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International technology licensing: Monopoly rents, transaction costs and exclusive rights

Preet S Aulakh[1], Marshall S Jiang[2] and Yigang Pan[1]

[1]Schulich School of Business, York University, Toronto, Canada; [2]Faculty of Business, Brock University, St Catharines, Canada

Correspondence:
PS Aulakh, Schulich School of Business, York University, Toronto, ON, M3J 1P3 Canada.
Tel: +1 416 736 2100, ext. 77914;
Fax: +1 416 736 5762;
E-mail: paulakh@schulich.yorku.ca

Abstract

As firms increasingly use licensing to exploit knowledge-based assets in global technology markets, appropriate structuring of these agreements has become an important line of research inquiry. One area that has received less attention is the nature of rights granted in inter-firm licensing relationships, although it is an important clause that has implications for profit generation from licensing of proprietary assets. Conceptualizing licensing rights in terms of number of licenses granted and exclusivity rights given to a licensee in a foreign market, this paper examines the determinants of these rights based on monopoly rents and transaction costs associated with different types of licensing contracts. Hypotheses are empirically tested through two studies, one based on large US manufacturing firms and the other on a cross-national sample of medium-sized firms actively involved in international technology licensing. Results from both studies show a greater propensity to use non-exclusive/multiple licensing when the licensed technology has greater potential to produce differentiated products, or when there is greater threat of substitutive technologies entering the market. On the other hand, innovative technologies and a higher degree of asset-specific investments required of the licensee for the technology are related to the use of single/exclusive licensing agreements.

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INTRODUCTION

Globalization of business environments, imperatives for quick and simultaneous entry into multiple foreign markets, shorter technology life cycles, and higher R&D costs for developing new technologies (Ohmae, 1989) necessitate the exploitation of firms' technological assets on a global scale (Arora & Fosfuri, 2000). For technology-oriented firms, a key means to exploit proprietary assets is through licensing their know-how to independent firms in exchange for some kind of financial pay-off. As a result, firms earn billions of dollars in revenues worldwide through licensing activities (Fosfuri, 2006), and companies anticipate further growth through licensing their technologies to other firms (*Economist*, 2005). The study of inter-firm licensing has thus become an important research area in the past decade, as evidenced by the many articles that examine the motivations behind technology licensing (Arora & Fosfuri, 2003; Fosfuri, 2006; Hill, 1997), its timing during the technology life cycle (Fosfuri, 2006; Kotabe,

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Sahay, & Aulakh, 1996; Mottner & Johnson, 2000), and the valuation and collection of licensing payments (Aulakh, Cavusgil, & Sarkar, 1998; Bidault, 2004; Contractor, 2001). One area that has received less attention in this emerging literature is the nature of exclusivity rights granted in inter-firm licensing relationships, although recent studies report it to be an important clause in licensing contracts, and one that has implications for profit generation from licensing of proprietary assets (Anand & Khanna, 2000; Bessy & Brousseau, 1998; Jiang, Aulakh, & Pan, 2007). The objective of this paper is to examine the determinants of exclusivity rights granted in the context of international technology licensing. In particular, we study the decision regarding licensing exclusivity by firms that are considering entering a foreign market through licensing, and which have to make a choice about the number and nature of licenses given in that market.

Licensing exclusivity represents a critical decision that has long-run implications for firms' market entry strategies. An exclusive license grants a licensee monopoly use of the technology within a territory and time period. This usually means the licensor forgoes its right to use the technology during the period within the territory. In the case of non-exclusive licensing, the licensor maintains the right to engage in more licensing, and multiple licensees can coexist within the same territory. Technology licensing can extract remaining value from a mature technology (Telesio, 1979), amortize R&D costs (Ohmae, 1990), and pre-empt competitors (Fosfuri, 2006), which implies that the more licensing, the better (Tang & Yu, 1990). A further advantage of licensing dispersion, especially for emerging technologies, is its ability to establish standards, with associated network effects, as highlighted by the competitive strategies of firms such as IBM, Ericsson, Intel, Matsushita, Microsoft, Philips, and Sony (Hagedoorn, 1993; Hill, 1997). Thus economic and strategic considerations may lead firms to disperse their know-how by granting rights to multiple licensees in a foreign market. However, technology licensing involves various transaction costs due to opportunism and bounded rationality (Williamson, 1975), which suggests that multiple licensing may be constrained by the costs to licensors. Licensing exclusivity also has implications for a licensor's future moves in a market, because exclusivity entails opportunity costs. If a licensor grants exclusivity to a single licensee, it relinquishes its right to enter the market physically using the licensed technology, even if it subsequently finds better opportunities for other modes of entry, such as joint ventures or wholly owned subsidiaries.[1] Furthermore, licensing exclusivity may also exacerbate the adverse selection problem (Bergen, Dutta, & Walker, 1992), because if the exclusive licensee fails to perform as expected, the licensor has few alternative options.

We argue that, in making the decision, the licensors' revenues must be balanced against the transaction costs related to granting of exclusive/single vs non-exclusive/multiple licensing rights in a given foreign market. In the following sections, we first discuss the monopoly rent potential and transaction costs related to licensing contracts, and identify a set of factors related to the revenue and costs aspects. Specific hypotheses derived from this discussion are subsequently tested on two separate samples, one based on large US-based manufacturing firms and the second on a cross-national sample of medium-sized enterprises.

In much of the international business literature, licensing is examined in the context of foreign entry modes. For instance, in the internationalization process models, licensing is considered a low-commitment/low-return entry mode, used by firms primarily to gain experiential knowledge about foreign markets before they are ready to commit additional resources to those markets (Arora & Fosfuri, 2000; Johanson & Vahlne, 1977). Research based on internalization theory examines licensing from a transaction costs perspective and compares its efficiency properties with those of other entry modes, such as exporting, joint ventures and wholly owned subsidiaries (e.g., Anderson & Gatignon, 1986; Buckley & Casson, 1976; Contractor, 1984). In particular, it is argued that the net profit extracted by the licensor from a licensing transaction is … lower than for keeping the technology in-house or licensing it to a firm's subsidiaries, because transaction and opportunity costs are higher for transferring technology to other firms. (Kotabe et al., 1996: 74).

Accordingly, past research has considered licensing as a second-best entry strategy to be used primarily to extract residual value from a mature technology (Telesio, 1979). Firms are, however, increasingly using licensing as a proactive strategy not only to appropriate profits from their R&D efforts in newer technologies, but also to establish standards and use licensing as a tool to gain global competitive advantage (Fosfuri, 2006; Hill, 1992, 1997; Kotabe et al., 1996). Thus, in this context, the more important theoretical and normative issues

are related to answering questions about "how to license" proprietary assets in foreign markets rather than "whether to license". Our paper, by focusing on one aspect related to the "how" of international licensing, advances licensing research within the international business literature. Furthermore, our paper advances the mode of entry research by conceptualizing and empirically demonstrating heterogeneity within the licensing entry strategy, which in past research is compared primarily with other investment entry modes.

