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Ownership Share of an International Joint Venture

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This paper analyzes the negotiation for ownership share of an international joint venture. We use Nash Bargaining to determine ownership and specify firms' behavior at the disagreement point: if the negotiation fails, the market becomes a Cournot duopoly. We show that all exogenous parameters have some effect on the equilibrium ownership share; even parameters that have no effect on the joint venture's production have an effect on the ownership share because they change the participating firms' bargaining positions. It is also shown that an increase in fixed cost may increase or decrease the ownership share depending on the initial bargaining positions.

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1. Introduction

International joint ventures or cross-border M&As have been widely observed. Especially, it seems that they appear in imperfectly competitive industries such as the automobile industry, where firms incur a huge fixed cost in their production.

In constructing a joint venture (abbreviated as JV), firms must consider (i) whether participating in a JV is profitable, and (ii) how ownership share is determined. Considering (i), Horn and Persson (2001) examine why firms set up JVs by using the concept of coalition. They consider an oligopolistic market where each firm chooses to either participate in a JV (either domestically or internationally) or behaves as a distinct firm depending on its profits. In their model, once the JV is set up, each firm's ownership (i.e., distribution of JV's profit) is assumed to be equal. As for (ii), Svejnor and Smith (1984), Al-Saadon and Das (1996), Nakamura and Xie (1998), and Das and Katayama (2003) use Nash bargaining in order to deal with the determination of ownership share endogenously. These articles focus on either of the above two issues. Especially, in the above literature that use Nash bargaining, the existence of a JV firm is presumed. That is, if the negotiation fails, firms do not produce at all; i.e. profits at the disagreement point are zero. However, it seems more natural to think that each firm produces and competes in the market even if the negotiation breaks down. In other words, when firms consider setting up a JV, they must consider both the (i) and (ii) at the same time.

The purpose of this paper is thus to clarify how the ownership shares of a JV are determined by a domestic firm and a multinational firm facing the choice of whether to offer a JV monopoly or a Cournot duopoly. As a tool to

determine ownership share, we use Nash bargaining following the existing literature. One novelty of our model is the inclusion of firm's production activities when the negotiation fails; i.e. to provide a specific disagreement point composed by duopoly profits.[1] As a result of the negotiation, the ownership share is determined as a Nash bargaining solution. This value is affected by exogenous parameters. We find that (1) even parameters which do not related the to JV (called *disadvantageous parameters*) affect the ownership share of the JV because they change each firm's profit, i.e. bargaining position (Proposition 1), (2) parameters which relate to the JV (called *advantageous parameters*) affect the ownership through the change of JV profits as well as duopoly profits (Proposition 2), and (3) the fixed cost level may increase or decrease foreign firm's ownership share, depending on the bargaining position of the foreign firm and domestic firm (Proposition 3).

This paper is organized as follows. In the next section, we provide a basic model. Then, in Section 3, we find the ownership shares of a JV as a Nash bargaining solution, and examine the effect of exogenous parameters on these ownership shares. Finally, we give some concluding comments in Section 4.

2. The Model

Consider two countries ; one is a developing country and the other is a developed country, which are called country h (home or host) and country f (foreign), respectively. There is a firm (or headquarters) in each country; we call them firm h and firm f after their countries. Firm h only supplies the market in country h, while firm f is a multinational firm and may supply its product to the market in country h via a JV with firm h or by exporting. In this model, we concentrate on the product market in country h. The other markets are negligible. The inverse demand function is provided by

$$P = P(X) \text{ with } P' < 0, \tag{1}$$

where X is total output in the product market. Once firm f chooses a JV, firm f and h negotiate over ownership shares. If the negotiation fails, they produce homogenous products as distinct firms, and competition occurs between these two firms.

