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Joint Venture Instability, Learning and the Relative Bargaining Power of the Parent Firms*

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Abstract

Foreign firms (FPs) with superior technology and other intangible assets try to enter an overseas market with either a fully-owned subsidiary (SUB) or an international joint venture (IJV) with as much ownership share as possible. The firms' intangible assets are an integral source of their bargaining power in their negotiations with potential joint venture partners (JPs) in the host country. Both FP's and JP's R&D capacity as well as other factors contribute to their respective bargaining power. However, FP's bargaining power relative to JP's does not remain constant over time. In a dynamic context, JP's learning from their own IJVs as well as the increasing R&D capacity of their industry will enhance JP's bargaining power. Such learning by JP, together with other factors, can seriously undermine FP's ownership of the IJV over time. Generally, changes over time in the business environment characterized particularly by the positions of FP's and JP's intangible assets can significantly reduce FP's expected ownership share in their FDI. This is consistent with the observation in the literature that IJVs are typically unstable over time.

Key words: foreign direct investment, international joint ventures, bargaining power, R&D, learning

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1. Introduction

The dynamic evolution of international joint ventures (IJVs) has attracted much interest in the literature. There is special interest in the impact IJVs might have on the future course of the parent firms as well as the outcomes for the IJVs themselves. For example, there is some empirical evidence suggesting that, regardless of the reasons that prompted two firms to form an IJV, the likelihood that this IJV will be stable and long-lasting versus abandoned or bought out depends crucially on the types of interactions the respective parent firms have with the IJV over time (Nakamura, Shaver and Yeung (1996)).

Suppose, for example, that a foreign firm with a new technology-based product sets up an IJV in a host country with a domestic firm with superb marketing capabilities. The IJV works well for the first few years, receiving complementary inputs from its parent firms. As the parent firm learns more about their IJV partner through interactions involving IJV operations, the foreign parent may come to feel it has accumulated enough knowledge about the domestic market, and the host country parent may also feel they have absorbed enough manufacturing knowledge of the products the IJV is producing. If the parent firms still see value in the division of labor based on the competence of the respective partners, the IJV will continue and may flourish over time. On the other hand if at least one partner thinks it has learned enough about the skill it was lacking at the outset of the IJV, the IJV will likely cease to exist. The parent firms' unique alliance experience trajectories also affect the nature and likelihood of the various possible ex post adjustments in these sorts of alliance partnerships (Reuer, Zollo and Singh (2002)).[1]

The dynamic evolution of IJVs and other types of alliances has been studied by many other authors as well. For example, termination patterns for IJVs were studied by Kogut (1989, 1991) and Barkema, Bell and Pennings (1996), Barkema and Vermeulen (1997) and Park and Ungson (1997). Joint

[1] Gleister, Husan and Buckley (2003) show that the major management lessons learned by IJV experienced partners and managers can be classified into the following three distinct groups: (1)the mangement of the IJV formation processes; (2)management of the boundary relationships between partners; and (3)the management of the operation of the IJV.

ventures and other types of alliances are also formed by firms for the purpose of entry deterrence and collusive agreements but such arrangements are not always long-lasting.[2]

One of the essential factors that these studies suggest as determining the evolution of IJVs is inter-organizational learning by firms. As the above example illustrates, learning from joint ventures could impact not only the fate of the IJVs that the parent firms have created but also the possible strategic alternatives the parent firms themselves face over time. There has been, however, relatively little research in the literature that relates learning and other evolutionary processes of the kinds discussed above to models of foreign direct investment (FDI) explicitly. This paper addresses this issue.

In this paper we use a bargaining model as a basic model of FDI and consider the process that describes how learning and other dynamic events may alter the relative bargaining power of the partners over time. Such a change in the relative power positions of the IJV partners often result in reorganization of the IJV ownership, leading to instability of IJVs.

The rest of the paper is organized as follows. In the next section, Section 2, we present a simple bargaining model which describes how the parent firms of an IJV involving intangible assets with possible spillovers (i.e. learning) determine their ownership shares in the IJV. We also discuss the properties of the model within a static single-period framework. In Section 3 we present empirical results supporting the bargaining model. In Section 4 we present empirical evidence that local partner firms' learn from their IJVs. Section 5 concludes.

2. Bargaining and the ownership share determination in international joint ventures

One of the main decisions facing a firm considering FDI is that of the ownership structure for its foreign subsidiary: should it be a fully-owned subsidiary, or should it be a joint venture with a firm in the host country? In case of a joint venture, how much ownership should the foreign parent firm have in the joint venture? The alternative theories of FDI cited above do not generally provide predictions about the

[2] Levenstein and Suslow (2002, Table 1) find that many international cartels last for less than 6 years while a few last for much longer.

ownership structure for firms' FDI.

Yet the ownership structure for a foreign subsidiary is particularly important for technology-based manufacturing firms whose competitive edge primarily comes from intangible assets such as engineering and scientific knowledge, production skills and know-how, and brand names. These intangible assets may also reflect product quality, marketing and other management techniques. It is generally difficult for a foreign firm to write a legal contract with a local joint-venture partner firm which specifies precisely the way in which a particular intangible asset is to be used in the joint-venture. For example, a licensing agreement which allows a joint venture to use its foreign parent firm's technology may not protect the licensor's property rights very well since the licensee might use the licensed technology for products other than the ones specified in the agreement. The joint venture partner may also obtain essential information related to the licensed technology from the joint venture.

Such a problem of skill spillover will likely be reduced if the provider of intangible skills owns substantial equity in the operations utilizing such skills. As pointed out by Grossman and Hart (1986), the ownership of an asset includes not only the entitlement to the return stream resulting from the use of the asset, but also the residual rights of control over all aspects of the use of the asset except those rights which are explicitly contracted away. In this sense equity participation in a direct investment plays an essential role in technology-based firms' expansions into foreign markets where potential competitors also do business.