LICENSING RIGHTS: CONCEPTUALIZATION

Licensing involves the granting of the right to make, use or sell a proprietary product, process, or service by a firm owning the rights to the intellectual property (licensor) to another firm (licensee) in return for some payment (Licensing Executives Society; www.les.org). Although each licensing agreement is unique, typical licensing contracts contain provisions regarding the nature of rights granted to the licensee, the compensation structure, and the duration of the agreement (Anand & Khanna, 2000; Bessy & Brousseau, 1998; Contractor, 2001). Our paper's main focus is on the issue of licensing rights in a given foreign market.[2] In terms of licensing rights, a licensor may grant exclusive or non-exclusive rights to a particular licensee (Pollzien, 1973). An exclusive license gives the licensee the right to use the intellectual property to the exclusion of others, including the licensor (Gallini & Wright, 1990). This right of exclusive use could be restricted to a particular geographical area and/or field of use. In non-exclusive licensing, a licensor keeps the right to issue additional licenses in the same geographical area, as well having the option to operate in the territory itself. Based on these definitions, exclusive licensing in a particular geographical area will mean that one licensee has monopoly rights to the use of the technology, whereas in non-exclusive licensing there is a possibility of multiple firms using the technology in the same territory. An appropriate issue in the context of our study is whether a licensor can grant multiple exclusive rights in a single country. While theoretically it is possible for the licensor to demarcate a country into different territorial spaces (e.g., each state or province within a country) and place restrictions on each licensee within individual spaces, evidence from the study of actual contracts as well as from legal issues related to vertical and horizontal constraints and competition policy suggests that, in practice, the licensing rights are typically granted on a country-by-country basis (Anand & Khanna, 2000; Bessy & Brousseau, 1998; Erutku, Freire, & Richelle, 2007).[3] Accordingly, we consider exclusive licensing to mean granting of licensing rights to only one firm in a particular country, whereas non-exclusive licensing is equated with multiple licensing in that market.[4] Our hypotheses are developed based on this conceptualization, although, as discussed later in the methods section, our operationalization of licensing rights in the two empirical studies incorporates the subtle distinction between single/multiple and exclusive/non-exclusive contracts.

When a firm uses licensing as an entry strategy in a foreign market, it gives the licensee the right to use the firm's know-how to replicate the licensor's entire commercialization process in a contractually defined geographical market (Teece, 1976). The net present value of the licensor's profit from licensing is a function of the royalty rate during the duration of the agreement, in addition to any up-front lump-sum payments and other minimum performance payments negotiated. Since the royalty rates are usually a percentage of the sales achieved by the licensee from the technology, the pay-off from the licensor's know-how is tied to the licensee's market performance. Furthermore, given that the licensor firm is sharing its proprietary know-how with an external entity, it is also concerned about appropriate use of know-how, adherence to quality standards, and appropriate marketing of finished products. One way to ensure adequate effort by the licensee, and ensure its contractual compliance, is to grant it sole rights to the use of the technology, so that the licensor can effectively monitor and provide adequate post-agreement support to the single licensee in a given market. From a licensee's perspective, in signing the licensee agreement, it commits itself to certain investments to commercialize the technology, and hopes to maximize its net present value of profits by being the only user of the technology in the market. Furthermore, it would like ongoing technical and managerial support from the licensor after the agreement is signed. Signing an exclusive agreement, therefore, could lead to alignment of objectives for both the licensor and licensee. This is akin to the alliance-type relationship reported in R&D partnerships in a number of studies (e.g., Cassiman & Veugelers, 2006; Hagedoorn, 2002).

A further advantage of using a single licensee per foreign market is the potential for "monopoly

rents". Monopoly rents, based on the monopoly power of an owner, arise because the owner can obtain income by controlling exclusive, non-replicable resources over an extended period of time (Evans, 1991). A single licensee in a local market with an advanced technology can command significantly higher revenues than its local competitors (Arora, Fosfuri, & Gambardella, 2002; Contractor, 1984), thus benefiting both licensor and licensee. In the case of multiple/non-exclusive licensing, competition would come from other licensees as well as from the licensor, and rent would dissipate to a lower level than a monopoly rent (Arora & Fosfuri, 2003). Based on these arguments, if there is potential for monopoly rent for a single licensee, and if the licensor can find a competent licensee in a foreign market, and write a comprehensive contract, the use of a single/exclusive licensee in each foreign market would maximize the licensor's returns from its licensing decision.

However, under certain conditions, monopoly rents are not tenable, which makes non-exclusive/multiple licensing more appropriate as a foreign market entry strategy. For instance, competition from other technologies in the foreign market, extent of innovation embedded in the licensed technology, the stage of the technology in its life cycle, and intellectual property protection afforded in a country impact on the monopoly rent potential of the technology (Arora & Fosfuri, 2003; Ginarte & Park, 1997; Kamien & Tauman, 1986). Furthermore, information asymmetries inherent in inter-organizational relationships create adverse selection and moral hazard problems, which make it difficult for the licensor to write comprehensive contracts with a licensee (Fosfuri, 2006; Gallini & Wright, 1990; Hill, 1992; Katz & Shapiro, 1986; Schmitz, 2002, 2007). In these situations, the licensor considers multiple licensees in a given market to maximize returns from its proprietary technology.

In choosing multiple licensing, it has to balance the revenues from multiple licensees with the associated costs, which we now discuss. Licensing relationships between independent firms involve transaction costs emanating from the transfer of know-how and the writing of contracts (Arora & Fosfuri, 2003; Hill, 1992; Teece, 1977). Transfer costs refer to the cost of codifying and transferring knowledge so that licensees can absorb knowledge effectively. Codifying knowledge requires the creation of blueprints, manuals, charts, and so forth. The costs of such knowledge codification can be high when transferring tacit knowledge, which is difficult to articulate (Barney, 1991; Contractor, 1984; Teece, 1977). Transferring knowledge involves human resources, such as personnel involved in training licensees and providing technical and managerial assistance. These costs, unlike knowledge codification costs, relate to the unique characteristics of the licensees. Although some training procedures may be routinized to save future training costs, modifying each training process to different technology transfer cases still involves substantial costs. Therefore heterogeneity in recipient firms' absorptive capacity will affect the way a source firm transfers its knowledge (Martin & Salomon, 2003). Even if a source firm can transfer knowledge successfully in one case, it cannot necessarily do so in another case, because of the different relative absorptive capacities of recipient firms (Lane & Lubatkin, 1998). Therefore, in attempting a successful transfer, a source firm faces three concerns (Martin & Salomon, 2003):

- it must be able to identify the different conditions in which its knowledge will be used by the recipient (Nelson & Winter, 1982), which vary across recipients' internal and environmental conditions;
- it must determine the recipient's readiness to absorb the knowledge, depending on the recipient's strengths and weaknesses (Arrow, 1969; Leonard-Barton & Sinha, 1993), and modify its efforts accordingly; and
- it must transfer knowledge in a proper form, in terms of both presentation and timing, to enable the recipient to absorb the underlying information effectively.

Because the knowledge transfer process may differ for each transfer to different recipients – not only because of the greater costs of personnel involved in multiple transfers of technology, but also because of the increased costs of adapting the transfer processes to particular recipients – transfer costs to the licensor in a given market are an increasing function of the number of licenses granted.

