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# Joint venture instability, learning and the relative bargaining power of the parent firms

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**Abstract**

Foreign partner firms' (FPs') superior intangible assets such as technology and marketing and other management skill are an integral source of their bargaining power in their negotiations with potential joint venture partners (JPs) and government regulators in the host country. FPs which can exercise high levels of bargaining power enter the host country market with either a fully owned subsidiary (SUB) or an international joint venture (IJV) with larger ownership shares than otherwise.

In this paper, we present such a bargaining power model. We then estimate the model using data for joint ventures in Japan for the post-World War II historical period. Our results are generally consistent with the model predictions. We then consider a dynamic context where JPs' learning from their own IJVs as well as the increasing R&D capacity of their industry will enhance JPs' bargaining power. Such learning by JPs, together with other factors, could undermine FPs' ownership of the IJV over time. Generally, changes over time in the positions, for example, of FPs' and JPs' intangible assets such as technology can significantly affect their relative bargaining power and hence affect their ownership shares in their IJVs. Our empirical results also confirm such learning effects on the part of the JP.


*Keywords:* Foreign direct investment; International joint ventures; Bargaining power; R&D; Learning

## 1. Introduction

The dynamic evolution of international joint ventures (IJVs) has attracted much interest in the literature. There is considerable research interest in exploring the impact IJVs might

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have on the future course of their 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, & Yeung, 1996).

Bleeke and Ernst (1995) stress the importance of firms' incorporating in their decision processes of alliances the potential consequences over time of the proposed alliances. Abegglen and Stalk (1985, p. 229) provide examples of the subsequent buyouts by one of the partners of foreign firms' joint ventures with Japanese partners. These studies suggest that, even though future events are not fully predictable, firm management could apply the concepts, for example, underlying our bargaining model discussed below for simulating the sorts of consequences that might occur over time for the joint ventures (or more broadly alliances) being proposed. For example, the local partner's capacity to learn the relevant technologies that drive the joint venture being proposed will likely enhance the relative bargaining power of the local partner and increase the probability of their buyout of the joint venture. On the other hand, the foreign partner's ability and willingness to learn management skills in local production, marketing and distribution might eventually result in increased bargaining power of the foreign partner, making it unnecessary for them to maintain the joint venture. In such a case the buyout of the joint venture by the foreign partner might follow.

Interactions between the partner firms are an important factor in the determination of their IJVs' future course. 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 firms learn more about their respective IJV partners through interactions involving IJV operations, the foreign parent may come to feel it has accumulated enough knowledge about the domestic (host country) market, and the host country parent may also feel it has 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, & 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 Barkema, Bell, and Pennings (1996), Barkema and Vermeulen (1997), Kogut (1989, 1991), and Park and Ungson (1997). Joint ventures and other types of alliances are also

[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) management of the IJV formation processes; (2) management of the boundary relationships between partners; and (3) management of the operation of the IJV.

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 (e.g. Demirbag & Mirza, 2000). 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 objective of our research is to provide information which is potentially useful for parent firms in designing their strategies on ownership of their foreign operations. Understanding essential factors which influence the future course of the ownership structures of their foreign operations would help the firms, for example, to decide how long particular IJVs should exist as joint ventures before they should be reorganized as their fully owned subsidiaries.[3]

The rest of the paper is organized as follows. In Section 2, we present a simple bargaining model which describes how the parent firms of an IJV involving R&D and other intangible assets with possible spillovers (i.e. learning) determine their ownership shares in the IJV. Practical measurement issues of firms' intangible assets such as R&D and management skills are also discussed in this section.[4] 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. Some simulation experiments on how parent firms' optimal ownership shares in their IJVs evolve over time in response to changes in various factors are also presented in this section. Section 5 concludes.

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[2] Levenstein and Suslow (2004, Table 1) find that many international cartels last for less than 6 years while a few last for much longer.

[3] Foreign operations' performance and their ownership structures are often found to be correlated (e.g. Killing, 1982; Ramaswamya, Gomesb, & Veliyathc, 1998). Most strategic alliances, which may or may not be set up as joint ventures, are dissolved as soon as their parent firms' objectives have been achieved. The times of such dissolutions are not often pre-determined and hence stochastic. Many IJVs share the same property as these strategic alliances.

[4] In this paper, we use intangible assets to mean non-physical assets which broadly include R&D, management skill and other knowledge-based assets as well as more traditional (in accounting sense) good will. In empirical implementation of our model to follow we focus on R&D (technology) as the primary intangible assets.

## 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 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. The integrity of ownership of technology-based firms' intellectual property rights is often difficult to secure even under legal contracts when other firms are allowed to exercise such rights. In particular, 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 the 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 & Dark, 1989 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 (1994) 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 (1994), their model does not consider the potential bargaining processes that may take place between FP and JP.

