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INVENTING AROUND AND IMPACTS ON MODES OF ENTRY IN JAPAN: A CROSS-COUNTRY ANALYSIS OF U.S. AFFILIATE SALES AND LICENSING

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Abstract: A common notion in the literature is that weak patent protection encourages internalization because it allows the firm to retain direct control over its intellectual assets by building its own subsidiary. However, "inventing around" may counteract this process. This patent practice which is most frequently associated with Japan allows rival firms to read laid open patent applications, and develop similar and competing products. A simple model demonstrates how "inventing around" can erode profits from FDI and encourage the licensing solution. This paper examines whether and how key legal and institutional features of Japan's patent system affected entry mode decisions. Findings from a cross-country analysis of U.S. affiliate sales and licensing receipts over 1986-1994 suggest that "inventing around" may have discouraged FDI and contributed to the high level of licensing in Japan, and to a lesser extent, other countries with similar patent regimes.

Key Words: Multinationals; Foreign Direct Investment; Licensing; Patent Rights

JEL Classification: F23 (Multinational firms); K33 (International Law); O34 (Intellectual Property Rights);

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1. INTRODUCTION

Firms choose different modes of entry to penetrate a market, including FDI, exporting, licensing, and joint ventures. The choice of entry is endogenous to institutional features such as foreign direct investment (FDI) regulations, antitrust laws and even patent protection. But it is still unclear how these institutional features affect a firm's choice of entry mode. This paper provides empirical evidence that institutional features of a patent system can influence the mode of entry.

A common view in the literature is that weak patent protection encourages internalization because it allows the firm to retain control over its intellectual assets by building its own subsidiary. Existing empirical evidence supports this notion, and suggests that weak patent protection in the host country encourages internalization by the multinational enterprise (MNE) (Smith, 1998; Seyoum, 1996).[1]

However, when imitation is possible, internalization may not necessarily enable the MNE to protect its trade secrets. For example, key legal and institutional features of the Japanese patent system (JPS), such as pre-grant disclosure, pre-grant opposition, and an extensive utility model system, allowed the patent practice of inventing around. This practice involves filing patent applications for incrementally different inventions around a disclosed novel patent application. Inventing around made it difficult and costly for the U.S. MNE to secure IPR protection in Japan, since local firms could invent around the MNE's laid open patent application, and develop a similar and competing product. The MNE could secure higher profits by licensing its technology to a local firm (and potential rival) that had a comparative advantage in dealing with the Japanese Patent Office (JPO). In this way, inventing around eroded the MNE's profits from FDI, and promoted the licensing solution.

[1] Lee and Mansfield (1996) found that the strength of IPR influenced the type of FDI in which the firm engaged, such that weak patent protection discouraged FDI in research and development, and that sensitivity to IPRs varied across industries.

The data presented below indicate that the per capita stock of FDI in Japan has been considerably lower than in other advanced industrial nations. The data also show that per capita licensing fees received by U.S. firms from Japan has been significantly higher than from similar nations. Previous authors have attributed the low level FDI in Japan to cross-shareholding, inter-firm networking and alliance capitalism (otherwise referred to as *keiretsu*) influences, bank-firm links, vertical groups, Japanese government tax and financial policy, and culture (Weinstein, 1996; Dunning, 1996).

This paper is an attempt to examine empirically institutional features of Japan's patent regime and impacts on entry mode decisions by U.S. firms. Specifically, prior to 1994, the legal and institutional features of the JPS promoted technology diffusion and cross-licensing with long pendency periods, pre-grant disclosure of patent applications, pre-grant opposition, and narrow patent claims (Weinberg, 1988; Ordover, 1991). These features of the JPS made it difficult for foreign firms to secure adequate patent protection and maintain monopoly rights to their inventions in Japan.[2]

A simple model demonstrates how inventing around can erode profits from FDI, relative to licensing. A cross-country empirical analysis over 1986 to 1994 reveals that, controlling for country characteristics and location advantages, the value of U.S. MNE affiliate sales in Japan is lower, and the value of licensing receipts from Japan is much higher, than that in other advanced industrialized nations. The findings indicate that inventing around may have discouraged FDI while promoting the licensing solution in Japan. While the focus of the analysis is on Japan, and the results hold for Japan, there is weak evidence that it is also true for other countries which allowed for inventing around.

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[2] Important changes to Japan's patent policy and domestic technology policy became effective in 1994, which promote more fundamental innovations (BNA, 1998). Also, effective January 1, 1999, Japan has changed its statute on patent damages in ways that move it closer to U.S. law on reasonable royalties and lost profit (see Gould and Sato, 1999).

Internalization

Internalization is familiar through the ownership-location-internalization (OLI) framework.[3] While OLI considers the necessary conditions for direct investment, it offers little direction about alternative choices, such as licensing, joint ventures, or exports. Yet to examine issues surrounding whether local production should occur within the firm through FDI, or at arm's length via licensing, it is necessary to explicitly consider internalization (Saggi, 1996; Ethier, 1986; Smith, 1998; Horstmann and Markusen, 1987).

The MNE's ability to retain control over its intangible assets is an important factor in this decision. Some stylized facts on intellectual assets (or knowledge capital), product newness and complexity include (i) a firm is reluctant to reveal its product or process to a licensee, who will have the knowledge even if it rejects the proposal; however, the potential licensee is not going to sign an agreement without knowing what it is buying; (ii) the newness of the product may create an informal asymmetry in the opposite direction: the potential licensee may have more information as to the marketability of the product in its local market than the MNE; and (iii) knowledge is easily learned by new employees who may be able to defect and start a new firm in competition with the MNE.[4]

Similarly, survey evidence from Dunning (1986) suggests that the most important factors operating against licensing are (i) difficulty of guaranteeing quality control, (ii) difficulty in achieving an adequate licensing agreement, (iii) inability to negotiate a satisfactory price for the ownership advantage, and (iv) difficulty of enforcing patent or trademark rights.

Measures of Patent Protection

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[3] The OLI framework originates from Dunning's eclectic paradigm (Dunning, 1976, 1981). Internalization originates from Williamson's (1975) transaction cost work.

[4] See Horstmann and Markusen (1987), Markusen (1999).

The principal provisions of Japan's patent laws are not particularly different than other industrialized countries nor are they discriminatory.[5] In fact, previous authors who have developed indices to measure IPR protection across countries rank Japan as having very strong protection. For example, the Park and Ginarte (1997) index captures five components of patent laws: duration of protection, membership in international patent agreements, provisions for loss of protection, and enforcement mechanisms. Out of 110 countries, Japan is ranked as having the 5th strongest patent laws for 1990 (a "3.94" on a continuous index from 0 to 5). Using this same index, out of the 15 countries examined below, Japan is ranked third highest over 1986-1994. In addition, the Rapp and Rozek (1990) index measures the conformity of national patent laws with minimum standards proposed by the U.S. Chamber of Commerce. Japan received the second highest rating category (a "4" on a discontinuous scale from 0 to 5). These standards include guidelines and rules for coverage of inventions, examination procedures, term of protection, transferability of rights, compulsory licensing, and effective enforcement against infringement.

Based on these measures, Japan's patent laws appear to meet a high standard. However, a closer examination of key features and patent practices in the Japanese system reveals high costs of obtaining patent protection in Japan relative to other advanced industrialized nations. Below is a description of how the JPS has encouraged incremental innovations and technology sharing, while promoting the licensing solution.

Utility Models, Pre-Grant Disclosure, and Pre-Grant Opposition

The JPO grants patents for inventions, defined as "the highly advanced creation of technical ideas utilizing natural laws," and grants utility models for "devices" defined as "the

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[5] All countries except the United States follow a first-to-file rule, and many others publish the contents of patent applications months within the filing date, examine applications only upon

creation of technical ideas utilizing natural laws."[6] The main difference between a patent and utility model is the inventive step requirement, which is much less restrictive for the latter (Boulware et al, 1994; Doi, 1986). The original purpose of the utility model system, which was to protect small inventions, contradicts the basic policy of the patent law, which is to protect inventions that meet the higher standard of inventive step or nonobviousness.

Until 1988, the JPO required that claims have a narrow scope (Aoki, 1997). This tradition continued through the early 1990s (Aoki, 1997; Kotabe, 1992; USTR, 1997). Sharply delimiting the breadth of patent coverage has the effect of reducing patent holders market power (Ordover, 1991). A narrow claim requirement allowed rival firms to file slightly altered versions of the invention embodied in the original application in the form of a utility model. Because of the narrow scope, utility model applications could easily get through the patent office more quickly than the original patent (Weinberg, 1988).

Also, in Japan, patent and utility model applications were laid open to the public eighteen months after filing. Many countries provide for pre-grant disclosure and pre-grant public opposition (usually within only the first three months of publication). These features combined with utility models are important here for the way firms in Japan used them to invent around original novel patents or disclosed applications.