Contractual costs in licensing agreements arise from multiple sources, both internal and external to the firms (Rindfleisch & Heide, 1997; Teece, 1988). Asymmetrical information about prospective licensees gives rise to direct costs in the form of partner screening expenses to reduce the risk of adverse selection (Bergen et al., 1992). During the

licensing process, licensees' behavioral uncertainty (e.g., possible opportunism) and the lack of an effective performance evaluation tool increase the licensor's costs of collecting information about whether the licensees have invested sufficiently in production and marketing according to the clause of minimum requirements in the licensing agreement. In addition, environmental uncertainty, such as changes in competition structures or governmental policies in the host market, may also require corresponding changes in the licensing agreements, which create negotiation/renegotiation and coordination costs. Also, when intellectual property protection is a concern, surveillance costs associated with monitoring any illegal use of the technological knowledge arise.

In order to optimize returns from technology licensing, a licensor tries to maximize its licensing rents net of its costs. We now identify a set of factors related to the foreign market in which the technology is licensed, the nature of the technology being licensed, and firm-level factors that may affect the potential revenues and costs for the licensor and thus its choice of licensing rights given in a particular foreign market.

HYPOTHESES

Intellectual Property Protection in the Foreign Market

Protection of intellectual property rights is an important aspect for firms possessing knowledge-based assets. Intellectual property protection (IPP) varies across countries, owing to the extent of coverage provided to different types of technology, the participation of individual countries in international IPP-related treaties, and the legal enforcement mechanisms in place (Ginarte & Park, 1997). There is a considerable amount of research examining the impact of IPP protection in individual countries on entry mode choices of foreign firms (e.g., Hagedoorn, Cloodt, & van Kranenburg, 2005; Oxley, 1999). The general findings here are that weak IPP leads to appropriability hazards for a firm possessing proprietary assets. In order to minimize these hazards, firms internalize the transactions through entry modes that afford greater organizational control and monitoring (Anand & Khanna, 2000; Teece, 1986).

While much of the earlier research used transaction costs reasoning to examine whether intellectual property protection would influence a firm's decision about whether to license its technology at all, recent studies have extended this rationale to examine the extent of licensing dispersion. For instance, Arora et al. (2002) argue that a decrease in transaction costs increases the incidence of technology licensing. When intellectual property protection is weak, the licensor has to expend considerable amount of time and effort monitoring whether the licensees are adhering to the contractual provisions and not diverting the technology outside the agreed terms, thus increasing transaction costs. This means that the costs of monitoring for intellectual property violations of licensees increase with the number of multiple licensees. In this case, the licensor is better off dealing with a single licensee in a given market so that it can monitor the licensee's behavior effectively. Conversely, when IPP is strong in a country, the licensor can deal with multiple licensees, as it needs less monitoring of individual licensees because the latter would be less likely to behave opportunistically, given the threat of legal sanctions afforded to the licensor by the country's IPP regime. Based on these arguments and support from recent research, we test the following hypothesis:

> **Hypothesis 1a**: The likelihood of using non-exclusive/multiple licensing in given foreign market increases when the country has a stronger intellectual property protection regime.

The above arguments are based on the assumption that intellectual property violations occur because of opportunistic behavior of the licensee, who diverts the technology to increase private benefits outside the terms of the contract. The licensor can minimize this opportunistic behavior through greater monitoring. However, a large part of intellectual property violations happen outside the domain of licensing partnerships. This is because many product and process patents can be invented around at modest costs, thus giving potential infringers access to proprietary technology (Mansfield, 1985). Or certain technologies (e.g., music and software) are easy to copy by others without requiring formal transfer of know-how. Such intellectual property infringements are more common in countries where IPP enforcement is weak. Kotabe et al. (1996: 80) suggest that when other firms have access to a technology, even without being licensed, a licensor firm can

> reap the rents … by dispersing its technology through licensing that, in a weak appropriability regime, would otherwise have been duplicated. This proactive dispersal of

> technology may help the firm avoid being pre-empted in the markets it serves and recover some of its investment in technology through royalties and licensing fees.

This argument suggests that weak IPP in a foreign market would induce granting of licensing rights to multiple licensees in order to pre-empt potential infringers and at the same time receive some revenues that it would have lost in any case.[5] Conversely, under this reasoning, in countries with a strong IPP regime, granting of an exclusive/single license to a firm allows the latter to earn monopoly rent, since there is a lower threat of rent dissipation from potential infringers in the product market. Based on these arguments, we also test an alternative hypothesis related to IPP in the foreign market and granting of licensing rights:

> **Hypothesis 1b**: The likelihood of using non-exclusive/multiple licensing in given foreign market decreases when the country has a stronger intellectual property protection regime.

Product Differentiation Potential

Recent research has examined the role of a technology holder's differentiation in the product market in determining the propensity to license the technology (Arora et al., 2002; Arora & Fosfuri, 2003; Fosfuri, 2006). There is evidence from a number of industries where the technology holder uses it to manufacture its own products, but also licenses the technology to other firms that are not direct competitors. Shepard (1987: 367) attributes this to

> subtle market segmentation. For example, an innovating firm sometimes licenses both a rival firm selling the product on the open market and a vertically integrated buyer producing only for internal use. The vertically integrated firm is a second source only for itself; the rival firms serve as a second source for other buyers.

Similarly, Kim and Vonortas (2006) argue that there are general-purpose technologies that find differential uses, and thus sale of technology does not create additional competition. In the context of our study, if the technology has a low product differentiation potential, each licensee would produce homogeneous products in that market, and competition between licensees would reduce industry profits, thus lowering licensing revenues to the licensor firm. For such technologies the optimal strategy would be to use an exclusive/single licensee per country, and grant monopoly rights. On the other hand, if the technology has potential to produce differentiated goods in the product market, it is possible that different licensees would produce versions of the product so as to not compete with each other. This would increase industry demand and generate more revenues for the licensor, that is, there would be potential for monopoly rent in each niche or market segment. Based on these arguments, we hypothesize that:

> **Hypothesis 2**: The likelihood of using non-exclusive/multiple licensing in a given foreign market increases when the licensed technology has greater potential to make differentiated products.

Technology Innovativeness

Radical innovation refers to fundamental and revolutionary changes in technology, whereas incremental innovation refers to minor improvements or adjustments in existing technology (Dewar & Dutton, 1986; Ettlie, Bridges, & O'Keefe, 1984). Because radical innovation requires a substantial increase in the amount of new knowledge (Dewar & Dutton, 1986), it is more complex, harder to codify owing to its newness, and harder to teach, because it represents a significant departure from other technologies. That is, technological knowledge involved in radical innovations is more tacit than that associated with incremental innovations.

A greater degree of technology innovativeness increases partner selection and transfer costs. Kogut and Zander (1992) suggest that it is more effective and efficient to transfer knowledge between similar knowledge bases than between dissimilar ones. In terms of technology licensing, this issue gives rise to the difficulty of selecting licensees: the more radical a technology, the more the knowledge departs from existing knowledge bases, and the fewer overlaps there are between the developed knowledge base of the innovator and those of others. Therefore the pool of prospective licensees is smaller, and transfer costs are greater, because the radically new technology is more tacit and contains few knowledge base overlaps. The complexity of innovative technologies and the degree of tacit know-how embedded in them require face-to-face communication and close cooperation between transacting firms (Kim & Vonortas, 2006; Narula, 2001; Teece, 1988), and often a licensor is required to have the capability to identify licensees' ambiguity so that time and effort are spent on transferring hidden knowledge about routines and processes

(Martin & Salomon, 2003). This means the costs of transferring know-how related to innovative technologies increase substantially with an increase in the number of licensees in a given market. In order to minimize the transfer costs and ensure effective transfer of tacit know-how embedded in innovative technologies, a licensor is better off dealing with fewer licensees in a given market, to ensure closer cooperation.