### *2.1. Firms' intangible assets and FDI*

The concept of intangible assets is of wide use in both academic research and business practices of management and various methods of measurement of intangible assets are implemented in practice.

Many previous studies have identified various forms of intangible assets as the driving force of firms' international expansion (e.g. Arora & Fosfuri, 2000; Balakrishnan & Koza, 1993; Hymer, 1960; Kogut & Zander, 1993; Teece, 1977; Von Hippel, 1994). A recent study of the Commission of the European Communities (Zambon, 2003) stresses the shift of corporate decision making emphasis from tangible to intangible assets and focuses on the measurement issues of intangible assets. Firms' intangible assets are typically assumed to consist of knowledge capital reflected in R&D and marketing/advertising skills, production and inventory control (e.g. JIT) skills, supplier management skills, patents and unpatented technology, good will and other types of management skills.[5] Evidence of technology spillover from foreign direct investment (e.g. Bernstein, 2000; Liu, Siler, Wand, & Wei, 2000; Spencer, 2000) also implies the managerial importance of firms' skill to protect their own technologies.

Some empirical estimates of technology spillover and related returns are also available (e.g. Bernstein, 2000; Bernstein & Mohnen, 1998; European Commission, 2001; Griffith, Redding, & Van Reenen, 2001; Luintel & Kahn, 2002). Abegglen and Stalk (1985, pp. 126–128) also describe their numerical estimates for the amount of technology spillover experienced by US firms as follows: the cumulative cost of all of the technology

[5] While there is no unique definition that characterizes firms' intangible assets empirically, a number of management skill and technology variables are often used as proxies for intangible assets in these empirical studies. It is generally accepted both by academics and practicing managers that these intangible non-physical factors are an integral part of the decision processes for firms' foreign direct investment and other types of foreign market entry. Firm managers, of course, must decide, depending on the real business circumstances they face, which intangible factors they should focus on. Similarly it is up to academic researchers to make judgements about which intangible factors should be considered as the driving force of the economic model being considered. (We wish to add that, in many ways, this situation is really not different even when academics or practicing managers consider firms' physical quantities such as numbers from financial statements. It is not usual that we have precisely the right kinds of variables correctly measured for the type of decision problems we have at hand. For example, most economists and financial analysts argue that accounting numbers which are often manipulated or based on book value are not suitable for firms' economic decision purposes. In such cases more appropriate proxies based on market transactions might have to be used in their analyses.) It is for these reasons that we feel it reasonable to use intangible assets in modeling firms' decision processes for foreign direct investment.

transferred to Japan from the West over the previous 20 years was only $17 billion, a fraction of the current annual US research and development budget. It was a cost that was very high, at times, for individual kaisha (Japanese firm). The down-payment on Dupont's nylon patent was equal to the entire capitalization at the time of Toyo Rayon, now Toray Industries…From the sellers' point of view, the results have been disastrous. Technologies sold to Japanese companies has come back in improved form to cerate competitive nightmares."

For practicing managers, many established consulting firms provide guidelines about how to measure intangible assets of various types. For example, in their presentation of 'the science of alliances: governance roles and responsibilities (Roussel, 2004)' Accenture emphasizes the importance of management's skill to value both tangible and intangible assets in light of changing market conditions. In describing the services they offer client firms, Ernst & Young (2004) emphasize their ability to value intellectual property and other intangible assets for the purpose of acquisitions, disposals, licensing and strategic alliances. The accounting profession has traditionally paid significant attention to valuation and measurement of firms' intangible assets including good will. Accordingly, in updating the changing business environment the Financial Accounting Standards Board of the United States recently issued new accounting standards that have changed both the method under which business combinations are accounted for and the method of accounting for acquired good will and other intangible assets. (SFAS 141 supercedes APB 16 and SFAS 142 supercedes APB 17.) These new rules mean that the valuation of intangible assets is of paramount importance (see, for example, Stout, 2001.)

Effectiveness of firms' technology spillover protection depends to a large extent on the legal environment. In this regard, it is possible to measure empirically enforceability of intellectual property (IP) rights protection (e.g. Ostergard, 2000) and hence such measurement framework can be potentially incorporated in our model. Empirical evidence also exists that, in making their FDI decisions, multinational firms do pay attention to the degree of enforcement of intellectual property rights protection in host countries (e.g. Mansfield, 1994 for India and Smarzynka, 2002 for Eastern Europe.)[6]

In Sections 2.1.1 and 2.1.2, 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

[6] Such enforcement affects firms' costs of technology spillovers in our model (see also Clegg & Cross, 2000.) We will further discuss IPR protection below.

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.[7]

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.