The pre-grant opposition provision allowed rival firms to file several opposing claims during the pendency period. The original applicant was required to respond to each opposition, else the patent would not be issued. Responding to oppositions was costly, as several firms in Japan had large expert patent staffs that would draft many oppositions (Weinberg, 1988). Further, since the term of protection began upon the date of filing, the longer the pendency period was drawn out, the shorter was the effective term of protection.

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request, and allow public oppositions to be filed before the patent is granted. See Jacobs and Hanellin (1997) for a categorical and detailed overview of patent laws across countries.

[6] Article 2(1) of Japan's Patent Law, Law No. 121, and Utility Model Law, Law No. 123, 1959 (Foster and Ono, 1966).

The opposition phase created strategic incentives for early bargaining between the applicant and those potential rivals who would be at a disadvantage should the patent be issued (Ordover, 1991).

Thus, it was in a competing firm's interest to file several oppositions against the application, as well as file multiple utility model applications around it, since they would be at a disadvantage should the patent be issued. Similarly, it was in the applicant's interest to cross-license the patent in order to preserve its term of protection. Consequently, bargaining prior to receiving the patent can increase the likelihood of settlement through licensing, especially when litigation is long and expensive, as was the case in Japan (Lesavich, 1995; Dinwiddie, 1995). As a result, the original inventor, say, the MNE, could easily lose exclusive rights to its invention and find any ownership advantage costly to maintain, if not dissipated.

In sum, the patent practice of inventing around did not necessarily allow the MNE to retain direct control of its intellectual assets under the FDI option. Accordingly, the traditional notion that weak patent protection encourages internalization is inapplicable to Japan. In contrast, features of Japan's patent regime made it difficult and costly for the U.S. MNE to secure IPR protection in Japan, and may have actually discouraged FDI while inducing firms to license their technology.

2. MODEL

In this section I present a simple model that incorporates inventing around into profit functions for different entry modes. Then, I specify the testable implications of the model.

The entry mode decision can be viewed as being a two-part decision. First, the firm decides whether to serve the foreign market by local production or exports. If the firm decides to produce locally, it must then decide whether to build a subsidiary and become a MNE, or provide its technology to a destination firm by licensing its patent.

Produce Locally

Internalization advantages can arise when the host country has characteristics that raise the cost of protecting assets, thereby creating a high risk of profit dissipation. Normally, firms choose FDI over licensing because they receive poorer protection from licensing than from setting up their own subsidiary.[7] Yet we observe that licensing was a more prevalent entry mode for U.S. MNEs into Japan over 1986-1994 (Table 1) and licensed sales outweighed affiliate sales in Japan for U.S. MNEs in 1990 (Table 2). A simple model presented below, which allows for inventing around and incorporates varying levels of patent protection, illustrates how inventing around can affect profits from FDI relative to licensing.[8]

Consider a firm (MNE) that decides to serve a foreign market via local production. Assuming the firm has market power and is a price setter, then price is a function of output and defined as:

$$P = P(\mathrm{x}) = \alpha - \beta\, \mathrm{x} \qquad \text{(a)}$$

where α is the intercept of the demand curve, β is the slope of the demand curve, and x is output. Assuming increasing returns to scale, cost is defined as

$$C = C(\mathrm{x}) = m\mathrm{x} + FC \qquad \text{(b)}$$

where m is constant marginal cost, and FC is fixed cost. The MNE compares profits under entry choices to decide whether to internalize production or enter some non-equity agreement

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[7] In Horstmann and Markusen's model, the existence of reputation induces the MNE to choose FDI over licensing under all circumstances (in the absence of commitment). Tang and Yu (1990) show that FDI is a firm's dominant strategy even if it can charge optimal licensing fees and that licensing is obtained only if direct foreign investment is restricted by government policies.

[8] This simple model abstracts from many other important issues in the licensing literature, such as asymmetric information, non-monopoly rents from licensing, and the principal agent problem, e.g., see Gallini and Wright (1990) for licensing issues under asymmetric information. Since the focus of this paper is to examine how key features of the JPS, which enabled inventing around, affected MNE's entry mode decisions in Japan, these issues would unnecessarily complicate the analysis.

such as licensing. Fixed costs are denoted by F under FDI, and G under licensing. Using subscript e to represent the two entry modes, FDI (f) and licensing (l), the MNE's general profit maximization problem is:

$$\max p_e = PX - mx - FC_e \qquad \text{where } e = f, l \tag{1}$$

Then each profit function can be written as:

$$P_f = Px_f - m_f x_f - F \tag{2a}$$

$$P_l = Px_l - m_l x_l - G \tag{2b}$$

Substituting price (a) into each profit function, and maximizing (2a) and (2b) with respect to output, returns

$$X_e = \left(\frac{a - m_e}{2b} \right) \qquad \text{where } e = l, f \tag{3}$$

Assuming identical marginal costs between FDI and licensing, then, equilibrium price can be written in terms of a, b, and m:

$$P = \left(\frac{ba + bm_e}{2b} \right) \qquad \text{where } e = l, f \tag{4}$$

Substituting price into the profit functions, maximum profits can be written as a function of exogenous parameters:

$$p_f = b\left(\frac{a - m_f}{2b} \right)^2 - F \tag{5}$$

$$p_l = b\left(\frac{a - m_l}{2b} \right)^2 - G \tag{6}$$

where $G < F$, and $m_l > m_f$. The fixed costs of FDI (F) exceed fixed costs of licensing (G) since F involves additional overhead and plant costs of the subsidiary plant. Both the marginal cost of licensing (m_l) and the marginal cost of FDI (m_f) involve production costs, but

m_l also includes additional monitoring costs, transaction costs, and negotiation costs (Markusen, 1995). Under the assumption of identical production costs, $m_l > m_f$.

Exports

Let the fixed costs of exporting (J) be such that J < G < F. Let the marginal costs of exporting (m_p) be such that $m_p > m_l > m_f$.[9] The latter is a reasonable assumption, as previous authors have found transportation costs to be as large as, and frequently larger than tariffs (Hummels, 1999). Given this ranking of marginal and fixed costs, the exporting option does not affect the decision between FDI and licensing. That is, given the firm's decision to produce locally, the effect of inventing around on the licensing v. FDI decision is independent of exporting.[10]

FDI versus Licensing

Suppose the MNE faces secure patent rights in the host country. In a large market like Japan, the MNE would prefer to incur the high fixed costs associated with FDI. Figure 1 plots the FDI and licensing profit functions and illustrates that the firm would choose FDI over licensing in a larger market. Profits are on the vertical axis and the demand parameter α is on the horizontal axis. At α_o, the MNE is indifferent between FDI and licensing. Holding β constant, a higher demand would make FDI the more desirable option. For instance, let β = 1, then P = α - x. Consider an increase in market size. At a higher α, say α", the MNE would favor the high fixed cost option and choose FDI. Or, a decrease in market size (α') would encourage the option with low fixed cost (licensing).

[9] The latter is a reasonable assumption, as previous authors have found transportation costs to be as large, and frequently larger, than tariffs (Hummels, 1999).

[10] Smith (1999) found that weak patent rights are a barrier to U.S. exports, but only to countries that pose a strong threat of imitation.

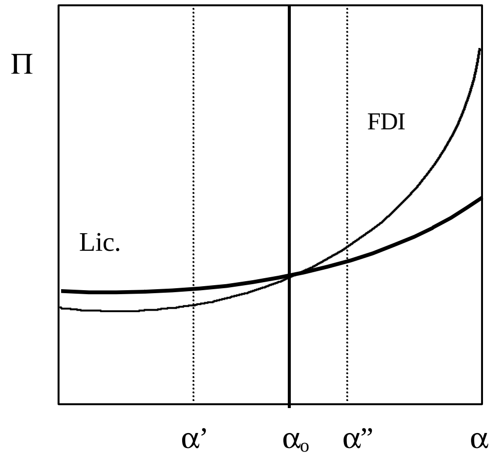

Figure 1: Profits from FDI and Licensing with Secure Patent Rights

Effects of the Patent System

Features of the JPS that enable inventing around render the above model invalid for Japan. When inventing around is possible then the MNE does not enjoy secure patent rights and therefore, a new model for Japan is needed.

For example, if the firm chooses to patent its trade secrets, then key features of the JPS allow local firms to "invent around" the MNE's original innovation, use opposition tactics to shorten the term of protection, and force cross-licensing. If the MNE chooses not to patent, a competitor can reverse engineer its products and imitate them. Either case results in the MNE's loss of control over its intellectual assets.

This paper argues that the nature of weak patent protection in Japan discourages FDI relative to licensing, since internalization does not allow the firm to protect its intellectual capital. The following section describes two ways to model the effect of the JPS on this entry decision.[11]

[11] While it is not immediately clear from this simple model what the other option might be (licensing or not participating at all and, thus, serve the market via exports), licensing is the constant option to which FDI is compared.