Two types of direct investment, fully-owned and jointly-owned subsidiaries, have different implications for the diffusion of a foreign parent firm's technology. While a fully-owned subsidiary can keep foreign parent firm's loss due to unauthorized use of its intangible assets to a minimum, the foreign parent firm (FP) might not be able to reap fully the return that its intangible assets could potentially earn. This may occur, for example, if FP or its 100% subsidiary, is not familiar with local production inputs and distribution and marketing practices. The geographical distance between FP and its fully-owned subsidiary in a host country also increases FP's cost of agency (monitoring). (See Brickley and Dark (1987) for empirical evidence that franchising is associated with the distance, a source of agency

(monitoring) cost, between the owner of an intangible asset (e.g. brand name, reputation) and the site of business operation using the intangible asset.)

A joint-venture partner (JP) in a host country may be able to provide management skills which, combined with FP's technology, could fully utilize the potential of the technology. On the other hand, JP may take advantage of the joint venture with FP as a learning experience for developing its own future technology. Nakamura and Yeung (1993) present a principal-agent model for the determination of FP's ownership share in a joint venture (JV) in which FP, the dominant provider of intangible skills to JV, chooses its ownership share in JV by balancing the marginal benefit (intrinsic profit) it receives from JV against the marginal cost of control (agency cost and technology spillover). In this model JP plays no role in the determination of its ownership share in JV. While there is some anecdotal evidence that ownership shares in some joint ventures are indeed determined in the manner assumed in Nakamura and Yeung (1993), their model does not consider the potential bargaining processes that may take place between FP and JP.

In the next two subsections of this paper we model technology-based firms' decisions on the forms of ownership for their foreign subsidiaries. We are particularly interested in the determinants of the forms of ownership for a foreign subsidiary: whether it is FP's fully-owned subsidiary or a joint venture with a JP; and the degree of FP's ownership in JV. In modeling joint ventures we treat FP and JP as symmetrically positioned partners who both face the potential spillover of their intangible assets. We approach this modeling problem from the perspective of the theory of contracts which addresses the question of the allocation of decision rights between contracting parties. Contractibility of foreign operations and control of residual rights play important roles in this framework. In analyzing ownership shares for joint ventures between FP and JP we make use of bargaining solutions which incorporate the bargaining power of both FP and JP. We show that FP's ownership share in its foreign subsidiary generally depends on the conditions under which its intangible assets (and JP's in case of a JV) are transferred to JV as well as on its bargaining power relative to JP's.

Later we apply our model predictions to analyze empirically the ownership structures of

technology-based foreign firms' operations in Japan. Our empirical findings are generally consistent with the model predictions.

Modelling ownership of foreign operations: why does ownership matter?

FP's operations in a host country generally require both tangible and intangible production inputs from FP, local firms and local workers. Suppose all production inputs required by FP's operations are observable and the quantities of the inputs used and the resulting output produced are verifiable. (This means that a dispute, for example, about the illegal use of FP's production input can be unequivocally resolved by a third party (like a court) which contradicts or confirms disputing party's observation.) Furthermore suppose that there are well-specified contracting mechanisms for the use of each input and the disposition of outputs. Under these ideal conditions there is no need for FP to own any part of its foreign operations since all aspects of the operations can be contracted out to local input providers and firms.

In practice there are certain important reasons why some of these ideal conditions fail to hold, particularly for an FP whose operations are large-scale and technology-based. First, many contractual relationships may result in the cost of agency due to the lack of incentives on the part of input providers in the host country. Vertical integration, or direct ownership of some of foreign operations may become essential.

Secondly, it is possible that certain production inputs (e.g. intangible assets) are not observable. The quantities of some intangible assets inputs and the output produced may not be all verifiable. For example, licensing FP's technology to a foreign firm for producing FP's product under FP's successful brand name requires no presence of FP in the host country as the owner of the production process. Yet, under certain circumstances it may be difficult for FP to limit the use of its licensed technology or its brand name to originally specified purposes without owning the production facilities in the host country. That is, ownership structure matters if transfer of inputs and the output produced from those inputs do not form contractible events. When the value of an input is not verifiable, it is difficult to write contracts to protect parent firms' benefits. This is the case, for instance, when transfer of intangible assets is involved

in a joint venture. The value of such a transfer is unverifiable, because the output resulting from such an asset transfer is hard to measure, and secondly the cost of transfer accrued to the parent firm, particularly the cost associated with the spillover of an asset is also difficult to measure. Noncontractible output arises, for example, when JV's accounting procedure cannot delineate every benefit resulting from the use of FP's transferred assets. The cost of spillover to FP of its technology or other intangible assets may arise because competitors (including joint venture partners) in the host country could potentially learn FP's technology first hand once it is placed in JV's production facilities. (Both IBM and Coca-Cola left India entirely in the late 1970s when the Indian government demanded that their indian operations be turned into joint ventures with local companies (Encarnation and Vachani (1985)).) OECD (1989) also notes that large-scale joint ventures and international patent networks have raised difficult legal questions regarding the ownership of intellectual property.

The problem of noncontractibility associated with technology and intangible assets does not seem to exist to the same degree for most tangible or physical assets (e.g. raw material, capital equipment), since the amounts of transfer of these assets and output resulting from their use are often verifiable. It is also important to note that so long as contracts can effectively protect the rights of parent (transferring) firms (i.e. complete contracting is possible), ownership structure may not matter even if there is information asymmetry between FP and its contracting firms including JP in the host country. On the other hand, Hart and Holmström (1987) stress that contract incompleteness can lead to departures from the first-best solution even when there are no information asymmetries among the contracting parties and the parties are risk-neutral. They also suggest that incompleteness can throw light on the importance of the allocation of decision rights or rights of control.

Foreign operations involving the cost of technology spillover

In this subsection, we discuss a case in which transfer of intangible assets is verifiable, but it is difficult to write a contract which prohibits potential competitors (including joint venture partners) from taking advantage of the transferred assets. This case happens, for example, when transferred assets are an observable brand name, a patent or a complete set of technology which is not divisible. The control

power that comes with ownership of foreign operations can reduce the potential spillover cost accrued to the owner. By controlling the way their assets are to be used, the owner can reduce or eliminate any inappropriate use of the assets.

