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JOINT VENTURES AMONG EXPORTING FIRMS

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Abstract: In this paper we examine the incentive for joint venture formation among exporting firms. We show that an increase in domestic demand increases the incentive for joint venture formation. An increase in world price, however, can either increase or decrease the incentive for joint venture formation.

JEL Classification No.: F23, L13
Key words: Joint ventures, synergy, export, world price

1. INTRODUCTION

In this paper we seek to provide a theory of joint venture formation among exporting firms.

In the last two decades the rate of joint venture formation has accelerated dramatically. For example, Hergert and Morris (1988) demonstrates that between 1979 and 1985 the number of US-EEC joint ventures increased from around 5 to around 200. Pekar and Allio (1994) find that since 1985 the rate of alliance formation in the US has been increasing at an annual rate of more than 25 percent. Joint venture activity between MNCs and firms from less developed countries have also increased drastically.

At a theoretical level there have been several studies that examine the question of joint venture formation. These include, among others, Al-Saadon and Das (1996), D'Aspremont and Jaquemin (1988), Bardhan (1982), Dhan and Hoy (1991), Chao and Yu (1996), Choi (1993), Combs (1993), Katz (1986), Marjit (1990, 1991), Kabiraj and Chaudhuri (1996), Purakayastha (1993), Ray Chaudhuri (1995, 1997), Svejnar and Smith (1986) etc. Somewhat surprisingly, the question of joint venture formation among exporting firms has received little theoretical attention. In this paper we make a modest beginning in this respect.

We consider a one period model where the firms can either pursue Cournot competition, or form a joint venture. In case a joint venture forms, the firms enjoy a synergy in their cost structure. Furthermore, we consider an open economy model so that, in addition to the domestic market, the firms can sell in the world market also.

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We find that depending on parameter values there can be either joint venture formation, or Cournot competition. Furthermore, an increase in domestic demand increases the incentive for joint venture formation. An increase in world price, however, can either increase or decrease the incentive for joint venture formation.

If the synergistic effect is small, then a joint venture forms if the world price is either very large, or very small. For intermediate values of the world price, there is Cournot competition. If the synergistic effect is large, then for relatively small values of the world price there will be Cournot competition, whereas for large values a joint venture will form.

2. THE MODEL

There are two firms, firm 1 and firm 2, who can either form a joint venture, or compete over quantities in the domestic, as well as the foreign market. We model a situation where the firms are large players in the domestic market. Thus the domestic demand (q) is negatively related to the price level (p). To keep things simple we assume that the demand function is linear, so that $q = A - p$. In the world market, however, they are very small and act as price takers. The price in the world market, p_w, is thus assumed to be exogenously given. We assume that $A > p_w$. This ensures that the firms would be willing to supply a positive amount in the domestic market.

In order to simplify the analysis we assume that there are protective tariff barriers which prevent the rest-of-the-world sellers from entering the domestic market. Thus while domestic firms can sell in the domestic as well as the world market, the rest-of-the-world sellers cannot invade the home market.

For simplicity we assume that the cost functions of the two firms are identical and of the form cq^2. In case a joint venture forms, however, both firms enjoy synergistic cost reductions. Thus the cost functions for both the partner firms become dq^2, where $d < c$.

The idea that joint ventures may lead to a synergy in the cost structure is of course not new. In joint ventures involving a foreign multinational (MNC) and a domestic firm (especially from a less developed country) it has often been argued that the MNC provides the superior technology, while the domestic firm provides a knowledge of local conditions, access to distribution channels etc. (See for example, Miller *et al.* (1996). Dymsza (1988) also provide several case studies that support this viewpoint.) In the Indian context, in the alliance between Hewlett and Packard (HP) and HCL in computers, HP hoped for a quick access to the Indian market, while HCL hoped to utilise HP's competence in business processes, production and quality maintence. (See Business India (1992).)

Furthermore, we assume that joint venture formation involves some coordination costs, say 'T'. Such costs may arise out of the different cultures of the two parent firms. (There have been some empirical studies in the management literature that demonstrate that cultural distances among the partner firms have a negative impact on the incentive for joint venture formation.) They may be also be attributed to the moral hazard

problems intrinsic to any joint venture. Another source of such costs may be the administrative costs of running a joint venture head-quarter. (See Dymsza (1988).)

In case a joint venture forms the resulting profits are assumed to be equally shared. There are two ways of interpreting this. First, we can assume that the government exogenously decides on the profit-sharing rule. Alternatively, we can assume that the profit-sharing rule is endogenously determined according to some bargaining procedure, say the Nash bargaining solution. Since the game considered here is completely symmetric, most bargaining solutions would yield a symmetric profit-sharing rule, thus the assumption of equal profit-sharing is, perhaps, not too unrealistic.