Case 1: FDI and Duopoly Outcome[12]

Suppose the MNE chooses FDI and has one competitor in the host country. Initially, the MNE produces X_h, a knowledge-based good, and the local firm in the host country does not produce a similar product. Upon entering the host country via FDI, the MNE introduces X_h, a new product to that market, and applies for patent protection. Features of the JPS allow a local firm to learn of the MNE's patent and invent around it. Then, a local firm can produce X_f, a similar but not identical product. This approach generates competition such that we have a duopoly outcome. Duopoly profits can be calculated as follows.

Denoting the MNE firm as *h* and the local firm as *f*, assume both firms have identical marginal costs of production. Assume linear demand such that the consumer inverse demand functions for these two goods are:

$$P_h = a - bX_h - gX_f, \qquad P_f = a - bX_f - gX_h \tag{7}$$

where α is the common intercept for these demand functions, and $0 <= \gamma <= \beta$. As shown in Figure 2, the parameter γ changes holding β constant, and represents the effectiveness of patent protection. The parameter γ governs the cross substitution between X_h and X_f, and the distance between 0 and β represents the degree of patent protection.

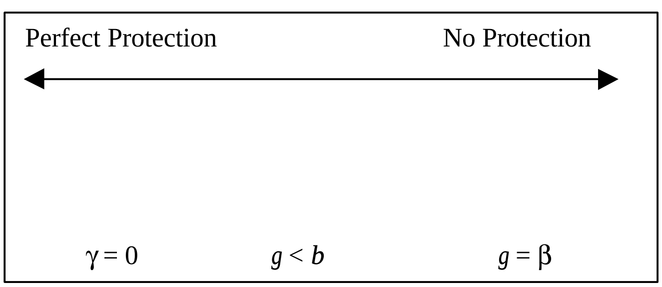

Figure 2: Parameter γ and Patent Protection

[12] I thank James Markusen for suggesting this modeling approach to me.

Then, revenue (R) for each firm is:

$$R_h = P_h X_h = aX_h - bX_h^2 - gX_f X_h \tag{8a}$$

$$R_f = P_f X_f = aX_f - bX_f^2 - gX_h X_f \tag{8b}$$

Following the Cournot assumption that each firm assumes its rival's output is fixed, and that firms optimize by setting marginal revenue (MR) equal to marginal cost (m), then each firm's marginal costs can be written as:

$$m = a - 2bX_h - gX_f \tag{9a}$$

$$m = a - 2bX_f - gX_h \tag{9b}$$

Solving MR to equal m such that each firm's output is a function of its rival's output,

$$X_h = \frac{a-m}{2b} - \frac{g}{2b} X_f \, , X_f = \frac{a-m}{2b} - \frac{g}{2b} X_h \tag{10}$$

At the Cournot equilibrium $X_h = X_f =$

$$X = \frac{a-m}{2b+g} \tag{11}$$

Then, (P-m) can be rewritten as:

$$\frac{(a-m)[(2b+g)-(b+g)]}{2b+g} = \frac{(a-m)b}{2b+g} \tag{12}$$

In equilibrium, the duopoly profits from FDI ($\Pi_{d,f}$) to the MNE are:

$$\Pi_{d,f} = (P-m)X - F = b[\frac{(a-m)}{2b+g}]^2 - F \tag{13}$$

The difference between X_h and X_f is the technology embedded in X_h. Accordingly, one way to allow IPRs to enter into this framework is through the parameter γ, which can be seen as inversely related to the strength of patent protection. Weak patent protection allows local firms to imitate MNE's product, in which case X_h and X_f are imperfect substitutes. For example, suppose the MNE produces a knowledge-based good and owns a patent on the knowledge or technology embedded in X_h. The local firm can invent around the patented technology related to X_h and produce an imperfect substitute X_f.

Consider equilibrium profits represented in equation (13). When $\gamma = 0$ there is perfect patent protection, the local firm cannot invent around the MNE's patent and thus does not produce X_f. Then, the MNE's profits are:

$$\Pi_{d,f} = b[\tfrac{(a-m_f)}{2b}]^2 - F \qquad (14)$$

and the difference between FDI and licensing profits depends solely on fixed costs (see Figure 3). As *g* increases and approaches β, it becomes easier for the local firm to imitate and invent around the MNE's original invention, and more difficult and costly for the MNE to retain control over its patent. The local firm produces X_f, similar but identical to X_h. Then the MNE's profits are:

$$\Pi_{d,f} = b[\tfrac{(a-m_f)}{2b+g}]^2 - F \qquad (15)$$

As *g* increases and patent protection weakens, X_f progressively becomes a perfect substitute for X_h. The MNE faces a duopoly outcome and lower profits. This is seen in the following partial derivative:

$$\frac{\partial \Pi_{d,f}}{\partial g} = -2b\left[\frac{(a-m_f)^2}{(2b+g)^3}\right] < 0 \qquad (16)$$

since α, *b*, *g*, *m* > 0. Duopoly profits from FDI decrease in *g*. When $\gamma = b$, there is no protection, and the foreign firm can easily invent around the MNE's original invention and imitate X_h. The MNE profits are:

$$\Pi_{d,f} = b[\tfrac{(a-m_f)}{3b}]^2 - F \qquad (17)$$

Thus, duopoly profits from the FDI entry mode decrease as patent protection weakens, specifically, as inventing around becomes more likely.

Case Two: Licensing and Monopoly Outcome

The other option for the MNE is to choose to transfer its technology to a local firm.

The local firm will begin producing the product upon receipt of the technology. Under this licensing option, profits to the MNE (from equation (6)) are:

$$\Pi_l = b[\tfrac{(a-m_l)}{2b}]^2 - G \tag{18}$$

This assumes that licensing profits are exogenous to the parameter γ; γ is irrelevant in the licensing option because once the MNE licenses its technology to the local firm, there is only one product, X_f. That is, under the licensing option, the MNE does not produce, $X_h = 0$, and $X_f > 0$.[13] Figure 3 graphs the licensing profit curve and the FDI profit curve relative to the parameter γ. FDI profits decrease in γ. At γ*, the MNE is indifferent between FDI and licensing. When there exists strong patent protection, or γ > γ*, the MNE chooses FDI. When there exists weak patent protection, or γ < γ*, the MNE chooses licensing.

Thus, key features of the JPS, which increase the threat of imitation and cost of patent protection, can influence FDI decisions by MNEs through affecting profits. When there is weak patent protection and it is possible for the local firm to invent around the MNE's patent, the local firm produces a similar and competing product, which results in lower profits for the MNE. In this way, when inventing around is possible, the MNE may find licensing the more profitable option. Licensing is a way for the MNE to co-opt (or buy off) its competitor.

[13] Without the simplifying assumption that licensing profits are exogenous to γ, then the Π_l curve would be downward-sloping in Figure 12. However, as long as Π_l is flatter than Π_f , the general results below still hold. The distribution of profits would change; as the threat of imitation increased, more profits would accrue to the licensee.

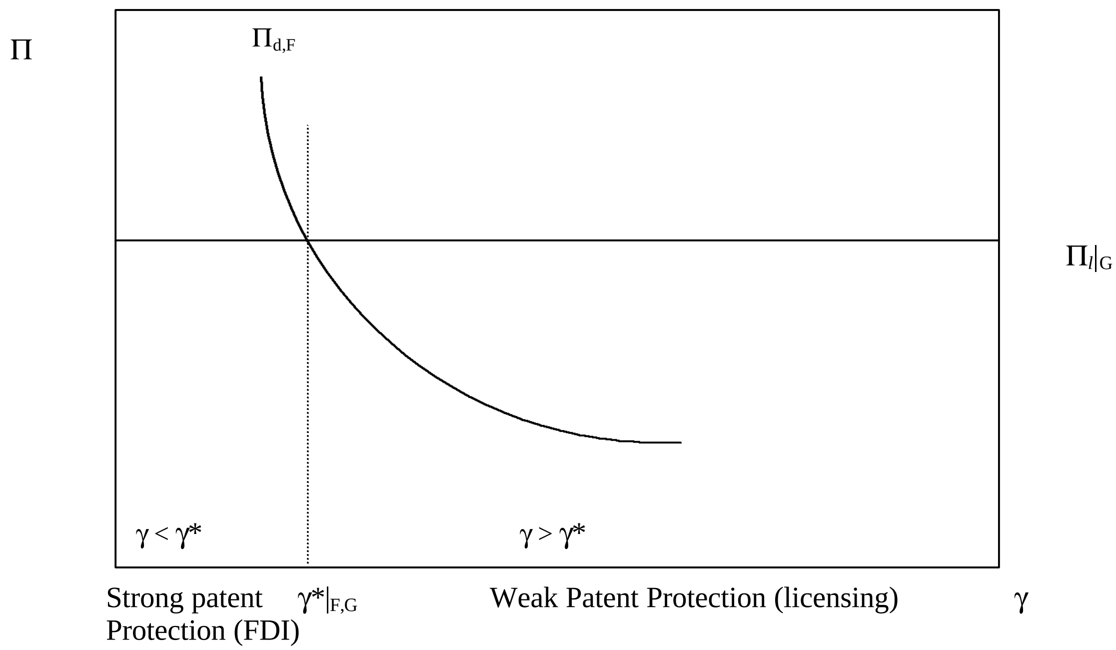

Figure 3: Profit Functions for FDI and Licensing

Evidence of Entry Modes

In reviewing data for 14 OECD countries plus South Korea from 1986 to 1994, the volume of U.S. affiliate sales in Japan as a share of Japan's GDP lies well below that of most other countries. In addition, licensing and royalty receipts for industrial processes from Japan as a share of Japan's GDP far exceeded that of all countries with the exception of South Korea.[14] The variables and data sources are described in the Appendix. Table 1 presents data on affiliate sales, manufacturing exports, and licensing receipts for U.S. MNEs by country, as a share of each country's GDP, over the period 1986-1994. Descriptive statistics for each ratio are presented below the ranked figures. The volume of U.S. affiliate sales in Japan as a share of Japan's GDP was the third lowest (.0075). Volume of U.S. exports to Japan as a share of Japan's GDP (.015) was lower than the mean over all the countries (.031).