*2.1.1. Ownership of foreign operations and contractibility*

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.[8]

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. Foreign agents who provide service and goods under contracts to the FP may have little incentive to be efficient providers. The FP may have to use extra resources to monitor the agents, and, may in the end feel vertical integration, or direct ownership of some or all of its foreign operations would be 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

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[7] Our bargaining model is reasonably general and theoretically justifiable (at least from the perspective of firm behavior) and yet it is empirically implementable. We point out that one of the reasons for our efforts to develop models like the one given in this paper is to respond to the criticism in the literature about the lack of theoretical frameworks in the topical area that our paper is concerned with. Yan and Zeng (1999), for example, argue the lack of theoretical frameworks for research in dynamic behavior of international joint ventures. The present approach potentially provides a theoretically sound and yet practical modeling approach to analysis of international joint ventures over time.

[8] The problem of non-contractibility associated with technology and other 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.

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. Non-contractible 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.[9]

OECD (1989) also points out that difficult legal questions regarding enforceability of protection of intellectual property rights (IPR) exist for large-scale joint ventures and international patent networks. The amounts of spillover depend, to some extent, on how IPR protection is implemented in the host country. In this sense, determination of how much of the foreign parent firm's patents and unpatented proprietary technologies is legally accessible to the local partner matters. The host country's legal environment also potentially constrains the validity of any contractual arrangements that the joint venture partners agree on (e.g. Smarzynka, 2002).

In many developing economies the host governments require the availability of technology transfer (and associated spillover) to be a pre-requisite for approval of the proposed joint ventures or other types of FDI. This was the accepted government policy in Japan until the 1970s. This is the policy in China. These national policies reflected in the legal (and cultural) environment and the associated technology management practices would often increase the local partner's bargaining power in demanding higher levels of joint venture ownership. Where significant growth is expected for the market of the host country, the foreign partner may still accept joint ventures with somewhat less than optimal ownership shares in the joint venture.

At its national economy level, a host country which is eager to receive foreign technology faces a policy trade-off between foreign firms' willingness to invest in that country and developing their own domestic industry on their own. The developing nations that favor their own domestic industry without FDI tend to have weak intellectual property rights protection. It is important to point out in this regard that there is empirical evidence

[9] For this reason some firms by corporate policy do not use joint ventures for their primary subsidiaries. For example, both IBM and Coca-Cola left India entirely in the late 1970s when the Indian government demanded that their fully owned Indian operations be turned into joint ventures with local companies (Encarnation & Vachani, 1985).)

linking multinational firms' willingness to invest in FDI with strong intellectual property rights protection in the host country (see Lee & Mansfield, 1996; Mansfield 1994, 1995).[10]

A number of anecdotal cases are also consistent with the evidence. For example, Japan chose the policies emphasizing developing technology-based manufacturing industries without FDI until the 1970s, which went together with relatively weak protection of intellectual property rights. Indeed Japan did receive relatively little (inward) FDI throughout the 1950s through the 1990s. Japan reversed their official policy in this regard following the burst of its financial bubble in 1990. It now argues it welcomes inward foreign direct investment. Despite such a reversal of the official policy the general business culture and policy environment in Japan which discouraged FDI for many decades does not appear to have changed much yet. Even the Japanese government now recognizes that Japan is paying the high price for the lack of adequate FDI in terms of the lack of foreign company generated competition in many industries and also the lack of employment such foreign firms might have generated in Japan.

### *2.1.2. Foreign operations involving the cost of technology spillover*

In this section, we present a model for 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.[11] 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.

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[10] For example, until the early 1990s enforcement of IPR protection in India was also poor and many US firms were reluctant to transfer their technology even under contract. Mansfield (1994, p. 15) notes, however, that more US firms are now willing to transfer technology to their affiliates in India which did change its environment for protection of intellectual property rights in the 1990s. Smarzynka (2002) presents recent empirical evidence on this for foreign direct investment in Eastern Europe: for example, the types of activities and industries FDI bring in are heavily influenced by the degree of enforcement of intellectual property rights protection in host countries.

[11] Our income variable (with expected value $Y$) does not include the costs and benefits of spillover of intangible assets such as technology. Our model thus focuses on analysis of such costs and benefits. Further discussion on this is found below.

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 non-contractible aspects of the 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 $\beta$ FP's ownership share in the operation, where $0 \leq \beta \leq 1$. Then JP's share is $1-\beta$. The net expected benefits from the operation for FP and JP are given by:[12]

$$\text{FP}: U_{\text{F}} = \beta Y + \beta g_{\text{F}} C_{\text{J}} - (1-\beta) C_{\text{F}} = \beta(Y + g_{\text{F}} C_{\text{J}} + C_{\text{F}}) - C_{\text{F}} \tag{1a}$$

$$\begin{aligned}\text{JP}: U_{\text{J}} &= (1-\beta) Y + (1-\beta) g_{\text{J}} C_{\text{F}} - \beta C_{\text{J}} \\ &= (Y + g_{\text{J}} C_{\text{F}}) - \beta(Y + g_{\text{J}} C_{\text{F}} + C_{\text{J}}).\end{aligned} \tag{1b}$$

$\beta g_{\text{F}} C_{\text{J}}$ and $(1-\beta) g_{\text{J}} C_{\text{F}}$, respectively, denote the portions of their respective partner's technology spillover that FP and JP receive., where $0 < g_{\text{F}}, g_{\text{J}} < 1$. When $g_{\text{F}} = 1$ ($g_{\text{J}} = 1$), then JP's (FP's) spillover all goes to FP (JP).