Suppose FP has an opportunity for foreign operation with the expected income Y, where Y is assumed to be constant. This operation requires intangible assets as inputs from both FP and JP, FP's potential joint venture partner. (Both FP and JP are assumed to be risk neutral firms in the following.) By licensing intangible assets required for the operation, either FP or JP alone, or a third party, could potentially run this operation under some (incomplete) contract. We assume that transfer of the intangible assets required for the operation is itself verifiable but the output resulting from the use of the transferred assets is not verifiable. Suppose that, without any ownership in the operation, FP and JP incur the maximum costs of technology spillover, C_F and C_J, respectively. These costs of spillover are assumed to decrease as the owners of intangible assets increase their ownership shares in the operation.

We also assume for simplicity that side payments are not allowed between FP and JP. (The introduction of such side payments, however, would not change our results to follow.) This assumption is justified on the practical ground that side payments in the context of international operations correspond to the contractible aspects of the use of intangible assets such as technology
and name brand. It is customary to contract away contractible aspects of transactions involving technical licencing or brand use in the form of lump-sum payments or royalty payments on product sales. We are interested, however, in noncontractible aspects of use of intangible assets for which meaningful side payments cannot be determined. In this paper we use ownership in an international operation as a primary decision variable.

Denote by β FP's ownership share in the operation, where $0 \# \beta \# 1$. Then JP's share is $1 - \beta$. The net expected benefits from the operation for FP and JP are given by:

$$\text{FP: } U_F = \beta Y + \beta g_F C_J - (1-\beta) C_F = \beta(Y + g_F C_J + C_F) - C_F \quad (1a)$$

$$\text{JP: } U_J = (1-\beta) Y + (1-\beta) g_J C_F - \beta C_J = (Y + g_J C_F) - \beta(Y + g_J C_F + C_J). \quad (1b)$$

$\beta g_F C_J$ and $(1-\beta)g_J C_F$, respectively, denote the portions of their respective partner's technology spillover that FP and JP receive., where $0 \le g_F, g_J \le 1$. When $g_F = 1$ (g_J=1) , then JP's (FP's) spillover all goes to FP (JP).

In order that FP and JP choose to have a JV, we must have

$$U_F \$ 0 \quad \text{or} \quad \beta \$ \underline{\beta} \tag{2a}$$

$$U_J \$ 0 \quad \text{or} \quad \beta \# \overline{\beta} \tag{2b}$$

where

$$\underline{\beta} = \frac{C_F}{Y + g_F C_J + C_F} \tag{3a}$$

$$\overline{\beta} = \frac{Y + g_J C_F}{Y + g_J C_F + C_J}. \tag{3b}$$

$\underline{\beta}$ is the minimum acceptable ownership share for FP, while $1 - \overline{\beta} = \frac{C_J}{Y + g_J C_F + C_J}$ is the minimum acceptable ownership share for JP. The feasible region for β, $(\underline{\beta}, \overline{\beta})$, is empty if

$$(Y+g_F C_J)(Y+g_J C_F) < C_F C_J$$

holds, that is, expected income including the benefits from the joint venture partner's technology spillover is small relative to the costs of the total spillover. In this case FP would have no foreign operation. In the following we assume $(Y+g_F C_J)Y+g_J C_F) > C_F C_J$. Note also that: $\underline{\beta} = 0$ if and only if $C_F = 0$, and $\overline{\beta} = 1$ if and only if $C_J = 0$.

Suppose both FP and JP cooperate fully in maximizing the joint expected benefit in determining their ownership shares. This provides us with the first-best solution β^{FB} as follows.

$$\underset{\beta}{\text{Max}}\ Y - (1 - \beta)(1-g_J)C_F - \beta(1-g_F)C_J \tag{4a}$$

subject to (2).

Note that if $g_F = g_J = 1$, then ownership share β plays no role since $U_F + U_J = Y$. The first-best optimal ownership share for FP is:

$$\beta^{FB} = \overline{\beta} \text{ if } (1-g_J)C_F > (1-g_F)C_J \tag{4b}$$

$$\beta^{FB} = \underline{\beta} \text{ if } (1-g_J)C_F < (1-g_F)C_J \tag{4c}$$

This means that, under ideal conditions, the ownership share for a parent firm with a larger spillover cost should be maximized. Note, in particular, that

$$\beta^{FB} = 1 \text{ if } C_J = 0, C_F > 0 \tag{4d}$$

$$\beta^{FB} = 0 \text{ if } C_J > 0, C_F = 0. \tag{4e}$$

The results (4d - e) are consistent with our intuition that if a joint operation requires transfer of only one parent firm's intangible assets, that parent firm should own the operation fully.

The general first-best solution (4b - c) is not likely to be implemented in practice since the assumption of full cooperation underlying the linear program (4a) is unlikely to hold given that neither the use of intangible assets nor the production output which makes use of the intangible assets as inputs are verifiable or contractible. Under such conditions both FP and JP will attempt to maximize their ownership shares in the operation to protect their own interests. Given that the first-best solution is not achievable, FP and JP begin negotiation.

A behavioral model which is suitable to describe the negotiation process between FP and JP in determining their ownership shares in the operation is the Nash bargaining solution (Nash (1950)). We denote the relative bargaining power of FP and JP, respectively, by α and $(1 - \alpha)$, where $0 \# \alpha \# 1$.

Following the literature (e.g. Fagre and Wells (1982)) we assume that the parent firms' bargaining power is an exogenously given parameter.[3] Then the Nash bargaining solution, β^{NB}, is given by

$$\underset{\beta}{\text{Max}} \; U_F^{\alpha} \; U_J^{1-"} \tag{5}$$

where U_F and U_J are given by (1a) and (1b). β^{NB} is given by

[3] This assumption will be relaxed in Section 4 where learning and other factors can change the bargaining parameter over time.

$$\beta^{NB} = \alpha \overline{\beta} + (1-\alpha)\underline{\beta} = \underline{\beta} + \alpha(\overline{\beta} - \underline{\beta}) \quad (6)$$

where $\overline{\beta}$ and $\underline{\beta}$ are given by (3b) and (3a), respectively. Note that, for $0 \# \alpha \# 1$, we have $\underline{\beta} \# \beta^{NB} \# \overline{\beta}$.