[14] Only the licensing and royalty receipts from industrial processes are considered since copyrights, trademarks, and broadcast rights are not particularly relevant to the analysis.

Licensing and royalty receipts from Japan as a share of GDP (.000364) (was second only to Korea) and was more than twice that of the mean (.000171).

Table 2 presents statistics on 1990 merchandise sales of U.S. affiliates in each country, broken down into three categories: affiliate sales, U.S. manufacturing exports, and an estimate of the value of the output of all goods and services of foreign-owned firms which are produced under license to U.S. firms.[15] As shown in Table 2, the percentage of licensed sales of total sales in 1990 was highest for Japan (23.6%) and then Korea (22.7%) and lowest for Canada (0.86%) and Spain (0.97%). The share of affiliate sales of total sales in 1990 was highest for Germany (82%) and the United Kingdom (80%), and lowest for Korea (9.6%) and Japan (27.2%). Exports as a percentage of total sales in 1990 were highest for Korea (67.6) and Spain (49.8%) and lowest for Germany (15.7%) and Italy (18.2%).[16] The Appendix presents the averages of each variable in descending order by country over 1986-1994, and descriptive statistics for each variable.

These data on entry modes illustrate that licensing was a prevalent source of entry for U.S. MNEs into Japan's market over 1986-1994 relative to the other countries examined, while FDI was the least exploited mode. With the exception of Korea, Japan was the only country for which the volume of licensed sales exceeded that of affiliate sales.[17] The next step is to present these results more formally, and examine the impact of inventing around in the entry mode decision.

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[15] Following Dunning (1996), licensed sales represent royalties and fees paid by unaffiliated firms in the licensee country multiplied by 20 (it being assumed that royalties and fees were calculated as five-percent of gross sales).

[16] While this paper explicitly considers the industrial processing portion of the licensing and royalty receipts, it is interesting to note that the inclusion of copyrights, trademarks, and broadcast rights do not compromise the results from the descriptive statistics or the econometric analysis.

[17] While Korea is the only non-OECD country in the dataset, it serves as a "test case" in the sense that Korea attracts little FDI, and that exports and licensing are more common modes of entry into that market.

Testable Hypotheses

The model presented above motivate two hypotheses that may be tested econometrically with panel data on affiliate sales, licensing receipts, country characteristics, and location advantages. The first proposition is that the value of U.S. MNE affiliate sales in Japan is lower compared to that of other advanced industrialized nations; and the value of licensing to Japan is higher compared to that of other advanced industrialized nations. Therefore, the first hypothesis relates to a cross-country analysis of the levels of affiliate sales and licensing receipts.

Hypothesis One: Controlling for country characteristics and location advantages, a cross-country comparison should reveal that the value of U.S. MNE affiliate sales in Japan is lower compared to that of other advanced industrialized nations; and the value of licensing to Japan is higher compared to that of other advanced industrialized nations.

The next proposition is that inventing around discouraged internalization and promoted the licensing solution.

Hypothesis Two: Controlling for country characteristics and location advantages, the patent practice of inventing around should account for, in part, the large outlying country-specific effects for Japan in the affiliate sales and licensing models.

3. ECONOMETRIC FRAMEWORK

Methodology

Determinant factors of the location of FDI include characteristics and location advantages of the potential host country. Country characteristics such as GDP and average income levels measure the market size of the host country. Location decisions can depend on government intervention. For instance, high trade costs and strict import controls can attract FDI while investment costs, such as high corporate tax rates, can deter FDI (UNCTAD, 1992). Transportation costs, measured by the distance between the host and source country, is also a location factor that can influence the choice between exports and foreign direct investment (UNCTAD, 1992).[18] Intellectual property protection can strengthen the ownership advantage, and in this way, can be thought of as a location advantage (Smith, 1998). Finally, abundance of skilled labor captures a comparative advantage by a factor proportion, which Maskus and Webster (1995) showed to be an important determinant of the location of FDI.

Thus, the following specification in logarithmic form is used to examine FDI and licensing:

$$\ln(Y_{it}) = \beta_0 + \beta_1 \ln(CHAR_{it}) + \beta_2 \ln(GOV_{it}) + \beta_3 (IPR_{it}) + \beta_4 \ln(SK_{it}) + \alpha_i + u_{it},$$
$$(i = 1, 2, \ldots, N;\ t = 1, 2, \ldots, T) \qquad (19)$$

where the dependent variable is either affiliate sales or licensing. Explanatory variables in CHAR include the country characteristics GDP and per capita (PC) GDP, and GOV includes the effective tax rate and trade costs. IPR is the standard Park and Ginarte IPR index (see Appendix) and therefore not in logarithmic form. SK indicates the abundance of skilled labor. The country-specific effects are measured by α_i. The data are represented by observations on N cross sectional units (countries) over T periods of time, where $N = 15$ and $T = 9$. Hence, there are altogether 135 observations.

Equation (19) generates country dummy variable coefficients $(\hat{a}_i)$ and allows a cross-country comparison. The country-specific effect for Japan has two interpretations: relative to the benchmark country and relative to the other countries' dummy variables. Statistical significance is determined by each country-specific t-statistic.

If inventing around is a significant determinant of behavior, then an analysis of the residuals should reveal that the predicted value of FDI in Japan is higher than the actual

[18] However, Smith (1998) found distance had a negative and statistically significant effect on both FDI and exports. See also Hollander (1984), Dunning and Buckley (1976), and Papanastassiou and Pearce (1990).

value; and, that the predicted value of licensing in Japan is lower than the actual value. The specification is:

$$\ln(Y_{it}) = \beta_0 + \beta_1\ln(CHAR_{it}) + \beta_2\ln(GOV_{it}) + \beta_3(IPR_{it}) + \beta_4\ln(SK_{it}) + \beta_5(DIST_i) + u_{it},$$

$$(i = 1, 2, \ldots, N;\ t = 1, 2, \ldots, T) \qquad (20)$$

Equation (20) controls for distance and therefore does not include the country-specific effects. From this specification, an analysis of each country's average residual over time $(\frac{1}{T}\sum \hat{u}_{it})$ allows a comparison of the actual and predicted values of the dependent variable by country. That is, a positive (negative) residual indicates that the actual value is greater (less) than the predicted value.

In order to examine the effects of inventing around on FDI and licensing decisions, I construct an index and dummy variable, which capture whether key patent provisions are present in each country over time, from data provided in Jacobs and Hennelin (1997). The presence of pre-grant disclosure, pre-grant opposition, and a system of utility models in country i in year t, is represented by the dummy variables PGD_{it}, PGO_{it}, and UM_{it}, respectively. The index variable IPR1 is the sum of these three dummy variables and measures the number of provisions by country over time:

$$IPR1_{it} = PGD_{it} + PGO_{it} + UM_{it}$$

The dummy variable IPR2 is the product of the three dummy variables and captures the simultaneous presence of these features. Thus, IPR2 serves as a proxy for inventing around:

$$IPR2_{it} = PGD_{it} \cdot PGO_{it} \cdot UM_{it}$$

The index variable IPR1 controls for the number of these key features present, while the dummy variable IPR2 explicitly controls for inventing around. For example, Australia's patent system provides for pre-grant disclosure and pre-grant opposition, but not a utility model system; thus, the value of IPR1 for Australia is 2 since two of these features are present, and IPR2 is 0 since not all three features are present.

Accordingly, in order to examine the effect of inventing around on entry mode decisions, I include IPR2 and then re-examine Japan's country dummy variable coefficient. The following specification is used to test Hypothesis Two:

$$\ln(Y_{it}) = \beta_0 + \beta_1\ln(CHAR_{it}) + \beta_2\ln(GOV_{it}) + \beta_3(IPR_{it}) + \beta_4\ln(SK_{it}) + \beta_5(IF_{it}) + \alpha_i + u_{it},$$

$$(i = 1, 2, \ldots, N;\ t = 1, 2, \ldots, T) \qquad (21)$$

Since there exists some time variance in IPR2, the country-specific effects can be included. The well-known problem with country dummy variables is that they tend to diminish the explanatory power of the determinant factors. However, the objective here is to estimate the country-specific effects once controlling for determinant factors, such as country characteristics and location advantages. Thus, we are less concerned with the explanatory power of the determinant factors, and more concerned with the contribution of the country-specific effects to the dependent variable. Also, while country dummy variables identify country-specific unobserved effects, it is difficult to determine the specific contribution of patent protection to entry mode choices from the country dummy variables alone. In this regard, results from equation (21) for Hypothesis Two must be interpreted with caution.

