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INTERNATIONAL LICENSING AND THE STRENGTHENING OF INTELLECTUAL PROPERTY RIGHTS IN DEVELOPING COUNTRIES DURING THE 1990s

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INTRODUCTION

Global intellectual property reform has been underway since the early 1990s (Box 1). With respect to international trade, a central pillar of the reform is the World Trade Organisation's *Agreement on Trade-Related Aspects of Intellectual Property Rights Agreement* (TRIPS) that came into effect on 1 January 1995. Clearly, a strengthening of intellectual property laws worldwide can benefit those in industrialised nations who own most of the intellectual properties (*e.g.* copyrights on books, music, and software, patent rights on inventions, and trademark rights on business symbols and names). However, a key premise of global intellectual property reform is that developing countries will also benefit; increased protection of intellectual property rights (IPRs) in developing countries could encourage rights-holders to be less reticent about the transfer of technology embodied in intellectual property in cases where there are economic incentives to do so. Indeed, Article 7 of the TRIPS Agreement provides that "the protection and enforcement of intellectual property rights should contribute to the transfer and dissemination of technology."[1] Article 66.2 of the TRIPS Agreement further stipulates that developed countries should encourage technology transfer to least developed countries. International technology transfer is important for developing and least developed countries, since local innovation capabilities are not as well developed relative to those of industrialised nations.[2] Advocates of strong IPRs argue that unless IPRs are secure, intellectual property owners will have weak incentives to market their technologies in developing regions (due to risks of infringement).

Much controversy remains, however, as to the extent to which stronger IPRs actually stimulate international technology transfer. Is the strengthening of IPRs an efficient way to promote technological change in developing nations? Theoretical arguments have supported both sides of the debate on IPR reform. For example, opponents argue that stronger IPRs increase the market power of firms and lead to higher prices, with the possible consequence that some developing countries may have even less access to new technology. Stronger IPRs also restrict the ability of local firms to develop through imitation. Proponents argue that infringement has only short-run benefits. In the long run, a regime that permits free copying of technologies will discourage firms from introducing new technologies to the market. Given the mixed signals provided by theory, it is important to seek clarification using more empirical approaches for assessing the actual effects of IPR reform. Currently, the availability of empirical evidence on the impacts of such reform

Box 1. **Strengthening of IPRs in developing countries during the 1990s**

During the past decade there was substantial change in the web of international treaties that governs IPRs in conjunction with national laws. Increasingly, developing and transition countries sought to ratify the core international IPR agreements or moved to improve their implementation of existing commitments. In addition, several new international IPR treaties were agreed with developing country participation.

The World Intellectual Property Organisation (WIPO) administers a series of international IPR agreements developed over many years. During the first half of the 1990s, coverage of IPR issues was notably extended through increased numbers of ratifications of existing WIPO-administered agreements by developing and transition countries. This occurred, in particular, in relation to the launching of economic reforms in the former socialist countries and in the lead up to the implementation of the World Trade Organisation's Agreement on Trade-Related Aspects of Intellectual Property Rights. Examples of increased ratifications during 1990 to 1995 include:

- The Berne Convention (concerning copyrights) experienced 36 new ratifications (as of 19 January 2005, the total number of ratifications was 159).
- The Paris Convention (concerning patents) experienced 36 new ratifications (as of 31 January 2005, the total number of ratifications was 169).

The TRIPS Agreement built on the framework of the WIPO-administered agreements and set forth minimum standards for IP protection across all WTO members. This agreement resulted in a strengthened application of IPR protection in many developing countries, albeit with implementation extended over a number of years due to transitional periods.

According to the TRIPS Agreement, WTO Members may implement in their law more extensive IPR protection than the minimum required under the agreement, provided that this does not contravene the agreement. In this spirit, regional trade agreements involving OECD members and developing countries often include IPR references going beyond the TRIPS agreement, as do some agreements among developing countries (*e.g.* Mercosur) (Lippoldt, 2003). For example, some agreements go beyond the TRIPS Agreement in requiring adherence to WIPO's Copyright Treaty and Performances and Phonograms Treaties (*e.g.* under the EU-Mexico or US-Jordan trade agreements).

The impact of the expanded recognition of internationally established IPRs is evident in the evolution of various indexes employed in the present paper to assess the strength of IPRs in developing countries (see table below). Each of these indexes shows a significant increase over the course of the 1990s. Notably, the Enforcement Effectiveness Index saw a substantial increase in the second half of the decade, which is at least partly related to the implementation of the TRIPS Agreement.

Box 1. **Strengthening of IPRs in developing countries during the 1990s** (*cont.*)

Recent OECD research (Park and Lippoldt, 2003 and 2004) indicates a tendency for favourable initial results in developing countries from this change; increased IPR stringency yielded gains in foreign direct investment (FDI), licensing and to some extent, trade; albeit with variation across sectors and countries (*e.g.* according to level of development).

Evolution of average IPR index scores for developing countries, 1990-2000

	Patent Rights Index	Copyrights Index	Trademark Rights Index	Enforcement Effectiveness Index
1990	1.98	0.42	0.40	0.14
1995	2.36	0.51	0.45	0.17
2000	2.72	0.57	0.54	0.36
Total observations	N = 215	N = 157	N = 108	N = 129

Notes: The maximum range of scores is 0-to-5 for the Patent Rights Index and 0-to-1 for the other indexes. See Appendix 1 and Park and Lippoldt (2004) for an overview of the composition of these indexes.

remains quite limited, particularly with respect to evidence at the firm or enterprise level.

The present paper responds to this situation by making an empirical contribution with respect to one of the main channels of technology transfer: international licensing. The aim is to consider the relationship between the strengthening of IPRs in developing countries during the 1990s and changes in international licensing activity. The empirical analysis uses two approaches. The first approach employs regression analysis to consider the relationship between the volume of licensing receipts of US enterprises (from unaffiliated sources) and the strength of IPRs, controlling for other factors. This regression analysis covers selected years during the 1990s and is conducted using firm-level data. The second analytical approach draws on an international data set to consider the relationship over time (for selected periods, 1989 to 2002) between changes in the host-country patent regime and changes in the number of licensing transactions between developed and developing countries.

In measuring the strength of IPRs, a particular innovation in this paper is the use of four quantitative indexes to characterise various dimensions of the strength of intellectual property regimes around the world, namely, patent rights, copy-

rights, trademark rights and enforcement effectiveness. The use of indicators for multiple instruments of intellectual property protection permits analysis of the effects that different types of IPRs have on licensing by industry and by source of licensing income (*e.g.* industrial processes, performances, books).

Two complementary firm-level data sets constitute the primary data sources used to investigate the relationship of IPR strength (as measured by the indexes) to international licensing.[3] The first provides data on US parent firms and their licensing receipts from unaffiliated sources from the rest of the world (a separate linked data set provides firm-level control variables). Using regression analysis, the national licensing data are then related to host country IPRs and other control variables.[4] The second data set provides international firm-level information – for both US and non-US enterprises – covering cross-border licensing transactions involving *international joint ventures or strategic alliances*.

The outline of this paper is as follows: the next section briefly describes the nature of licensing agreements, then follows a review of the existing empirical work on the relationship between licensing and IPRs. We subsequently present the quantitative measures of IPR strength as employed in this paper followed by a discussion of the analytical framework, data and empirical findings. The final section provides some concluding thoughts.

LICENSING AGREEMENTS

Large and increasing volumes of income are earned globally each year from commercial transactions related to direct technology transfer (for a sample of 17 OECD countries, these receipts amounted to more than $104.8 billion in 2001[5]). Maskus (2004) points to five main channels for technology transfer through market-mediated mechanisms: trade in goods and services; foreign direct investment, joint ventures, cross-border movement of personnel and licensing.[6] While flows via each channel embody technology, it is at present not possible to determine precisely the relative magnitudes of their technology content. However, Maskus points out that "licenses typically involve the purchase of production or distribution rights (protected by some intellectual property right) and the technological information and know-how required to make effective the exercise of those rights." Citing balance of payments data, Maskus notes that in 2001 OECD member countries earned more than $70 billion in royalty revenue from licensing and other types of arm's length trade in technology (*i.e.* excluding intra-firm flows).

Gutterman (1995, p. 173) provides a useful working description of licensing arrangements as being created "when one party, the 'licensor', which owns or otherwise controls the right to specify the uses of a valuable legal right, grants to the other party, the 'licensee', the right or license to utilise the legal rights for the purposes specified in the contract between the parties." The licensee can

compensate the licensor for the use of the licensed subject matter via a flat (lump-sum) fee and/or through royalties based on the income earned by the licensee. The royalty rate can be a fixed or varying percentage of the licensee's value of output, units of output, gross or net sales, or gross or net profits.[7] Compensation can also be "in kind", such as when the licensee provides to the licensor a share of the goods produced.

A license agreement is a commercial contract between the licensor and licensee. While agreements vary from contract to contract, they contain several key elements.[8] First and foremost, it specifies the subject material, whether it be a patented technology, a copyrighted work, a registered trademark or industrial design, trade secret, or other intangible asset. In many cases, the license is a "hybrid" in the sense that it covers two or more kinds of IPRs; this can occur in cases where granting one type of right (*e.g.* use of a patent) may not be enough to enable the licensee to produce and sell a good (*e.g.* the licensee may also need the right to use the corresponding trademark). Secondly, the licensing contract also specifies the functional use permitted of the IPRs. This may range from a simple use-license (which gives the right to use the licensed subject matter without the right to copy or distribute the subject matter)[9] to a broad license covering manufacturing and distribution.

Naturally, license agreements may also specify some restrictions, particularly with regard to competition. For example, licenses may be exclusive or non-exclusive (permitting competition with other licensees or even with the licensor). National, regional, and international laws may specify geographic market restrictions. Depending on the exhaustion regime, parallel importing may be banned.[10] Other important elements specified in licensing agreements include: expiry date (if any); performance warranty (that the licensed subject matter performs under the right conditions, enabling the licensee to use it to achieve an intended result); and termination contingencies (in the event of bankruptcy of either party). The licensing agreement may also reference the terms of technical support, training and assistance (provided by the licensor to the licensee).