Depending on their profit levels the two firms will either form a joint venture, or pursue Cournot competition. We first solve for the Cournot–Nash equilibrium.

Let q_{id} and q_{iw} represent the amounts supplied by the i-th firm in the domestic and the foreign market respectively. If p_i denotes the profit of the i-th firm under Cournot competition we can write

$$p_i = (A - q_{1d} - q_{2d})q_{id} + p_w q_{iw} - c(q_{id} + q_{iw})^2, \quad i = 1, 2. \tag{1}$$

Clearly firm i has two strategic variables, q_{id} and q_{iw}. The reaction functions are obtained from the following first order conditions:

$$\partial\pi_i/\partial q_{id} = A - 2q_{id} - q_{jd} - 2c(q_{id} + q_{iw}) = 0, \quad i \notin j, \tag{2}$$

$$\partial\pi_i/\partial q_{iw} = p_w - 2c(q_{id} + q_{iw}) = 0, \quad i = 1, 2. \tag{3}$$

We then argue that the outcome will be symmetric. Let the equilibrium output levels of the i-th firm in the domestic and the world market be $\bar{q}_{id}$ and $\bar{q}_{iw}$ respectively. From equation (3) we can write:

$$\bar{q}_{id} + \bar{q}_{iw} = p_w/2c, \quad i = 1, 2. \tag{4}$$

Summing up equation (2) over i, and re-arranging, we obtain:

$$\begin{aligned} \bar{q}_{1d} + \bar{q}_{2d} &= [2A - 2c(q_{1d} + q_{1w}) - 2c(q_{2d} + q_{2w})]/3 \\ &= 2(A - p_w)/3, \end{aligned} \tag{5}$$

where the last step follows from equation (4). We next substitute equations (4) and (5) into equation (2) to obtain:

$$\bar{q}_{id} = (A - p_w)/3, \quad i = 1, 2. \tag{6}$$

Clearly $\bar{q}_{id}$ is independent of 'i' and we can write:

$$\bar{q}_{1d} = \bar{q}_{2d} = \bar{q}_d = (A - p_w)/3. \tag{7}$$

Interestingly enough domestic supply is independent of the cost parameter, and only depends on domestic demand and world price. We can similarly argue that $\bar{q}_{iw}$ is independent of i. Substituting equations (7) into (4) we obtain:

$$\bar{q}_{1w} = \bar{q}_{2w} = \bar{q}_w = [p_w(3 + 2c) - 2Ac]/6c. \tag{8}$$

Here let us point out that similar results have been obtained by Agarwal and Barua (1994) and Marjit and Roy Chaudhuri (1997).

The intuition for the result is simple. Since we make the small country assumption all firms take world price as given. Thus in equilibrium marginal cost is equated to the world price p_w. Thus in the domestic market the world price acts as a surrogate for the marginal cost. Since p_w is the same for all the firms, the result follows.

It is easy to see that the level of export is increasing in the world price p_w, but decreasing in domestic demand, as well as the cost parameter 'c'.

Since we are interested in the case where the firms export a positive amount in the world market, we impose the restriction that $\bar{q}_w > 0$, i.e.

$$p_w > \tilde{p}_w = 2Ac/(3 + 2c)\,. \tag{9}$$

Straightforward calculations now yield that the equilibrium profit level of the two firms are:

$$\bar{p} = A(A - 2p_w)/9 + p_w^2/4c + p_w^2/9\,. \tag{10}$$

Next notice that $\partial\bar{\pi}/\partial A = 2(A - p_w)/9$. Thus the Cournot profits are increasing in the level of domestic demand. We then observe that $\partial\bar{\pi}/\partial p_w = (4p_w c + 9p_w - 4Ac)/18c$. Notice that from equation (9) it follows that $2p_w c + 3p_w - 2Ac > 0$. This implies that $4p_w c + 6p_w - 4Ac > 0$, which in turn implies that $\partial\bar{\pi}/\partial p_w$ is positive.