A radical innovation is also more likely to generate monopoly rent in a given market. Given the potential for above-normal returns, a technology holder would like to appropriate these rents for itself (Evans, 1991). Literature suggests that for radical innovations (and especially for core technologies), a firm is better off exploiting the market through internalized transactions (Hill, 1992; Narula, 2001). In the context of our study, a firm that decides to enter a given market through licensing can achieve a quasi-internalized situation by ensuring a monopoly position for the licensee and granting it exclusive rights for the market so that there is no inter-licensee competition in the product market. The firm will refrain from licensing to multiple licensees when entering a new market, in order to keep a monopoly rent (Kamien & Tauman, 1986; Kamien, Tauman, & Zang, 1988). Taken together, the above arguments, related both to the potential for a firm to earn monopoly rents from radical innovation and to the associated transfer costs, lead to the following hypothesis.

Hypothesis 3: The likelihood of using non-exclusive/multiple licensing in a given foreign market decreases when the level of innovation of the licensed technology is high.

Substitutive Threat

Substitutive threat occurs when similar technologies enter the same arena and thereby create competition in both the product and the technology markets. Arora et al. (2002) suggest that when a technology takes a monopolistic position in a market, the firm has a lower incentive to license in order to avoid diluting monopoly profit. Competition in the product market reduces monopoly rents as a result of the rent dissipation effect (Arora & Fosfuri, 2003; Fosfuri, 2006), which occurs when products commercialized from other technologies appear in the same market. When confronting potential substitutes, the incumbent will respond by establishing entry barriers (Gallini, 1984; Porter, 1980). One such barrier is by licensing the existing technology to multiple licensees who are less formidable competitors than the potential intruders (Eswaran, 1994; Rockett, 1990). The incumbent may even subsidize its licensees to reduce its own profit level to a degree where potential intruders find the market unattractive (Eswaran, 1994). When substitutive threats are from within the market, the incumbent may opt to license to potential competitors and maintain its technology as the dominant design in the industry (Hill, 1992). In short, the firm will resort to a faster dissemination of the incumbent technology when the substitute technology is imminent. Through a fast penetration of the market, the firm hopes to cut off the opportunities available to incoming substitutive technologies.

When there is a threat of competitive technologies entering a market, a licensor firm could also take actions to achieve first-mover advantage in that market (Hill, 1992; Lieberman & Montgomery, 1988). In technology markets, first-mover advantage could manifest itself through the establishment of dominant standards for the licensed technology (Hill, 1997; Katz & Shapiro, 1986). The first mover can pre-empt scarce assets (e.g., available licensees) and ensure initial adoption of its technology by customers, which establishes a significant image in customers' minds (Lieberman & Montgomery, 1988). In a market larger than the size required by the minimum economic scale, a single licensee takes longer to spread across the entire market, so the licensor may lose its first-mover advantage in some portions of the market covered by competitors. Multiple licensing can cover the market faster, because licensees make parallel efforts to diffuse the products and, even more important, the licensor has pre-empted competent licensees so that they are no longer available to competitors. As a result, non-exclusive/multiple licensing offers the optimal choice for the licensor to gain a first-mover advantage.[6] Based on these arguments, we hypothesize that

Hypothesis 4: The likelihood of using non-exclusive/multiple licensing in a given foreign market increases when the substitutive threat is higher.

Licensee Asset Specificity

We consider an investment by the licensee in a licensing project as an example of asset specificity. Firms license their technology for several reasons: because they lack the resources to take advantage of

it (Telesio, 1979), or because the required direct investment is so substantial that they prefer licensing as a first step (Miller & Folta, 2002). Although other options, such as joint ventures or wholly owned subsidiaries, are available, their feasibility is uncertain, whereas licensing offers a means by which to extend market reach without risking direct investment.

When the licensor attempts to avoid direct investment, it is likely to encounter higher negotiation costs, because it must persuade potential licensee(s) to launch the licensed project with the promise of technical and managerial support. From the licensee's perspective, asset specificity raises the stakes: it must transform its resources into technology-specific assets that cannot be put to other uses if the licensed technology fails to perform satisfactorily. That is, the greater the licensee's asset specificity, the more uncertainties and risks it faces (Williamson, 1975). To reach a satisfactory agreement, both partners must make credible commitments that constitute a "mutual hostage" situation (Williamson, 1983). Specifically, the licensee must invest heavily in the technology commercialization if the licensor commits commensurable obligations, such as exclusive support and relinquishing the right to license to others in the market. Moreover, when the technology requires greater asset-specific investments, fewer potential licensees have the required resources, so the licensor may encounter the problem of a limited number of qualified licensees willing to make asset-specific investments. The licensee can use this scarcity condition to gain bargaining power and demand exclusive collaboration and support from the licensor. Based on these arguments, we hypothesize that:

Hypothesis 5: The likelihood of non-exclusive/multiple licensing in a given foreign market decreases when licensee asset specificity related to the particular technology is high.

METHOD

Research Setting and Data Collection

We used survey data to test the hypotheses.[7] Given the possibility of different considerations behind the licensing of technology across firm types and geographical contexts, we tested the hypotheses based on data collected from two separate surveys over a period of time. This allowed us to test the hypotheses by triangulated cross-sample and cross-method comparisons (Tan & Peng, 2003). As suggested by Brewer and Hunter (1989: 83), multi-method designs that employ data "independently of one another but are focused as tightly as possible upon the particular question being investigated" allow for more robust theory testing. It is in this spirit that we conducted two studies to examine the robustness of our theorization. The first study was based on data from large US-based manufacturing firms with international licensing agreements, and the second study consisted of medium-sized firms in different countries that also were involved in licensing their technology to independent firms outside their home market. Given the focus of our study, we provided the following definition to the respondents:

A licensing agreement is the supply of technology by your firm to a foreign firm and the permission to use this property in the foreign country for a fee or some other form(s) of compensation. Thus, in the licensing agreement, your firm does not actually export your final products to that foreign country, but instead, provides the technology know-how to your foreign licensee, who uses it to manufacture products.

Study 1 sample. The first study sample consisted of Fortune 500 US industrial firms. Data were collected in two stages. In the first stage, the presidents/CEOs of the sample firms were contacted through mail. A personalized letter along with a summary of the proposed research and a contact form were mailed, requesting their participation in the study and asking them to provide the names of two executives who managed the respective firms' international licensing agreements. In the second stage of data collection we mailed questionnaires to the 301 managers identified in stage 1. The managers were asked to choose one country where their firms had licensing agreement(s) with independent firms they were most familiar with, and answer all questions with respect to their firm's initiation and the subsequent relationships with the respective licensees. After two reminders, 110 completed questionnaires were received, for an effective response rate of 36.5%. The respondents had on average 11.7 years with their respective firms and 8.2 years of experience in dealing with the firms' operations in the country they had selected. The job titles of the 110 respondents were as follows: President, 4; Vice President, 37; Director, 33; Technology Manager/Area Manager, 30; Division Counsel, 6.