To the extent that transactions are voluntary, licensing arrangements should be mutually beneficial to the licensor and licensee. The licensee acquires the right to use new technology or know-how (subject to specific conditions) without having to undertake costly research and development (R&D), and can thereby capitalise on the licensor's reputation and expertise. In exchange, the licensor derives not only royalties but may also capitalise on the licensee's local contacts and familiarity with the local market. The licensor may also derive benefits from technical "improvements" to the licensed subject matter made by the licensee. Some licensing agreements may provide for a grant-back clause whereby the licensor obtains a license to any improvements made by the licensee. Of course, parties weigh these benefits against the cost of licensing. These costs include

transactions costs (of searching for partners, initialising and maintaining agreements over time) and, in the case of the licensor, the costs of forgoing monopoly rents (which the licensor could have earned by exercising the rights exclusively). The latter may explain the attractiveness of cross-border deals: international licensing has the advantage of avoiding competition directly in domestic markets.

Licensing agreements are inextricably linked to the underlying intellectual or intangible subject matter. The question of interest is how the quantity and value of licensing agreements vary with the terms and strength of IPRs.

LITERATURE REVIEW

The economic literature on intellectual property underscores diverse theoretical effects of changes in protection, with positive or negative outcomes depending on a complex variety of assumptions and conditions. The consequent theoretical ambiguity means that empirical approaches have a critical role to play in assessment of intellectual property issues. Despite this inherent need for empirical analysis, the economic relationship between IPRs and licensing has received only limited and non-conclusive consideration in the literature.

Potentially, stronger IPRs can have both positive and negative effects on licensing. Yang and Maskus (2001a) identify an *economic returns effect* whereby stronger intellectual property protection reduces the risk of imitation (or defection by a licensee) and thereby increases the profitability of licensing. Among other things, stronger protection implies that licensing and royalty contracts can be better enforced or that the licensor has greater bargaining power *vis-à-vis* the licensee in terms of being able to extract a greater share of the rent. Under a weak system of intellectual property protection, the licensor may have to give up a greater share to the licensee so as to reduce the incentive of the latter to defect.

On the other hand, excessive strengthening of IPRs could in theory create situations whereby *monopoly power effects* dominate and lead to a reduction of investments in R&D. This could occur as a consequence of the increase in monopoly protection that rights-holders might gain over their existing intangible assets, enabling the rights-holders to better exploit these assets. Where such protection reduces threats from potential rivals (who could imitate or invent around existing products), less incentive may exist to upgrade existing intellectual property or to develop new varieties. If in such cases stronger IPRs lead to a slowing in the pace of innovation, there could be fewer new technologies available for licensing. This scenario would indicate some potential for stronger IPRs to reduce licensing activities. Thus, between the economic returns effect and the monopoly power effect, the theoretical prediction of stronger IPRs on licensing is uncertain *a priori*.[11]

A review of the existing empirical literature reveals that most of the studies on licensing issues employ data from US sources where the licensors tend to be

US firms. One reason is that data on US multinationals are quite comprehensive and readily available. It is also the case that US multinationals account for the bulk of global multinational firms. Indeed in international samples of such firms, the share originating in the US typically accounts for one-half or more of the total.[12] While most of the empirical studies find qualified support for the argument that strong patent protection stimulates licensing, they differ in the specifics. For example, they differ in the type of licensing covered, which may be licensing to unaffiliated third parties (*i.e.* arms-length) or to affiliated parties (such as licensing between a parent firm and an affiliate, or between two or more affiliates of the same parent). The studies differ in the variables that they control for while examining the relationship between IPRs and licensing. They also differ by sample period, type of sample (whether cross-sectional or panel data), and countries covered (namely the "licensee" countries). These and other differences need to be considered when comparing the study results.

One of the earliest studies drawing a connection between patent protection and licensing was authored by Contractor (1984). Using cross-sectional data, the study tries to explain the determinants of the ratio of receipts in the United States of royalties and licensing fees from unaffiliated sources to various measures of direct investment activity. The study finds that the patent intensity of a nation (defined as flows of new patents in force) attracts licensing (and thus technology transfers). The argument behind this is that patent protection increases the income extractable from licensing. Another early (well-cited) study is by Mansfield (1994) which finds that US multinationals are less likely to engage in technology transfer with unaffiliated firms in countries where intellectual property protection is weak. However, this finding depends on the industry or nature of the technology. US firms in the chemicals and electronics industries appeared to place a greater emphasis on intellectual property protection, whereas firms in the metals and transportation industries were seen to be less reliant on it. Drawing on cross-sectional data on US multinationals' licensing activities in 50 countries, Smith (2001) finds that the effect of stronger IPRs on international licensing depends on the imitative capabilities of host countries. In situations where imitative risk is low, stronger IPRs serve primarily to raise rents to rights holders. In countries where imitative capabilities are high, stronger patent rights stimulate licensing to unaffiliated foreign firms.

Yang and Maskus (2001a) extend the analysis of US foreign licensing to a panel data set covering three time periods (1985, 1990 and 1995) and 23 partner countries, of which approximately ten are developing or emerging market economies. The study finds that countries with stronger patent rights attract larger volumes of licensed technology from unaffiliated sources. In contrast, the study also finds that patent rights have either a significant negative effect or insignificant influence on licensing of technology between affiliated sources. The authors argue

that this is consistent with internalisation theories of the multinational enterprise. That is, for these kinds of transactions, in cases where there less risk of imitation from affiliated parties, the "monopoly power effect" may dominate. Whereas some studies focus on data concerning the value of licensing transactions, Yang and Maskus (2001a) point out that from value data it is not possible to discern whether the strengthening of IPRs stimulates more licensing contracts (*i.e.* quantity) or causes an increase in licensing fees per contract (*i.e.* price). Either way, the value of fees (price times quantity) increases; however, the difference is that an increase in the quantity of deals or contracts could reflect increases in the variety of technologies introduced to an economy rather than simply increases in the "rents" per technology.

Nicholson (2003b) focuses his investigation on count data rather than value data. The dependent variable of interest is the number of US firms that received licensing or royalty fees from unaffiliated sources. The empirical analysis here is cross-sectional and pools together data for 1995 from 49 destination countries and 82 industries. The study finds that R&D intensive firms are more apt to license when patent protection is strong. Capital-intensive firms are less apt because they already enjoy de-facto protection from imitation owing to their expensive set up costs and complex inputs.

The foregoing studies use data from the US Bureau of Economic Analysis (BEA) based on aggregations to the industry or national level. Branstetter *et al.* (2002) present a study based on *firm-level* analysis of the effects of strengthened IPRs on international licensing using BEA micro-data, taking into account the timing of specific national reform initiatives (but not differentiating among different types of IPRs or the level of enforcement). The study covers four survey benchmark years (1982, 1989, 1994 and 1999) and 16 countries. A key finding is that IPR reforms stimulate US firms to license abroad to affiliated parties (especially where the parent companies patented extensively prior to the reforms).

In contrast to the previous studies, Fosfuri (2003) finds weak effects of IPRs on international licensing. This study also uses firm-level data for the world chemical industry (from the *Chemintell* database) and an index of patent rights.[13] The empirical analysis employs a panel data set of 75 destination countries for the time periods 1981-83, 1984-87, 1988-91, and 1992-96 (data are averaged for each time period). The author aggregates the data across firms to arrive at national level figures. Hence, the sample size is 300 (= 75 countries × 4 periods). The study finds that country risk significantly explains variation in licensing behaviour but that patent rights have an insignificant or negative effect on licensing. One possible explanation for this finding is that the sample largely consists of firms with process innovations.[14] For such innovations, patents may not be the most effective mechanism for appropriating the returns to innovation. Thus, Fosfuri's finding does not preclude the importance of other kinds or aspects of IPRs (particularly enforcement), nor the importance of patent rights to product innovations.

Finally, Anand and Khanna (2000) explore how IPRs may help explain international licensing patterns and contract structure. The study employs data on international licensing contracts from the *Joint Ventures and Strategic Alliances* database of the Securities Data Company (SDC).[15] The authors construct a sample of all licensing contracts in the database involving at least one US partner over the period 1990-1993 (approximately 1 400 deals). A key finding is that licensing in the pharmaceutical and chemical sectors is dependent on patent protection, while licensing in the semiconductor industry is relatively less dependent on it. The authors hypothesise that the difference is attributable to the product characteristics. Contents and boundaries of knowledge are relatively easy to specify for pharmaceutical and chemical products; this makes for well-defined patent rights. For semiconductor products (*e.g.* circuit layouts), the knowledge boundaries are less well defined and, as a result, patent protection offers less effective protection against imitation.

The literature points to evidence of a generally positive relationship between IPR strength and licensing, subject to certain conditions and with some variation by sector. The present paper builds upon and extends this previous work, exploring in more detail the determinants of licensing flows, the variation in flows by sector and level of economic development, and the relationship of licensing to FDI and exports.[16] In contrast to the earlier studies, the paper takes into account the changes in the strength of multiple instruments of intellectual property protection – *i.e.* patents, copyrights and trademarks – as well as ratings of enforcement effectiveness. This permits an examination of the effects of different types of IPRs on licensing, by industry and by source of licensing income (*e.g.* industrial processes, performances, books).

INDEXES OF INTELLECTUAL PROPERTY RIGHTS AND ENFORCEMENT

Four dimensions of IPRs are considered in this study, each measured by a different IPR index. Three of them cover standard statutory rights: patent rights, copyrights, and trademark rights. The fourth examines enforcement effectiveness in practice. A guiding principle in choosing legal features for each index is not to be exhaustive but rather selective, choosing those legal features that yield maximum variability across countries. Furthermore, the selection must take into account the availability of the underlying information across countries. Appendix 1 provides a summary of the legal features in each type of IPR index and of how the indexes are scored.[17]

Patent rights

The measure of patent rights is taken from Ginarte and Park (1997) and Park and Wagh (2002). The index of patent rights ranges from zero (weakest) to five (strongest). The value of the index is obtained by aggregating the following five

components: extent of coverage, membership in international treaties, duration of protection, absence of restrictions on rights, and statutory enforcement provisions. Coverage refers to the subject material (type of invention or creation) that can be protected; duration refers to the length of protection; restrictions refer to the less than exclusive use of those rights; membership in international treaties indicates the adoption into national law of certain substantive and procedural laws of those international agreements. Membership in an international treaty may also signal the willingness of particular nations to adhere to shared international principles such as non-discrimination. The enforcement component consists of mechanisms that aid in enforcing one's patent rights (such as injunctions against infringers). Each of these components is scored on a scale from 0 to 1 (reflecting the fraction of legal features that are available). The overall value of the patent rights index is the unweighted sum of the component scores.