We then solve for the joint venture outcome. The aggregate profit under a joint venture is as follows:

$$\begin{aligned} p = {} & (A - q_{1d} - q_{2d})(q_{1d} + q_{2d}) + p_w(q_{1w} + q_{2w}) \\ & - d(q_{1d} + q_{1w})^2 - d(q_{2d} + q_{2w})^2 - T\,. \end{aligned} \tag{11}$$

Observe that the joint venture firm decides on how much to supply in the two markets, $(q_{1d} + q_{2d})$ and $(q_{1w} + q_{2w})$, and how much to produce in the two plants, $(q_{1d} + q_{1w})$ and $(q_{2d} + q_{2w})$. Let us first find out the aggregate output from each plant, $(q_{id} + q_{iw})$. Clearly, the marginal revenue, p_w, must equal the marginal cost for each plant, $2d(q_{id} + q_{iw})$, i.e.

$$q_{id} + q_{iw} = p_w/2d\,, \quad i = 1, 2\,. \tag{12}$$

Next notice that the marginal revenue in the domestic market, $A - 2(q_{1d} + q_{2d})$, must equal the marginal revenue in the world market, p_w. This implies that

$$q_{1d} + q_{2d} = (A - p_w)/2\,. \tag{13}$$

Finally observe that

$$\begin{aligned} q_{1w} + q_{2w} &= 2(q_{id} + q_{iw}) - (q_{1d} + q_{2d}) \\ &= p_w/d - (A - p_w)/2\,. \end{aligned} \tag{14}$$

Note that the aggregate production of the two firms under Cournot competition, p_w/c, is less than that under a joint venture, p_w/d. Whereas the aggregate supply in the domestic market under Cournot competition, $2(A - p_w)/3$, is larger compared to that under the joint venture, $(A - p_w)/2$. *Thus aggregate export is higher under a joint venture.*

The intuition for this result is as follows. In this framework joint venture formation leads to collusion. Even if $c = d$, with joint venture formation, there is monopoly in

the domestic market, so that domestic sale declines. With aggregate output remaining the same, export would increase. Moreover, with joint venture formation learning takes place as that $c > d$. This leads to an increase in aggregate production. Since domestic sale is not affected, export would rise.

We then substitute equations (12), (13) and (14) into equation (11) to solve for the equilibrium profit level of the joint venture, firm, $\tilde{p}$. Since this is equally distributed between the two firms, the individual profit levels are:

$$\tilde{p}/2 = A^2/8 - Ap_w/4 + p_w^2/8 + p_w^2/4d - T/2 . \tag{15}$$

It is straightforward to demonstrate that $\tilde{p}$ is increasing in both A and p_w. (That $\tilde{p}$ is increasing in p_w follows from the fact that aggregate export under a joint venture is positive. See equation (14).)

Obviously the firms opt for a joint venture if and only if the profit from a joint venture, $\tilde{p}/2$, exceeds that under Cournot competition, $\bar{p}$, i.e.

$$A^2/8 - Ap_w/4 + p_w^2/8 + p_w^2/4d - T/2 > A(A - 2p_w)/9 + p_w^2/4c + p_w^2/9 . \tag{16}$$

Re-arranging terms and simplifying we obtain

$$A^2/72 - Ap_w/36 + p_w^2/72 + p_w^2(c - d)/4cd > T/2 . \tag{17}$$

We then examine the impact of changes in the two demand parameters, A and p_w, on the incentive for joint venture formation. Define

$$Z(A, p_w) = A^2/72 - Ap_w/36 + p_w^2/72 + p_w^2(c - d)/4cd . \tag{18}$$

Notice that

$$\partial Z/\partial A = A(A - p_w)/36 > 0 . \tag{19}$$

Thus as A increases the right hand side of equation (17) increases, and hence the chances that a joint venture will form are greater.

The effect of a change in p_w is, however, more complex. It is easy to see that:

$$\partial Z/\partial p_w = p_w/36 + p_w(c - d)/2cd - A/36 . \tag{20}$$

Furthermore

$$\partial Z/\partial p_w|_{p_w=0} = -A/36 < 0 . \tag{21}$$

Moreover, $Z(A, p_w)$ is convex in p_w and achieves its minimum at $\bar{p}_w$, where

$$\bar{p}_w = A/[1 + 18(c - d)/cd] < A . \tag{22}$$

Thus $Z(A, p_w)$ is U-shaped, being negatively sloped for $p_w < \bar{p}_w$, and positively sloped if $p_w > \bar{p}_w$. (See Fig. 1.) Of course p_w must satisfy the restriction imposed by equation (9), i.e. $p_w > 2Ac/(3 + 2Ac)$. Clearly, $\bar{p}_w > 2Ac/(3 + 2c)$ if and only if

$$13d > 12c . \tag{23}$$

We are now in a position to analyse the impact of a change in p_w on the incentive for joint venture formation. First consider the case where equation (23) holds. This is likely to be satisfied if the synergistic effects are not too large, so that the two cost parameters,

