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International Licensing and the Strengthening of Intellectual Property Rights in Developing Countries

Walter G. Park

Douglas C. Lippoldt

OECD

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

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By Walter Park and Douglas Lippoldt

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ABSTRACT

This study presents an empirical analysis of the extent to which stronger intellectual property rights promote international technology transfer through licensing activities. The analysis focuses on licensing activities of U.S. multinationals as well as on international licensing alliances between firms in developing and developed nations. Both aggregate level data and firm level data are examined. The study provides general support for the proposition that the strengthening of intellectual property rights - as measured by selected indicators - has had a net positive effect on technology transfer via licensing during the 1990s. 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. In particular, patent rights and effective enforcement 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.

Keywords: intellectual property rights, licensing, economic development

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

Executive Summary

This study presents an empirical analysis of the extent to which stronger intellectual property rights (IPRs) promote international technology transfer through licensing activities. Reform of the global IPR framework over the last decade has been at least partly motivated by the premise that developing economies will benefit from increased technological inflows as a consequence. However, the theoretical literature does not provide unambiguous predictions about this premise and the empirical evidence is scant, particularly at the firm or enterprise level. Consequently, a goal of this study is to help shed light on the actual experience of developing countries.

Licensing transactions are a means by which technology can be transferred from one party to another. Although the details of individual licensing agreements vary, they can include terms referring to technical support, training and other assistance to be provided by the licensor to the licensee. They can enable the licensee to acquire the right to use new technology (subject to specific conditions) without having to undertake costly research and development (R&D) and to capitalise on the licensor's reputation and expertise. In exchange, the licensor derives fees and royalties, can capitalise on the licensee's local reputation and knowledge, and may obtain reciprocal licenses to any technical improvements made by the licensee (*e.g.* grant-backs). Thus, licensing transactions can provide for technology transfer to developing countries, while yielding mutual benefits to both parties.

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, copyrights, 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).

The empirical analysis uses two approaches. The first approach employs regression analysis to consider the relationship between licensing receipts of US enterprises (and their foreign affiliates) and the strength of intellectual property rights, controlling for other factors. The regression analysis covers selected years during the 1990s and is conducted first using aggregate data and then using firm-level data. The second analytical approach draws on an international data set including licensing transactions and covering joint ventures and strategic alliances of both US and non-US licensor firms. It considers the relationship over time (for selected periods, 1989 to 2002) between changes in the host-country patent regime and changes in the number of intellectual property licensing transactions between developed and developing countries.

The study finds general support for the proposition that the strengthening of intellectual property rights - as measured by the indicators employed in the study - has had a net positive effect on technology transfer via licensing. There was some variation in this effect across the dimensions of IPRs considered:

- The empirical analysis finds that controlling for other factors (*e.g.* gross productivity, corruption, tariff rates, and country risk), patent rights and effective enforcement of statutes strongly influence licensing. Stronger patent rights and more effective enforcement enhance the degree of appropriability of the returns to innovation and hence increase the value of the intangible asset to

be licensed. Thus, the "receipts" of licensing fees and royalties are found to vary positively with stronger patent rights and more effective enforcement.

- Stronger patent rights are found to increase licensing relative to foreign direct investment (FDI) in developed regions and at the same time to increase FDI relative to licensing in developing regions. The reason may be that a critical level of patent protection is needed before firms have an incentive to relinquish direct control and engage in licensing (as opposed to FDI). The less developed economies tend to have weaker initial IPRs when they launch reforms. Therefore, even after the first stages of IPR reform they may not yet extend sufficient IPR protection so as to encourage licensing.

- Copyrights and trademark rights can also influence technology transfer, but exercise comparatively weak influences once patent protection is controlled for. This may be due to the fact that most license fees are derived from licensing industrial processes. On the other hand, trademark protection can potentially have a negative impact on licensing by increasing firms' abilities to exercise market power.

- 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. Copyrights are important for the licensing of books, trademarks, franchising, and broadcasting. Enforcement effectiveness is especially important in the chemicals, electrical and electronic, and services industries.

- Patent reform is found to contribute positively to international licensing alliances between developed nation licensor firms and developing nation licensee firms. 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 witnessed the smallest declines in licensing deals).

- The correlation between international licensing alliances and patent reforms varies by high-technology group. In the biotech and electronics groups, stronger patent reform has generally led to greater increases (or fewer decreases) in licensing deals. However, in the computer group, the "medium" reformers attracted the greatest increase in deals, whereas in the communications group, both the high and low reformers had the most gains in deals. Modest patent reform may be of some benefit to licensing activities in technological fields, such as computers and communications, where the innovation process is cumulative and sequential. Modest patent strength may better enable opportunities for knowledge diffusion and sharing of common pool resources (such as internet tools and data networks).