Copyrights

This index is obtained from Reynolds (2003). The copyright index consists of four components: coverage, usage, enforcement, and membership in international treaties. Coverage again refers to the subject matter that is protected and is intertwined with copyright duration (since the length of protection varies with subject matter). The usage component addresses the degree to which copyright holders have control over their copyrights (*vis-à-vis* the use of their works by others). The enforcement component also includes provisions that aid in enforcing a copyright holder's rights (such as the availability of criminal penalties for infringement). The treaties cover various global conventions and agreements (as described in Appendix 1). Each component is scored on a scale from 0 to 1, again reflecting the fraction of legal features that are available. The overall score for the copyright index is the unweighted average of the four components. Hence, the copyright index ranges from zero (lowest) to one (highest).

Trademark rights

This index is also presented in Reynolds (2003). The trademark index consists of three components: coverage, procedures (which incorporates enforcement features and possible restrictions on the rights holder), and international treaties. The coverage component refers to types of names and symbols that can be trademarked. The procedures component addresses the manner in which trademark rights are procured and enforced; hence the procedures component incorporates enforcement features. The international treaties component incorporates various global conventions and agreements on statutory and procedural laws. Each component is scored on a scale of 0 to 1, indicating again the fraction of legal features

that are available. The overall score for the trademark index is an unweighted average of the three components.

Enforcement effectiveness

No formal, empirical studies have been conducted internationally on the actual enforcement of IP laws in practice. However, some information is available from reports filed with the US *Trade Representative* (USTR) concerning intellectual property enforcement in various countries.[18] A major limitation is that the reports may largely represent the views of US firms as to what constitutes effective and adequate enforcement. Another limitation is that some complainants may have ulterior motives for filing complaints; for example, to seek assistance in penetrating foreign markets because they are not able to compete against local firms on price, product quality, or other factor alone. On the other hand, having no measure at all of enforcement in practice would be a serious omission. Thus, notwithstanding these limitations, an index is developed to reflect the experience of IP enforcement as documented in these reports. The index can then be compared to, and used in conjunction with, the statutory IP indexes.

The enforcement effectiveness index focuses on the execution of laws. Laws may be ineffectively implemented for two main reasons: *i*) because of a *lack of willingness* on the part of policy authorities to provide or enforce them (because the authorities, for whatever reason, do not agree with a strong intellectual property policy), or *ii*) because of a *lack of capacity* to enforce laws effectively. This may arise because of a lack of resources, training, and experience. The value of the enforcement effectiveness index ranges from zero (if enforcement measures are unavailable or inadequate) to half (if enforcement measures are available but not effectively carried out) to one (adequate).

EMPIRICAL ANALYSIS

The empirical analysis proceeds on the basis of two analytical approaches, both using firm-level data on licensing. The first approach uses regression analysis to examine the relationship between licensing receipts and IPRs. The second considers the relationship between the strength of IPRs and the volume of licensing activity.

Regression analysis

Framework and methodology

There are few theoretical studies on the relationship between intellectual property protection and licensing that might serve as a guide for specification of applied models.[19] Most empirical work to date is based on *ad hoc*, but intuitive,

equations that are typically log-linear. In a similar approach, the model employed in the present study begins with a simple conceptualisation of licensing at the firm-level that is expanded based on insights from the literature and intuition, taking into account the availability of data.

Licensing receipts depend essentially on the technology or asset to be licensed and the rate or fee that can be commanded:

$$\text{Licensing receipts} = \rho A \qquad [1]$$

where A denotes the stock of technologies (or creations) and ρ the flow rate (or average income or yield per technology).

At the firm-level, ρ and A depend on a variety of factors; they are each a function of firm-specific and environmental factors. The strength of IPRs, one of the environmental factors, is a main variable of interest in the present analysis; it is one factor potentially shaping ρ and A and, consequently, variation in licensing receipts. Other variables (Z_1 and Z_2) are introduced as controls to help explain that part of the variation not accounted for by the strength of IPRs.

$$\text{Licensing receipts} = \rho f(\text{IPR}, Z_1)\, A f(\text{IPR}, Z_2) \qquad [2]$$

With respect to the flow rate, ρ, theory would a point to a positive relationship to IPR regimes. If stronger IPRs result in a greater ability of the technology owner to appropriate the returns to innovation and creation, then one might anticipate this to be associated with greater licensing flows. Moreover, the strength of IPRs can be expected to affect the level of technological development, A. Here the situation is more ambiguous. The market expansion effect of stronger IPRs may give greater incentives for innovation and thus expand the supply of technologies (increasing the size of A) or the monopoly power effect of IPRs may dominate and slow down the rate of innovation (decreasing the size of A).

To date, ρ and A have not been measured directly on an internationally comparable basis. However, we can empirically assess the factors that determine ρ and A and, hence, licensing receipts. Equation [3] presents such a model, taking into account firm-specific and environmental factors. This model will serve as the basis for the analysis that follows:

$$\text{Log (Licensing}_{i,n,t}) = \alpha_0 + \alpha_1 \log (Z_{1i,t}) + \alpha_2 \log (Z_{2i,t}) + \alpha_3 \log (\text{IPR}_{n,t}) \qquad [3]$$
$$+ \text{“Industry Dummies”} + \text{“Time Dummies”} + \text{Error}_{i,n,t}$$

where the subscript i denotes the firm, n denotes country, and t denotes time. IPR is the key variable of interest, representing the strength of intellectual property rights. Z_1, Z_2 and the dummies are control variables. The selection of specific variables was based on insights from the literature, intuition and data availability. In operationalising the various permutations of the model, the control variables “Z” were specified as firm-level covariates (market size and the R&D intensity) or key environmental factors (tariff levels, country risk and corruption). Dummy variables

were included to control for industry group and macro effects (time period). The error term was included to pick up factors that have not been explicitly captured by the other variables.

By expressing the variables as logarithms, the regression yields coefficients indicating the "elasticity" of response. For example, if the dependent variable is the log of "licensing receipts" and the independent variable is the log of "IPR", then the coefficients provide an estimate of the relationship such that a 1% increase in "IPR" is associated with α_3% increase in licensing fees, holding other factors constant.

As with IPR strength, each of the selected control variables "Z" might be expected to influence the flow rate or supply of technologies. The market size facing the firm (as proxied by sales) may positively affect both the flow rate as well as the supply of technologies, with bigger markets tending to provide larger incentives to develop and exploit intellectual property. In contrast, the effect of the R&D intensity of firms (*i.e.* their ratio of R&D expenditure to sales) may be more ambiguous. R&D intensity may positively stimulate the supply of technologies, if the intensity of R&D is associated with the extent of "fruits" from innovation. However, the R&D intensity of a firm may also reveal the R&D content of particular technologies, with greater R&D investment being associated with more caution. That is, a firm's engagement in technologies with a higher R&D content could make the management more concerned about the ability of third parties to exploit the results of their R&D. Holding other factors constant, such firms may be less willing to license (or outsource) their technologies to third parties. Conversely, firms could tend to be less concerned about the misappropriation of technologies with a low intensity of R&D.

The three environmental control variables are operationalised as mean tariff rates and indexes of country risk and corruption. Tariff rates might be expected *a priori* to influence the choice of mode of market entry and, consequently, technology transfer. High tariff rates may make licensing more attractive because the border protection creates a barrier to trade in the goods that embody the intellectual property. On the other hand, both country risk and corruption might be expected *a priori* to negatively affect licensing as they may make it harder to appropriate the returns from use of the intellectual property.

In the context of the present analysis, equation [3] is used to test three principle hypotheses related to the influence of IPR strength on the ability of intellectual property holders to appropriate returns via international licensing arrangements. First, it permits an assessment of the hypothesis that the strength of IPRs influences international licensing receipts and that the extent of this influence varies by type of intellectual property right and effectiveness of IPR enforcement. The equation is also used to test the hypothesis that the influence of IPR strength on

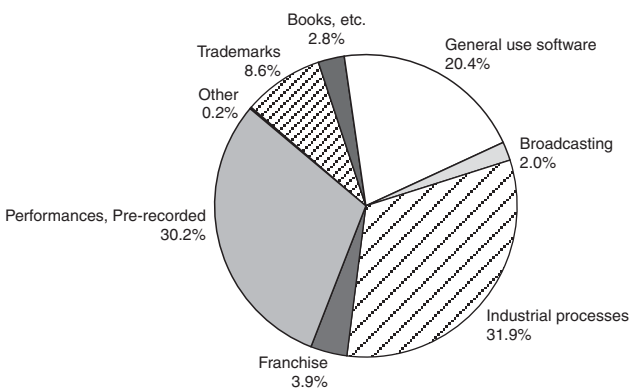
international licensing varies according to the sector and the nature of property to be licensed. Finally, a variation of the equation is used to test the hypothesis that the strength of IPRs influences the choice of channel for international technology transfer between licensing and FDI, licensing and export of the products that embody the technology, and licensing to unaffiliated or affiliated entities.

Sample statistics

Equation [3] is estimated for a sample of US parent firms over three time periods 1992, 1995, and 1999. This is not a balanced panel since some firms appear in some periods but not in others. The full sample consists of over 7 000 observations, covering 11 industries and 91 countries. The sample is based on firm-level data from two surveys of the US Bureau of Economic Analysis (BEA). The BE-93 survey provides information on the international payments and receipts of royalties and licensing fees of US-based firms (including US parent companies as well as firms that are not multinationals). The payments and receipts are broken down by source of income (*e.g.* from broadcasting, franchises, books). For the purposes of the present analysis, the database provides the industry classification of the US firm and the country from which the firm receives royalties and fees. The firm-level control variables come from the BEA's BE-10 survey database which provides information on US parent and affiliate financial and operating characteristics.[20] A concordance between the BE-93 and BE-10 data was established.[21]

Figure 1 shows the breakdown in receipts of royalty and licensing fees by source of revenue during 1992 to 1999. For all US based firms during this period,

Figure 1. **Sources of US royalty and licensing fees from intangible assets, 1992-99**



Source: US, BEA Survey, BE-93.

32% of royalties and fees are derived from the licensing of industrial processes; 30% from pre-recorded performances (*e.g.* musical tapes and compact disks); 20% from general use software; and 9% from the use of trademarks (*e.g.* business symbols and names). The other items in the figure account for comparatively small shares of the total.[22]

Table 1, Part A, presents some key characteristics of the licensing receipts for US parent firms in 1999 (in real 1995 dollars). 80% of these flows originated in countries where per capita GDP exceeded $18 000 (in real 1995 dollars). Moreover, 73% of the receipts were from affiliated parties. The remainder come from arms-length (unaffiliated) parties. In countries where per capita GDP was below $18 000, a greater proportion of the flows came from unaffiliated sources (probably because US firms have relatively fewer affiliates in developing countries).