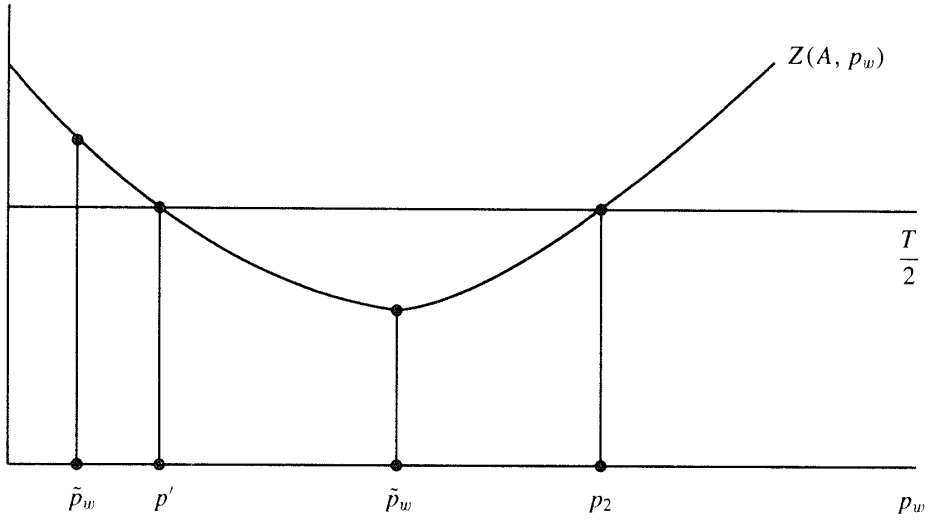

Fig. 1.

'c' and 'd', are approximately the same. This is the case represented in Fig. 1. From the diagram it is obvious that a joint venture forms if p_w is either too small, or too large. For intermediate values of p_w the firms opt for Cournot competition.

We then consider the case where equation (23) fails to hold. This is likely to happen when the synergistic effect is large, so that 'd' is very small compared to 'c'. In this case a joint venture obtains for large values of p_w, whereas for small values of p_w the firms opt for Cournot competition.

We summarise the above discussion in Proposition 1 below. We need some more notation. Let p_1 (respectively p_2) be the minimum (respectively maximum) p_w such that (17) holds with an equality.

PROPOSITION 1. (i) *The firms opt for a joint venture if and only if* $A^2/72 - Ap_w/36 + p_w^2/72 + p_w^2(c-d)/4cd > T/2$.

(ii) *The incentive for joint venture formation is increasing in A, the domestic demand parameter.*

(iii) *The impact of a change in the world price,* p_w, *is more complex.*

(a) *If* $13d > 12c$, *then the firms opt for Cournot competition if* $\max\{\tilde{p}_w, p_1\} < p_w < p_2$. *If either* $\tilde{p}_w < p_w < p_1$ (*assuming that* $\tilde{p}_w < p_1$), *or* $p_2 < p_w$, *then a joint venture forms.*

(b) *If* $13d < 12c$, *then the firms opt for Cournot competition if* $\tilde{p}_w < p_w < p_2$ (*assuming that* $\tilde{p}_w < p_2$). *If* $\max\{\tilde{p}_w, p_2\} < p_w$, *then the firms opt for a joint venture.*

The intuition for the above result can be understood in terms of the following basic tradeoff.

If a joint venture forms, firms sell less at home so as to obtain a higher monopoly price. However, in that case they have to sell less at the world price, which is lower than the monopoly price. These two effects setup a tension which drives the result in Proposition 1.

First consider Proposition 1(ii). As the size of the domestic market increases firms become more interested in forming a joint venture so as to take advantage of the increased market size. Of course this implies that firms have to export more. However, the first effect dominates and hence the result.

We then consider Proposition 1(iii). Let us first consider the case where the synergic effect is small, i.e. equation (27) holds. If the world price is low then there is little incentive to export. Thus domestic considerations predominate and forming a joint venture is optimal. Whereas if the world price is high then exporting becomes attractive. Now by forming a joint venture the firms can keep domestic output as low as possible. So that a joint venture forms. For intermediate values of the world price, however, both the above effects are weak, and hence Cournot competition obtains. Next consider the case where the synergic effect is weak, i.e. equation (27) does not hold. In this case 'c' is going to be reasonably large. Since we restrict attention to the case where $p_w > \tilde{p}_w$, this implies that p_w cannot be too low. Hence the difference in the result in the two cases.

3. CONCLUSION

In this paper we provide a theory of joint venture formation among exporting firms and relate the incentives for joint venture formation to the demand parameters.

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