Study 2 sample. The sampling frame for the second study consisted of firm managers belonging to the Licensing Executives Society (LES). This association has over 12,000 members from around the world, and its mandate is to "share best practices, current standards, and trends in licensing and intellectual asset management" (www.lesi.org). Since the members belong to different kinds of organizations (including law firms, universities, etc.), we randomly identified 574 respondents who had the title related to "licensing managers" of commercial firms and for whom the contact information was available. We sent out e-mails to these 574 managers, in which we described the purpose of the study and asked them to participate in the Internet survey by visiting the website on which we posted the questionnaire. In the introduction to the web-based survey, we again provided them with a context of the study and asked them to choose a foreign country where they are currently licensing the technology and respond to the survey based on that market. After follow-up reminders, we received 137 responses, for a response rate of 23.9%. Licensor firms were located in 16 different countries, and licensee firms were located in 29 countries. The average number of years of experience in technology licensing for the respondents was 6.76 years. Confidentiality requirements prohibited us from collecting a lot of firm-specific data.

The comparative data characteristics of the two samples are provided in Table 1. The Study 1 sample consisted of relatively large US-based firms with more international experience. The Study 2 sample consisted of medium-sized licensor firms from a range of countries, with an average international

Table 1 Characteristics of samples of the two studies

	Study 1		*Study 2*	
Sample	US *Fortune* 500 manufacturing firms		Licensing Executives Society	
Number of responding firms	110		137	
Size of responding firm (mean number of employees)	7,880		1,888	
Firm geographical diversification (mean number of countries)	25.37		7.90	
Respondent experience with firm (mean no. of years)	11.70		6.76	
Home market of licensor firms (no. of responding firms from each country)	US (110)		US (70) Japan (13) France (12) UK (7) Canada (6) Sweden (6) Netherlands (5) Taiwan (5)	Germany (3) India (3) Australia (2) Argentina (1) Austria (1) Belgium (1) Switzerland (1) Norway (1)
Foreign market where technology is licensed (no. of firms choosing a particular country)	Argentina (3) South Africa (1) Indonesia (4) Brazil (2) Switzerland (2) Italy (4) Chile (3) Turkey (1) Mexico (3) Columbia (2) Venezuela (2) Oman (1) Panama (1) Philippines (2) Russia (1) Saudi Arabia (1)	India (6) Australia (1) South Korea (5) Israel (1) Canada (2) Taiwan (3) Japan (33) China (7) United Kingdom (3) Netherlands (2) Egypt (1) Finland (3) France (3) Germany (6) Hong Kong (1)	US (30) Germany (13) Japan (12) UK (11) Malaysia (6) China (5) Italy (4) Poland (4) Taiwan (4) Netherlands (4) France (4) Norway (3) Greece (3) New Zealand (3) Turkey (3)	Vietnam (3) Luxembourg (3) Indonesia (3) India (3) Australia (3) Belgium (3) Portugal (2) Chile (2) Brazil (1) Switzerland (1) Egypt (1) Ghana (1) Iran (1) Jordan (1)

experience of 7.9 years. The licensor firms in both samples identified a diverse set of countries where their firms' technology was licensed.

Measures

Since we collected data at two different times, we were able to refine some of the constructs when we conducted the second study, based on our experience during the first study. Accordingly, the operationalization of some of the variables differed in the two studies. Although in both cases there is considerable convergent validity of the operationalization, given the differences, we analyzed the data for each sample separately. This also allowed us to validate our conceptualization across two set of firms. The items used to measure the various constructs for each sample are provided in the Appendix.

Dependent variables. Based on our conceptualization, we operationalized the dependent variable differently in the two studies. In Study 1, respondents were asked to provide the number of licensing agreements for a particular technology in the identified foreign country. A dichotomous variable, *multiple licensing*, was computed, which took the value 1 if the firm had more than one licensee in a given market, and 0 if only a single license was issued in the chosen foreign country. There were 10 firms for which there was missing data, so subsequent analyses are performed on a sample size of 100, with 48 firms having a single licensing agreement and 52 having multiple licensing agreements in the specific market. In Study 2, respondents were asked to identify the exclusive terms of the licensing agreement of a licensing case he/she was familiar with. A dichotomous variable, *non-exclusive licensing*, was coded 1 for non-exclusive licensing agreements and 0 for those where exclusive rights were granted in the given foreign market. There are 78 cases of non-exclusive licensing and 59 cases of exclusive licensing.

Independent variables. *Intellectual property protection* in the foreign market for both studies is operationalized from the patent rights index developed by Park (2008). *Product differentiation potential* of the licensed technology is measured through a proxy related to whether the technology is used for making end products, or intermediate products or components. Since intermediate products and components can be uniquely combined to produce differentiated products by different firms, such technologies would have greater product differentiation potential. *Innovation in the licensed technology* is operationalized through a single-item measure in both studies. *Substitutive threat* is defined as the extent to which competitive technologies are entering the given foreign market. Accordingly, a single-item measure was used in Study 1 that captures the frequency of new competitors with similar technologies entering the industry in a foreign market, and in Study 2 a three-item Likert scale was used. *Asset specificity of the foreign licensee* captures the level of investments specific to the licensed technology that a potential licensee has to make, and accordingly two- and four-item Likert scales were used to in the two studies.

Control variables. We control for a number of country-, industry- and firm-level variables that may affect internal uncertainty for the licensing firms and thereby influence licensing decisions in a given market. *Cultural distance* between the home countries of the licensor and licensee firms may impact on the perceived transfer and coordination costs related to the licensed technology. We operationalize cultural distance using Kogut and Singh's (1988) formula related to the four cultural dimensions of Hofstede. The size of the foreign market where the technology is licensed may be related to the minimum economic scale aspects for the licensee. That is, if the market is small, then a potential licensee may demand exclusive rights to cover its investments around the technology. A larger market, on the other hand, may be able to accommodate multiple licensees. Accordingly, we control for *foreign market size* and operationalize it as the natural log of the country's gross national income. We also control for industry by incorporating industry technology turbulence in our model.[8] Technological turbulence refers to the degree of the rate of technological change in an industry (Jaworski & Kohli, 1993). High technological turbulence is distinguished by shorter life cycles. Under high technology turbulence, there are several problems a licensor has to face. First, with a high level of turbulence, new technologies emerge and disappear rapidly, and therefore a monopoly position for a technology is hard to maintain. Second, a high level of technology turbulence increases the uncertainty of the time span during which the focal technology is still valuable in a market (Roy & Dugal, 1999). Given a smaller window of opportunity to extract rents from the innovation

in a foreign market, a licensor is likely to disperse its technology to multiple licensees, so as to ensure adequate returns from licensing before its technology faces obsolescence (Gallini, 1984). *Industry technology turbulence* is operationalized as the speed of technological changes in the industry where the particular technology is being licensed. Finally we control two licensor related variables: *licensor's international experience*, measured as the number of years of international experience; and *geographical diversification*, measured as the number of countries where the technology is licensed by a particular licensor.