Part B presents sample statistics for the indexes of intellectual property protection employed in the following analysis. As can be seen from the mean scores, the developed countries (with per capita GDP exceeding $18 000) tend to have stronger IPRs than do the less developed nations (with per capita GDP below $18 000). Among less developed nations, there tends to be a greater degree of variation for each type of intellectual property protection. For instance, the coefficient of variation of the enforcement effectiveness rating exceeds 100% for developing nations but is less than 30% for developed nations.[23]

Part C provides sample correlations among the measures of IPRs and royalty and licensing fees. The various indexes of IPRs are positively correlated with receipts of income from intangible assets, signifying that US parent firms derive greater fees from regions where intellectual property regimes are stronger. This could be the result of firms having greater incentives to license their technologies in countries with stronger IPRs as well as of firms being better able to capture rent or income from their intellectual assets abroad if the host country more strongly enforces its IPRs. The various indexes of IPRs are also positively correlated with one another. Patent rights and enforcement effectiveness are most highly correlated. This suggests that, in general, the strength of patent statutes correlates well with enforcement in practice (though of course exceptions exist). Copyrights and trademark rights are also highly correlated. Countries that protect copyrights strongly tend to protect trademark rights strongly, and *vice versa*.

E*mpirical results*

Tables 2 to 6 provide estimates of the various formulations of equation [3]. Tables 2 to 5 focus on international licensing by US parent firms to unaffiliated parties; Table 6 considers licensing to both affiliates and unaffiliated parties.

Table 2, column 1, presents the results of estimating a basic formulation of the equation. The model captures 12% of the variation in international licensing by

Table 1. **Sample statistics**

Part A. Royalty and licensing fees for the use of intangible assets, received from abroad by US parent firms

	Annual value of fees for 1999 ($ billion)	Percentage share from affiliated sources	Percentage share from unaffiliated sources
All countries	33.4	72.6	27.4
Nations with per capita GDP > $18 000	26.7	74.5	25.5
Nations with per capita GDP < $18 000	6.7	64.8	35.2

Part B. Intellectual property rights indexes

	Patent rights	Copyrights	Trademarks	Enforcement effectiveness
Maximum possible range of scores	0 to 5	0 to 1	0 to 1	0 to 1
All countries:				
Mean	3.36	0.67	0.56	0.60
Standard deviation	(0.87)	(0.15)	(0.16)	(0.40)
Nations with per capita GDP > $18 000:				
Mean	3.87	0.74	0.62	0.91
Standard deviation	(0.46)	(0.11)	(0.13)	(0.21)
Nations with per capita GDP < $18 000:				
Mean	2.81	0.59	0.49	0.26
Standard deviation	(0.88)	(0.15)	(0.16)	(0.28)

Part C. Correlation matrix

	Licensing fees	Patent rights	Copyrights	Trademark rights	Enforcement effectiveness
Licensing fees	1				
Patent rights	0.373	1			
Copyrights	0.286	0.491	1		
Trademark rights	0.197	0.497	0.660	1	
Enforcement effectiveness	0.419	0.719	0.444	0.509	1

Notes: All US dollar amounts are in real 1995 US dollars. The data in Part A are based on the BEA firm-level surveys (*i.e.* BE-10 and BE-93) used in the regression analysis presented in Tables 2 to 6. The sample period for Parts B and C is 1992 to 1999.

US parent firms. A B*reusch-Pagan* test rejects the null hypothesis of heteroskedasticity.[24] All of the key independent variables are statistically significant at the 1% level. The variable "IPR" is the sum of all three statutory indexes (patent rights, copyrights, and trademark rights), all equally weighted. A 1% strengthening of intellectual property protection is associated with a 0.4% increase in the receipts

Table 2. **Intellectual property rights: royalty and licensing fees from unaffiliated sources, firm level**

	Dependent variable: log (licensing)				
	(1)	(2)	(3) GDP per capita > $18 000	(4) GDP per capita < $18 000	(5)
Constant	1.619***	2.034***	0.902	1.551***	–8.739***
	(0.375)	(0.271)	(0.663)	(0.330)	(1.516)
Log (IPR)	0.405***				
	(0.144)				
Log (Patent rights)		0.406***	1.560***	0.359***	0.647***
		(0.094)	(0.349)	(0.095)	(0.170)
Log (Copyrights)		0.095	0.948***	–0.450***	0.162
		(0.117)	(0.232)	(0.126)	(0.157)
Log (Trademark rights)		–0.123	–0.360*	–0.197**	–0.029
		(0.085)	(0.190)	(0.091)	(0.111)
Enforcement effectiveness	0.473***	0.469***	0.363**	0.177	0.250*
	(0.116)	(0.080)	(0.162)	(0.137)	(0.137)
Log (Firm R&D intensity)	0.023***	0.022*	0.026***	0.013**	0.026***
	(0.005)	(0.005)	(0.008)	(0.007)	(0.006)
Log (Firm sales)	0.246***	0.247***	0.235***	0.260***	0.254***
	(0.014)	(0.014)	(0.019)	(0.018)	(0.016)
Log (Tariff rate)					0.079
					(0.058)
Log (Country risk index)					2.66***
					(0.363)
Log (Corruption index)					–0.545***
					(0.108)
Industry group fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.12	0.12	0.10	0.16	0.13
Number of observations	7 019	7 019	3 773	3 246	5 280

N*otes*: All dollar amounts shown here or in the underlying data are denominated in real 1995 US dollars. The dependent variable, Licensing, denotes the royalty and licensing fees received by US parent firms from unaffiliated sources. The unit of analysis is the US parent firm. Firm R&D Intensity is defined as the ratio of the parent firm's R&D expenditure to its sales. Key variables and sources are defined in appendices to this paper. The model is estimated over three time periods: 1992, 1995, and 1999. Columns (3) and (4) show the results of splitting the sample into two groups of countries, those with sample average GDP per capita above and below $18 000. Standard errors are in parentheses and italicised. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

of *unaffiliated* licensing fees. An increase in the level of protection either raises the ability of firms to appropriate the returns to technology (through ρ in equation [1]) or increases the incentive of firms to license (through A in equation [1]). Both sales and R&D intensity also influence licensing positively. Note that the statutory level of protection is an important explanatory factor even after controlling for a measure of enforcement effectiveness (which itself is a statistically significant determinant

of licensing). Thus, "laws on the books" have an important effect (independent of the actual implementation of the laws).

Table 2, column 2, highlights the effects of separating out the different statutory indexes of IPR. This reveals that patent rights are the most important form of intellectual property protection for unaffiliated licensing. The copyrights and trademark rights variables are not statistically significant in this specification. The coefficient estimate of the patent rights variable is very similar to that of the aggregate IPR variable in column 1; the coefficient estimates of the other independent variables are also very close to their respective values in column 1.

Columns 3 and 4 of the table report the results of splitting the sample between countries whose GDP per capita is above and below $18 000 (in real 1995 US dollars), respectively. Column 3 shows that both patent rights and copyrights stimulate US parent firms' licensing in relatively rich countries. US firms are more sensitive to licensing copyrightable works in developed countries than in less developed countries, possibly since the imitative potential of foreign firms is higher in the developed markets. Copyrights have a negative effect on licensing in the relatively poorer countries. It appears that stronger copyrights enable US parent firms to exercise stronger monopoly power in the developing markets, which would increase the return for each license while having a negative effect on overall licensing in those markets. For both developed and less developed regions, trademark rights exert a negative influence on licensing. Stronger protection for symbols and names seems to enable firms to enjoy greater market power in all markets. One possible reason is that, whereas stronger patent rights may lead to further innovation, stronger trademark rights tends to allow for a stronger exercising of existing rights. In less developed markets, the index of enforcement effectiveness does not appear as an important influence on licensing. The main reason is that most countries in this sub-sample score low on enforcement effectiveness and thus the index does not have much variability in this sub-sample.

In column 5, additional country-level control variables are included. The main motivation is to see if the intellectual property variables are robust to their inclusion. Controlling for country risk, corruption, and trade restrictiveness (via the mean tariff rate) does not affect the result that patent rights are an important determinant of licensing. The tariff variable turns out not to be a significant factor, while country risk and corruption are significant at the 1% level. The results indicate that corruption negatively contributes to licensing, and that lower country risk contributes positively to licensing. (Note that the sign for country risk is negative, because a higher value of the index is associated with a lower country risk.) The inclusion of these variables reduces the statistical significance of the index of enforcement effectiveness. This may be due to the fact that corruption and country risk pick up similar factors as the enforcement effectiveness index (*e.g.* bureaucratic inefficiency, unreliable administration, and policy risk and uncertainty). Under

corrupt regimes and/or risky business climates, laws (including intellectual property laws) are not likely to be very effectively and adequately implemented.

The inclusion of country risk and corruption as control variables reduced the sample size as shown in column 5 by about 25% compared with the results presented in columns 1 and 2 of the table. In the following tables, the model is rerun for various sub-groups of the sample. In order to avoid overly restricting the sample size, the control variables for country risk and corruption are not used in the subsequent tables. Given that there is some interrelation between the nature of these control variables and the enforcement effectiveness index, and taking into account that the enforcement indicator is targeted more directly at the implementation of intellectual property laws, this narrowing of the range of control variables should not unduly compromise the robustness of the model.

Table 3 shows the results of estimating equation [3] according to the type of intellectual property licensed. As can be seen from the results, copyrights and effective enforcement positively stimulate the licensing of books and related materials, while copyrights have a mild negative effect and enforcement effectiveness a strong positive effect on the licensing of franchise assets. R&D intensity is not important to the licensing of franchises or books and related materials. Patent protection and enforcement positively and significantly stimulate the licensing of industrial processes, pre-recorded performances, and general use software. The finding that the strength of patents is positively associated with the licensing of software is of particular interest in view of recent debates about whether software is better protected (or should be protected) by patents or copyrights.