In extreme cases where either FP or JP has all the bargaining power, we have

$$\beta^{NB} = \overline{\beta} \qquad \text{if } \alpha \,/\, 1 \quad (7a)$$

$$\beta^{NB} = \underline{\beta} \qquad \text{if } \alpha \,/\, 0. \quad (7b)$$

Comparing (7a - b) with (4b - c), we see that the first-best solution and the Nash bargaining solution coincide in the extreme cases where $(1-g_J)C_F > (1-g_F)C_J$ implies that FP possesses the entire bargaining power $\alpha = 1$, or symmetrically, $(1-g_J)C_F < (1-g_F)C_J$ implies that JP possesses the entire bargaining power $(1-\alpha)=1$. In general, however, β^{NB} does not coincide with β^{FB}.

The loss of efficiency incurred by adopting the Nash bargaining solution rather than the first-best solution is given by the difference in expected income from the operation $Y - (1 - \beta)(1-g_J)C_F - \beta(1-g_F)C_J$ evaluated at $\beta = \beta^{FB}$ and $\beta = \beta^{NB}$. It is calculated using (4b - c) and (6) as follows:

$$[\overline{\beta} - \alpha\overline{\beta} - (1 - \alpha)\underline{\beta}][(1-g_J)C_F - (1-g_F)C_J]$$

$$= (1 - \alpha)(\overline{\beta} - \underline{\beta})[(1-g_J)C_F - (1-g_F)C_J] \text{ if } (1-g_J)C_F > (1-g_F)C_J \quad (8)$$

and

$$[\overline{\beta} - \alpha\overline{\beta} - (1 - \alpha)\underline{\beta}][(1-g_J)C_F - (1-g_F)C_J]$$

$$= \alpha(\overline{\beta} - \underline{\beta})[(1-g_F)C_J - (1-g_J)C_F] \text{ if } (1-g_J)C_F < (1-g_F)C_J. \quad (9)$$

An upper bound for the efficiency loss is given by $(\overline{\beta} - \underline{\beta})|(1-g_J)C_F - (1-g_F)C_J|$. This upper bound is achieved when the entire bargaining power rests with the parent firm whose net cost of spillover is smaller than the other parent firm's.

An important empirical issue is how the Nash bargaining solution β^{NB} depends on FP's bargaining power, α. From (6) we see that $d\beta^{NB}/d\alpha = \overline{\beta} - \underline{\beta} > 0$. β^{NB} increases linearly as FP's bargaining power relative to JP's increases. Thus the greater the parent firm's bargaining power is, the larger its ownership

share in the IJV operation becomes. This also implies that with a higher bargaining power FP will be able to receive a larger share of IJV's profits $\beta Y+\beta g_F C_J$. (See (1a).)

Summary of findings

In the previous subsection we have presented a bargaining model for FP's foreign operations. In our model transfer of intangible assets is verifiable but its use is not verifiable. Also contractibility of output is not satisfied, and potential parent firms are likely to demand positive ownership shares in JV. The first-best solution is likely to be feasible only if a foreign operation requires only one of the parent firms' intangible assets (usually FP's intangible assets). In such a case, FP will set up a fully-owned subsidiary ($\beta^{FB} = 1$) and contract out necessary production inputs locally.

If the first-best solution for setting up a fully-owned subsidiary is not feasible, FP and its potential JP will either adopt a second-best strategy or proceed to a Nash bargaining solution. We have argued that the latter is more likely to be implemented in practice. Our empirical results show that, in case of joint ventures, FP's ownership share is correlated positively (negatively) with the amount of transfer of FP's (JP's) intangible assets from FP (JP) to JV. FP's ownership share also increases (decreases) with FP's (JP's) bargaining power relative to JP's (FP's).[4]

In the next Section 3, we present our empirical results using a sample of foreign firms' operations in Japan.

3. Bargaining model: foreign firms' FDI operations in Japanese manufacturing industries

We have shown that FP's ownership shares in its IJV are positively correlated with its bargaining power relative to JP's. Fully-owned subsidiaries (SUB) arise in the limiting case where FP's bargaining

[4] The present model can be extended to more complex models. These models differ in the types of inputs of intangible assets IJV requires from its parent firms. For example, we can consider the case where neither the amounts transferred of intangible assets nor the output resulting from the use of such assets are contractible. Another case is where the characteristics from the two previous models are combined (Nakamura and Xie (1998)). In all cases contractibility of output is not satisfied, and potential parent firms are likely to demand positive ownership shares in JV. Also it is shown that FP's ownership share in its IJV increases with its relative bargaining power in all of these cases.

power relative to JP's is very large. In this section we estimate the bargaining model empirically and test its theoretical relationship between FP's ownership share and relative bargaining power.

Foreign direct investment in Japan

Foreign firms increased their direct investments in Japan from about $930 million in 1984 to more than $3.2 billion in 1988. Most of these investments came from the U.S. and Europe. Foreign firms' operations in Japan are large relative to domestic Japanese firms. About one third of foreign affiliated firms are capitalized at more than 100 million yen while 99% of all domestic Japanese firms are capitalized at less than 100 million yen (Toyo Keizai (1989)). This is also reflected, for example, in the fact that U.S. firms' operations in Japan are considerably larger, on average, than U.S. firms' foreign operations in other countries (U.S. Dept. of Commerce (1980, 1985)). They are also more profitable than domestic firms (Nakamura (1991)).

The ownership patterns for foreign firms' subsidiaries were under strict government supervision until 1950. By the 1950 Law Concerning Foreign Investment, however, foreign firms were permitted to own at most 49% of Japanese firms. This law was changed in 1973 to permit foreign firms to obtain, subject to certain exceptions, full ownership. In 1977, 7% of U.S. firms' subsidiaries reported they were required to limit their U.S. parent firms' equity. In 1982 the fraction decreased to 3%. This compares with 1982 fractions of, for example, 1% for France and for West Germany, 2% for Italy and 3% for Australia (Contractor (1990)). Thus it appears that the shares of foreign ownership in Japan could be, and were, adjusted relatively frequently in recent years in response to company and government policies reflecting the interests of foreign and Japanese parent firms and Japanese domestic considerations. For example, at least 314 (190) foreign firms' subsidiaries have been established in Japan in 1988 (in 1989) while the ownership patterns for at least 151 (100) subsidiaries have changed during the same period (Toyo Keizai (1989, 1990)).