Our model assumes that joint venture's future income is a random variable but its expected value ($Y$) is constant. This implies that the partner firms' costs and benefits of spillover enter as separate terms in the firms' net benefit functions (1a) and (1b). Note also that the joint venture's income can be either a static random variable or a stochastic process with constant expected value $Y$.[13] In order to focus on the factors of immediate interest to us our model given above implicitly assumes the following: (1) the economic fundamentals underlying a proposed joint venture which generate its future expected income ($Y$) are assumed to be known to both parent firms at the outset of their negotiations; and (2) all predictable time-varying factors (e.g. seasonalities) have been removed from our joint venture income. These assumptions are reasonable and realistic. For example, it is not likely that one joint venture partner could hide knowledge of some fundamentals that might contribute to the true income potentials of the proposed joint venture from the other negotiating partner, given that both partners involved are assumed to be highly sophisticated players in international business. Both parties can also protect themselves from such potential deceptions by contract. The second assumption allows us to remove

[12] We follow the framework in Nakamura and Xie (1998).

[13] One stochastic process we have in mind for the joint venture income is a random walk process. (Since we do not need this assumption, it is not explicitly assumed in the paper.) Substantial amounts of empirical evidence exist in the literature suggesting that the income processes of firms including joint venture firms follow a random walk (e.g. Albrecht, Lookabill, & McKeown, 1977; Dechow, Kothari, & Watts, 1998; Watts & Leftwich, 1977). Conditional on the current income which is viewed as constant, expected value of a random walk process is also constant representing the past income.

the sources of known time-varying factors from our expected income considerations. Our model assumptions still allow for occurrences of unexpected surprises or shocks.

In our modeling framework the joint venture partners will adjust their ownership shares in response to changes in the values of model parameters (including $Y$ and the factors which describe the bargaining power parameter) without delay in each time period.[14] This framework also accommodates the local partner's learning which is reflected in their increased R&D spending. Such changes in R&D expenditures will enter our model estimation through changes in the bargaining power parameter and prompts changes in the joint venture ownership shares.

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

$$U_{\mathrm{F}} \geq 0 \quad \text{or} \quad \beta \geq \bar{\beta} \tag{2a}$$

$$U_{\mathrm{J}} \geq 0 \quad \text{or} \quad \beta \leq \bar{\beta} \tag{2b}$$

where

$$\underline{\beta} = \frac{C_{\mathrm{F}}}{Y + g_{\mathrm{F}} C_{\mathrm{J}} + C_{\mathrm{F}}} \tag{3a}$$

$$\bar{\beta} = \frac{Y + g_{\mathrm{J}} C_{\mathrm{F}}}{Y + g_{\mathrm{J}} C_{\mathrm{F}} + C_{\mathrm{J}}}. \tag{3b}$$

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

$$(Y + g_{\mathrm{F}} C_{\mathrm{J}})(Y + g_{\mathrm{J}} C_{\mathrm{F}}) < C_{\mathrm{F}} C_{\mathrm{J}}$$

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 $(Y + g_{\mathrm{F}} C_{\mathrm{J}})Y + g_{\mathrm{J}} C_{\mathrm{F}}) > C_{\mathrm{F}} C_{\mathrm{J}}$. Note also that: $\underline{\beta} = 0$ if and only if $C_{\mathrm{F}} = 0$, and $\bar{\beta} = 1$ if and only if $C_{\mathrm{J}} = 0$.

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 $\beta^{\mathrm{FB}}$ as follows

$$\begin{aligned} &\mathrm{Max}_{\beta}\, Y - (1 - \beta)(1 - g_{\mathrm{J}}) C_{\mathrm{F}} - \beta(1 - g_{\mathrm{F}}) C_{\mathrm{J}} \\ &\qquad \text{subject to (2).} \end{aligned} \tag{4a}$$

Note that if $g_{\mathrm{F}} = g_{\mathrm{J}} = 1$, then ownership share $\beta$ plays no role since $U_{\mathrm{F}} + U_{\mathrm{J}} = Y$. The first-best optimal ownership share for FP is:

$$\beta^{FB} = \bar{\beta} \quad \text{if} \quad (1 - g_{\mathrm{J}}) C_{\mathrm{F}} > (1 - g_{\mathrm{F}}) C_{\mathrm{J}} \tag{4b}$$

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[14] We point out below that US firms, for example, adjusted their ownership shares in their FDI operations in Japan frequently in response to the Japanese government policy changes.