EMPIRICAL RESULTS

The hypotheses were tested using binomial logit regressions. A binomial logistic function was specified separately for each sample to estimate the impact of the predictor variables on the probability that the licensing firms will select multiple licensing (Study 1) and non-exclusive licensing (Study 2). In a logit model, one of the binary options in the dependent variable must be used as a base case. Accordingly, the utility of single and exclusive licensing was assigned a value of zero, and the multiple/non-exclusive licensing choices were estimated with reference to it. Before running the logit models, collinearity diagnostics were performed using the correlations between the independent variables that are provided in Table 2. The size of the bivariate correlations for the independent variables, as well as the variance inflation factors, does not point to a multicollinearity that is high enough to impact on the

Table 2 Descriptives and correlation matrices

	Mean	*Std dev.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Study 1 (N=110)												
1. Cultural distance	62.89	19.60	1.00									
2. Foreign market size[b]	6.93	1.62	0.10	1.00								
3. Technology turbulence	3.38	1.11	0.05	0.23*	1.00							
4. Licensor international experience	37.96	22.47	0.14	−0.05	0.06	1.00						
5. Intellectual property protection	3.59	1.13	−0.14	0.68***	0.16	−0.24*	1.00					
6. Geographical diversification	25.37	29.49	−0.01	−0.07	0.02	0.35***	−0.16	1.00				
7. Product differentiation potential[a]	0.36	0.64	−0.09	−0.01	−0.04	−0.06	0.02	0.28**	1.00			
8. Innovativeness	2.23	1.09	0.15	−0.03	−0.01	0.07	−0.03	−0.08	0.26*	1.00		
9. Substitutive threat	3.06	1.14	0.10	−0.16	−0.06	0.08	0.01	−0.19†	−0.16	0.11	1.00	
10. Licensee asset specificity	3.80	0.95	0.00	−0.07	0.10	0.31**	−0.09	−0.01	−0.05	−0.16	0.11	1.00
Study 2 (N=137)												
1. Cultural distance	39.44	30.58	1.00									
2. Foreign market size[b]	7.11	1.80	−0.25**	1.00								
3. Technology turbulence	2.99	0.80	−0.06	0.04	1.00							
4. Licensor international experience	8.17	3.58	−0.16†	0.06	−0.09	1.00						
5. Intellectual property protection	3.95	0.98	−0.40***	0.64***	0.09	0.01	1.00					
6. Geographical diversification	7.90	4.14	0.13	0.04	−0.02	0.46***	−0.13	1.00				
7. Product differentiation potential[a]	0.34	0.66	0.02	−0.08	0.08	−0.04	−0.14	0.09	1.00			
8. Innovativeness	3.11	1.18	0.06	−0.05	−0.11	0.02	−0.10	0.03	0.08	1.00		
9. Substitutive threat	3.18	0.99	−0.10	0.17*	0.15+	−0.14	0.23**	−0.06	0.02	−0.19*	1.00	
10. Licensee asset specificity	3.19	0.91	−0.08	0.11	0.06	−0.01	0.08	0.01	0.02	−0.08	0.08	1.00

†$p<0.10$; *$p<0.05$; **$p<0.01$; ***$p<0.001$.
[a]Dichotomous variable (the numbers in the mean and SD columns for these variables connote the proportion in group 1 and group 0, respectively).
[b]Foreign market size=ln(Foreign country gross national income).

Table 3 Hierarchical logit regressions

Independent variable	*Study 1 Dependent variable= Multiple licensing*		*Study 2 Dependent variable= Non-exclusive licensing*	
	Model 1	*Model 2*	*Model 1*	*Model 2*
Intercept	−5.21**	−7.14**	0.72	3.86*
Cultural distance	0.02	0.03†	−0.01*	−0.02*
Foreign market size	0.51**	0.61*	0.17†	0.13
Industry technology turbulence	0.01	0.07	0.80***	0.86**
Licensor international experience	0.01	0.02	−0.15*	−0.16*
Geographical diversification	0.02*	0.03*	0.03	0.05
Intellectual property protection in foreign market (Hypothesis 1)		0.23		−0.39
Product differentiation potential: (0 final product; 1 intermediate product) (Hypothesis 2)		0.68†		0.49†
Innovativeness of licensed technology (Hypothesis 3)		−0.56*		−0.77***
Substitutive threat in foreign market (Hypothesis 4)		0.44*		0.66**
Asset specificity of foreign licensee (Hypothesis 5)		−0.25*		−0.61**
Model χ^2 (d.f.)	18.16(5)**	29.94(10)***	21.71(5)***	54.34(10)***
−2 Log likelihood	86.73	74.95	162.76	129.27
Correctly classified	68.40%	77.60%	65.90%	79.00%
Nagelkerke R^2	0.28	0.44	0.20	0.45

†p<0.10; *p<0.05; **p<0.01; ***p<0.001 (one-tailed tests).

stability of the estimated coefficients (Neter, Wasserman, & Kutner, 1985).

Results of both regressions are provided in Table 3. We used hierarchical logit regressions, where in Model 1 only the five control variables are included. Model 2 has both the control and predictor variables. The fit of the models was tested through log of the likelihood ratio. As can be seen in Table 3, the predictor variables significantly enhance the fit of the models. The model chi-square value of 29.94 is significant at p=0.001 for Study 1, and the value of 54.34 is significant at p=0.001 for Study 2, thus rejecting the null hypothesis that the estimated coefficients, except the constant, are all zero. The overall fit of the model, represented by a significant chi-square and its predictive ability (77.60% of the observations are correctly classified with a Nagelkerke R^2 of 0.44 for Study 1, and 79.00% with a Nagelkerke R^2 of 0.45 for Study 2), points to the appropriateness of the set of variables used in this study in predicting the granting of licensing rights in foreign markets.[9]

In Hypothesis 1, we had competing hypotheses (Hypotheses 1a and 1b) about the likelihood of non-exclusive/multiple licensing when considering intellectual property protection. The results for neither study support the hypotheses (b=0.23, p>0.10 for Study 1, and b=−0.39, p>0.10 for Study 2), and we shall discuss this non-significant effect in the next section. Hypothesis 2 is related to the impact of the product differentiation potential of the licensed technology on the granting of licensing rights. We suggest that a high potential for producing differentiated products would create a situation where a licensor could use multiple licensing in a given market without creating inter-licensee competition, since it is possible that each licensee might produce products for diverse niches or market segments. The coefficient for this variable is positive and significant in both studies (b=0.68, p<0.10 and b=0.49, p<0.10), thus supporting Hypothesis 2. Our finding is different from some recent studies about the relationship between product differentiation and licensing propensity. This research suggests that licensing propensity decreases with degree of product differentiation because

> When the good is highly differentiated, each technology holder has a well-defined market niche. Any entrant licensed by the technology holder will be a closer competitor to the technology holder than to other technology holders. Instead when the good is homogeneous, the negative effect due to increased competition is spread across all incumbents, while only the licensor shares the profits of the new entrants. (Arora et al., 2002: 187)

Fosfuri (2006) finds support for this effect in the global chemical industry. In these studies, a basic assumption is that different users of a given licensed technology will produce similar products, so that greater number of licensees will compete with each other in the product market, thus producing a "rent dissipation" effect for the licensor (Fosfuri, 2006). However, in our study we relax this assumption and suggest that intermediate product technologies can be used by various licensees to produce differentiated products. For such technologies, the rent dissipation is minimized, and multiple licensees can coexist without creating inter-licensee competition.

In Hypothesis 3 we suggested that a level of innovativeness in the licensed technology creates both a potential for sustainable monopoly rents and higher transfer costs, since the licensor has to coordinate closely with a licensee to transfer embedded knowledge in a radically new technology. These, taken together, would lead to a preference for dealing with fewer licensees. Thus we proposed a negative relationship between innovativeness and the likelihood of non-exclusive/multiple licensing. This hypothesis is supported, as the coefficients are negative and significant ($b=-0.56$, $p<0.05$ for Study 1 and $b=-0.77$, $p<0.001$ for Study 2).