The general policy implication of this study for developing economies is that IPR reform should be part of a general strategy for promoting economic development (along with other complementary policy reforms). Patent rights and effective enforcement are instrumental in enabling developing nation firms to access and exploit technologies and know-how through licensing agreements with developed nation parties. Future analyses should explore the impacts of specific types of licensing agreements, arrangements, and technologies on the development process.

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

1. Introduction

1. 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 IPRs in developing countries could encourage rights-holders to be less reticent about the transfer of technology 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 intellectual property rights (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).

2. 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, empirical evidence on the impacts of reform is scarce, particularly evidence at the firm or enterprise level.

3. This paper responds to this situation by making an empirical contribution to the debate. The aim, in particular, is to consider the relationship between variation in IPR strength during the 1990s and international licensing activity, taking into account the implications for the associated process of technology transfer. The empirical analysis uses two approaches. The first approach employs regression analysis to consider the relationship between licensing receipts of US enterprises (and their foreign affiliates) and the strength of intellectual property rights, controlling for other factors. The regression analysis covers selected years during the 1990s and is conducted first using aggregate data and then using

[1] A full text of the agreement is available on the WTO web site: http://www.wto.org. NB, 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.

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.

4. 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, copyrights, 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).

5. Three different data sets are used to investigate the relationship of IPR strength (as measured by the indices) to international licensing.[3] The first comprises *aggregate national data* on licensing receipts of foreign affiliates of U.S. multinationals; that is, for each country, licensing receipts of U.S. foreign affiliates are aggregated across firms and industries operating in that country to arrive at a national figure for that country. Using regression analysis, the national licensing data are then related to host country IPRs and other control variables.[4] The second data set comprises *firm-level data* on U.S. licensing receipts from the rest of the world. The third 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*.

6. The outline of this paper is as follows: section 2 briefly describes the nature of licensing agreements. Section 3 reviews the existing empirical work on the relationship between licensing and IPRs. Section 4 presents the quantitative measures of IPR strength that are employed in this paper. Section 5 discusses the empirical findings, which are presented in three sub-sections corresponding to each of the datasets mentioned above. Section 6 summarises the main findings and provides some concluding thoughts.

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 - 1995 include:

-- The Berne Convention (concerning copyrights) experienced 36 new ratifications (as of 3 November 2004, the total number of ratifications was 157);

-- The Paris Convention (concerning patents) experienced 36 new ratifications (as of 24 September 2004, the total number of ratifications was 168).

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

[3] See Appendix B for the sources of data.

[4] See Appendix C for a brief discussion of the methodology.

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

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 indices employed in the present paper to assess the strength of IPRs in developing countries (see table below). Each of these indices 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.

Recent OECD research [Park and Lippoldt (2003)] indicates a tendency for favourable initial results in developing countries from this change; increased IPR stringency yielded gains in FDI 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

Year	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

Note: See Appendix A for an overview of the composition of these indices.

2. Licensing Agreements

7. Licensing is one mechanism for transferring technology from one party to another. As a useful working definition, licensing arrangements seen to be 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."[5] 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.[6] Compensation can also be "in kind," such as when the licensee provides to the licensor a share of the goods produced. (The statistical treatment of royalty and license fees is discussed in Box 2.)

8. The license agreement is a commercial contract between the licensor and licensee. While agreements vary from contract to contract, they contain several key elements.[7] 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 intellectual property rights; 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)[8] to a broad license covering manufacturing and distribution.

5 From Gutterman (1995), p. 173.

6 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.

7 See Appendix B of Ehrbar (1993) for a sample licensing agreement.

8 For example, end-user licenses are prevalent in software agreements.

9. 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.[9] 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).

10. 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 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.

11. 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 intellectual property rights.

Box 2. International licensing – a services trade issue

With respect to international transactions, the current, recommended statistical treatment for international licensing was laid out in the 5th edition of the IMF's Balance of Payments Manual (1993). In that framework, royalties and license fees are defined to include "the exchange of payments [imports] and receipts [exports] between residents and nonresidents for the authorised use of intangible, nonproduced, nonfinancial assets and proprietary rights (such as patents, copyrights, trademarks, industrial processes, franchises, etc.) and with the use through licensing agreements, of produced originals or prototypes (such as manuscripts and films)."

In the balance of payment statistics (and in accordance with the treatment of similar items under the system of national accounts), royalties and license fees fall under the services section of the current account. The 5th edition of the IMF's manual shifted the classification of royalties and license fees from "income from assets" to "services". In part, this reclassification of royalties and license fees was motivated in recognition of the increasing importance of these types of international transactions and in order to "facilitate international negotiations concerning such issues pertaining to *services*."