Table 3 also indicates a significant positive relationship between patent rights and the licensing of trademarks. This may be the case for technologies where both patent and trademark protections are desired jointly (*e.g.* in order to better tie a product to a business name or symbol). Licensors may in some cases bundle the underlying process or product and the associated trademark in order to ensure quality control or to prevent confusion among the ultimate consumers or users of a technology. Likewise, pre-recorded performances may also be associated with an underlying patentable technology that is licensed, so that the licensing of performances is dependent on a certain minimum level of patent rights. Trademark rights are associated positively and significantly with the licensing of pre-recorded performances, but negatively and significantly with the licensing of industrial processes. Holding other factors constant, tighter trademark regimes may permit firms to better exploit their own processes in the market without having to license to competitors. Finally, it is somewhat surprising to find that trademark laws have no statistically significant influence on the licensing of trademark rights. It does not seem plausible that trademark strength is not a factor in the decision to license business names and symbols, but it may be that the market power and market expansion effects of stronger trademark protection cancel out.

Table 3. **Intellectual property rights and US royalty and licensing fees: by sectoral source of fees, firm level data**

	Dependent variables:					
	Log (BOOKS)	log (FRAN)	log (INDUS)	log (PERF)	log (SOFT)	log (TM)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.478	0.418	1.717***	2.218***	1.246	3.938***
	(0.835)	(0.850)	(0.576)	(0.738)	(1.027)	(0.534)
Log (Patent rights)	–0.382	0.052	0.415***	0.726***	0.915***	0.503**
	(0.280)	(0.193)	(0.142)	(0.267)	(0.301)	(0.210)
Log (Copyrights)	0.973***	–0.432*	0.020	0.269	0.182	0.136
	(0.346)	(0.236)	(0.188)	(0.323)	(0.344)	(0.242)
Log (Trademark rights)	–0.138	–0.145	–0.462***	0.538**	0.061	–0.027
	(0.255)	(0.176)	(0.134)	(0.236)	(0.253)	(0.177)
Enforcement effectiveness	0.624***	0.889***	0.429***	0.749***	0.743***	0.008
	(0.219)	(0.172)	(0.123)	(0.233)	(0.236)	(0.167)
Log (Firm R&D intensity)	0.062	–0.029	0.049***	–0.129***	0.043**	0.088***
	(0.044)	(0.018)	(0.017)	(0.026)	(0.021)	(0.011)
Log (Firm sales)	0.286***	0.201***	0.233***	0.147***	0.197***	0.119***
	(0.066)	(0.049)	(0.025)	(0.043)	(0.040)	(0.026)
Industry group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.10	0.21	0.08	0.21	0.19	0.08
Number of observations	772	662	3 109	845	1 027	1 488

Notes: BOOK denotes fees from books and related materials, FRAN from franchises, INDUS from industrial processes, PERF from pre-recorded performances, SOFT from general-use software and TMARK from trademarks. (The sample size for fees from broadcasting was too limited for analysis.) All dependent variables are in real 1995 US dollars. See also notes to Table 2. Standard errors are in parentheses. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

Table 4 shows the regression results by industry group, which need to be interpreted with caution due to measurement issues.[25] In general, patent rights appear to be a positive influence on licensing in the Electrical and Electronics group, Transportation group, and Services[26] group (and mildly influential in the Financial group). Enforcement effectiveness appears statistically important in the Chemicals group, Food and Kindred group, Electrical and Electronic group, Services and Financial groups, and mildly important in Wholesale trade. (Firms in the latter group do conduct quite a bit of research and development, and are not simply limited to distribution activities.[27]) Copyrights have a positive influence on licensing for firms in the Chemicals group. Trademark rights have a negative influence on licensing among firms in the Chemicals group and a mildly negative influence among firms in the Metals and Electrical and Electronics group. Machinery is

Table 4. **Intellectual property rights and licensing: by industry and all regions, firm level data**

Industry group:	Dependent variable: log (Licensing)								
	Food and kindred	Chemicals	Metals	Machinery	Electrical, electronics	Transport	Wholesale	Finance	Services
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	1.44	1.93**	2.99**	3.313***	–2.32*	–4.79***	0.72	2.37***	1.29**
	(1.94)	(0.86)	(1.48)	(1.17)	(1.27)	(1.70)	(2.32)	(0.92)	(0.57)
Log (Patent rights)	–0.051	–0.08	0.57	0.34	0.714**	1.73***	–0.024	0.57*	0.53*
	(0.334)	(0.22)	(0.49)	(0.55)	(0.36)	(0.59)	(0.85)	(0.30)	(0.26)
Log (Copyrights)	–0.27	0.62**	0.51	0.83	–0.10	0.36	0.75	–0.074	–0.10
	(0.46)	(0.29)	(0.63)	(0.68)	(0.51)	(0.70)	(0.83)	(0.42)	(0.28)
Log (Trademark rights)	–0.11	–0.55**	–0.89*	–0.52	–0.62*	–0.36	–0.58	0.068	0.18
	(0.32)	(0.23)	(0.46)	(0.45)	(0.36)	(0.48)	(0.58)	(0.31)	(0.21)
Enforcement effectiveness	0.89***	0.43**	0.29	0.45	1.10***	–0.20	0.89*	0.88***	0.66***
	(0.32)	(0.20)	(0.35)	(0.43)	(0.34)	(0.44)	(0.55)	(0.28)	(0.21)
Log (Firm R&D intensity)	–0.15***	0.27***	–0.07*	0.023	–0.077**	0.33***	0.21***	–0.049**	–0.018*
	(0.042)	(0.06)	(0.038)	(0.05)	(0.036)	(0.11)	(0.035)	(0.021)	(0.011)
Log (Firm sales)	0.21*	0.29***	0.03	0.12**	0.43***	0.56***	0.45***	0.095**	0.26***
	(0.12)	(0.05)	(0.082)	(0.06)	(0.065)	(0.08)	(0.12)	(0.048)	(0.035)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R	0.10	0.11	0.03	0.03	0.11	0.17	0.44	0.07	0.09
Number of observations	269	925	230	351	513	338	164	606	1 315

N*otes*: The dependent variable is the log of real licensing and royalty fees in real 1995 dollars. See also notes to Table 2. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses and italicised.

the only industrial group where none of the intellectual property variables exerts a statistically significant influence. One reason may be that firms in this industry are capital-intensive. As Nicholson (2003b) points out, such firms enjoy *de facto* protection from imitation owing to their expensive set up costs and complex inputs.

For a number of industry groups, the R&D intensity variable exerts a negative influence on licensing. In this case, the higher R&D to sales ratio, holding other factors constant, may reduce the willingness of firms to license given that the R&D content of technologies is higher. With higher R&D content, firms may develop a greater concern about appropriability issues and may be more protective of their innovation investments. Indeed, as the results in the next table will show, firms may be induced to switch to other modes of technology transfer – that is, choosing FDI over licensing for technologies that are more R&D-intensive.

In Table 5 the model is specified with a view to considering whether changes in IPR strength at the margin affects licensing relative to other channels of technology transfer, such as FDI and exports. The dependent variable is the log of the ratio of unaffiliated licensing to either FDI (Panel I) or exports (Panel II). For the purposes of this exercise, "FDI" refers to investment in physical plant and equipment (net of accumulated depreciation) and "exports" refers to US parent firm exports to unaffiliated parties.

The results in Panel I of Table 5 point to a bias in favour of licensing in association with a strengthening of patent rights. This is true for licensing in both developed and less developed markets. Stronger copyrights favour licensing relative to FDI in richer markets and FDI relative to licensing in developing markets. Stronger trademark protection is found to favour FDI in developing markets. More effective enforcement favours licensing in richer markets but has a neutral effect in developing markets. A higher R&D to sales ratio is found to favour FDI. When R&D intensity is high, FDI may be the preferred mode of technology transfer for internalisation reasons – that is, the risk of imitation and copying may be higher when the firm licenses to unaffiliated third parties than when the firm does its own production abroad. An increase in market size (*i.e.* sales) also favours FDI relative to unaffiliated licensing.

Panel II of Table 5 examines the effect of IPRs on the ratio of licensing to exports. Here, an increase in patent strength is found to favour licensing in poorer markets while having a neutral effect on licensing in richer markets. An increase in trademark strength favours trade relative to licensing in developing markets. Given that trademark strength has been seen to augment the market power of firms, it may be somewhat expected that as these rights are strengthened, firms choose to exercise their market power via exports rather than licensing to competitors. Higher R&D intensity and sales of firms have a positive influencing on exporting relative to licensing.[28]

Table 5. **Intellectual property rights and US royalty and licensing fees relative to trade and foreign direct investment**

	I. Dependent variable: Log (licensing/FDI)			II. Dependent variable: Log (licensing/exports)		
	All countries	GDP per capita > $18 000	GDP per capita < $18 000	All countries	GDP per capita > $18 000	GDP per capita < $18 000
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.58***	1.44***	5.24***	7.91***	5.93***	9.01***
	(0.31)	(0.74)	(0.39)	(0.66)	(1.49)	(0.89)
Log (Patent rights)	0.42***	1.45***	0.40**	0.61**	1.21	0.57**
	(0.11)	(0.39)	(0.11)	(0.23)	(0.79)	(0.26)
Log (Copyrights)	0.16	0.89***	–0.31**	0.38	0.75	0.06
	(0.13)	(0.26)	(0.15)	(0.28)	(0.52)	(0.34)
Log (Trademark rights)	–0.15	–0.31	–0.23**	–0.36*	–0.25	–0.54**
	(0.097)	(0.21)	(0.11)	(0.20)	(0.42)	(0.24)
Enforcement effectiveness	0.41***	0.39**	0.13	0.32*	0.32	–0.003
	(0.091)	(0.18)	(0.16)	(0.19)	(0.36)	(0.36)
Log (Firm R&D intensity)	–0.012**	–0.015*	–0.014*	–0.37***	–0.36***	–0.40***
	(0.006)	(0.009)	(0.008)	(0.012)	(0.018)	(0.017)
Log (Firm sales)	–0.80***	–0.81***	–0.79***	–0.56***	–0.53***	–0.61***
	(0.016)	(0.022)	(0.021)	(0.033)	(0.045)	(0.049)
Industry group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.34	0.33	0.36	0.41	0.38	0.45
Number of observations	7 019	3 773	3 246	6 801	3 684	3 117

Notes: FDI refers to expenditures on plant and equipment abroad and Exports to the export of goods and services to unaffiliated parties (both in real 1995 US dollars). See also notes to Table 2. Standard errors are in parentheses. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