In Hypothesis 4 we hypothesized that substitutive threat from competitors' technology in a foreign market would increase the likelihood of the licensor giving out multiple licenses or keeping the option of multiple licensing by giving non-exclusive rights to a particular licensee. We find support for this hypothesis. The coefficients are positive and significant for both samples ($b=0.44$, $p<0.05$ for Study 1 and $b=0.66$, $p<0.01$ for Study 2). The competition in the technology market serves as a direct driver for out-licensing. Logically, the more intense the competition in the technology market, the more a licensor out-licenses. In other words, the greater the presence of other technologies in the market, the more a licensor uses non-exclusive or multiple licensing to pre-empt competitors exploiting their technologies through licensing.

In Hypothesis 5 we hypothesized that licensor firms are less likely to use non-exclusive/multiple licensing when the level of asset specificity of the licensee related to the technology is high. We found negative and significant coefficients ($b=-0.25$, $p<0.05$ for Study 1 and $b=-0.61$, $p<0.01$), supporting Hypothesis 5. This suggests that a licensee's high level of investment can be translated into a high bargaining power in licensing negotiations, which helps the licensee to restrict further licensing rights granted by the licensor in a given foreign market. Unlike much of the prior research, we include this important licensee-related factor because we believe licensing decisions are based on bilateral considerations. Research in marketing highlights the importance of bilateral credible commitments when a manufacturer makes exclusivity decisions to select channels of distribution for its products (Fein & Anderson, 1997), and in a technology market we argue that the licensee plays a similar role to that of a distributor in a product market. Similar to research in marketing, we find that a licensee may demand credible commitments from the licensor if it is making specific investments related to the licensed technology. An exclusive contract provides one way for the licensor to make the commitment required by a potential licensee.

Overall, we find good support for our hypothesized relationships. That is, after controlling for various factors, we find consistent results across two different research settings. We also want to note the coefficients related to foreign market size. In both studies we find a positive association between foreign market size and the likelihood of using non-exclusive/multiple licensing. Foreign market size could be related to the minimum economic scale for the licensed technology: that is, for a larger potential market, the size of the market is greater than the minimum economic scale. In this case the licensee is not only willing to contract with the licensor but also may be more open to accept additional licensees. Conversely, smaller markets could support only one licensee, and thus the licensor has a preference for an exclusive/single licensee.

CONCLUSIONS

We identify some determinants of the licensing dispersion pattern (i.e., single/exclusive or multiple/non-exclusive licensing) in a foreign market to gain a better understanding of international licensing, which is becoming an increasingly important method that firms use to exploit their technological assets globally (*Economist*, 2005). In one of the few detailed examinations of licensing contracts, Anand and Khanna (2000) report across-industry variations in the use of exclusive contracts by licensing firms. Our study probes this phenomenon further by addressing firm-level heterogeneity in

the choice of licensing rights granted in particular markets. We provide theoretical insights into and empirical confirmation of the role of potential monopoly rents and various types of transaction costs associated with interorganizational licensing.

Our study helps integrate two theoretical approaches that have been used to understand interfirm licensing. In the first, which is rooted in economics and takes an analytical approach, scholars examine licensing dispersion as a mechanism to influence competitive structures in the marketplace, as multiple licensing can deter entry by competitors (Eswaran, 1994; Gallini, 1984; Gallini & Winter, 1985), establish standards (Hill, 1997), eliminate competition (Hill, 1992), enhance demand (Shepard, 1987), and generate profits (Arora & Fosfuri, 2003). The second stream, which appears primarily in the international business area, uses transaction costs analysis to examine whether licensing provides an efficient means of entering new markets compared with other methods such as joint ventures or wholly owned subsidiaries. In this line of thinking, scholars implicitly assume licensing as exclusive or single licensing in a given market. Our study incorporates these two views, and the findings suggest that after a firm decides to license its technology in a particular market, its decision to grant specific licensing rights depends on the balance between effectiveness and efficiency considerations that arise from strategic and cost imperatives.

One perplexing result of our study is the impact of intellectual property protection in a foreign market on granting of licensing rights. None of the competing hypotheses is supported. In these hypotheses, we had suggested that a licensor wants to maximize the rent of the current technology in response to different levels of uncertainty arising from the level of intellectual property protection (Beckman, Haunschild, & Phillips, 2004), by either reducing transaction costs (Hypothesis 1a) or strengthening a monopoly position (Hypothesis 1b). One possibility is that competing pressures of monopoly rents and transaction costs cancel out the positive and negative effects. Another explanation of these non-significant results could be related to some recent research that suggests a more nuanced relationship between IPP and a firm's decision to license its technology. In particular, Arora and Ceccagnoli (2006) find that the effectiveness of patent protection increases licensing propensity only when the technology developer lacks complementary assets to commercialize the technology; whereas for firms in possession of complementary assets, patent protection decreases the propensity to license the technology to other firms. Our data do not allow us to test these particular conditioning effects, and in fact they highlight some of the limitations inherent in our samples. In Sample 1 most of the firms are large, established firms that commercialize their technologies in some markets (including domestic) and use licensing in others. However, our Sample 2 may be biased, as it could consist of firms that are pure developers of technology and rely on licensing to other firms to commercialize it in different markets. The nature of the data collection process precludes us from differentiating these firms from ones that develop the technology and have the complementary assets to commercialize it. Thus the nature of both samples (the first may not have variance in the degree of complementary assets, and in the second we cannot differentiate the ones having complementary assets from those that do not) constrains our ability to do fine-grained analysis of some of the possible relationships, and we acknowledge this as a limitation of the study.

We also acknowledge that our paper tests only a preliminary model of the determinants of licensing rights granted in international markets. There may be other factors that are equally important, and incorporation of these in theoretical and empirical analyses could further this area of research. For instance, in our study we incorporate only issues related to licensing revenues net of transaction costs as a prime objective of firms in determining their licensing strategy. However, there is evidence that licensing is increasingly being used as a real option to enter foreign markets (Jiang, Aulakh & Pan, 2009; Miller & Folta, 2002), and accordingly the decision criteria for granting licensing rights from this perspective may be different from those based on transaction costs. Furthermore, the relative importance of the particular licensed technology in the overall portfolio of a firm's technologies may impact on the exclusivity rights granted. In particular, for peripheral technologies, a firm may overlook some of the transaction costs and disperse the technology to multiple licensees, whereas for core technologies it would want greater control about their use, and license these through exclusive relationships with a single or few firms. The duration of the licensing agreement can also play an important role, because shorter terms increase the licensor's strategic flexibility by enabling it to correct adverse selection decisions in a given

market. We hope that future research will incorporate some of these issues in examining technology licensing, as well as using more fine-grained conceptualization and operationalization of the various types of usage clauses included in licensing contracts.

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NOTES

[1]By definition, when a firm grants exclusive rights to another firm, it forgoes its right to use the technology in the territorial/usage domain granted to the licensee. The only way a licensor could get around this would be if it had an option clause to acquire part or the whole of the licensee's assets.