The international statistical framework further distinguishes between the *use* of assets such as intellectual property and the *purchase or sale* of such assets. Whereas royalties and license fees concern use and fall under the current account trade in services heading, the acquisition or disposal of nonproduced, intangible assets (such as patents, copyrights, trademarks, franchises etc) falls under the capital account.

Source: IMF (1993), Balance of Payments Manual, 5th edition, International Monetary Fund, Washington, DC.

3. Literature Review

12. The theoretical effects of changes in intellectual property protection on licensing tend to be ambiguous, depending on the various modelling assumptions and conditions. It is in this context that empirical work plays, and will continue to play, a critical role in the literature. Potentially, stronger IPRs

[9] For example, anyone except the authorised dealer (*e.g.* a licensee) may be prohibited from selling products in a particular geographic area.

can have both positive and negative effects on licensing. Yang and Maskus (2001) 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.

13. 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 (as a consequence of the increased monopoly protection rights-holders gain over their existing intangible 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. To the extent that stronger IPRs may slow down the pace of innovation, there would be fewer new technologies available for licensing. This scenario would indicate some potential for stronger intellectual property rights 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*.

14. In theory and practice, licensing must also be considered in relation to alternative modes of technology transfer, such as exports, foreign direct investment (FDI) and joint ventures. 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 (2003*a*), 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.

15. In practice, there is not likely to be a smooth transition from exporting to FDI to licensing by firms as IPRs strengthen. Too many complex factors are at play and need to be held constant. Indeed, some companies (particularly small ones) use licensing as a means to test a market before engaging in FDI, or resort to licensing because they have difficulty penetrating a market on their own, via exports or FDI. Licensing can involve relatively minimal commitment and make it easier for firms to enter and exit a market, whereas other means of entry may be less flexible. For example, export sales may face tariff and non-tariff barriers; FDI can be costly to set up and may face restrictions (such as on foreign ownership). Furthermore, in environments where IPR regimes are weak, licensing may be the optimal "defensive" solution. By giving local firms a share in the rents, the licensors create local vested interests in protecting proprietary technologies. Thus, historically (in the pre-TRIPS era), some observers have noticed that many U.S. and European companies have turned to licensing in Asia and Latin America, where piracy rates are high, as a safeguard against infringement.[10] On the other hand, Maskus *et al.* (2004) more recently find that in China weaker IPRs would discourage licensing because of increased contracting costs and legal uncertainty. In view of the foregoing considerations, it is clear that modelling the choices among alternative modes of technology transfer in a unified framework is a worthy, but complex task. The choices may not follow a very stable or deterministic set of decision rules.

16. Turning to the empirical literature, the limited number of studies to-date have also produced some mixed findings about the impact of IPRs on international licensing. While most of the reviewed studies

[10] See, for example, Ehrbar (1993), p. xxii.

find qualified support for the argument that 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 results of these empirical studies. At the same time, most of the studies to-date employ U.S.-based data where the licensors are U.S. firms. This is the case because data on U.S. multinationals are quite comprehensive and readily available. It is also the case that U.S. multinationals account for the bulk of global multinational firms. Indeed in mixed samples of U.S. and non-U.S. firms, the U.S. firms typically account for a significant share of the sample (about half or more).

17. One of the earliest studies drawing a connection between patent protection and licensing was authored by Contractor (1984). Using cross-sectional data for either 1977 or 1980, the study tries to explain the determinants of the ratio of U.S. receipts of unaffiliated royalties and licensing fees to various measures of direct investment activity. The study finds that the patent intensity of a nation (defined as patents in force) attracts licensing (and thus technology transfers).[11] 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 U.S. 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. U.S. 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. Smith (2001), furthermore, 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. Smith (2001)'s empirical analysis is based on cross-sectional data on U.S. multinationals' technology transfer activities in 50 countries. (The data are from a 1989 benchmark survey and cover aggregate manufacturing; that is, the data are not disaggregated by industry).

18. Yang and Maskus (2001) extend the analysis of U.S. foreign licensing to a panel data set covering three time periods (1985, 1990, and 1995) and 23 partner countries, of which approximately 10 are developing or emerging market economies (including Korea, Singapore, Hong Kong, Brazil, Mexico, Venezuela, Philippines, Indonesia, South Africa and Israel). Due perhaps to the small sample size, no separate statistical analysis is conducted for developed and developing countries. The study finds that patent laws have positive effects on: (a) receipts of royalties and licensing fees from unaffiliated sources, (b) receipts of unaffiliated fees generated from the licensing of industrial processes, and (c) receipts of fees from unaffiliated sources relative to exports. In contrast, the study finds that patent laws have either a significant negative effect or insignificant influence on receipts of fees from 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.