Regardless of whether firm f chooses a JV or to compete as separate firms, it must incur a capital cost for production; expressed as a lump-sum fixed cost F. If a JV is set up, firm f and h share the fixed cost at a rate equal to ownership shares. Let $\beta \in [0,1]$ be the fixed cost share burdened by the foreign firm. Then, firm f and firm h incurs βF and $(1-\beta)F$, respectively. After selling the product, they distribute the profit in accordance with their investments. That is, the JV's profit is distributed at a rate of β for firm f and $(1-\beta)$ for firm h, respectively.

We consider the following two-stage game. In Stage 1, firm f and h negoti-

[1] This is similar to Abe and Zhao (2004); and Tomoda and Kurata (2004).

ate to determine the ownership shares of the JV.[2] Following the literature on determination of ownership, they engage in one-time Nash bargaining before setting the JV. If the negotiation fails, each firm sets up a plant in its home country and supplies to the market separately. Then, in Stage 2, the firm(s) provides products to the market given the market structure determined in Stage 1.

The cost function of each firm is provided by

$$C_i = C_i(X_i; w_i, \gamma_i, \tau) \tag{2}$$

for $i = h, f$. X_i is output produced by firm i and w_i is wage level in country i. Assume that $w_h < w_f$; i.e. the host developing country has a lower wage than the foreign developed country. γ_i is the original production technology such that $\gamma_h > \gamma_f$ i.e. the foreign developed country prevails in production technology. τ is a trade cost; firm f is assumed to incur this cost in exporting. τ includes transport cost and trade barriers such as import tariffs. Assume that the cost function has the following relations: $\partial C_i / \partial X_i > 0$, $\partial^2 C_i / \partial X_i^2 \geq 0$, $\partial C_i / \partial w_i > 0$, $\partial C_i / \partial \gamma_i > 0$, and $\partial C_i / \partial \tau > 0$. On the other hand, the cost function of the JV is provided by

$$C = C(X; w_h, \gamma_f). \tag{3}$$

Since the JV is set up in the host country, it can exploit the lower wage w_h, and higher technology γ_f originally held by.[3] Assume that $\partial C / \partial X > 0$, $\partial^2 C / \partial X^2 \geq 0$, $\partial C / \partial w > 0$, and $\partial C / \partial \gamma > 0$.

3. Determination of Ownership Share

We now find the subgame perfect equilibrium of the game. In the second stage, we have two market structures: Cournot duopoly or JV monopoly. So, we need to examine the equilibrium under Cournot duopoly and under JV monopoly, respectively.

3.1 Cournot duopoly

Once the negotiation between firm f and h fails, each firm sets up a plant in the domestic country, and the market structure is assumed to be Cournot duopoly. From (1) and (2), profits of these firms are as follows.

[2] One rational for the negotiation to be in the first stage is that firms would hope to set up JV because they have following advantages if they do so; (i) they can exploit the lower wage w_h and the higher technology γ_f, (ii) firm f can save transport cost τ, and furthermore, (iii) they can eliminate the rival in the market. The exact condition for them to set up JV is shown in (11).

[3] Firm f has no incentive to restrict offering higher technology because $\beta\Pi$, the profit which firm f receives, is monotonic in γ.

$$\pi_h = P(X)X_h - C_h(X_h; w_h, \gamma_h) - F \tag{4}$$
$$\pi_f = P(X)X_f - C_f(X_f; w_f, \gamma_f, \tau) - F \tag{5}$$

Note that $X = X_h + X_f$. The first order conditions for (4) and (5) are

$$P'(X)X_h + P(X) - \frac{\partial C_h}{\partial X_h} = 0 \tag{6}$$

$$P'(X)X_f + P(X) - \frac{\partial C_f}{\partial X_f} = 0. \tag{7}$$

From (6) and (7), we obtain the equilibrium output levels X_h^* and X_f^*. Thus, substituting them back into (4) and (5), we have the equilibrium profits π_h^* and π_f^*.