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

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

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

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

The results (4d) and (4e) 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 first-best solutions (4b) and (4c) are not likely to be implemented in practice since the assumption of full cooperation underlying the linear programming problem (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 IJV 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 $\alpha$ and $(1-\alpha)$, where $0 \leq \alpha \leq 1$.

Following the literature (e.g. Farge & Wells, 1982) we assume that the parent firms' bargaining power is an exogenously given parameter.[15] Then the Nash bargaining solution, $\beta^{NB}$, is given by

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

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

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

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

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

$$\beta^{NB} = \bar{\beta} \quad \text{if} \quad \alpha \equiv 1 \tag{7a}$$

$$\beta^{NB} = \beta \quad \text{if} \quad \alpha \equiv 0. \tag{7b}$$

Comparing (7a) and (7b) with (4b) and (4c), we see that the first-best solution and the Nash bargaining solution coincide in the extreme cases where $(1-g_J)C_F > (1-g_F)C_J$

[15] We will relax this assumption in Section 4 where learning and other factors can change bargaining power over time.

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, $\beta^{NB}$ does not coincide with $\beta^{FB}$.

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), (4c) and (6) as follows:

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

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

and

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

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

An upper bound for the efficiency loss is given by $(\bar{\beta}-\underline{\beta})|(1-g_J)C_F-(1-g_F)C_J|$. 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 firms.[16]

An important empirical issue is how the Nash bargaining solution $\beta^{NB}$ depends on FP's bargaining power, $\alpha$. From (6) we see that $d\beta^{NB}/d\alpha=\bar{\beta}-\underline{\beta}>0$. $\beta^{NB}$ 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).

### 2.2. Summary of findings

In Section 2.1.2, 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. We believe this model describes at least approximately many practical situations involving technology-based firms' ownership decisions on their FDI. 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,

[16] As a policy application, suppose only FP suffers from spillovers due to host country's weak IP protection (i.e. $C_F>0$, $C_J=0$, $g_J=1$ and $g_F=0$ in (1a) and (1b), and $\beta=CF/(Y+CF)$ by (3a) and (3b)). Then FP's optimal negotiated ownership share in the IJV is $\beta NB=\alpha+(1-\alpha)\beta>\alpha$ by (6), i.e. FP must demand for a larger share than the share, $\alpha$, which corresponds to the amount of FP's intrinsic contribution to the IJV. If host country strengthens IP protection and hence eliminates FP's spillovers, then we have $C_F=\beta=0$ and $\beta^{NB}=\alpha$. FP now must consider only the fundamentals that it can contribute to the IJV in negotiating for its ownership share in the IJV.

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).[17]

### *2.3. Relevance of the bargaining approach*

As is seen from Eqs. (1a) and (1b)), our model is not a two-person zero-sum game for various combinations of values for the model parameters $C_J$, $C_f$, $g_F$, $g_J$ and $\beta$. For this reason von Neumann and Morgenstern's (1944, 1947, 1953) theory of zero-sum two-person games cannot be used for analyzing the present problem. It is precisely for this type of the problem that the original Nash bargaining solution (Nash, 1950) was proposed (e.g. Crawford, 2000). A number of variations of the original Nash model were also developed (e.g. Rubinstein, 1982).

In general, all bargaining situations including ours have two things in common that distinguish them from two-person zero-sum game situations: (1) the total payoff to the negotiating parties should be greater than the sum of what they would get in the absence of agreement; and (2) it is not a zero-sum game.

The Nash bargaining solution we use in this paper is an essential component of the theories that explain, for example, the behavior of the firm (Grossman & Hart, 1986) and the strategic implications of trade wars and trade agreements in international business (Grossman and Helpman (1995)). For these and other reasons the use of the Nash bargaining solution provides a rigorous theoretical foundation for studying the bargaining processes involved in joint venture formations.

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 IJVs are positively correlated with its bargaining power relative to JP's. Fully owned subsidiaries (SUB) arise in the limiting case where FP's bargaining power relative to JP's is very large. In this section we estimate

[17] The present model can be extended to more complex models with different types of inputs of intangible assets IJV requires from its parent firms. 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. (Nakamura & Xie, 1998.)

the bargaining model empirically and test its theoretical relationship between FP's ownership share and relative bargaining power.