19. Whereas some studies focus on data concerning the value of licensing transactions, Yang and Maskus (2001) point out that with value data it is not possible to discern whether the strengthening of IPRs

[11] However, Contractor (1984) uses patent data from the World Intellectual Property Office (WIPO) *Industrial Property Statistics*, which imperfectly capture patents in force. WIPO reports flow data (*e.g.* number of patent applications and number of patents granted per year), but not the stock. Whereas "patents in force" is normally a stock concept, defined in terms of those patents granted to date whose patent rights have not yet expired.

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.

20. Nicholson (2003*b*) focuses the investigation on count data rather than value data. The dependent variable of interest is the number of U.S. firms that received licensing or royalty fees from unaffiliated sources.[12] The empirical analysis here is cross-sectional (for 1995) and pools together 49 destination countries and 82 industries. The author does not analyze the effects of IPRs separately by industry, but is able to report that industries most oriented towards licensing are publishing and high-technology manufacturing and chemicals sectors. The industry least oriented is wholesale. 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.

21. The foregoing studies by Contractor (1984), Smith (2001), Yang and Maskus (2001), and Nicholson (2003*b*), use data from the U.S. Bureau of Economic Analysis (BEA) based on industry or national-level aggregations of the dataset. Branstetter *et al.* (2002) present a study based on firm-level analysis of the effects of IPRs on international licensing using micro-data from the BEA. This study is based on a panel of four survey benchmark years (1982, 1989, 1994 and 1999). A key finding is that IPRs stimulate U.S. foreign licensing to affiliated parties but not to unaffiliated parties. This contrasts sharply with findings in the previous studies (as well as with findings in this paper that are also based on BEA micro-data). One factor that may explain the contrast with previous studies is that the analysis in Branstetter *et al.* (2002) depends on a sample of just twelve developing countries (*i.e.* countries where most of the transactions are with affiliates). As there is much more variation in the affiliated licensing data than in the unaffiliated, it may be that their measure of IPRs was better able to capture the effects on licensing to affiliates than non-affiliates.[13]

22. Fosfuri (2003) is another study that 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.[14] 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 (*i.e.* time-averaged data, per period). While the data are at the firm level, the author aggregates across firms to arrive at national level figures. Hence, the sample size is 300 (= 75 countries x 4 periods). The study finds that country risk significantly explains 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. 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 intellectual property rights (particularly enforcement), nor the importance of patent rights to product innovations.

[12] Another way to study quantity data is to study directly the quantity of licensing deals and contracts. This paper later explores such an approach using a dataset on joint ventures and strategic alliances (see Empirical Section). The Anand and Khanna (2000) study reviewed below also examines this particular dataset (or older version thereof).

[13] The study also uses the "dummy variable" approach to measuring intellectual property reforms. The dummy variable assigns a value of one if a reform has taken place and zero otherwise. This approach does not incorporate the various features (and nuances) of a legal system and does not distinguish between patent reforms, trademark reforms, and so forth. Moreover, it does not distinguish between a major reform and a minor one, nor allow for the fact that reform is an ongoing process and not a one-shot affair.

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

23. Indeed, a recent survey of the biotechnology industry conducted by the Swiss Federal Institute for Intellectual Property confirms that, for process innovations, biotech firms prefer trade secrecy to patent protection.[15] 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). Thus, firms again prefer secrecy if they deem the commercial exploitation of their inventions to be too small relative to the costs of procuring patent rights. The study provides some further qualifying comments concerning the secrecy vs. patent rights issue:

> "*Patents, however, cannot be omitted in the intellectual property strategy of biotechnological entities because only patents provide a legally binding form of appropriation. One main justification of a patent system is to disseminate knowledge through disclosure. Only patents can protect the intellectual property and at the same time make the intellectual property available for broader public use through means of public disclosure. Secrecy, as an alternative to patents, could decrease public welfare by reducing the flow of ideas among firms, thus reducing the overall rate of innovation. Consequently, from a policy point of view, patents are more desirable than secrecy and other alternative protection measures." [Thumm (2003), p. 66]*

24. Finally, Anand and Khanna (2000) explore how intellectual property rights may help explain patterns in international licensing and in the structure of contracts. The study employs data on international licensing contracts from the *Joint Ventures and Strategic Alliances* database of the Securities Data Company (SDC).[16] The authors construct a sample of all licensing contracts involving at least one U.S. partner over the period 1990-1993. Approximately 1400 deals are in the sample. A key finding in the study 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 characteristics of products. For pharmaceutical and chemical products, it is relatively easy to specify the contents and boundaries of knowledge. This makes for well-defined patent rights. For semiconductor products (such as the circuit layout) where knowledge boundaries are less well specified, patent protection ineffectively protects against imitation.[17] The authors argue that these product characteristics may also explain observed contracting behaviour. Licensing contracts in the chemicals industry can more easily specify limits on use as compared to contracts in the electronics and computing industries. This would explain why exclusive contracting is more prevalent in the chemicals sector while cross-licensing is more prevalent (and arms-length contracting less prevalent) in the electronics and computing industries.