Consider the comparative statics on these outputs. Define

$$\Delta \equiv \begin{pmatrix} \Delta_{hh} & \Delta_{hf} \\ \Delta_{fh} & \Delta_{ff} \end{pmatrix},$$

where

$$\Delta_{hh} \equiv \frac{\partial^2 \pi_h}{\partial X_h^2} = P''X_h + 2P' - \frac{\partial^2 C_h}{\partial X_h^2}$$
$$\Delta_{hf} \equiv \frac{\partial^2 \pi_h}{\partial X_h \partial X_f} = P''X_h + P'$$
$$\Delta_{hf} \equiv \frac{\partial^2 \pi_f}{\partial X_f \partial X_h} = P''X_f + P'$$
$$\Delta_{ff} \equiv \frac{\partial^2 \pi_f}{\partial X_f^2} = P''X_f + 2P' - \frac{\partial^2 C_f}{\partial X_f^2}.$$

Assume that the demand function (1) is not too convex for the second order conditions to be fulfilled. Since the firms produces homogeneous goods, $\Delta_{hh} < \Delta_{hf} < 0$ and $\Delta_{ff} < \Delta_{fh} < 0$ under this setting. For example, consider a change in trade cost τ. Then, total differentiating (6) and (7) with respect to τ, and solving by Cramer's rule, we obtain

$$\frac{dX_h}{d\tau} = \frac{-\Delta_{hf}\dfrac{\partial^2 C_f}{\partial X_f \partial \tau}}{|\Delta|} > 0, \quad \frac{dX_f}{d\tau} = \frac{\Delta_{hh}\dfrac{\partial^2 C_f}{\partial X_f \partial \tau}}{|\Delta|} < 0. \tag{8}$$

because $|\Delta| = \Delta_{hh}\Delta_{ff} - \Delta_{hf}\Delta_{fh} > 0$. We thus find that an increase in trade cost τ is advantageous for firm h and disadvantageous for firm f. This result is quite intuitive. It is widely known that these sign conditions also hold in the comparative statics for profits insofar as Cournot stability is satisfied. Iterating the same procedure with the other exogenous parameters, we obtain the following relationships:

Lemma 1

(i) $\dfrac{\partial \pi_h}{\partial \tau} > 0, \quad \dfrac{\partial \pi_f}{\partial \tau} < 0$

(ii) $\frac{\partial \pi_h}{\partial w_f} > 0, \ \frac{\partial \pi_f}{\partial w_f} < 0$

(iii) $\frac{\partial \pi_h}{\partial w_h} < 0, \ \frac{\partial \pi_f}{\partial w_h} > 0$

(iv) $\frac{\partial \pi_h}{\partial \gamma_f} > 0, \ \frac{\partial \pi_f}{\partial \gamma_f} < 0$

(v) $\frac{\partial \pi_h}{\partial \gamma_h} < 0, \ \frac{\partial \pi_f}{\partial \gamma_h} > 0.$

3.2 JV monopoly

Next, we find the output and profit under JV monopoly. From (1) and (3), the profit of the JV is organized as follows.

$$\Pi = P(X)X - C(X; w_h, \gamma_f) - F \tag{9}$$

The first order condition for (9) is

$$P'(X)X + P(X) - \frac{\partial C}{\partial X} = 0. \tag{10}$$

We find the equilibrium output under JV monopoly from (10). It is straightforward to see that $\partial \Pi / \partial \gamma_f < 0$ and $\partial \Pi / \partial w_h < 0$.

3.3 Nash bargaining solution

We now analyze the ownership negotiation. Firm f and h enter into one-time Nash bargaining to determine ownership share. Their objective is

$$\max_{\beta} \{\beta \Pi - \pi_f\}\{(1-\beta)\Pi - \pi_h\} \tag{11}$$

i.e. to maximize the Nash product. Since the sum of duopoly profits is smaller than the monopoly profit (i.e. $\pi_h + \pi_f < \Pi$), the JV monopoly always appears in equilibrium.