In estimating the above equations, sensitivity analysis from a fixed-effects model with panel data indicated evidence of heteroskedasticity and autocorrelation. Thus, a cross-sectionally heteroskedastic and timewise autoregressive model is estimated with generalized least squares (GLS) (see Kmenta, 1986).

Empirical Results

Hypothesis One

The findings reveal strong support for Hypothesis One. Controlling for country characteristics and location advantages, the empirical results indicate that U.S. MNE affiliate sales in Japan are much lower than in other advanced industrialized countries. Table 3 reports estimation results for the affiliate sales model. The last row indicates whether the country dummy variable for Japan is one of the top three outliers among the countries.[19] Table 4 reports the corresponding average residual by country and country-specific effects $(\hat{a}_i)$. That Japan is the largest country in GDP terms might bias the interpretation of the country-specific effects. Thus, each country-specific residual and dummy coefficient is weighted by the respective country's log (GDP) and reported in the next column.

While our main interest is the country-specific effects, it is worthwhile to review the estimation results for the other explanatory variables.[20] In general these results are robust to changes in specification. In Table 3, the first column reports results obtained with OLS estimation. The model fit quite well (Adj. R^2=0.691). Including the distance variable explained an additional 4.4% as reported in the second column. As expected, market size had a positive and significant effect on affiliate sales, while the effect of tax rates was negative and insignificant. The host country's abundance of skilled labor had a positive and significant effect on affiliate sales. Overall, income levels and trade costs had negative and significant effects on affiliate sales. The strength of IPR protection had a negative and significant effect on U.S. affiliate sales. Distance had a negative and significant effect on affiliate sales.

The third and fourth columns show fixed effects estimation results from OLS and GLS, respectively. The inclusion of the country-specific effects explained roughly an additional 29% of the variation. The reason to add the country-specific effects is not to better fit the model, but rather because their analysis is central to testing the hypotheses. Measuring shifts in the regression line with fixed effects accounted for changes in the estimated coefficients for per capita GDP, trade costs, and skilled labor abundance. Specifically, with fixed effects the effect of income levels was positive but insignificant, while the effect of

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[19] The benchmark countries for the affiliate sales and licensing models are Spain and The Netherlands, respectively.

[20] Resulting coefficients from the pooled OLS estimations generally match that of previous authors, such as Tamura (1996), Smith (1998) and Yang (1998).

high trade costs was positive and significant on affiliate sales. Interestingly, the host country's abundance of skilled labor had a negative but insignificant effect on affiliate sales in the fixed effects model.[21] Notwithstanding fixed effects, the size of the host country market had a strong positive and significant effect on U.S. affiliate sales, while high average effective corporate tax rates in the host country deterred FDI. The strength of IPR protection had a negative and significant effect on U.S. affiliate sales. This result is consistent with the traditional notion that weak patent protection encourages internalization.[22]

As shown in Table 4, the estimated country-specific effects for Japan were robust to the various specifications. In the OLS estimation, the predicted value of U.S. affiliate sales for Japan exceeded the actual value by 41% (column 1). Once controlling for distance this value declined to 32% (column 2). After adjusting for GDP, Japan's residual remained among the top three negative outliers. Results from OLS with fixed effects (column 3) indicated that the GDP-adjusted country-specific effect for Japan was the second largest negative and significant outlier (-0.236). From GLS estimation with country-specific effects (column 4), Japan was the third largest negative and significant outlier (-0.280). These results indicate that the country-specific effect for Japan is among the furthest away from the benchmark country and in the negative direction, and is one of the largest negative values relative to the other country dummy variables in each specification. These findings support the first part of Hypothesis One.[23]

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[21] It appears that Sweden and Norway are influencing this result. Sweden, an advanced manufacturing economy, has the highest value for skilled labor abundance and a fairly low value for affiliate sales. Norway, a country rich in natural resources, has the second highest value for PCGDP and the lowest value for affiliate sales. Not surprisingly, the coefficient on skilled labor abundance was positive and significant with these two countries excluded.

[22] Results obtained from including a more general investment cost index (kindly provided by Carr, Markusen, and Maskus) instead of the effective tax rate were identical in sign and significance to those obtained from including the effective tax rate (available upon request).

[23] Given the robustness of the country-specific effects estimates, the ranking order provides sufficient information. For example, results from means tests indicated that the country-

The estimation results for the licensing model are reported in Table 5. The explanatory variables accounted for 69% of the variation, and the fixed effects explained an additional 21%. Controlling for distance did not explain any additional variation. As expected, market size had a positive and significant effect on licensing receipts. The effect of tax rates was negative but insignificant, while the effect of trade costs was positive and significant. Overall, income levels had a negative and significant effect and skilled labor abundance had a positive and insignificant effect on licensing. Distance had a negative but insignificant effect on licensing. However, once controlling for fixed effects, the effect of income levels was positive and significant, while the effect of skilled labor abundance was negative. The result that strong IPRs had a positive and significant effect on licensing sustained the inclusion of fixed effects, and concurs with previous authors' findings that strong patent protection in a host country to increase unaffiliated licensing, such as Smith (1998) and Yang (1998).

Table 6 reports the country-specific effects for the licensing model. The first two columns report the GDP-weighted average country residuals over time. This value for Japan is the largest positive value among the countries and suggests that the actual value of licensing receipts from Japan far exceeded the predicted value. The GDP-weighted country-specific effects obtained with OLS are reported in the third column, and this figure for Japan is the second largest positive and significant value across countries (0.687). The resulting fixed effects from GLS estimation also reveal that this figure for Japan (0.710) is the second furthest away from the benchmark country and in the positive direction, and, it is the largest positive and significant value relative to the other country dummy variables. These findings indicate that the value of U.S. unaffiliated industrial processing licensing receipts from Japan is much higher than that of other industrialized nations, controlling for country characteristics

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specific effect for Japan was significantly different than that for Canada in the OLS and GLS with fixed effects estimations for affiliate sales. Results are available upon request.

and location advantages, and support the second part of Hypothesis One.

Hypothesis Two

The index variable IPR1 had an overall negative and insignificant effect on FDI and did not affect Japan's dummy variable coefficient (Tables 3 and 4, column 5). Thus, the results provide little or no evidence that the presence of patent system features such as pre-grant disclosure, pre-grant opposition, and provisions for petty patents deter FDI.

Table 3, column 6 shows that the dummy variable IPR2, which controls explicitly for inventing around, had an overall negative and significant impact on U.S. affiliate sales (-0.603). This result is consistent with the notion that inventing around decreased profits from FDI by increasing the threat of imitation and cost of patenting. The last column in Table 4 shows that the inclusion of IPR2 did not affect the country-specific effect for Japan in the affiliate sales model, which remained among the top three negative outliers. This suggests that inventing around does not account for Japan's outlying country-specific effect in the FDI model; rather other unobservable factors, such as cross-shareholding, bank-firm links and vertical may be influencing the low value of U.S. affiliate sales in Japan groups (see Weinstein, 1996).

Table 5, column 5 shows that that the variable IPR1 had a negative and significant impact on licensing receipts. This suggests that cumulatively, these patent system features generally deter licensing. However, the inclusion of IPR1 did not affect the fixed effect for Japan, which remained positive but insignificant. The variable IPR2, which explicitly controlled for inventing around, had a positive and significant effect (2.04) on licensing (column 6). More importantly, once controlling for IPR2, the country-specific effect for Japan became negative and insignificant (-1.02) as reported in Table 6. These findings suggest that the possibility of inventing around, in part, accounts for the high level of licensing in Japan.

Reviewing the results for the other countries that allowed for inventing around, and for which IPR2 took on a value of 1, might allow a more general conclusion. Results obtained from GLS estimation show that the fixed effects for these countries were negative and significant outliers in the affiliate sales model (Germany, -0.076; Italy, -0.656; Japan, -2.228; Korea, -1.621; see Table 4, column 4).[24] After controlling for inventing around this value became positive and insignificant for Germany (0.002), positive and significant for Italy (0.101), and remained negative and significant for Korea. This provides some general support for the model's prediction that inventing around erodes FDI profits.

Table 6, column 4 shows that the fixed effect for each of these countries in the licensing model was positive (Germany, 3.49; Italy, 2.40, Korea, 3.75; Spain, 1.66) and significant only for Korea. Column 6 shows that the fixed effect for each country became negative after controlling for inventing around (Germany –2.74; Italy, -2.73; Spain, -2.97).[25] This result may allow a more general conclusion. It suggests that the possibility of inventing around promotes the licensing solution, not only in Japan, but also in other countries where inventing around is possible.