25. The present paper extends previous work by integrating the various approaches to empirically analyzing the effect of intellectual property protection on international licensing. The paper examines aggregated data as well as firm level data, U.S. and non-U.S. licensor information, value and quantity of licensing contracts, and affiliated and unaffiliated licensing transactions. The paper also looks at different instruments of intellectual property protection – for example, patents, copyrights, and trademarks – as well as ratings of enforcement effectiveness. This permits an examination of the effects of different types of

[15] See Thumm (2003), pp. 29-33.

[16] The Joint Ventures and Strategic Alliances database is presently owned and distributed by *Thomson Financial Inc*. A more comprehensive use of the database can be found in Vonortas (2003). This database is also used in the empirical section of this paper.

[17] Anand and Khanna (2000) point out that in this industry suing for infringement may be difficult because it could turn out that the plaintiffs themselves are infringing on the patents of defendants.

IPRs on licensing by industry and by source of licensing income (*e.g.* industrial processes, performances, books).[18]

4. Indexes of Intellectual Property Rights and Enforcement

26. Four different kinds of IPR indices are used in this study. 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 selective; that is, to choose those legal features that yield maximum variability across countries. Furthermore, the information has to be widely available across countries. Appendix A provides a quick summary of the legal features in each type of IPR index and of how the indexes are scored. The appendix also provides explanatory notes to the legal features and scoring methodology.

(A) Patent Rights

27. 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.

(B) Copyrights Index

28. 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 A). 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).

(C) Trademark Rights Index

29. This index is also in Reynolds (2003). The trademark index consists of three components: coverage, procedures (which incorporates enforcement features and possible restrictions on the rights holder), and

[18] The empirical analysis does not 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 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.

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.

(D) Enforcement Effectiveness

30. No formal studies have yet been conducted on how IP laws are actually enforced in practice. However, some information is available from reports filed with the *U.S. Trade Representative (USTR)* concerning intellectual property enforcement in various countries.[19] A major limitation is that the reports may largely represent the views of U.S. 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.

31. 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).

5. Empirical Analysis

(A) Sample Statistics

32. The regression analyses in this paper employ two different data sets from the U.S. Bureau of Economic Analysis. The first data set (referred to as BE-10 survey) is based on benchmark surveys of U.S. Direct Investment Abroad (see Appendix B). This data set provides information on the receipts of royalties and licensing fees of foreign affiliates of U.S. multinationals. The data cover majority-owned non-bank affiliates of non-bank U.S. parents and are aggregated by host country.[20] The second data set (BE-93 survey) is a micro-database of U.S. based firms (including U.S. parent companies as well as firms that are not multinationals). The database provides information on the receipts of royalties and licensing fees of those U.S. based firms from different countries.

33. Part A of Table 1 is based on the first data set. It shows the average flow of licensing and royalty fees received by foreign affiliates of U.S. multinationals, where the average is taken over the three benchmark survey years: 1989, 1994, and 1999. On average, U.S. foreign affiliates receive over USD 2.7 billion dollars in such fees (in real 1995 dollars) per annum. Most of these receipts (about 98%)

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

[20] For example, receipts of royalties and licensing fees associated with country X represent the receipts of such fees by foreign affiliates of U.S. multinationals located in country X, where those receipts come from licensees across different countries (including any amount from country X).

are by foreign affiliates located in developed countries (whose per capita GDP exceeds USD 10 000 in real 1995 terms). Furthermore, almost two-thirds of the licensing and royalty fees come from affiliated firms (either the parent firm or other foreign affiliates). The remainder comes from unaffiliated sources (either unaffiliated U.S. firms or unaffiliated foreign firms). However, in the case of fees from developing nations, a larger share (more than 85%) is derived from affiliated sources. This reflects the fact that U.S. firms do not deal as much with arms-length partners in developing nations.