[2]Compensation in most licensing agreements includes a combination of fixed lump-sum up-front payment as well as royalties, usually as a proportion of the licensee's sales (Bessy & Brousseau, 1998) We assume in this paper that licensing agreements will have some type of royalty payments, because of which the licensor's profits are dependent on the success of the licensee. If it collects all payments up-front, then its decision criteria for granting licensing rights will be different. More importantly, it will be less concerned about ex post inter-licensee competition and the associated rent dissipation effects. Regarding the duration of the agreement, although this is an important issue, since it impacts on the net present value of profits accruing to the licensor, and may therefore impact on the nature of licensing rights given to a licensee, data limitations do not allow us to model this in our analysis.

[3]In fact, rather than within-country restrictions, many exclusive rights are given at the regional level (e.g., South Asia, Europe, Latin America), or worldwide exclusive rights are granted.

[4]Most studies that develop theoretical models of licensing rights equate exclusive licensing with a single licensee and non-exclusive licensing with multiple licensing (e.g., Gallini & Wright, 1990; Schmitz, 2007; Shepard, 1987).

[5]Multiple licensing can also deter potential infringers, because more licensees mean more competition, which lowers the price. Because potential infringers must expend costs to acquire the technology, if the cost cannot be offset by the profit earned at the low price, the potential infringer will no longer be interested. A related issue, however, is that if a weak IPP regime allows infringements without threat of legal sanction, why would a potential infringer pay for the technology through a licensing agreement? Here, one possibility is that stealing a technology and understanding the stolen knowledge are not costless. Not only does a pirating firm have to spend money in the process of illegal acquisition and understanding the technology, it also has to invest money in commercializing the technology, which is highly risky owing to the non-availability of technical assistance in the commercialization process. Therefore there is a trade-off between all the costs of pirating and the payment for the technology. For a low enough price for the technology, the potential infringer may be willing to get into the legal domain.

[6]We assume that the foreign market is larger than the minimum economic scale required to accommodate multiple licensees. This is a reasonable assumption, because if the foreign market size is small relative to MES, then the threat of competitive technologies will be low, because no other licensees would be willing to undertake a licensing agreement.

[7]The limited empirical research on licensing has focused primarily on industry-level analysis owing to the non-availability of published sources containing licensing decisions of individual firms (Anand & Khanna, 2000). In light of this and other concerns about the operationalization difficulties from secondary data sources (Fosfuri, 2006), we decided to use a survey-based research design. We are cognizant of some inherent problems of survey-based research, and we took adequate steps in the data collection process to ensure validity of the data.

[8]Another factor that may be important is the potential for the innovative technology to set up dominant standards/design, in which case the licensor is better off dispersing its technology to multiple licensees to ensure greater diffusion of the technology, thus creating entry barriers for subsequent technologies (Hill, 1997; Kotabe et al., 1996; Shapiro, 1985). However, our data do not allow us to examine the standard-setting potential of the technology, so we do not incorporate it in our model. Similarly, we are not able to incorporate industry dummies in the analysis owing to data constraints and small sample sizes.

[9]The observations correctly classified in the models are almost 50% better than a random classification,

thus pointing further towards the robustness of the hypothesized relationships. For both the samples we also see that the control variables have some explanatory power beyond the random classification. We also performed the Hosmer and Lemeshow goodness-of-fit tests, and they all show good fit of the models.

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APPENDIX

See Table A1.

Table A1 Operational measures for the two samples

Variable	*Sample 1*	*Sample 2*
Licensing rights in a foreign market	*Multiple licensing*: Respondents were asked to choose a particular technology and provide the number of firms to which the technology is licensed in the chosen foreign market. Out of the 100 firms that provided the data, 48 firms had single and 52 had multiple licensing agreements in the particular market	*Non-exclusive licensing*: Respondents were asked to choose a particular technology and foreign licensee and to state whether the licensee was granted exclusive rights for the use of the technology in the foreign market. Out of the 137 firms that provided the data, 59 firms granted exclusive and 78 granted non-exclusive rights
Intellectual property protection in the foreign market	Index of Patent Rights (Park, 2008)	Index of Patent Rights (Park, 2008)
Product differentiation potential	0, technology used primarily in the production of final goods; 1, technology used primarily for the production of intermediate goods or components	0, technology used primarily in the production of final goods; 1, technology used primarily for the production of intermediate goods or components
Innovation in the licensed technology	Relative to competitors, the level of innovation in the licensed technology is: (1 very low to 5 very high)	Whether the licensed technology could be described as a minor improvement on previous technologies, as a significant change, or as a breakthrough innovation in the industry
Substitutive threat in the host country	Frequency of new competitors (domestic and foreign) with similar technologies entering the industry in this foreign market (1 low to 5 high)	Three-item Likert scale (1 strongly disagree to 5 strongly agree) (1) The presence of similar technologies causes threats to our licensee firms in this market (2) The presence of similar technologies causes threats to the success of our licensing strategy in this market (3) Many companies with comparable technologies are entering this market (α=0.77)
Asset specificity of foreign licensee	Two-item Likert scale (1 strongly disagree to 5 strongly agree) (1) The licensee has to make substantial investments which are specific to technology provided by our firm (2) It will be very costly for the foreign licensee to replace our firm as a source of technology (α=0.72)	Four-item Likert scale (1 strongly disagree to 5 strongly agree) (1) Significance of a potential licensee's investment in the licensing project (2) The transferability of the investment to other purposes (3) The commitment of time and money for the licensee in the installation of the licensed technology (4) Efforts needed in adapting the technology to local market demands (α=0.89)
Cultural distance	Euclidean distance between licensor and licensee markets based on Hofstede's four culture dimension (Kogut & Singh, 1988)	Euclidean distance between licensor and licensee markets based on Hofstede's four culture dimension (Kogut & Singh, 1988)

Table A1 *Continued*

Variable	*Sample 1*	*Sample 2*
Foreign market size	Natural log of country gross national income (UN statistics)	Natural log of country gross national income (UN statistics)
Industry technology turbulence	Speed of technological changes in the industry (1 very slow to 5 very fast)	Four-item Likert scale (1 strongly disagree to 5 strongly agree) (1) The technology in this industry is changing rapidly (2) Products are created very quickly in this industry (3) Production process changes quickly in this industry (4) Product quality changes quickly in this industry (α=0.83)
Geographical diversification	Number of foreign countries in which the licensor has licensing agreements	Number of foreign countries in which the licensor has licensing agreements
Licensor international experience	Number of years of international experience	Number of years of international experience

About the Authors

Preet S Aulakh is Professor and Pierre Lassonde Chair in International Business at the Schulich School of Business, York University. He obtained his PhD from the University of Texas at Austin. His research focuses on cross-border strategic alliances, emerging economy multinationals, and technology licensing. His research has appeared in journals such as the *Academy of Management Journal*, *Organization Science*, *Journal of International Business Studies*, *Journal of Management Studies*, and *Journal of Marketing*, among others. E-mail: paulakh@schulich.yorku.ca.

Marshall S Jiang is an Assistant Professor of International Business at Brock University. He obtained his PhD from the Schulich School of Business at York University. His research focuses on international knowledge transfer, technology licensing, effect of FDI on indigenous innovative capability, and mode of entry. E-mail: mjiang@brocku.ca.

Yigang Pan is Professor of Marketing at the Schulich School of Business, York University, Toronto, Canada. He obtained his PhD from Columbia University. His research interests are mainly in market entry strategies and brand strategies. E-mail: pan@yorku.ca.

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