^{-rt}dt - F$$

The reservation (i.e., no-agreement) payoff of the foreign firm is $R \equiv \int_0^{\infty} \pi(c, c, c)e^{-rt}dt$.

Then the question is whether firm 1 can make an offer, A, to the local firm. Such an offer will be possible iff

$$T - A \geq R$$

or

$$\begin{aligned} &\int_0^{\tau^*} [\pi_J(c', c) - \pi_0(c', c) - \pi(c, c, c)]e^{-rt}dt \\ &\quad + \int_{\tau^*}^{\infty} [\pi(c', c', c') - \pi(c, c, c)]e^{-rt}dt \geq F - I \end{aligned} \tag{17}$$

Note that (17) can be satisfied for a wide range of parameters' configurations. For example, suppose $c' < \underline{c}$ and $F \leq I$; then (17) is necessarily satisfied.[6] Under this scenario, both the insider and the outsider get exactly the same payoff.

The above analysis clearly shows that there are situations where firm 1 and 2 (or 3) can write a JV contract and reap benefits at least for some time. However, under the conditions stated in Section 2, eventually the partners will wind up their JV relation and act as Cournot competitors in the market place.

5. CONCLUSION

In this paper we have constructed a simple model of JV formation and eventually break down of the JV. In the real world we often find that one multinational and a host firm in an oligopoly industry form a JV to reap mutual benefits at least for some time, and then after few years of operation they wind up their relation. We have considered the case when the JV is dissolved amicably. Incentives for dissolving the JV comes in our paper from an external source, that is, the 'catching up' capability of the outside-venture firm. This is not properly recognized in the literature. Initially JV dominates friendly licensing, but once the outside-venture firm in the industry invents around and comes up with an identical technology, the competitive advantage of the JV is eroded and the horizontal break down or the friendly separation becomes an optimal decision. We have also determined the optimal date of break down of the venture firm. Larger the initial incentive to form a JV, the earlier is the date of break down.

We have assumed linear demand function in the paper. This has helped not only to simplify the calculation but also provide a better insight to understand the results.

[6] When (17) does not hold, complication will arise in solving the game. In this case the maximum that the foreign firm can offer to a local firm is $(T-R)$. Then each local firm has a larger incentive to be an outsider rather than an insider. However, one possible (Nash) equilibrium (in pure strategy) will be one local firm accepting the offer and the other firm rejecting it. Then, of course, our result underlying Proposition 1 holds. For possible equilibrium in mixed strategies, see Roy Chowdhury (1998).

However, our basic result should hold even for a general demand function. Also in the paper the behaviour of the 'outside' venture firm to acquire the technology has been a little bit artificial. It may be improved upon in a more general model with R&D rivalry.

APPENDIX

We have

$$V(\tau, G) = (G/r)e^{-r\tau}.$$

The optimal τ will satisfy

$$\text{F.O.C}: \quad V_\tau(\tau, G) - I_\tau(\tau) = 0$$

$$\text{S.O.C}: \quad V_{\tau\tau} - I_{\tau\tau} < 0.$$

Then from F.O.C we have

$$\frac{d\tau^*}{dG} = -\frac{V_{\tau G}}{V_{\tau\tau} - I_{\tau\tau}}.$$

Therefore,

$$\frac{d\tau^*}{dG} < 0 \quad \text{as} \quad V_{\tau G} < 0.$$

As c' falls, G goes up, and hence τ^* is reduced.

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