Solving (11), we obtain the optimal ownership level as

$$\beta^* = \frac{1}{2} + \frac{\pi_f - \pi_h}{2\Pi}. \tag{12}$$

The second term in the right hand side of (12) expresses the bargaining position for both firms. If $\pi_f > \pi_h$, firm f's ownership is greater than half, and vice versa. If $\pi_f = \pi_h$, (i.e. bargaining positions are equal), $\beta^* = 1/2$.

Let us examine the effect of changes in exogenous parameters on the ownership share. First, consider slight changes in τ, γ_h, and w_f, which are inactive under JV monopoly. All of these parameters are disadvantageous for firms; that is, γ_h is the lower technology, w_f is the higher wage, and τ is the trade cost for firm f. Thus, we call them *disadvantageous parameters*. Let α_1 be a disadvantageous parameter. Differentiating (12) with respect to α_1, we have

$$\frac{\partial \beta^*}{\partial \alpha_1} = \frac{\frac{\partial \pi_f}{\partial \alpha_1} - \frac{\partial \pi_h}{\partial \alpha_1}}{2\Pi}. \tag{13}$$

From (13) and Lemma 1, we find that:

Proposition 1
If trade cost is higher, host technology is lower and/or foreign wage is higher, and the foreign ownership share becomes lower.

Note that disadvantageous parameters do not affect the JV's profit at all, but do affect the amount of distributed profits. This effect appears because we specify firms' behavior at the disagreement point, a point which has been ignored in the literature so far. Proposition 1 says that: When the technology of the host country improves (i.e. γ_h decreases), firm h's profit under Cournot duopoly increases. Then, the higher technology improves firm h's bargaining position. Alternatively, consider a cost where the host government receives no tariff income. However, the policy has an indirect effect on domestic welfare; it improves host firm's bargaining position, and then raises firm h's ownership share β, and the domestic welfare thus increases.

Next, we consider the effects of w_h and γ_f, which are active in both monopoly and duopoly cases. These parameters are advantageous for firms: i.e. w_h is the lower wage and γ_f is the higher technology. So, we call them *advantageous parameters*. Let α_2 be an advantageous parameter. Then, differentiating (12) with respect to α_2,

$$\frac{\partial \beta^*}{\partial \alpha_2} = \frac{\frac{\partial \pi_f}{\partial \alpha_2} - \frac{\partial \pi_h}{\partial \alpha_2}}{2\Pi} + \frac{-(\pi_f - \pi_h)\frac{\partial \Pi}{\partial \alpha_2}}{2\Pi^2}. \tag{14}$$

We call the first term the *bargaining position effect* (BP effect) and the second term the *joint venture monopoly effect* (JVM effect), respectively. The first term is the same as in (13); we thus see that a change in disadvantageous parameters only has a BP effect (see(13)). On the other hand, advantageous parameters affect β throughout the change of JV profit Π as well as duopoly profits $\pi_i\,(i = h, f)$.

Consider a slight change in γ_f. Then, we have

$$\frac{\partial \beta^*}{\partial \gamma_f} = \frac{\frac{\partial \pi_f}{\partial \gamma_f} - \frac{\partial \pi_h}{\partial \gamma_f}}{2\Pi} + \frac{-(\pi_f - \pi_h)\frac{\partial \Pi}{\partial \gamma_f}}{2\Pi^2}.$$

From Lemma 1, the BP effect is negative. On the other hand, the JVM effect is ambiguous. Since $\partial \Pi / \partial \gamma_f < 0$, the JMV effect is negative (positive) if $\pi_f < \pi_h\,(\pi_f > \pi_h)$. Thus, an increase in firm f's technology substantially increases firm f's ownership share as firm f's bargaining position is stronger because both the BP and JVM effects work in the same direction. On the other hand, if firm f's ownership share does not increase so much because BP and

JVM effects work in opposite directions. Therefore, the effect of a change in foreign technology is different depending on initial bargaining positions.