### 3.1. 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 US 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 US firms' operations in Japan are considerably larger, on average, than US firms' foreign operations in other countries (US 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 US firms' subsidiaries reported they were required to limit their US 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)). Further details of the history of Japanese business environment concerning FDI and technology transfer in our sample period are discussed in Appendix B.[18]

Our bargaining model applies to ownership share determination problems under general joint venture conditions. In this paper, we apply this model to explain observed ownership shares of technology-based IJVs in Japan which were created until the 1980s. The post-World War II period until the late 1970s in Japan is well known for the heavily regulated policies on FDI where joint ventures were generally preferred to fully owned subsidiaries by Japanese government regulators. In this period FPs negotiated with not only with JPs but also with the Japanese government which had to approve any form of FDI.[19] Many prominent JVs were established during this historical period. We limit our sample period to the end of the 1980s. By the end of the 1980s regulations on FDI and the associated foreign ownership shares were mostly gone. It is also around this period that

[18] In Appendix B we discuss Japanese industrial policy which favored IJVs over fully owned subsidiaries until the end of the 1970s. This is our primary reason why we have chosen our sample period to study IJVs.

[19] Pan and Li (2000, p. 181) note that the lack of bargaining power vis a vis the host country government parties is a primary reason for foreign firms' inability to get permission for a 50% or higher equity stake in their IJVs in China.

many technology-based Western firms began establishing their fully owned subsidiaries instead of joint ventures.[20]

### 3.2. Our sample period

Historically speaking, the first significant event of our interest is relaxation in Japan's policy environment towards FDI, particularly technology-based foreign firms' FDI occurred around the early 1980s, as noted above. Most of formal legal restrictions were removed and foreign manufacturers were able to establish fully owned subsidiaries, if they so desired. As a result relatively fewer JVs were established. Another major event in the Japanese economy happened in late 1990 when a financial bubble burst in Japan. The Japanese economy since then has been experiencing various types of significant macro-level and firm-level changes and restructuring. Our sample period includes the first event which adds appropriate variance to our sample of joint ventures. Our sample period ends right before the burst of the Japanese bubble by design. Japan's post-bubble period consists of many changes in regulations (not all of which are being removed) and institutions, which resulted in a drastic change in the business environment of that country for both inward and outward FDI. It is our plan to study the post-bubble period in a separate study.

### 3.3. 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, $\beta$, 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) $\beta$.

### 3.4. 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:

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

where $\varepsilon_1$ is a normal random variable with mean zero and variance $\sigma_1^2$ and $F$ is the distribution function for a standard normal variable. The function $G_1$ is given by

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

---

[20] This is consistent with our model prediction that FP's increased bargaining power relative to that of JP's will lead FP to set up fully owned subsidiaries or joint ventures with increased ownership share for FP.

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 ($\alpha$ in Eq. (5)), or equivalently, JP's bargaining power ($1-\alpha$), is not observable, we consider proxies ($P$) which are thought to affect FP's and JP's bargaining power.

More specifically, $P$ in Eqs. (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-

Table A1
Descriptive statistics: bargaining model sample

| | All | Fully owned ($\beta=1$) | Jointly owned ($\beta<1$) |
|---|---|---|---|
| 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[e] | .06(.05) | .08(.05) | .05(.04) |
| R&D-JP[e] | – | – | .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[h] | .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[j] | – | – |
| No. of observations | 231 | 94 | 137 |

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 US and Japanese industries to which the parent firms of US–Japan joint ventures belong.

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

[h] FP is a European firm.

[i] Industry dummy variables.

[j] Calculated using the expanded sample described in Table A2.

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 overseas, 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 non-contractibility 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 US 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 Eq. (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

Table 1
Probit estimates for the probability that foreign firms choose fully owned subsidiaries

| | (1) | (2) |
|---|---|---|
| %IMP | 2.102***[a] (8.34)[b] | 2.314*** (4.68) |
| %EXP | .571 (1.32) | −.342 (.367) |
| %R&D*US | – | .219*** (2.85) |
| %R&D*JPN | – | −.459*** (3.52) |
| #W-JV[a] | .000 (.991) | .000 (.514) |
| Elec.eq.dummy | – | – |
| Prec.dummy | .022 (.081) | .891 (1.11) |
| Pharma.dummy | .175 (.681) | .896 (.090) |
| Gen.machi.dummy | .671*** (3.31) | 1.12 (.175) |
| Constant | −1.704*** (7.71) | .543 (.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] The sample of firms for the regression reported in this column includes US firms' operations in Japan for which all relevant data required for the regression are available. In particular, in order to run this regression we had to drop the IJVs with missing data from the original sample of 231 operations used for the regression reported in column (1). (Typically R&D data is missing for at least one of the partners of the excluded IJVs.)

including industry dummies are not statistically significant. Our results are consistent with the bargaining hypothesis.

### 3.5. 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 Eq. (12) below in which P now contains firm-specific R&D-to-sales and P/E ratios.

$$\beta = G_2(P, B_2) \tag{12}$$

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[21] 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 & Yeung, 1994). The industry dummies are not generally significant. (The only exception is in the first column (1) where no R&D nor P/E variables are included.)