34. Part B shows some sample statistics of the measures of intellectual property protection. The patent rights index ranges from 0 to 5, while the other indexes range from 0 to 1. In terms of the coefficient of variation, the indexes of patent rights, copyrights, and trademark rights exhibit similar degrees of variability (around 33% - 36%).[21] The enforcement effectiveness rating exhibits a much greater degree of volatility across countries and over time (with a coefficient of variation of 86%). In general, developed countries have stronger intellectual property rights than do the developing nations. Among developing nations, there is also a greater degree of variation in intellectual property protection. For instance, the coefficient of variation of the enforcement effectiveness rating exceeds 100% for developing nations but is less than 50% for developed nations.

35. Part C provides some sample correlations among the measures of intellectual property rights and royalty and licensing fees. The various indexes of IPRs are positively correlated with receipts of income from intangible assets, signifying that U.S. firms derive greater fees from regions where intellectual property regimes are stronger. This could be the result of U.S. firms having greater incentives to license their technologies in countries with stronger IPRs as well as of U.S. 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.

36. The second data set (*i.e.* the micro database of U.S.-based firms) provides some information on the composition of licensing fees by type of royalty and licensing fees.[22] Chart 1 shows the breakdown in royalty and licensing fees by source of revenue (or by type of income) during 1992 - 1999.[23] For instance, 31.9% of fees are derived from U.S. firms licensing industrial processes abroad; 30.2% from pre-recorded performances (such as musical tapes, compact disks, etc.); 20.4% from general use software; and 8.6% from the use of trademarks (such as business symbols and names). The other items account for a small share, such as books, broadcasting, and franchising.[24]

[21] 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).

[22] Note that this composition does not necessarily apply to the licensing data of foreign affiliates in the first data set.

[23] Fees for previous years are available, but are in a different database format. Thus, the two data sets are not readily compatible without further adjustment.

[24] The data on source of fees are available by geographic breakdown (*e.g.* Europe, Japan, Asia, etc.). 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.

(B) Empirical Results

(i) Aggregate Level Data

37. Table 2 reports on the results of estimating the relationship between licensing and intellectual property rights using aggregate national data. For each nation, the data are aggregated across U.S. foreign affiliates and industries. Most previous studies on this relationship, as mentioned earlier, have used this form of aggregated data. The dependent variable is the log of royalties and licensing fees received by foreign affiliates of U.S. multinationals per affiliate employee. Column 1 shows that affiliate gross product per worker significantly explains U.S. licensing fees earned per affiliate worker (holding other factors constant).[25] In other words, holding everything else constant, foreign affiliates of U.S. multinational firms derive more licensing income in host countries where affiliate product per worker is greater. The greater product per worker could reflect higher productivity in local markets, which make exploitation of technology more attractive.

38. The results in column 1 also indicate that only patent rights in affiliate host countries have a statistically significant association with license fees per worker earned by affiliates in the host country. Differences in the strength of copyrights and trademarks rights across countries do not help explain differences in licensing fees earned by affiliates from those countries. Another way of putting this is that patent rights are the more important determinant of U.S. licensing fees (and thus of the incentive to license and/or the ability to appropriate returns from licensing). The coefficient estimate indicates that a 1% increase in the patent rights index increases the inflow of licensing fees by 1.5%. Overall, the model explains 46% of the variation in the data (as seen from the adjusted R-squared).

39. Column 2 shows the results of dropping the copyright and trademark right indexes from the model, as both of these measures do not have strong explanatory power at the national level (as opposed to the firm level). In their place, the enforcement effectiveness index is added, along with other variables that other studies in the literature have often controlled for (namely, the tariff rate, country risk, and corruption).[26] In this specification, the patent rights variable is statistically insignificant at the national level, but the enforcement effectiveness index is highly statistically significant. This suggests that the patent rights index (in the previous regression or model) proxies for some omitted factors like enforcement in practice. As the sample statistics have shown, both the patent rights and enforcement effectiveness indexes are highly correlated. Note that gross product per worker also falls in significance as an explanatory variable (although it is still statistically significant at conventional levels). The other control variables – country risk, tariffs, and corruption – are not statistically significant.[27]

40. Next, in columns 3 and 4 of Table 2, the analyses are repeated with a change in the dependent variable. Instead of licensing fees per worker, the dependent variable here is the ratio of licensing fees to the stock of foreign direct investment (FDI) abroad.[28] The goal is to examine the impact of IPRs on the magnitude of licensing relative to FDI. The results suggest that trademark protection and country risk have

[25] The dependent variable is in per worker terms to control for the size or scale of operations abroad. A larger scale should generally entail a higher volume of fees. Thus the empirical analysis (at least at the national level) examines whether IPRs have an impact on licensing fees over and above some reference scale of operations.