4. Concluding Remarks

How patent rights affect FDI, licensing, and other modes of entry is a fairly new area of research, and within this area, this paper appears to be the first attempt to examine whether and how the patent practice of inventing around affects entry mode decisions. The goal of this paper was to investigate the effects of key features of the JPS on entry mode decisions by U.S. MNEs, using data on U.S. affiliate sales and licensing receipts from unaffiliated firms across 15 countries. The general proposition is that the patent practice of inventing around

[24] Spain was the benchmark country for the affiliate sales model, and thus, no fixed effect was estimated.

[25] This country dummy variable for Korea could not be estimated with the inclusion of IPR2.

allows local firms in the host country to imitate original inventions relatively easily and produce competing products, consequently, eroding profits under the FDI option for the MNE. The model presented above demonstrated that inventing around can lead to lower profits under the FDI option for the MNE because is discourages internalization (and relatively, encourages licensing), as a mode of entry. The empirical findings indicate that

(1) Controlling for country characteristics and location advantages, the value of U.S. MNE affiliate sales in Japan is much lower than that in other advanced industrialized nations.

(2) Controlling for country characteristics and location advantages, the value of U.S. licensing to unaffiliated firms in Japan far exceeded that in other advanced industrialized nations.

(3) Key patent system features, such as pre-grant disclosure, pre-grant opposition, and a utility model system, which combined enabled the practice of inventing around, may have contributed to the high level of licensing in Japan. There is weak evidence that this was also true in other countries that allowed for inventing around.

However, the empirical results should be interpreted with caution as they rely on the interpretation of country-specific unobserved effects. Notwithstanding, these findings at best suggest that inventing around may undermine the presumed notion that weak patent rights encourage internalization, and at least demonstrate a need to consider the *nature* of patent weak patent rights in the entry mode decision.

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Table 1
Entry Modes by U.S. MNEs

Country	**Affil Sales/ GDP**	**Country**	**Exports/GDP**	**Country**	**Unaffil. Ind. Proc. Fees/GDP**
Canada	0.1813	Canada	0.1511	Korea	0.000697
Netherlands	0.0999	Korea	0.0493	**Japan**	**0.000364**
Belgium	0.0955	Belg-Luxmbg	0.0451	Belgium	0.000210
UK	0.0894	Netherlands	0.0443	Sweden	0.000181
Australia	0.0587	Australia	0.0267	Netherlands	0.000168
Germany	0.0554	New Zealand	0.0259	Switzerland	0.000130
Spain	0.0453	Switzerland	0.0221	New Zealand	0.000123
France	0.0362	UK	0.0214	Canada	0.000120
Italy	0.0260	**Japan**	**0.0147**	Australia	0.000117
New Zealand	0.0251	Sweden	0.0124	Norway	0.000112
Sweden	0.0176	Germany	0.0110	UK	0.000093
Switzerland	0.0168	France	0.0104	France	0.000071
Japan	**0.0075**	Norway	0.0099	Italy	0.000070
Korea	0.0067	Spain	0.0095	Germany	0.000064
Norway	0.0044	Italy	0.0066	Spain	0.000043
Mean	0.051	Mean	0.031	Mean	0.000171
Median	0.036	Median	0.021	Median	0.000120
Std. Dev.	0.048	Std. Dev.	0.036	Std. Dev.	0.000165
Minimun	0.004	Minimun	0.007	Minimun	0.000043
Maximum	0.181	Maximum	0.151	Maximum	0.000697

Table 2
Sales of U.S. MNEs by type, across countries, 1990

Country		**Affil. Sales**	**Exports**	**Unaffil. IP Fees**	**TOTAL**
Australia	in bln US 90$	19.237	7.779	0.660	27.676
	% of TOTAL	69.509	28.106	2.385	
Belgium	in bln US 90$	18.924	8.979	0.440	28.343
	% of TOTAL	66.769	31.679	1.552	
Canada	in bln US 90$	95.747	85.547	1.580	182.874
	% of TOTAL	52.357	46.779	0.864	
France	in bln US 90$	45.695	12.172	1.560	59.427
	% of TOTAL	76.893	20.482	2.625	
Germany	in bln US 90$	89.183	16.995	2.140	108.318
	% of TOTAL	82.334	15.690	1.976	
Italy	in bln US 90$	29.970	7.112	2.100	39.182
	% of TOTAL	76.489	18.152	5.360	
Japan	in bln US 90$	23.669	42.747	20.560	86.976
	% of TOTAL	27.213	49.148	23.639	
Korea	in bln US 90$	1.795	12.579	4.237	18.611
	% of TOTAL	9.645	67.590	22.765	
Netherlands	in bln US 90$	29.887	11.576	1.180	42.643
	% of TOTAL	70.087	27.146	2.767	
New Zealand	in bln US 90$	0.978	1.100	0.060	2.138
	% of TOTAL	45.745	51.448	2.806	
Norway	in bln US 90$	0.536	0.529	0.200	1.265
	% of TOTAL	42.386	41.799	15.816	
Spain	in bln US 90$	21.243	21.489	0.420	43.152
	% of TOTAL	49.228	49.799	0.973	
Sweden	in bln US 90$	4.094	3.898	0.880	8.872
	% of TOTAL	46.144	43.937	9.919	
Switzerland	in bln US 90$	4.533	3.705	0.480	8.718
	% of TOTAL	51.993	42.501	5.506	
UK	in bln US 90$	90.977	20.662	1.820	113.459
	% of TOTAL	80.185	18.211	1.604	

Table 3
Estimation Results for Affiliate Sales Model
Dependent Variable: Affiliate Sales

Column	(1)		(2)		(3)		(4)		(5)		(6)	
	OLS		OLS		OLS w/FE		GLS w/FE		GLS w/FE		GLS w/FE	
CONST	5.396	**	9.061	**	-4.807	**	-4.748	**	-5.146	**	-4.767	**
	(2.421)		(1.631)		(2.099)		(1.034)		(1.116)		(1.078)	
GDP	1.362	**	1.292	**	1.315	**	1.270	**	1.148	**	1.111	**
	(0.083)		(0.063)		(0.342)		(0.193)		(0.193)		(0.191)	
PC GDP	-0.712	**	-1.063	**	0.031		0.097		0.128		0.166	
	(0.238)		(0.183)		(0.327)		(0.199)		(0.208)		(0.205)	
TAX	-0.158		-0.341		-0.657		-0.510		-0.373		-0.344	
	(3.547)		(0.352)		(0.661)		(0.334)		(0.332)		(0.332)	
Trade Cost	-0.041	**	-0.012	**	0.0035	**	0.002	**	0.0017	**	0.0018	**
	(0.008)		(0.002)		(0.0013)		(0.0005)		(0.0006)		(0.0006)	
IPR	-0.91	**	-0.543	**	-0.290		-0.263	**				
	(0.242)		(0.149)		(0.226)		(0.064)					
Skilled Labor	2.906	**	1.355	**	-0.136		-0.341		-0.153		-0.199	
Abundance	(1.297)		(0.445)		(0.539)		(0.376)		(0.409)		(0.406)	
Distance			-0.0002	**								
			(0.00003)									
IPR1									-0.031			
									(0.037)			
IPR2											-0.603	**
											(0.109)	
Adj R2	0.691		0.735		0.987		0.978		0.970		0.971	
Japan Significant Neg. Outlier?	Yes		Yes		Yes		Yes		Yes		Yes	

Notes: n = 135. Standard errors are in parentheses.
** (*) indicates significance at the 5 (10) percent level.