Empirical specification and estimation results

We test our bargaining model in two stages. In the first stage we estimate the probability that FP sets up a fully owned subsidiary (SUB) as a function of P, a bargaining variable, and other explanatory

variables. Assuming that the bargaining model hypothesis holds, the variables that increase FP's bargaining power (JP's bargaining power) increase (decrease) the probability that FP sets up its own fully owned subsidiary. In the second stage, assuming that FP sets up an IJV, we estimate FP's ownership share in the IJV, β, as a function of P and other explanatory variables (B_1). If the bargaining model hypothesis holds, then the variables that increase FP's bargaining power (JP's bargaining power) increase (decrease) β.

FP's probability of setting up a SUB

We estimate the probability that FP chooses a fully-owned subsidiary, SUB (dependent variable q = 1), over a joint venture, JV (q = 0), using a probit model:

$$\text{Prob}(q = 1) = \text{Prob}(G_1(P,B_1) > \varepsilon_1) = F(G_1) \quad (10)$$

where ε_1 is a normal random variable with mean zero and variance σ_1^2 and F is the distribution function for a standard normal variable. The function G_1 is given by

$$G_1 = (1/\sigma_1)(\text{ a function of regressors}) = G_1 (P, B_1) \quad (11)$$

Our sample consists of 231 foreign affiliated manufacturing firms in electric equipment, general machinery, precision and pharmaceutical industries. Foreign parent firms which fully or partially own these operations adjust their ownership shares in these operations regularly to reflect their optimal decisions. Also the skills spillover to Japanese competitors in these industries is known to be of significant concern for foreign parent firms. Thus our data seem quite suitable for testing our model implications. (See Table A1 in Appendix A1 for descriptive statistics of the sample.)

Since FP's bargaining power (α in Equation (5)), or equivalently, JP's bargaining power (1- α), is not observable, we consider proxies which are thought to affect FP's and JP's bargaining power.

More specifically, P in Equations (10) and (11) consists of variables which affect FP's bargaining power relative to JP's. As proxies for the factors affecting P we consider the following variables: the proportion of imports from FP in IJV's procurement (%IMP), the proportion of exports in IJV's sales (%EXP), the R&D-to-sales ratios for FP and JP (R&D-FP and R&D-JP), the price-to-earnings rations for FP and JP (P/E-FP and P/E-JP) and the size of FP's operation in Japan measured by the number of

workers (#W-JV).

IJV's imports from FP's global production network reflect FP's superb technology and other intangible assets including its ability to manage global operations. Hence they provide FP with a considerable amount of bargaining power. Most of IJV's imports are in the form of intermediate goods from FP. Since FP's technology is less likely to be lost to potential competitors if IJV imports FP's technology in the form of intermediate goods rather than in the form of technology licensing agreement, %IMP also measures the degree of FP's bargaining power which allows FP to transfer its technology in the form of intermediate goods rather than relying on licensing agreements. IJV's exports (%EXP) also reflects the fraction of IJV's output that is sold to overses, often through FP's superior global distribution and marketing channels. This suggests that %EXP also contributes to FP's bargaining power.

One of FP's most important intangible assets is its investment in R&D (R&D-FP), which strengthens its bargaining power. It is also likely that large R&D-FP is associated with higher levels of noncontractibility in IJV's output and the inputs from FP as well as higher degree of potential spillover of FP's technology. Our prediction is that the higher R&D-FP, the more ownership FP demands in JV. JP's R&D status (R&D-JP) in Japan, on the other hand, negatively impacts FP's bargaining power and hence negatively correlated with FP's ownership in JV. (We will replace firm R&D ratios with the corresponding industry average R&D ratios for the U.S. and Japan, R&D-US and R&D-JPN, in FP's first stage choice between SUB and a JV, since FP's potential JV partners and their firm-specific R&D ratios are unknown.)

The price-earnings ratios, P/E-FP and P/E-JP, are expected to capture the intangible (financial, managerial and other) assets FP and JP each own. In bilateral negotiations between FP and JP, therefore, a large value for P/E-FP (P/E-JP) is likely to increase (decrease) FP's bargaining power. In order to capture the long-term effects of intangible assets we include as our P/E variables the price-earnings ratios averaged over 10 years prior to the sample periods in the JV ownership share equation (11).

FP's other important intangible assets include its brand name, the reputation of its product outside

Japan and its ability to organize its operations in Japan as part of its international network of production. Many successful FP operations in Japan export significant amounts of their output to overseas markets, including FP's operations elsewhere outside Japan. Such exports also reflect FP's ability to take advantage of Japan's comparative advantage in manufacturing. JV's export-to-sales ratio generally reflects the strengths of FP's brand name, product reputation and ability for global production strategy, and hence FP's bargaining power.

We also include IJV's size (number of workers JV employs, #W-JV). The large size of FP's operation may weaken FP's bargaining power because of the difficulty (e.g. agency cost) associated with having to manage a large local workforce alone without a Japanese partner.

In (11) the explanatory variables of particular interest are %IMP(+), %EXP(+), %R&D-US(+), %R&D-JPN(-) and #W-JV(-), where the expected signs are given in parentheses. Estimation results for our probit model (11) are presented in Table 1. %IMP, %R&D-US and %R&D-JPN are highly significant with expected signs. Other variables including industry dummies are not statistically significant. Our results are consistent with the bargaining hypothesis.

FP's ownership share in IJV

If FP chooses to have an IJV, FP's ownership share (s) in IJV is determined by the bilateral negotiation between FP and JP according to Equation (12) below in which P now contains firm-specific R&D-to-sales and P/E ratios.

$$\beta = G_2 (P, B_2) \qquad (12)$$

Since (12) is to be estimated using data on IJVs, our estimating equation will be conditional on the event that FP chooses IJV. We use Heckman's (1976,1979) selection bias specification[5] to correct for such sample conditioning in estimating (12).