[26] See, for example, Fosfuri (2003), Nicholson (2003b) and Smith (2001). In this paper, the tariff rate is used to measure the level of trade intervention, country risk to measure risk to profits and general property, and corruption to capture non-enforcement (or inconsistent enforcement) of laws and rules in practice.

[27] This contrasts with the previous findings, particularly on country risk (see Fosfuri 2003), is that a different sample of countries and industries is considered. Another plausible reason is that the country risk and corruption variables were, in previous studies, proxying for omitted factors, such as enforcement of laws and rights.

[28] FDI is measured as the net PP&E (Physical Plant and Equipment, minus accumulated depreciation).

a statistically significant effect on the ratio of licensing to FDI. In other words, stronger trademark protection or reduced country risk, holding other factors constant, increases the propensity to license vis-à-vis FDI. The other kinds of intellectual property rights have no discernable impact on licensing relative to FDI perhaps because trademarks are more closely linked to a firm and its products and technologies than are the other kinds of IPRs. For instance, when trademark protection of business names or symbols is stronger, firms are more willing to let other firms market their products or use their technologies, since the quality and other characteristics can be more easily attributed to, or identified with, the original firms (or owners of the intellectual properties). Likewise, reduced country risk precludes the outright expropriation of assets of either the licensor or licensee for the use of another party (public or private). The statistical insignificance of the other kinds of IPRs or other factors on the ratio of licensing fees to FDI may simply mean that there is no impact on licensing per FDI or that there are proportionate impacts on both FDI and licensing.

41. Foreign affiliates of U.S. multinational firms earn licensing fees from both affiliated and unaffiliated parties. To what extent does the strength of intellectual property protection influence the scale of licensing to each type of licensee? The results presented in columns 5 – 8 provide an indication. The dependent variable is again licensing fees per worker. The results in column 5 indicate that licensing fees received by foreign affiliates from affiliated parties vary positively and significantly with patent rights in the affiliates' host countries (but not with copyrights and trademark rights). Once enforcement effectiveness and other variables are controlled for, however, patent rights appear to reflect the importance of an omitted factor, namely enforcement effectiveness (see column 6). As for licensing with unaffiliated parties, patent rights are highly important, even after controlling for enforcement effectiveness and other variables. A 1% increase in patent rights stimulates licensing fees from unaffiliated parties by more than 2%. Thus the strength of patent rights is more important to the decision by U.S. firms to deal at arms length with third parties.[29] Since firms may have closer ties to affiliated parties – and can perhaps better monitor inappropriate use of proprietary technologies – it could be plausible that IPRs play less of a key role in determining a firm's licensing relationship with affiliated parties than with unaffiliated (arms length) parties.

42. Note that gross affiliate product per worker abroad has at best a mild influence on decisions to license with affiliated or unaffiliated parties. Thus, compared to the findings in columns 1 and 2, gross product per worker better explains differences in licensing behaviour between groups of transactors rather than within groups. As the sample statistics had indicated, a large share of licensing relationships in developing countries is with affiliated parties. Thus, when the sample is pooled (*i.e.* affiliated and unaffiliated parties are mixed), gross product per worker may be capturing the influence that economic development has on the composition of licensing relationships between affiliated and unaffiliated parties. As an economy develops, firms seem more willing to deal with arms length parties. This is because increased development is associated with stronger patent rights, and stronger patent protection in turn stimulates licensing with unaffiliated parties.

43. Table 3 reports the results of splitting the sample into developed and developing countries. Of course, this reduces the sample size considerably for either sample. However, doing so permits an examination of the underlying differences (to the extent that the data permit). It is likely that firms behave differently when transacting with parties in developing countries as opposed to those in developed markets. Part A of Table 3 shows the results of estimating the model on the developed country sample. Host country patent rights are a strong influence on the licensing fees and royalties received by affiliates operating in the host country (both relative to affiliate employment and to FDI). The intuition for this is that patent rights

[29] This finding is consistent with those in Mansfield (1994), Yang and Maskus (2001), and Smith (2001), but conflicts with that in Branstetter et. al. (2002), as discussed in the literature review.

work to increase the value of the asset to be licensed by enhancing the ability of firms to appropriate the returns to their intangible asset.

44. The enforcement effectiveness index is insignificant in this within-group sample (since the index does not vary much among developed countries, such as those in Europe and Japan). Patent rights are modestly important to licensing with affiliated parties in developed countries, and quite important to licensing with unaffiliated parties in developed countries. Gross product per worker is quite important to determining firms' overall international licensing but modestly important to determining firm's international licensing with unaffiliated parties.