The same logic applies to a change in w_h. We have

$$\frac{\partial \beta^*}{\partial w_h} = \frac{\frac{\partial \pi_f}{\partial w_h} - \frac{\partial \pi_h}{\partial w_h}}{2\Pi} + \frac{-(\pi_f - \pi_h)\frac{\partial \Pi}{\partial w_h}}{2\Pi^2}.$$

From Lemma 1, the BP effect is positive. Regarding the JVM effect, it is negative (positive) if $\pi_f < \pi_h$ ($\pi_f > \pi_h$) because $\partial \Pi / \partial \gamma_f < 0$. Thus, for example, an increase in the wage in country h via e.g. economic development, causes firm f's ownership share to increase substantially if $\pi_f > \pi_h$ because the above two effects have opposite signs. We summarize these results as Proposition 2.

Proposition 2

(1) In terms of a change in γ_f,

$sign$ (BP effect) $=$ $sign$ (JVM effect) if $\pi_f < \pi_h$

$sign$ (BP effect) $= -$ $sign$ (JVM effect) if $\pi_f > \pi_h$

(2) In terms of a change in w_h,

$sign$ (BP effect) $= -$ $sign$ (JVM effect) if $\pi_f < \pi_h$

$sign$ (BP effect) $=$ $sign$ (JVM effect) if $\pi_f > \pi_h$

Finally, we consider the effect of fixed cost F. Note that we find that the numerator in (12) is independent of F from (4) and (5). Then, we have

$$\frac{\partial \beta^*}{\partial F} = \frac{-(\pi_f - \pi_h)\frac{\partial \Pi}{\partial F}}{2\Pi^2}. \tag{15}$$

That is, a change in F only includes the JVM effect. No BP effect exists. Since $\partial \Pi / \partial F < 0$, we find the following relations.

Proposition 3

A large fixed cost makes the foreign ownership share large (small) if the foreign firm's bargaining position is stronger (weaker); that is,

$$\frac{\partial \beta^*}{\partial F} = \begin{cases} > 0 & if \quad \pi_f > \pi_h \\ < 0 & if \quad \pi_f < \pi_h \end{cases}.$$

Proposition 3 implies that the effect of fixed cost depends on the initial bargaining position. If firm f is in a stronger position, an increase in F raises the ownership share of firm f. However, if firm f is in a weaker position, an increase in F lowers firm f's ownership share.

4. Concluding Remarks

We have analyzed the ownership shares of an international joint venture. These are determined by the negotiation between a domestic and a foreign

firm, which is a common setting in the literature. Furthermore, we consider a more realistic situation by specifying firms' behavior when negotiations fail.

We show that three kinds of parameters affect the ownership share differently. The first kind is called disadvantageous parameters, which are inactive for the JV. They change the bargaining position of firms (BP effect only). The second kind is called advantageous parameters, which related to the JV. They can induce changes in both JV and oligopoly profits (BP effect). The direction of the change in profits depends on the magnitude of these two effects. Finally, the third parameter is fixed cost; a change in fixed cost affects the fixed cost only JV (JVM effect only). There are no changes in bargaining positions: increases foreign ownership share if the foreign firm's bargaining position is stronger, but decreases it if it is weaker. In our model, since we consider only two firms, the JV is monopolist. If n firms exist in the economy, the JV will no longer be a monopolist but rather a oligopoly. However, the above two effects will still exist and their directions will hold.

In some countries, the ownership of international joint ventures is regulated by government.[4] If the government regulated foreign ownership shares, its object would be to maximize domestic welfare. This can be done in two alternative ways. One is to use trade barriers such as a tariff and a corporate tax. As our results have shown (see Proposition 1), they have an indirect effect on ownership requirements (see Katrak (1984); and Tomoda and Kurata (2004)). However, without such policies, the ownership of a JV is determined by parameters even if some of them have no effect on the JV at the ownership negotiation.

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[4] For details on these regulations, see JETRO (2002).

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