Table 4

Country-Specific Effects for Affiliate Sales Model

Column	(1) OLS		(2) OLS		(3) OLS w/FE			(4) GLS w/FE			(5) GLS w/FE			(6) GLS w/FE		
	$(\frac{1}{T}\sum \hat{u}_{it})$	$\frac{(\frac{1}{T}\sum \hat{u}_{it})}{LGDP_i}$	$(\frac{1}{T}\sum \hat{u}_{it})$	$\frac{(\frac{1}{T}\sum \hat{u}_{it})}{LGDP_i}$	$\hat{a}_i$		$\frac{\hat{a}_i}{LGDP_i}$	$\hat{a}_i$		$\frac{\hat{a}_i}{LGDP_i}$	$\hat{a}_i$		$\frac{\hat{a}_i}{LGDP_i}$	$\hat{a}_i$		$\frac{\hat{a}_i}{LGDP_i}$
Constant			7.175		-4.807			-4.748			-5.146			-4.767		
Australia	0.174	0.031	0.149	0.026	0.693	*	0.122	0.316	*	0.056	0.253		0.045	-0.343		-0.060
Belgium	0.514	0.098	0.473	0.090	1.581	**	0.301	1.138	**	0.217	0.810	**	0.154	0.225		0.043
Canada	0.055	0.009	-0.199	-0.031	1.464	*	0.231	1.174	**	0.185	1.264	**	0.200	0.723	**	0.114
France	-0.166	-0.024	-0.209	-0.030	-0.035	*	-0.005	-0.401	**	-0.057	-0.457	**	-0.065	-1.010	**	-0.143
Germany	0.059	0.008	0.235	0.032	0.317	**	0.043	-0.076	**	-0.010	-0.028		-0.004	0.002		0.000
Italy	-0.275	-0.039	-0.159	-0.023	-0.304	**	-0.044	-0.656	**	-0.094	-0.723	**	-0.104	0.703	**	0.101
Japan	-0.410	-0.051	-0.319	-0.040	-1.877	**	-0.236	-2.228	**	-0.280	-2.161	**	-0.271	-2.117	**	-0.266
Netherlands	0.662	0.119	0.673	0.121	1.576	**	0.283	1.161	**	0.209	0.801	**	0.144	0.234		0.042
New Zealand	0.174	0.046	0.215	0.057	0.504		0.133	0.034		0.009	-0.258		-0.068	-0.916	*	-0.242
Norway	-0.385	-0.081	-0.157	-0.033	-1.718	*	-0.360	-2.086	*	-0.437	-2.275	*	-0.477	-2.920	**	-0.612
Sweden	-0.372	-0.069	-0.370	-0.069	1.388	**	0.257	-0.638		-0.118	-0.941		-0.174	-1.523		-0.282
Switzerland	0.002	0.000	0.082	0.015	-0.270		-0.050	-0.822		-0.153	-1.121	*	-0.208	-1.693	**	-0.314
UK	0.365	0.053	0.225	0.033	0.853	*	0.124	0.546	**	0.080	0.055	**	0.008	n/a	**	n/a
Korea	-0.076	-0.014	-0.044	-0.008	-1.227	**	-0.222	-1.621	**	-0.293	-1.757	**	-0.317	-1.755	**	-0.317
Spain	-0.115	-0.019	-0.351	-0.057												

Note: ** (*) indicates significance at the 5 (10) percent level.

Table 5
Estimation Results for Licensing Receipts Model
Dependent Variable: Licensing Receipts

Column	(1)		(2)		(3)		(4)		(5)		(6)	
	OLS		OLS		OLS w/FE		GLS w/FE		GLS w/FE		GLS w/FE	
CONST	-9.929	**	-9.078	**	-30.076	**	-25.624	**	-12.635	**	-14.362	**
	(2.074)		(2.274)		(8.937)		(8.352)		(3.269)		(3.399)	
GDP	0.910	**	0.884	**	1.427		1.289		1.006	**	0.865	*
	(0.067)		(0.072)		(1.343)		(1.239)		(0.396)		(0.441)	
PC GDP	-0.383	**	-0.395	**	2.984	**	2.261	**	0.386		0.624	
	(0.191)		(0.192)		(1.436)		(1.068)		(0.488)		(0.531)	
TAX	-1.079		-1.012		-2.059		-2.260	**	-3.022	**	-2.923	**
	(2.858)		(2.861)		(2.383)		(1.086)		(1.165)		(1.166)	
Trade Cost	0.581	**	0.595	**	0.298	**	0.131	**	0.073	*	0.793	*
	(0.181)		(0.182)		(0.136)		(0.045)		(0.039)		(0.040)	
IPR	0.826	**	0.924	**	1.368	*	0.527	**				
	(0.194)		(0.222)		(0.761)		(0.236)					
Skilled Labor	0.823		0.631		-3.542	**	-0.440		0.436	*	0.274	
Abundance	(1.025)		(1.047)		(1.695)		(0.996)		(1.039)		(1.067)	
Distance			-0.108									
			(0.118)									
IPR1									-0.212	**		
									(0.088)			
IPR2											2.044	**
											(0.815)	
Adj R2	0.694		0.694		0.903		0.947		0.938		0.939	
Japan Significant Pos. Outlier?	Yes		Yes		Yes		Yes		Yes		No	

Notes: n = 135. Standard errors are in parentheses.
** (*) indicates significance at the 5 (10) percent level.

Table 6
Country-Specific Effects for Licensing Receipts Model

Column	(1) OLS		(2) OLS		(3) OLS w/FE		(4) GLS w/FE		(5) GLS w/FE		(6) GLS w/FE	
	$(\frac{1}{T}\sum \hat{u}_{it})$	$\frac{(\frac{1}{T}\sum \hat{u}_{it})}{LGDP_i}$	$(\frac{1}{T}\sum \hat{u}_{it})$	$\frac{(\frac{1}{T}\sum \hat{u}_{it})}{LGDP_i}$	$\hat{a}_i$	$\frac{\hat{a}_i}{LGDP_i}$	$\hat{a}_i$	$\frac{\hat{a}_i}{LGDP_i}$	$\hat{a}_i$	$\frac{\hat{a}_i}{LGDP_i}$	$\hat{a}_i$	$\frac{\hat{a}_i}{LGDP_i}$
Constant					-30.080 **		-25.624 **		-12.632		-14.362	
Australia	0.160	0.028	0.031	0.005	1.001	0.176	1.428 *	0.252	-0.099	-0.017	-0.310	-0.055
Belgium	0.221	0.042	0.124	0.024	-0.416	-0.079	-0.156	-0.030	0.367	0.070	0.295	0.056
Canada	0.125	0.020	0.078	0.012	2.925 *	0.462	3.514 **	0.555	-0.391	-0.062	-0.342	-0.054
France	-0.064	-0.009	-0.048	-0.007	2.314	0.328	2.519	0.357	-0.663	-0.094	-0.722	-0.102
Germany	-0.018	-0.002	-0.016	-0.002	3.330	0.454	3.499	0.477	-0.481	-0.066	-2.749 **	-0.375
Italy	-0.131	-0.019	-0.081	-0.012	2.325	0.333	2.400	0.344	-0.439	-0.063	-2.739 **	-0.393
Japan	0.377	0.047	0.202	0.025	5.474 *	0.687	5.658 *	0.710	1.190	0.149	-1.020	-0.128
Netherlands	0.001	0.000	0.050	0.009								
New Zealand	-0.194	-0.051	-0.093	-0.025	-3.071 *	-0.812	-2.546	-0.673	-0.123	-0.033	-0.533	-0.141
Norway	-0.239	-0.050	-0.104	-0.022	-2.687 *	-0.563	-1.815	-0.380	-0.584	-0.122	-1.020	-0.214
Sweden	-0.010	-0.002	-0.042	-0.008	-0.445	-0.082	-0.172	-0.032	-0.106	-0.020	-0.204	-0.038
Switzerland	0.073	0.013	0.039	0.007	-2.367	-0.439	-1.556	-0.289	-0.646	-0.120	-0.625	-0.116
UK	0.115	0.017	0.085	0.012	3.811 *	0.555	3.846 *	0.560	-0.316	-0.046	-0.327	-0.048
Korea	0.225	0.041	0.125	0.023	4.093 **	0.739	3.754 **	0.678	2.255 **	0.407	n/a	
Spain	-0.333	-0.054	-0.153	-0.025	1.495	0.243	1.663	0.270	-0.638	-0.104	-2.972 **	-0.482

Note: ** (*) indicates significance at the 5 (10) percent level.

APPENDIX

Averages of Variables over 1986-1994 in Ranking Order with Descriptive Statistics

Country	GDP	Country	Affil. Sales	Country	Exports
Japan	**2885.663**	Canada	102.151	Canada	85.547
Germany	1539.773	UK	85.791	**Japan**	**42.747**
France	1162.249	Germany	84.966	Spain	21.489
Italy	1069.128	France	42.236	UK	20.662
UK	958.919	Italy	27.829	Germany	16.995
Canada	563.894	Netherlands	25.896	Korea	12.579
Spain	475.327	**Japan**	**21.776**	France	12.172
Australia	290.567	Spain	21.489	Netherlands	11.576
Netherlands	261.711	Belgium	18.096	Belg-Luxmbg	8.979
Korea	253.721	Australia	17.017	Australia	7.779
Sweden	221.436	Sweden	3.898	Italy	7.112
Switzerland	219.088	Switzerland	3.705	Sweden	3.898
Belgium	189.758	Korea	1.753	Switzerland	3.705
Norway	118.288	New Zealand	1.100	New Zealand	1.100
New Zealand	43.923	Norway	0.529	Norway	0.529
Mean	683.563	Mean	30.549	Mean	17.125
Median	290.567	Median	21.489	Median	11.576
Std. Dev.	756.526	Std. Dev.	33.627	Std. Dev.	21.691
Minimun	43.923	Minimun	0.529	Minimun	0.529
Maximum	2885.663	Maximum	102.151	Maximum	85.547