Estimation results for (12) are presented in Table 2. Both %IMP and %EXP have positive signs, as expected, and are significant at a 1% level. JP's bargaining power reflected in R&D-JP and P/E-JP is also significant. JV's size (#W-JV) is also significant and negative, as expected. This is consistent with the presence of FP's agency cost for monitoring its large operation in Japan. Such agency cost is reduced by allowing a local partner, JP, to participate in JV's management (Nakamura and Yeung (1993)). The industry dummies are not generally significant. (The only exception is in the first column (1) where no R&D nor P/E

[5] See also Amemiya (1985, §10.7).

variables are included.)

It is also important to note that in Table 2 once bargaining variables are accounted for, selection bias term and industry dummies become insignificant. This increases our confidence that our regressors capture the essential factors underlying FP's and JP's ownership decisions in their IJV.

4. Learning from joint ventures

We have presented empirical evidence which is consistent with our bargaining model in a static context. In this model the relative bargaining power each IJV partner possesses (i.e. α and $(1-\alpha)$, respectively) is assumed to be fixed over time. Our empirical results suggest that certain factors affect such bargaining power and hence the ownership shares of the IJV partners. Such factors include, for example, each partner's R&D capacity. In this paper we focus on JPs' learning from their IJVs and show empirically that accumulation of JPs' R&D capacity is affected by their experience with IJV operations over time. This implies that the JP's (local IJV partner's) exposure to running the IJV itself may strengthen their relative bargaining power position over time, which in turn may necessitate reorganization of the ownership of the IJV itself. This occurs because each IJV partner's intangible assets are important determinants of their relative bargaining power, as we have seen above. This also suggests that IJV partners' learning from their own IJVs is an important source of the observed dynamic instability of IJVs.

Because of the heavily protected environment in which IJVs were set up in the earlier years of our sample period in Japan, it is likely that the Japanese government enforced the requirement that there be some calculated technology spillovers out of IJVs in order for permit to be issued to the IJVs.[6] It would not be surprising either that some of the JPs which entered into IJV arrangements in the 1960s and early 1970s with foreign firms counted on such spillovers to turn around their failing business strategies. For example, it is well known that many of the Japanese firms that sought IJVs were not necessarily the industry leaders in the respective Japanese markets.[7] We also note that even though the primary area of focus for spillovers from

[6] Many Western multinationals argue that this is being practiced in China.

[7] For example, Mitsubishi Heavy Industry (MHI) set up an IJV (Caterpillar_Mitsubishi) with Caterpillar in the construction machinery industry where Komatsu was the industry leader and another IJV (Mitsubishi Motor Corporation) with Chrysler in the passenger car industry where Toyota and Nissan were the industry leaders. It is interesting to note that Komatsu and Toyota, which are both still industry leaders, never had IJVs in Japan with foreign firms. MHI was not a player in either the construction machinery or passenger car industries at the time these IJVs were set up. Nevertheless, MHI (or, more broadly, the Mitsubishi keiretsu group) was desperate to enter these growing markets and establish separate companies.

IJVs to JPs was technology, such spillovers could have also taken place in the area of advertising and marketing skill. For example, the notion of differentiated consumer markets and strategies for developing them by investing in advertising and marketing were almost non-existent in Japan in the 1960s. It is possible that the IJVs gave their JPs opportunities to learn sophisticated advertising and marketing methods.

Estimation results

We expand our sample used in Section 3 to include all Japanese manufacturing firms that were listed in the first section of the Tokyo Stock Exchange in fiscal year 1990. This subsumes our earlier sample used for estimating the bargaining model. Expanding our earlier sample was necessary, since our present estimation task involves estimating the effects on JPs of the relatively infrequent occurrences of IJVs.. Our focus will be estimating such effects on Japanese partner firms primarily because the IJVs we consider during the sample periods were typically set up with technology transfer purposes in mind by Japanese partners (and the Japanese government). Whether such actions did impact, for example, JPs' R&D behavior is of our interest. Secondly the IJVs in our study were generally quite small relative to their foreign parent firms and hence were highly unlikely to have influenced the behavior of their FPs. Thirdly detailed data for many of the FPs are often not available from public sources for the historical period we consider. We are interested in Japanese firms listed in the first section of the Tokyo Stock Exchange because they are considerably larger and more established than second section firms. Typically more data are available for first section firms. Relevant firm data were collected for the sample period 1961-90. During this period the first section firms and foreign firms established 134 manufacturing IJVs that were operational in 1991. (See Table A2 in Appendix A2 for the descriptive statistics of our sample.)

We measure the learning effects of IJVs on JPs' R&D-sales ratios by the following regression:

$$\text{JP's R\&D} = G_3 (\#\text{JVs}, B_3), \tag{13}$$

where #JVs is the total number of IJVs being operated by JP to the previous year. B_3 includes a dummy variable corresponding to whether JP set up a new IJV in the present year (JV-dummy), industry average R&D-sales ration (Ind_R&D) and a time trend (calendar year, Year). The primary variable of interest is #JV, which we regard as a proxy for JP's learning from JPs' older IJVs. Table 3 shows our regression results for our learning model for various historical sample periods.

JP's learning from IJV

We see from Table 3 that, after controlling for industry effects, #JVs have significantly positive effects on increasing JP's R&D level. It is of interest to note that the degree of impact increased significantly from the period 1961-70 (when the impact was negative) to the period 1981-90. This implies that joint ventures' spillover effects on JPs' R&D have become increasingly important over time. This is in contrast to the immediate effects of newly set up joint ventures (JV-dummy) that were positive in the 1960s but became increasingly more negative over time. This suggests that in the 1960s foreign firms chose Japanese IJV partners that were strong in R&D but this practice was dropped in the 1970s and 1980s. In the last two decades, the Japanese partners chosen were generally weak in R&D (and increasingly so). This is consistent with the notion that, because of the industrial policy that was operational from the late 1950s to 1960s, joint ventures were allocated to Japanese firms with strong R&Dto maximize the effectiveness of transfers of overseas technology. This was no longer the case in the 1970s and 1980s when firms with weaker technology bases attempted to improve their positions by getting involved in IJVs. Our overall results for the period 1961-90 (model (1)) are that JPs continue to receive positive spillovers in R&D from their IJVs even though they do not receive any benefit from the IJV established in the current year.