[21] See also Amemiya (1985, §10.7).

Table 2
Determinants of foreign firms' ownership shares in joint ventures

| | (1) | (2) | (3) |
|---|---|---|---|
| %IMP | .772***[a] (3.28)[b] | 1.08* (1.64) | .973* (1.68) |
| %EXP | .274*** (3.61) | .485** (3.56) | .458*** (3.84) |
| R&D-FP | – | .245 (.326) | −.413 (.570) |
| R&D-JP | – | −.072** (2.40) | −.079*** (3.24) |
| P/E-FP | – | – | −.001 (.277) |
| P/E-JP | – | – | −.002*** (3.28) |
| #W-JV | −.00001*** (2.81) | −.00001 (1.61) | −.00001* (1.90) |
| Elec. Eq. dummy | – | – | – |
| Prec. dummy | −.042 (.851) | −.046 (.382) | .041 (.421) |
| Pharmac. dummy | .047 (1.09) | .036 (.451) | .065 (.951) |
| Gen. Machi. dummy | .111* (1.84) | .161 (1.22) | .147 (1.22) |
| Selection bias[c] | −.5.58** (2.60) | −.784 (1.19) | −.6.49 (1.19) |
| Constant | .509*** (17.42) | .463*** (6.76) | .545*** (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.
[c] The possible bias due to selection into the subsample of IJVs is corrected by Heckman's (1976, 1979) selection bias term.
[d] All IJVs.
[e] The sample of firms for these regressions reported in this column includes U.S-Japan IJVs for which all relevant data required for the regressions are available. In particular, in order to run the regressions we had to drop the IJVs with missing data from the original sample of 137 operations used for the regression reported in column (1). (Typically either R&D or P/E data are missing for at least one of the partners of the excluded IJVs.)

It is also important to note in Table 2 that 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. $\alpha$ 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.[22] 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.[23] We also note that even though the primary area of focus for spillovers from 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.

### *4.1. 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 on 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) only. 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 1961–1990. During this period the first section firms and foreign

[22] Many Western multinationals argue that this is being practiced in China since the late 1980s.

[23] 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.

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 equation:

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

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.

### 4.2. 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 1961–1970 (when the impact was negative) to the period 1981–1990. 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&D to 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 1961–1990 (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. In the next subsection we briefly summarize

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 |

Table 3
Japanese parent firms' learning from their international joint ventures

| | (1) 1961–1990 | (2) 1961–1970 | (3) 1971–1980 | (4) 1981–1990 |
|---|---|---|---|---|
| Constant | .0004**(2.01) | −.0005*** (4.37) | .0015* (1.87) | .0039 (1.05) |
| #JVs | .0013*** (8.44) | −.0005*** (4.24) | .0018*** (7.06) | .0053*** (5.26) |
| Ind_R&D | .9861*** (69.2) | .944*** (.03) | .9591*** (33.5) | 1.09*** (21.4) |
| Year | −.0000* (1.83) | .00005*** (3.30) | −.0001* (1.86) | −.0002 (1.24) |
| JV-dummy | −.0214*** (4.72) | .0123*** (9.26) | −.0292*** (3.60) | −.3525*** (5.04) |
| Selection bias | – | – | – | – |
| Adjusted $R^2$ | – | – | – | – |
| No.of obs. | 12717 | 3734 | 4481 | 4502 |

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

Japan's historical background of FDI and industrial environment that is relevant to our disucssions.

### *4.3. 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.[24] 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 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 decreases from the current 100 to 98% after the changes. If the Japanese government

[24] 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 US figure for the same period is 3.8% (1982) and 4.2% (1992). (Japanese Science and Technology Agency (1997, p. 216,; Tables 2 and 3)).

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. We have also argued that at

least some of such losses in FP's ownership shares in their IJVs in Japan in our sample period may have been possibly the calculated consequences of the strategies of the IJVs' respective Japanese parent firms.[25] Ascertaining more precise role of learning in the observed changes in the ownership of IJVs is a subject of our future research.

## Appendix A

### *A.1. A1. Estimating bargaining model for FDI operations: descriptive statistics*

Table A1

### *A.2. Estimating JP's learning from IJVs: descriptive statistics*

Table A2

## Appendix B. Historical background of Japan's FDI environment and industrial policy

In the 1950s through the 1970s all aspects of the use of foreign exchange were regulated by Japan's Foreign Exchange Law. The Japanese government argued their severe restrictions on foreign exchange was necessary because of the scarcity of Japan's foreign exchange reserve. The Ministry of International Trade and Industry (MITI), for example, used this and other industrial policy laws to determine which companies could license which foreign technologies for what prices under what sorts of conditions. Since full foreign ownership was in general prohibited, foreign firms which wanted to enter the Japanese market had to either license their technologies to Japanese firms which in turn would produce and sell the foreign firms' products, or to set up joint ventures with Japanese partners so that the foreign parent's technologies could be licensed to the joint ventures. (IBM[26] and Texas Instruments[27] were two exceptional cases where they were able to operate their fully owned subsidiaries in Japan.)