In Tables 2 through 5, the focus has been on unaffiliated licensing. Table 6 examines whether changes in IPR strength affects the share of unaffiliated licensing in total licensing (to both affiliated and unaffiliated parties). The results presented in Table 6 indicate that variations in patent rights and trademark rights have no influence on the share of unaffiliated licensing to total among US parents. Increased enforcement effectiveness and copyright protection, however, favour unaffiliated licensing in the developed markets. This suggests that copyrightable works are at relatively high risk of imitation in richer countries, so that firms license such works primarily to affiliated parties (unless copyright protection and enforcement are sufficiently secure). According to the results, variations in any form of IPRs have neutral effects on affiliated *versus* unaffiliated licensing in less developed countries. Given that IPRs are comparatively weaker in these markets,

Table 6. **Intellectual property rights and the share of licensing fees from unaffiliated sources in total licensing fees**

	Dependent variable: Log (share)		
	All countries	GDP per capita > $18 000	GDP per capita < $18 000
	(1)	(2)	(3)
Constant	–4.493***	–3.759***	–2.215
	(0.635)	(1.072)	(1.32)
Log (Patent rights)	0.247	–0.54	0.389
	(0.221)	(0.54)	(0.303)
Log (Copyrights)	0.156	0.639**	–0.411
	(0.234)	(0.325)	(0.363)
Log (Trademark rights)	–0.040	–0.149	0.243
	(0.017)	(0.264)	(0.253)
Enforcement effectiveness	0.824***	0.637***	0.158
	(0.155)	(0.254)	(0.416)
Log (Firm R&D intensity)	–0.008	0.004	–0.058**
	(0.011)	(0.013)	(0.025)
Log (Firm sales)	0.169***	0.213***	–0.002
	(0.031)	(0.034)	(0.074)
Industry group fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Adjusted R-squared	0.10	0.08	0.11
Number of observations	2 936	2 120	816

Notes: The dependent variable, Share, denotes the ratio of royalty and licensing fees received by US parent firms to the total received by US parents (from both affiliated and unaffiliated sources). Standard errors are in parentheses. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

it may be that more substantial changes in IPRs are required to affect the share of unaffiliated licensing.

It is of interest to note that increased R&D intensity strongly favours affiliated licensing in less developed countries. The reason may be familiar. For technologies of higher R&D content, firms may be less willing to license to third parties, preferring either FDI (as discussed above) or licensing to *affiliated* parties. The cost of misappropriations is higher for technologies with greater R&D content, and thus firms are more likely to be safeguarding these assets through channels where they retain a degree of direct control. However, an increase in sales (or market size) strongly favours unaffiliated licensing in developed markets. An expansion in market size among developed economies may give firms the incentive to license to third parties. In some cases, firms may not be able to meet the increased demand via their own expansion and therefore may prefer to license in order to better exploit the market potential (thereby reaping profit indirectly via licensing fees and royalties).

Summing up the findings from the regression analysis, there is support for each of the three hypotheses laid out in the introduction to this section. Broadly speaking, IPR strength is found to influence international licensing receipts. The models yielded statistically significant coefficients for many of the IPRs variables, while admittedly explaining only a modest portion of the overall variation. IPR strength appears to be a significant influence on licensing receipts, but is not the dominant influence. Moreover, the extent of the influence of IPRs varied according to the type of intellectual property right and the effectiveness of IPR enforcement. In particular, in the case of patent rights and enforcement effectiveness, most specifications of the model found a significant positive relationship to licensing. The influence of IPR strength on international licensing was also found to vary – in some cases, widely – according to the sector and the nature of property to be licensed. IPR strength was generally found to influence the choice of channel for international technology transfer, albeit with some variation depending on the model specification (exceptions included a lack of statistical significance for any IPR variables in the case of licensing *versus* exports in developed countries and the case of licensing to unaffiliated *versus* affiliated parties in less developed countries).

Joint ventures and strategic alliances data

Another perspective on licensing activities at the firm level can be gleaned from an examination of data on international joint ventures and strategic alliances. The hypothesis is that the strengthening of intellectual property reforms would increase the number of international alliances (particularly those involving developing countries or emerging economies where IPRs were historically weak). Cross-border alliances would benefit from such a strengthening because of the improved ability to enforce contracts and because of reduced risks of imitation by third parties or defections by partners. These factors should impact on the profitability of alliances and the willingness of participants to share knowledge, license (or cross-license) proprietary technologies or symbols and names, and invest in joint projects.

This section focuses on international licensing transactions between firms in a developed country (*e.g.* US, Japan or European Union countries) and firms in less developed or emerging economies (*e.g.* Korea, Singapore, Brazil).[29] Information on such transactions was drawn from the *Joint Ventures and Strategic Alliances* database, which contains information on over 100 000 transactions conducted since the mid-1980s and covering both private and public sector parties.[30] For the present analysis, only those licensing transactions were selected where firms in a developed country licensed intellectual property to firms in a developing or emerging economy during the period from 1989 to 2002 (about 1 000 transactions). Licenses granted by a developing country firm to a developed country firm or to another developing country firm were excluded.[31] This selection permits a focus on the

Table 7. **Sample international licensing deals involving developed and developing country firms, 1989 to 2000**

	Participant firms (nations)	Licensing fees* (millions US$)	High-tech group**
1989	Daewoo Telecommunications (Korea)		
	Hitachi Ltd (Japan)	0.5	COMPUTER
1990	Jia Non Enterprise Co. Ltd (Chinese Taipei)		
	Ecogen Inc. (USA)	0.3	BIOTECHNOLOGY
1991	Energy Conversion Devices Inc. (United States)		
	Samsung Electronics Co. Ltd (Korea)	2.5	OTHER
1991	Akkumulatorgyár (Hungary)		
	Furukawa Battery Co. Ltd (Japan)	0.1	OTHER
1992	Intl Power Machines Corp (United States)		
	Allis Electric Co. Ltd (Chinese Taipei)	2.1	ELECTRONICS
1992	Aura Systems Inc. (United States)		
	Daewoo Electronics Co. Ltd (Korea)	1.5	ELECTRONICS
1993	Western India Group (India)		
	Interline Hydrocarbon Inc. (United States)	1	OTHER
1994	Saliva Diagnostic Systems Inc. (United States)		
	Orgenics Ltd (Israel)	0.2	BIOTECHNOLOGY
1995	Derma Sciences Inc. (United States)		
	PT Tempo Scan Pacific (Indonesia)	1.5	BIOTECHNOLOGY
1995	Daewoo Corp (Korea)		
	PBR Automotive (Australia)	10.8	OTHER
1995	Oracle Systems Corp (United States)		
	Tata Consultancy Services (India)	3	COMPUTER
1995	Ziran Electronics (Canada)		
	Gaozhou Dong Ling Electronics (China)	3.5	COMPUTER
1997	Hughes Corp (United States)		
	Nippon Denro Ispat Ltd (India)	11	COMMUNICATIONS
1998	Compositech Ltd (Chinese Taipei)		
	Fidelity Venture Capital Corp (United States)	1	ELECTRONICS
1998	Kia Motors Corp (Korea)		
	LucasVarity PLC (United States)	200	OTHER
2000	Chongqing Municipal Authority (China)		
	Phoenix Technology Corporation (Australia)	15	OTHER
2000	Nuance Communications Inc. (United States)		
	Skynet (Intl Grp) Hldgs Ltd (Hong Kong)	3.2	COMMUNICATIONS
2000	Horizon.com Ltd (United States)		
	EVCI Career Colleges Inc. (Singapore)	4	COMPUTER

Notes: * Licensing fees are in nominal US dollars and refer to initial fees. ** The categories defined as high-tech included biotechnology, computers, communications, electronics, and other (robotics, lasers, nuclear technology, propulsion systems, non-communication satellites, advanced materials, defence-related products, and advanced manufacturing).

impact of changes in patent regimes in developing or emerging economies on inward technology inflows via licensing agreements with developed countries.

Overall, there were 28 developing/emerging market economies in the sample that had firms which were licensees of firms in developed nations. Table 7 shows

some examples of licensing agreements between developed and developing/emerging economy firms, along with the licensing fees[32] involved and the high-tech classification of the alliance. The deals range in initial value from $300 000 to $200 million dollars. Unfortunately, less than 10% of the transactions report the initial licensing fee. Thus, the focus in the following analysis is on "counts" or numbers of licensing deals concerning intellectual property (rather than on the fees associated with the transactions).

Table 8 shows the top twenty country pairs in terms of numbers of licensing deals. Many of the transactions involve Asian economies. The US/Korea pair is the most frequently cited. There were 73 recorded deals over the 13-year period where US firms licensed technologies to Korean firms (particularly to firms like Samsung, Goldstar and Daewoo). In second place is the US/China pair, which produced 51 deals between US licensors and Chinese licensees; in third place is the US/Chinese Taipei pair, with 42 deals. The leading country pair not involving the US is the Japan/Korea pair with 18 deals, followed by Canada/China and Canada/Korea with 13 deals each.

A key issue of interest from these data is whether patent reform on the part of developing and emerging economies was associated with increased access to

Table 8. **Licensing alliances involving developing and emerging markets: top 20 country pairs, 1989-2002**

	Licensor nation	Licensee nation	Cross-border licensing deals between firms
1.	United States	Korea	73
2.	United States	China	51
3.	United States	Chinese Taipei	42
4.	United States	India	28
5.	United States	Singapore	26
6.	United States	Hong Kong	19
7.	Japan	Korea	18
8.	United States	Russia	15
9.	United States	Brazil	14
10.	United States	Mexico	14
11.	Canada	China	13
12.	Canada	Korea	13
13.	United States	Israel	11
14.	United States	Malaysia	10
15.	United States	Argentina	9
16.	Germany	Korea	7
17.	Japan	China	7
18.	United States	Indonesia	7
19.	United States	Thailand	7
20.	United Kingdom	China	6

Note: Each entry shows the number (not the value) of licensing deals between firms from the different country pairs.

foreign, developed nation technologies via licensing agreements. To analyse this, the 28 developing/emerging partner economies were sorted into three groups according to the extent of their patent system reforms during the sample period. A patent reform is considered *high* if the measured patent index increased by more than 20% in value over the sample period; *low* if it increased by less than 7%. All changes in-between are classified as *medium*. The cut-offs (7% and 20%) were chosen where there was a noticeable enough break and where the resulting group sizes could be roughly balanced. There were nine countries each in the high and low reform groups and ten in the medium reform group.