Learning as a source of IJV Instability: a synthesis

Our framework allows us to consider certain simulation experiments.

Case 1. For example, suppose in 1981, an FP currently has a fully-owned subsidiary (SUB) with the following characteristics: %IMP=.69, %EXP=.09, #W-JV=649, R&D-FP=.08 and Ind R&D-JPN=.01. It is expected that the relevant Japanese manufacturing industry will massively increase their R&D expenditures from the current almost non-existent level of 0.01 to a new level of .05 within the next 10 years. This is in part driven by Japanese competitors who are learning fast from their technology based IJVs with FP's global competitors.[8] Under the Japanese government directives FP's subsidiary will have to reduce the amount of intermediate goods it sources from FP from the current level of 69% to 10%. They expect the export level to go up from the current 9% to 12%. All other variables are expected to remain constant for the next 10 years. FP understands that their relative bargaining position in Japan will probably change in response to these

[8] The impact of learning from IJVs on their JPs' R&D capacity can be also calculated numerically using our regression results reported in Table 3. We note that the average R&D-sales ratio for all manufacturing firms in Japan increased significantly from 2.15% to 3.52% during the 10-year period: 1982-1992. The corresponding U.S. figure for the same period is 3.8% (1982) and 4.2% (1992). (Japanese Science and Technology Agency (1997, p.216, Table 2-3).

expected changes in their business environment and is interested in estimating the probability that they keep the present subsidiary as a fully owned subsidiary in 10 years.

Using (11) and our probit regression results reported in Table 1 we can calculate the probability F(G1) before and after the expected changes in the business environment. Suppose we use estimated coefficients in column (2) of Table 1 and calculate the expression G1 using the relevant mean values for all the explanatory variables. We get 3.02 and 2.16 for G1 for before and after the specified business environment changes. Using a normal probability table we find that the probability of full ownership for FP deceases from the current 100% to 98% after the changes. If the Japanese government requires that SUB achieves complete import substitution (local procurement) of the intermediate goods SUB imports from FP, then %IMP becomes zero and G1 decreases to 1.23. Under this scenario the probability of FP's full ownership decreases further to 89%, more than a 10% decline compared to the present 100%.

Case 2. As another example, consider an IJV currently owned by FP and JP with FP's ownership being 85%. FP is concerned that their bargaining position relative to JP's will fall, which may force them to give up their majority ownership. The presently anticipated changes over the next 10 years in FP's business environment are as follows: import substitution (%IMP drops from 50% to 20%); %EXP and R&D-FP remain constant, respectively, at 12% and 6%; JP's R&D capacity increases significantly from 1% to 5%; the number of employees (firm size) of the IJV (#W-JV) increases from 300 workers to 1,000 workers; and all other variables remain constant (Electric equipment dummy=.33, Precision dummy=.12, Pharmaceutical dummy=.15, General machinery dummy=.40, selection bias=1.051).

Using our estimation results reported in Column (2) of Table 2, we find that FP's expected ownership share in the IJV after the changes in business environment is 52%, a drop of more than 30% from the current level of 85%.

Finally we note that selection bias term in Table 2 may be interpreted as the unobservable forces that resist FP's ownership in the IJV. Such resistance may represent factors such as the general strength of JP and the corresponding Japanese domestic industry, the regulations that the host government imposes on foreign companies and the like. Such forces strengthen JP's bargaining position. Suppose such resistance forces are expected to increase significantly from the current level of .528 (Table A1) to 1.0 over the next 10 years. Then FP's expected ownership share further declines by 30% to 20.1%.

5. Concluding remarks

We have presented a dynamic framework for firms' FDI. Foreign firms (FPs) with superior technology and other intangible assets try to enter an overseas market with either a fully-owned subsidiary (SUB) or an international joint venture (IJV) with as much ownership share as possible. The firms' intangible assets are an integral source of their bargaining power in their negotiations with potential joint venture partners (JPs) in the host country. Using foreign firms' technology-based IJVs located in Japan we have presented some empirical evidence that a bargaining model describes this process well. Both FP's and JP's R&D capacity as well as other factors contribute to their respective bargaining power. However, FP's bargaining power relative to JP's does not remain constant over time. We have presented empirical evidence that, in a dynamic context, JP's learning from their own IJVs as well as the increasing R&D capacity of their industry will enhance JP's bargaining power. Such learning by JP, together with other factors, can seriously undermine FP's ownership of the IJV over time.

We have shown that changes over time in the business environment characterized particularly by the positions of FP's and JP's intangible assets can significantly reduce FP's expected ownership share in their FDI. This is consistent with the observation in the literature that IJVs are typically unstable over time. Ascertaining more precise role of learning in the observed instability of IJVs is a subject of our future research.

Appendix A1. Estimating bargaining model for FDI operations: descriptive statistics

Table A1. Descriptive Statistics: Bargaining Model Sample

	All	Fully owned (β=1)	Jointly owned (β<1)
FP's ownership share (β)	.74 (.25)[a]	1.0(0)	.56(.17)
%IMP	.49(.37)	.69(.33)	.35(.33)
%EXP	.11(.19)	.09(.14)	.12(.15)
#W-JV[b]	619(2,156)	649(1,812)	599(1,211)
#W-FP[c]	47,306(76,677)	42,050(51,383)	50,951(97,200)
CAPITAL-JV[d]	4,446(34,261)	3,023(12,112)	5,432(11,121)
R&D-FP[c]	.06(.05)	.08(.05)	.05(.04)
R&D-JP[c]	---	---	.02(.03)
Ind R&D-FRN[f]	.07(.03)	.08(.03)	.06(.03)
Ind R&D-JPN[f]	.05(.02)	.06(.02)	.05(.02)
P/E Ratio-FP[g]	15.4(4.3)	15.7(4.0)	15.2(.02)
P/E Ratio-JP[g]	---	---	36.3(35.8)
Europe[e]	.39	.40	.38
Electric Equipment[i]	.28	.23	.33
Precision[i]	.12	.12	.12
Pharmaceutical[i]	.18	.22	.15
General Machinery[i]	.42	.43	.40
Selection bias	.528[k]	---	---
No. of observations	231	94	137
Europe[e]	.39	.40	.38

Source: Calculated from Toyo Keizai (1993). Data are for 1991.