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[25] It is of interest to note that many Japanese technology-based firms now believe that a similar situation will happen to IJVs in China in due course.

[26] IBM established its fully owned subsidiary, IBM Japan, in 1937 which continued to sell IBM products in Japan except during World War II. IBM Japan, however, was allowed to produce locally by the Japanese government only after it agreed in 1960 to license the key patents IBM owned for the computer industry to Japanese manufacturers. IBM Japan began local production in 1964. (Shijo, 1988.)

[27] In 1964 Texas Instruments applied for a permit to set up a fully owned subsidiary in Japan to produce semiconductors, particularly ICs. MITI rejected this application in order to protect the domestic industry. In 1967 MITI agreed to approve TI's request for its FDI only if TI accepted the following conditions: (1) the subsidiary must be a 50-50 joint venture with a Japanese company; (2) licensing of all the patents held by TI to Japanese competitors; and (3) restricted production for the initial 3 years of operation after establishment (Itoh & Kiyono, 1988). In the end Sony agreed to set up this joint venture with TI in 1968. With liberalization of the government policies, Sony was able to transfer their 50% stake in the joint venture to TI in 1971.

Japanese government's decisions on joint ventures were based on the Law Concerning Foreign Capital enacted in 1950. MITI's decisions on technology licensing and joint ventures were not independently made. Rather they were made based on the industrial policies for Japan's economic development and were implemented using the Foreign Exchange Law and the Law Concerning Foreign Capital. Both laws favor large established firms in what the government consider the key industries with significant inter-firm networks (e.g. keiretsu). This is because the Japanese government thought these types of firms could contribute more to Japan's foreign exchange reserve and to the development of the industries in terms of technology and management skills (e.g. Itoh & Kiyono, 1988; Komiya, 1988). It was then no surprise that in 1952 MITI refused to even hear Masaru Ibuka's request for approval of licensing of Bell Laboratories' transistor patents owned by Western Electric. Ibuka, working for tiny Tokyo Tsushin Kogyo (TTK) in Tokyo (established in 1945 following World War II; subsequently renamed Sony in 1958), became aware of the potential of transistors while on his trip to the US in 1952 and his firm began negotiating licensing of their transistor patents with Western Electric. Even after Western Electric agreed to license their patents to TTK for $25,000 (which was an enormous sum for TTK), MITI, which was angry that TKK ignored MITI's initial rejection for licensing, continued refusing to approve the importation of the patent. Only in 1954 after a personnel change did MITI decide to approve the licensing and allocation of the foreign exchange. MITI's views were consistent: they believed that the only companies that could contribute to the technological development of the Japanese economy were large established firms such as Toshiba, Mitsubishi Electric and Hitachi which about the same time were approved for licensing all necessary transistor technologies including manufacturing technologies from RCA for the price much higher than TTK's single patent licensing price.

In response to the development of the Japanese economy and also to the severe foreign pressure for Japan's trade liberalization, the Foreign Exchange Law, the Law Concerning Foreign Capital and other laws that MITI and other government agencies used to regulate imports of foreign technologies and foreign direct investment in general were revised throughout the 1970s. By the early 1980s, MITI lost most of their tools for effectively regulating technology imports and foreign direct investment. This is seen by the fact, for example, that more IJVs began to be established for the parent firms' firm-specific reasons (e.g. Japanese partner tries to strengthen their weaknesses by appropriate IJVs). Mitsubishi Motor and Caterpillar-Mitsubishi established by MHI discussed earlier are two such examples. A more recent example is SGI Japan (Silicon Graphics (40%), NEC (40%), NEC Software (20%)) which was set up in 1987 to develop and market SGI products. This joint venture complements NEC's product lines of high-performance large-scale supercomputers, the markets of which are of strategic importance to NEC. NEC is competing in these markets with its domestic makers such as Hitachi and Fujitsu as well as US producers.

Finally considerably increased IP protection began to be implemented both legally and also in terms of business practices in the 1990s during the prolonged deep recession following the burst of the financial bubble. The main reason for this is that many policy makers thought the lack of adequate IP protection was in part responsible for the Japanese economy's loss of competitiveness in the global market. Now many firms pay much larger

rewards than ever before to their employees who contributed to the firms by their major inventions. Such inventions were freely used by the firms in the past. Japanese courts are also more sympathetic, for example, towards (both domestic and foreign) patent holders' claims about infringements of their IP rights. (Study is yet to be done to measure the impact of this Japanese change in policy on FDI.)

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