For each of these country groups, the number of licensing deals was considered for the period before and after the signing of the TRIPS Agreement in 1995. More specifically, let $x_{89\text{-}94}$ and $x_{97\text{-}02}$ denote the number of licensing deals a reform group's firms had with firms in developed nations during the 1989-1994 and 1997-2002 periods, respectively. Note that these two periods are of the same duration (namely five years). The reason for summing across years is that licensing deals can fluctuate from year to year, and the reason for eliminating the middle years 1995 and 1996 is to exclude the immediate transition years into TRIPS.[33] The analysis considers the association of change in patent index scores with changes in licensing transactions and does not explicitly measure causality.[34] The analysis focuses on the change in licensing deals between those two periods:

$$\Delta x = x_{97\text{-}02} - x_{89\text{-}94}.$$

Note that x is the aggregate volume of deals per patent reform group (*i.e.* aggregating across countries), and Δx the change in aggregate volume per group over time.

Table 9, Part A, shows the change in numbers of licensing transactions for the pooled sample (in the sense of pooling across licensor nations). Firms in developing and emerging economies that least strengthened their patent regimes experienced an overall reduction in licensing deals (by 2) during the period considered. In contrast, firms in developing and emerging economies that most strengthened their patent regimes experienced an overall increase of 28 deals over the same time period. Those firms in countries with a medium degree of patent reform gained two more licensing deals. Hence, there appears to be a positive correlation between changes in licensing deals and changes in patent regimes.

Part B of Table 9 breaks down the sample by licensor nation. Since the US is the dominant licensor nation, it was separated from the rest of the world. The data show that firms in countries with low degree of patent reforms had seven fewer deals with US firms over this period, while firms in countries with a high degree of patent reform experienced an increase in transaction of 13. The pattern is somewhat different between developing and emerging economies and other developed licensor nations. While firms in countries with the strongest patent

Table 9. **Relationship between patent reform and high-tech licensing deals**

Part A. Pooled sample

		Number of licensing deals		
		1989-94	1997-2002	Change:
Strengthening of patent regime	Low	55	53	–2
	Medium	24	26	2
	High	33	61	28

Part B. Breakdown by licensor:
i) US *sources*

		Number of licensing deals		
		1989-94	1997-2002	Change:
Strengthening of patent regime	Low	39	32	–7
	Medium	18	24	6
	High	27	40	13

ii) N*on*-US *sources*

		Number of licensing deals		
		1989-94	1997-2002	Change:
Strengthening of patent regime	Low	16	21	5
	Medium	6	2	–4
	High	6	21	15

N*otes*: 1) Each row in the table shows the levels and changes over time in the volume of licensing transactions between developing nation licensees and developed nation licensors, as experienced by the developing nations with the specified degree of patent reform. The change in the volume of transactions is for the developing nations in the reform group as a whole. 2) The strengthening of patent regime refers to the change in the index of patent rights of the recipient (licensee) nation. The strengthening of patent rights is considered low if the index grew by less than 7% over the period 1989-2002, and medium if the index grew by more than 7% but by less than 20% over the same period. 3) Only "high-tech" licensing transactions are included (see the notes to Table 7 for the list of high-tech industries covered).

reform gained more deals than those in countries with the lowest degree of patent reform, firms in countries with a medium degree of patent reform actually experienced a modest decline in transactions.[35]

The overall perspective is that the hypothesis is valid. Stronger patent rights generally appear to be associated with increased technology inflows via licensing transactions (in terms of counts of transactions). While there is an exceptional case where the medium-reform nations experienced a decline in such transactions while low-reform nations increased the flow of transactions, it is never the case that low reform nations dominate high reform nations in attracting deals. Moreover, there is no evidence from these flows that stronger patent systems inhibit

technological inflows (*e.g.* as might happen in high-reform countries if IPR strength increased to permit market power effects to dominate).

CONCLUSION

The empirical analysis presented in this study provides general support for the proposition that the strengthening of IPRs – as measured by the selected indicators – has had a net positive effect on international licensing of technologies between unaffiliated parties during the 1990s. The empirical evidence is based on licensing activities of US multinationals as well as on international licensing alliances between firms in developing/emerging and developed nations. This section highlights the main findings and discusses some of the key development related issues.

US multinational firms account for most of the world's international licensing activities. The bulk of their licensing income is derived from developed countries. About 70% of their income is derived from affiliated firms. Furthermore, most of the US royalties and licensing fees come from licensing industrial processes, prerecorded performances, and software. The US is also the leading participant licensor nation in global licensing alliances. Among the developing/emerging market economies, the leading participant licensee economies are Asian (Korea, Chinese Taipei, Singapore, Hong Kong, and China). Securing licensing contracts with developed country partners (such as those in the US, UK and Japan) appears to be an important strategy in the developmental catch up process.

The regression analyses indicate that, controlling for other factors, patent rights are a statistically significant determinant of licensing receipts while trademark and copyright protection are weak influences on licensing. Stronger patents and effective enforcement increase the ability of agents to appropriate the returns to their innovation and thereby increase the value of the intangible asset to be licensed. This generally leads to a positive association between IPR strength and licensing income, as confirmed by the firm-level data. Copyrights are also seen to be a positive influence on licensing in developed country markets, but copyright and trademark rights are seen to be a comparatively negative influence on licensing into less developed country markets. The market power effect of copyright and trademark protection seems to overwhelm the economic returns effect.

Most sources of licensing income (*e.g.* industrial processes, software, prerecorded performances) respond positively to patent protection. Enforcement effectiveness is important to each of the sources of licensing income (except for trademark fees). Copyrights are important for the licensing of books and related materials. Trademark rights *per se*, however, have an insignificant impact on the licensing of trademarks. In this instance, the economic returns and monopoly power effects of trademark protection may have offsetting effects. The effects of

IPRs on licensing vary by industry group as well. Patent rights are found to be influential in the services, electrical and electronic, and transportation industries, while not influential in the machinery and wholesale trade industries. Enforcement effectiveness is especially important in the chemicals, electrical and electronic, finance, and services industries.

The growth in international licensing alliances between developed nation licensor firms and developing nation licensee firms also seems to correlate positively with patent reform. Though the late 1990s were a period of decline in global licensing deals via joint ventures and strategic alliances, overall those developing nations that reformed their patent regimes the most enjoyed the greatest increases in licensing agreements with developed nations (or had the lowest decreases in licensing deals). This was generally the case whether the developed partner nation was the US or another country.

The general implication of this study for developing economies is that IPR reform should be one part of a general strategy for promoting economic development in combination with other complementary policy reforms. Patent rights and effective enforcement, in particular, can be instrumental in enabling firms in developing nations to access and exploit technologies and know-how through licensing agreements with parties in developed nations. Overall, the analysis presented here indicates that where developing countries have moved to address weaknesses in these areas in recent years, they have tended to experience enhanced access to technology through licensing.

Notes

1. A full text of the TRIPS agreement is available on the WTO web site: *www.wto.org*. Note: the text of the TRIPS Agreement refers at various points to "technology transfer", "transfer of technology" and "transfer and dissemination of technology", but does not define these terms.
2. See UNCTAD (2003), p. 129.
3. See Appendix 2 for the sources of data.
4. The section entitled "Empirical analysis" provides a discussion of the specific methodology employed.
5. This amount ($104.8 billion) refers to data for 2001 from 17 OECD member countries concerning receipts from the sale and use of patents, licenses, trademarks, designs, know-how and closely related technical services including technical assistance) and for industrial research and development carried out abroad, among other elements. For details, see OECD (2005), pp. 53 and 71.
6. Maskus (2004) also identifies several non-market channels for international technology transfer including imitation, departure of employees, publicly-available test and patent application data, and temporary migration.
7. If the royalty rate is variable, it could, for example, start at a low rate initially and then rise to a higher rate later on.
8. See Appendix B of Ehrbar (1993) for a sample licensing agreement.
9. For example, end-user licenses are prevalent in software agreements.
10. For example, anyone except the authorised dealer (*e.g.* a licensee) may be prohibited from selling products in a particular geographic area.
11. Reforms in intellectual property regimes may make one form of technology transfer more attractive than another and thus induce substitutions among the different modes of transfer. Stronger IPRs may increase or decrease licensing because stronger IPRs may reduce or increase the other kinds of technology transfer activities. Nicholson (2003a), for example, shows that when wages in destination or host countries are relatively low, a foreign multinational firm is likely to choose production abroad (*i.e.* FDI) over exporting as IPRs strengthen. Furthermore, if the level of IPRs is not too strong, FDI dominates licensing. That is, the risk that a competitor will imitate the affiliate producer is likely to be less than the risk that a potential licensee will defect. However, as IPRs strengthen further and risks of defection are reduced further, firms may switch to licensing. The assessment of such substitution effects among modes of technology transfer is beyond the scope of the present paper, but remains an area in need of expanded empirical analysis.

12. For example, using data from the IMF *Balance of Payments Yearbook* (item 266, receipts of royalties and licensing fees, annual), it can be seen that between 1980 and 2003, the US share of overall receipts varied between 54% and 67% in each year during this period and amounted to 60% in an average year.

13. The *Chemintell* database is marketed by Thomson Publishing, but is no longer updated (since 1999).

14. Indeed, a recent survey of the biotechnology industry conducted by the Swiss Federal Institute for Intellectual Property confirms that, for process innovations, Swiss biotech firms prefer trade secrecy to patent protection (Thumm, 2003, pp. 29-33). From the perspective of these enterprises, patent applications have the drawback that technical information must be disclosed. This is a disadvantage for biotechnological process innovations that are relatively easy to circumvent. Firms also perceive process innovations to be harder to enforce than product innovations, so that when firms have less control over their process inventions, they would prefer to keep them secret. Furthermore, patent applications are costly. Firms must be selective in their patenting decisions in order to keep costs down (particularly if the firms are small to medium-sized companies).

15. The *Joint Ventures and Strategic Alliances* database is owned and distributed by *Thomson Financial Inc.* A more comprehensive use of the database can be found in Vonortas and Kim (2004). It is also used in the empirical section of this paper.

16. The empirical analysis in the present paper does not, however, fully integrate the different modes of technology transfer (namely: merchandise trade, FDI, joint ventures, and licensing), which exceeds the scope of this paper. The paper does explore licensing relative to FDI and exports, and a previous study (Park and Lippoldt, 2003) examined trade and FDI. A full integration of the modes of technology transfer is deferred to future research.