Country	Unaffil. IP Fees	Country	Unaffil. Total Fees	Country	Investment Cost
Japan	**1.0630**	**Japan**	**1.3478**	Korea	52.80
Korea	0.1903	UK	0.2338	Italy	48.05
Germany	0.0984	Germany	0.2275	Spain	47.26
UK	0.0893	Korea	0.2085	France	44.36
France	0.0824	Canada	0.1770	Norway	37.62
Italy	0.0752	France	0.1457	**Japan**	**37.38**
Canada	0.0668	Italy	0.1288	Sweden	35.51
Netherlands	0.0424	Australia	0.0833	Australia	33.87
Sweden	0.0403	Netherlands	0.0698	Belgium	32.43
Belgium	0.0400	Sweden	0.0622	Switzerland	30.75
Australia	0.0341	Belgium	0.0590	Canada	29.95
Switzerland	0.0286	Spain	0.0490	New Zealand	27.89
Spain	0.0205	Switzerland	0.0459	UK	27.08
Norway	0.0130	Norway	0.0197	Netherlands	26.49
New Zealand	0.0053	New Zealand	0.0133	Germany	24.21
Mean	0.126	Mean	0.191	Mean	35.710
Median	0.042	Median	0.083	Median	33.868
Std. Dev.	0.263	Std. Dev.	0.328	Std. Dev.	8.800
Minimun	0.005	Minimun	0.013	Minimun	24.205
Maximum	1.063	Maximum	1.348	Maximum	52.800

Country	Trade Cost	Country	Population	Country	Per Capita GDP
Korea	48.65	**Japan**	**0.1234**	Switzerland	32522.96
Japan	**42.86**	Germany	0.0776	Norway	27838.98
Spain	40.60	UK	0.0576	Sweden	25863.92
Norway	39.42	Italy	0.0572	**Japan**	**23365.96**
Australia	39.23	France	0.0567	Canada	20772.83
Canada	37.36	Korea	0.0428	France	20475.09
France	36.59	Spain	0.0388	Germany	19867.48
Italy	35.15	Canada	0.0272	Belgium	19024.80
Switzerland	34.37	Australia	0.0170	Italy	18689.37
New Zealand	29.36	Netherlands	0.0150	Netherlands	17448.21
Sweden	26.70	Belgium	0.0100	Australia	17080.71
UK	25.42	Sweden	0.0086	UK	16646.12
Netherlands	21.90	Switzerland	0.0067	New Zealand	13012.16
Germany	21.17	Norway	0.0042	Spain	12232.92
Belgium	20.28	New Zealand	0.0034	Korea	5896.58
Mean	33.270	Mean	0.036	Mean	19382.540
Median	35.146	Median	0.027	Median	19024.800
Std. Dev.	8.671	Std. Dev.	0.034	Std. Dev.	6525.369
Minimun	20.281	Minimun	0.003	Minimun	5896.581
Maximum	48.647	Maximum	0.123	Maximum	32522.959

Country	DIST	Country	Skilled Labor Abundance	Country	TAX
Australia	15958	Sweden	0.4165	New Zealand	0.0609
New Zealand	14097	UK	0.3255	Belgium	0.0530
Korea	11175	Canada	0.3051	Spain	0.0526
Japan	**10910**	Norway	0.3017	Korea	0.0446
Italy	7223	Netherlands	0.2774	Switzerland	0.0419
Sweden	6641	Belgium	0.2518	**Japan**	0.0418
Switzerland	6607	Australia	0.2392	Sweden	0.0324
Germany	6406	New Zealand	0.2342	Canada	0.0318
Norway	6238	Italy	0.2281	Germany	0.0293
Belgium	6222	France	0.1961	Australia	0.0284
Netherlands	6198	Switzerland	0.1913	UK	0.0265
France	6169	Germany	0.1834	France	0.0252
Spain	6096	**Japan**	**0.1483**	Italy	0.0211
UK	5904	Spain	0.1306	Netherlands	0.0201
Canada	734	Korea	0.0813	Norway	0.0153
Mean	7772	Mean	0.234	Mean	0.0350
Median	6406	Median	0.234	Median	0.0318
Std. Dev.	3769	Std. Dev.	0.085	Std. Dev.	0.0135
Minimun	734	Minimun	0.081	Minimum	0.0153
Maximum	15958	Maximum	0.416	Maximum	0.0609

Country	IPR	Country	IPR1	Country	IPR2
Netherlands	4.24	Germany	3.0	Australia	0.0
Italy	4.05	Italy	3.0	Belgium	0.0
Japan	**4.01**	Japan	3.0	Canada	0.0
Belgium	3.95	Korea	3.0	France	0.0
France	3.93	Spain	3.0	Netherlands	0.0
Korea	3.89	Australia	2.0	New Zealand	0.0
Sweden	3.80	France	2.0	Norway	0.0
Switzerland	3.80	New Zealand	2.0	Sweden	0.0
Germany	3.77	Norway	2.0	Switzerland	0.0
UK	3.57	UK	2.0	UK	0.0
Spain	3.55	Canada	1.0	Germany	1.0
New Zealand	3.34	Belgium	1.1	Italy	1.0
Australia	3.30	Netherlands	1.0	Japan	1.0
Norway	3.29	Sweden	1.0	Spain	1.0
Canada	2.81	Switzerland	0.0	Korea	1.0
Mean	3.687	Mean	1.9	Mean	0.3
Median	3.800	Median	2.0	Median	0.0
Std. Dev.	0.375	Std. Dev.	1.0	Std. Dev.	0.5
Minimun	2.813	Minimun	0.0	Minimun	0.0
Maximum	4.240	Maximum	3.0	Maximum	1.0

Variables and Data Sources

Data for the estimation form a panel of cross-country observations over the period 1986-1994. The countries included are Australia, Belgium, Canada, France, Germany, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and United Kingdom. The *Survey of Current Business* from the U.S. Department of Commerce reports affiliate sales of U.S. non-bank manufacturing affiliates.[1] Annual sales values abroad are converted into millions of 1990 U.S. dollars using an exchange-rate adjusted local wholesale price index, with exchange rates and price indexes taken from the *International Financial Statistics* (*IFS*) of the International Monetary Fund. Gross domestic product data are also provided by the *IFS* and similarly converted into millions of 1990 U.S. dollars. Data on total royalties and license fees received by U.S. firms from unaffiliated and affiliated firms abroad are also provided by *Survey of Current Business* and converted into 1990 U.S. dollars using a wholesale price index. The current analysis focuses on manufacturing activity, thus, licensing fees from industrial processes is used, and not fees from books, records, tapes, broadcasts and recording of live events, and franchises.

The cost of investing in the affiliate country and is a simple average of several indexes of impediments to investment, reported in the *World Competitiveness Report* of the World Economic Forum (see Carr et al, 1998). The indexes include restrictions on ability to acquire control in a domestic company, limitations on the ability to employ foreign skilled labor, restraints on negotiating joint ventures, strict controls on hiring and firing practices, market dominance by a small number of enterprises, an absence of fair administration of justice, difficulties in acquiring local bank credit, restrictions on access to local and foreign capital markets, and inadequate protection of intellectual property (Carr et al, 1998). The index ranges from 0 to 100 with 100 representing the highest investment cost. The trade cost index was also taken from the *World Competitiveness Report*, and is defined as a measure of national protectionism, or efforts to prevent importation of competitive products (Carr et al, 1998.), and ranges from 0 to 100 with a higher number representing a higher trade cost. Distance is measured as the number of kilometers from Washington, D.C. to the capital of the affiliate country. Skilled labor abundance is defined as the sum of occupational categories 0/1 (professional, technical and kindred workers) and 2 (administrative workers) in employment in each country, divided by total employment. Annual surveys of the *Yearbook of Labor Statistics* of the International Labor Organization contain figures from which these data are compiled. Population data are provided by *IFS*.

The volume of U.S. manufacturing exports to each affiliate country is provided by *Survey of Current Business,* U.S. Department of Commerce and converted into 1990 U.S. dollars using a wholesale price index provided by *IFS*. Following Grubert and Mutti (1991), the average effective tax rate is calculated as the ratio of foreign taxes paid to the affiliate country to book income of U.S. MNEs in that country. The tax and book income data are provided in *Statistics of Income Bulletin*, various years, Internal Revenue Service.

The IPR index is provided by Park and Ginarte (1997) and captures five components of patent laws: coverage of patent protection, duration of protection, membership in international patent agreements, provisions for loss of protection, and enforcement mechanisms. The scale ranges from 0 to 5 with 5 representing the highest IPR protection. Previous authors have used this index as a measure of patent protection (Yang, 1998).

However, the focus of this paper is to examine the effects of institutional features of the JPS which allow inventing around on entry mode decisions. Accordingly, IPR1 and IPR2 are constructed variables that capture the presence of pre-grant disclosure (PGD), pre-grant

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[1] Data on GDP, affiliate sales, investment and trade cost indexes, and distance were kindly provided by David Carr, James Markusen and Keith Maskus.

opposition (PGO), and utility models (UM) in host countries over 1986-1994. These variables were compiled from data provided in *Patents Throughout the World* by Jacobs and Hanellin (1997). The index variable IPR1 is the sum of the three dummy variables indicating how many of these features are present, and ranges from 0 to 3. Since all three features must be present to allow the practice of inventing around, the dummy variable IPR2 is the product of these dummy variables, and acts as a proxy for the practice of inventing around. A measure of 1 (0) indicates that (not) all three features are present.