[a] Numbers in parentheses are standard deviations.

[b] Numbers of workers employed by FP's operation in Japan.

[c] Numbers of workers employed by FP.

[d] Capitalization (book value) for FP's operation in million yen.

[e] Firm R&D/sales ratios for the parent firms of U-S-Japan joint ventures

[f] Industry R&D/sales ratios for the U.S. and Japanese industries to which the parent firms of U.S.-Japan joint ventures belong.

[g] The price-earnings ratios for the parent firms of U.S.-Japan joint ventures.

[h] FP is a European firm.

[i] Industry dummy variables.

k Calculated using the expanded sample described in Table A2.

Appendix A2. Estimating JPs' learning from IJVs: descriptive statistics

Table A2. Descriptive Statistics: Learning Model Sample

	1961-90 Mean (s.d.)	1961-70 Mean (s.d.)	1971-80 Mean (s.d.)	1981-90 Mean (s.d.)
R&D	.00544 (.01125)	.00045 (.00229)	.00532 (.00916)	.00972 (.01519)
Ind_R&D	.00544 (.00694)	.00045 (.00143)	.00532 .00447	.00970 (.00870)
Year	16.100 (8.2236)	5.8187 2.7702	15.598 2.8694	25.128 (2.653)
JV-dummy	.01054	.01848	.01049	.003998
Log(sale)	10.506 (1.3320)	10.070 (1.3170)	10.559 (1.2820)	10.815 (1.2970)
#JVs	.20186 (.63620)	.09962 (.36851)	.22227 (.64167)	.26633 (.77961)
No. of obs.	12717	3734	4481	4502

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Table 1. Probit Estimates For the Probability that Foreign Firms Choose Fully-Owned Subsidiaries

	(1)	(2)
%IMP	2.102***[a]	2.314***
	(8.34)[b]	(4.68)
%EXP	.571	-.342
	(1.32)	(.367)
%R&D*US	---	.219***
		(2.85)
%R&D*JPN	---	-.459***
		(3.52)
#W-JV[a]	.000	.000
	(.991)	(.514)
Elec.eq.dummy	---	---
Prec.dummy	.022	.891
	(.081)	(1.11)
Pharma.dummy	.175	.896
	(.681)	(.090)
Gen.machi.dummy	.671***	1.12
	(3.31)	(.175)
Constant	-1.704***	.543
	(7.71)	(.640)
Log likelihood	-126.42	-47.76
No. of obs.	231[c]	92[d]

[a] See the text for the variable definitions. *,**,***: statistically significant at 10%, 5% and 1%, respectively.
[b] Numbers in parentheses are asymptotic absolute t-ratios.
[c] Includes all observations.
[d] Includes U.S. firms' operations in Japan for which all relevant data are available.

Table 2. Determinants of Foreign Firms' Ownership Shares in Joint Ventures

	(1)	(2)	(3)
%IMP	.772***[a]	1.08*	.973*
	(3.28)[b]	(1.64)	(1.68)
%EXP	.274***	.485**	.458***
	(3.61)	(3.56)	(3.84)
R&D-FP	--	.245	-.413
		(.326)	(.570)
R&D-JP	--	-.072**	-.079***
		(2.40)	(3.24)
P/E-FP	--	--	-.001
			(.277)
P/E-JP	--	--	-.002***
			(3.28)
#W-JV	-.00001***	-.00001	-.00001*
	(2.81)	(1.61)	(1.90)
Elec.Eq. dummy	--	--	--
Prec.dummy	-.042	-.046	.041
	(.851)	(.382)	(.421)
Pharmac.dummy	.047	.036	.065
	(1.09)	(.451)	(.951)
Gen.Machi.dummy	.111*	.161	.147
	(1.84)	(1.22)	(1.22)
Selection bias[c]	-.558**	-.784	-.649
	(2.60)	(1.27)	(1.19)
Constant	.509***	.463***	.545***
	(17.42)	(6.76)	(6.80)
R^2	.228	.457	.548
No.of obs.	137[d]	49[e]	49[e]

[a]See the text for the variable definitions. *,**,***: statistically significant at 10%, 5% and 1%, respectively.
[b]Numbers in parentheses are heteroskedasticity corrected absolute t-ratios (Amemiya(1985), White(1980)).
[c]The possible bias due to selection into the subsample of IJVs is corrected by Heckman's(1976, 1981) selection bias term.
[d]All IJVs.
[e]U.S-Japan IJVs for which all relevant data are available.

Table 3. Japanese Parent Firms' Learning from their International Joint Ventures[a,b]

	(1)	(2)	(3)	(4)
	1961-90	1961-70	1971-80	1981-90
Constant	.0004**	-.0005***	.0015*	.0039
	(2.01)	(4.37)	(1.87)	(1.05)
#JVs	.0013***	-.0005***	.0018***	.0053***
	(8.44)	(4.24)	(7.06)	(5.26)
Ind_R&D	.9861***	.944***	.9591***	1.09***
	(69.2)	(.03)	(33.5)	(21.4)
Year	-.0000*	.00005***	-.0001*	-.0002
	(1.83)	(3.30)	(1.86)	(1.24)
JV-dummy	-.0214***	.0123***	-.0292***	-.3525***
	(4.72)	(9.26)	(3.60)	(5.04)
Selection bias	---------	---------	---------	---------
Adjusted R^2	---------	---------	---------	---------
No.of obs.	12717	3734	4481	4502

[a]Numbers in parentheses are absolute t-ratios based on heteroskedasticity-corrected standard errors.
[b] *,** and *** denote, respectively, significance at 10%, 5% and 1% levels.