17. Detailed explanatory notes are available in Park and Lippoldt (2004), Appendix A [available on-line at: *www.oecd.org/trade*, under "Working Papers" (No.10)].

18. See the annual USTR reports entitled *National Trade Estimate: Report on Foreign Trade Barriers*, which are available on-line at: *www.ustr.gov*/*Document_Library*/*Reports_Publications*/*Section_Index.html*.

19. Markusen (2001) and Yang and Maskus (2001b) provide some useful insights in this regard.

20. The data employed here are from the benchmark survey years: 1989, 1994, and 1999. The 1989 values are used to correspond with the licensing data in 1992 (earliest year in BE-10), the 1994 values for licensing in 1995, and 1999 values for licensing in 1999. Data after 1999 in BE-10 are still preliminary.

21. The authors would like to thank C. Fritz Foley, Harvard Business School, for providing a concordance mapping between the two BEA surveys.

22. Data on source of fees are also available according to geographic origin (*e.g.* for Europe or Japan). However, such data may reveal information about the earnings of certain firms (since a few of them may operate in particular countries or regions). Thus, for confidentiality reasons, the sample statistics by region cannot be provided.

23. The coefficient of variation measures the degree of variation in the data (*i.e.* the standard deviation as a percentage of the mean). Given that the different indexes are measured on different scales, the coefficient of variation is useful because it is unit-free

(*i.e.* does not depend on the scale of measurement). In terms of the coefficient of variation, the indexes of patent rights, copyrights, and trademark rights exhibit similar degrees of variability (around 22 to 25%). The enforcement effectiveness rating exhibits a much greater degree of volatility across countries and over time (with a coefficient of variation of 67%).

24. A regression of the residuals was run on past variables and the test statistic NR2 was well below the critical value of chi-square statistic (for 1 degree of freedom).

25. The results should be interpreted with caution since there may be classification issues in the database used here. Firms may be engaged in multiple industrial activities or have divisions which correspond to different industrial activities (*e.g.* one division may be in manufacturing and another division in wholesale trade). While the present regression will capture the sum effect for firms across industry groups, there may be an unknown degree of error in the results for particular industrial activities or classes of activities (*e.g.* due to variation in the survey respondents' assessment of this issue).

26. The Services group includes such areas as the licensing of professional and technical services (*e.g.* engineering services), consulting, and computer systems designs, among others.

27. Firms in the wholesale trade industrial group may be engaged in multiple activities (*e.g.* manufacturing and distribution). For example, a number of high-technology firms report the receipt of royalties and licensing fees related to their wholesale trade operations (rather than as fees related to their manufacturing activities, possibly due to the fact that their licensees are engaged in marketing and distributing their high-tech products).

28. As a background exercise for this paper, the ratio of FDI to exports was examined in relation to IPR strength. The results indicate that IPRs have a weak or neutral affect on the FDI-export ratio. However, increased sales and R&D intensity tend to favour FDI over exports.

29. Note that the definitions of developed country and less developed/emerging country differ between this analysis and the previous. Here, developed countries are categorised as OECD members as of 1989 (except Turkey) and the less developed/emerging countries are those that were not OECD members at that time.

30. The database contains various types of transactions (*e.g.* licensing, research, manufacturing or marketing agreements).

31. The vast majority of international technology alliances are within or among developed nations.

32. The licensing fees refer to the initial flat fees or costs of the deal. The stream of future income or payments associated with royalties or profit sharing arrangements is not included in this initial estimate.

33. Vonortas and Kim (2004) find that the number of licensing deals peaked worldwide around the mid-1990s. The number of world licensing deals appears to follow an inverted-V path during the 1990s.

34. For example, some licensing agreements might have been entered into which were negotiated prior to intellectual property reforms (rather than as a result of any influences from TRIPS).

35. One possible interpretation of the decline in licensing transactions for medium-reform economies is that non-US licensor nations found mild patent reform to be more attractive than medium for purposes of gaining entry into local markets, but found strong

patent reform to be more attractive for protecting their more valuable assets. Another explanation is that the analysis here does not control for other factors (as regression analyses do). The medium reform countries may have been strengthening their patent systems, but their market sizes and other relevant policies may not have been as attractive. There may also be political and geographic ties that non-US firms have had with low patent reform nations which gave the latter some advantages (in attracting licensing deals) over the medium reform nations.

Appendix 1

Intellectual Property Rights Indexes – Summary of Criteria and Measurement

This appendix summarises the components of each IPR index employed in the present study.

I. Patent Rights Index

1)	Membership in International Treaties	Signatory	Not signatory
	• Paris Convention and Revisions		0
	• Patent Cooperation Treaty		0
	• Protection of new varieties (UPOV)		0
2)	Coverage	Available	Not available
	• Patentability of pharmaceuticals	1/7	0
	• Patentability of chemicals	1/7	0
	• Patentability of food	1/7	0
	• Patentability of plant and animal varieties	1/7	0
	• Patentability of surgical products	1/7	0
	• Patentability of micro organisms	1/7	0
	• Patentability of utility models	1/7	0
3)	Restrictions on patent rights	Does not exist	Exists
	• "Working" requirements		0
	• Compulsory licensing		0
	• Revocation of patents		0
4)	Enforcement	Available	Not available
	• Preliminary injunctions		0
	• Contributory infringement		0
	• Burden-of-proof reversal		0
5)	Duration of Protection	Full	Partial
		1	$0 < f < 1$

where f is the duration of protection as a *fraction* of the full potential duration. Full duration is either 20 years from the date of application or 17 years from the date of grant (for grant-based patent systems).

Overall score for Patent Rights Index: sum of points under (1) – (5).

II. Copyrights Index

1)	Coverage	Score:	
	a) General (Literary and artistic works)	Duration of protection as % of 70 years	
	b) Performances	Duration of protection as % of 70 years	
	c) Sound recordings	Duration of protection as % of 70 years	
	d) Films	Duration of protection as % of 70 years	
	e) Broadcasts	Duration of protection as % of 70 years	
	f) Droite de Suite (Shares in resale)	Share as % of max (top censored at 5%)	
	g) Computer Programmes	1 if available, zero otherwise	
	Sub-Score (*out of* 1, *average of a – g*)		
2)	Usage	Cumulative score:	
	Extent of Private Use:		
	i. Full use or no mention of private use	0	
	or *ii.* Private study or fair dealing	0.33	
	or *iii.* Use but with tax on devices or media	0.66	
	or *iv.* No private use allowed	1	
3)	Enforcement	Available	Otherwise
	a) Criminal sanctions	1	0
	b) Preliminary injunctions	1	0
	c) Seizure and destruction	1	0
	d) Anti-circumvention provision	1	0
	Sub-Score (*out of* 1, *average of a – d*)		
4)	International Treaties	Member	Otherwise
	a) Berne Convention 1886	1	0
	b) Universal Copyright Convention 1952	1	0
	c) Rome Convention 1961	1	0
	d) Geneva Convention 1971	1	0
	e) Universal Copyright Convention 1971	1	0
	f) Brussels Convention 1974	1	0
	Sub-score (*out of* 1, *average of a – f*)		

Overall score for Copyright Index: average of (1) – (4)

III. Trademark Rights Index

1. Coverage	Available	Otherwise
a) Service marks	1	0
b) Certification marks	1	0
c) Collective marks	1	0
d) Colours	1	0
e) Shapes (3-dimensional, packaging, etc.)	1	0
f) Well-known marks	1	0

Sub-score (*out of* 1, *average of a – f*)

2) Procedures	Available	Otherwise
a)Prohibition of marks in *bona fide* use	1	0
b) Licensing restrictions	1	0
c) Use or lose provisions in law	1	0
d) International exhibition protection	1	0
e) Criminal penalties	1	0
f) Local lawyer requirements	1	0
g) Marks can become generic	1 (if law)	0
h) Transferability of mark without business	1 (if permitted)	0
i) Priority goes to first to use a mark	1 (if 1st-to-use)	0 (1st-to-file)

Sub-score (*out of* 1, *average of a – i*)

3) International Treaties	Member	Otherwise
a) Paris Convention 1883	1	0
b) Madrid Agreement 1891	1	0
c) Nice Agreement 1957	1	0
d) Lisbon Agreement 1958	1	0
e) Vienna Agreement 1973	1	0
f) Trademark Law Treaty 1994	1	0

Sub-Score (*out of* 1, *average of a – f*)

Overall score for Trademark Rights Index: average of (1) – (3)

IV. Enforcement Effectiveness

This index is a qualitative measure of the effectiveness of IPR enforcement in practice. It is based on reports filed with the US Trade Representative documenting experience with enforcement in countries outside the United States. The reports describe complaints, if any, about enforcement procedures and/or about the failure of the proper authorities to carry out the laws on the books. The failure to enforce may be due to some inability on the part of the authorities to carry out those laws or due to a conscious policy choice. The absence of substantive laws (other than enforcement provisions) is already incorporated in the previous indexes, and thus complaints about the lack of substantive laws are not incorporated here.

Enforcement effectiveness = 0 if enforcement measures are not available or inadequate to deter abuse;

½ if enforcement measures are available but not effectively carried out (*e.g.* due to lag in policy implementation or resource barriers);

1 otherwise.

Appendix 2

Data Sources

1. Intellectual Property Rights

- Patent Rights Index: Ginarte and Park (1997), Park and Wagh (2002).
- Copyrights and Trademark Rights Indexes: Reynolds (2003).
- Enforcement Effectiveness Index: Derived from USTR National Trade Estimate: Report on Foreign Trade Barriers, various issues.

2. Licensing and Related Data

- Firm level: Bureau of Economic Analysis, US Department of Commerce, International Investment Division, Cross Border Trade Database (BE-93 Survey), Annual Survey of Royalties, Licensing Fees, and Other Receipts and Payments for Intangible Rights between US and Unaffiliated Foreign Persons.
- Firm level: Bureau of Economics Analysis, US Department of Commerce, International Investment Division, US Direct Investment Position and Related Balance of Payments Flows (BE-10 Survey).
- Licensing deals: Securities Data Corporation (SDC) Platinum Version 2.3: Joint Ventures and Strategic Alliances Database, Thomson Financial Inc. (by subscription).

3. Other

- GDP per capita and GDP deflator (1995 = 100): World Bank Development Indicators 2001, CD-ROM.
- Tariff Rate: Gwartney and Lawson (2001).
- Corruption Perceptions Index: Transparency International (*www.transparency.org*).
- Country Risk: International Country Risk Guide (*www.countrydata.com*).

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