45. Part B of Table 3 shows the results of estimating the model on the developing country sample. Since data on the gross product and employment of affiliate firms in developing countries are not as widely available, gross domestic product per worker is used instead. The indexes of copyright and trademark rights are dropped since they were shown to be insignificant and their inclusion would make the estimates inefficiently measured (in an already small sample). The results indicate that patent rights have a weak influence on the licensing income of affiliates in developing markets. However, there is a statistically significant, negative impact of patent rights on the ratio of licensing to FDI, indicating that a strengthening of patent rights would favour FDI or local production in developing markets. Patent rights are in general low in the developing region. It is possible that a critical threshold level of patent rights is required before firms choose licensing over FDI. The latter offers fewer agency cost problems (such as monitoring costs). The enforcement effectiveness index is important in explaining differences in licensing overall, and modestly important in explaining differences in affiliated licensing. But the enforcement effectiveness index fails to explain differences in unaffiliated licensing. As U.S. foreign affiliates engage in very little unaffiliated licensing in developing markets, the sample size of unaffiliated transactions in developing countries is small. The limited variability in the data may account for the weak statistical results. Indeed the fit of the model for the developing country unaffiliated sample is quite low (as seen by the adjusted R-squared).

(ii) Firm Level Data

46. In the firm level regression analyses, the dependent variable is at the firm level, while the independent variables are at the industry and national level. For instance, IPRs are measured for a nation as a whole (since laws generally apply at the national level, though different industries and firms may receive relatively stronger or weaker protections).[30] The dependent variable is the level of royalty and licensing fees (rather than those fees divided by the number of workers in a firm, since only industry wide employment figures are presently available). In any case, it is of interest to see how a firm's absolute licensing activity varies with IPRs, holding other factors constant.

47. Table 4 reports on the firm level results. The dependent variable is the log of a firm's total royalty and licensing fees received from abroad. Total fees refer to the sum of fees from different types of intangible assets (such as books, performances, trademarks, and so forth). All the firm level regressions

[30] The reason the independent variables are not at the firm level (though they are available) is that the firm level data on the independent variables (such as gross product, employment, and capital stock) are essentially in a different database than the firm level data on the dependent variable (namely royalty and licensing fees). Data for the dependent variable come from survey data on unaffiliated transactions (*i.e.* BE-93 survey). To obtain information on the independent variables at the firm level requires matching the BE-93 survey data to U.S. parent survey data. But the two surveys use different enterprise identification numbers to identify the same firms. Thus, it is necessary to develop a concordance between the two databases before they can be merged into one empirical dataset. (This is not trivial task, but may be feasible.) Another factor to consider is that even if concordance is achieved, the parent survey data would not be able to provide data on operations, such as gross product and employment, for all the firms in the BE 93 survey because the latter survey includes coverage of companies other than U.S. parents.

control for industry group fixed effects, country region fixed effects, and time fixed effects. The different time periods are 1992, 1995, and 1999.[31] The different industry groups are: Food and Kindred Products; Chemicals (Drug and Non-drugs); Metals (Ferrous and Non-ferrous, and fabricated); Machinery; Electrical and Electronic Products; Transportation; Wholesale Operations; Services; and Other. The different country groups are: Canada; Asia Pacific; Europe; Latin America & Other Western Hemisphere; Africa; and Middle East.

48. Column 1 of Table 4 shows the base model results. Both patent rights and enforcement effectiveness are statistically strong influences on a firm's royalty and licensing fees from abroad. It is significant that these two variables which do not vary across firms or their industries, but across countries and time, are found to be critical influences on a firm's licensing activities abroad. The adjusted R-squared (or the percentage of the variation in the data explained) is fairly low, and can be attributable to the absence of firm level independent variables. The dependent variable (and hence the residual or error term), varies across several dimensions (firms, industries, countries and time), while the covariates vary in at least one dimension less.

49. As columns 2 – 4 of Table 4 show, the importance of patent protection and enforcement is robust to the inclusion of other control variables, such as gross product per worker (at the industry level)[32], the tariff rate, country risk assessment, and corruption levels abroad. Patent rights and enforcement effectiveness remain significant even after controlling for other types of intellectual property rights. Copyrights in particular are found to be a significant influence on overall licensing activities abroad. This is in contrast to the national level evidence shown earlier. Moreover, trademark rights are also a significant explanatory factor, except that trademark strength has a negative effect, suggesting that stronger trademark rights increase the market power of firms abroad and thus reduce the flow of licensing fees. Thus, the firm level data pick up certain effects of IPRs that the aggregated data are not able to capture.

50. Table 5 shows the results of separating out the different sources of royalty and licensing fees. The objective here is to see whether different types of licensing transactions are sensitive to patent rights. Part A of this table focuses on patent rights and enforcement effectiveness, and Part B on all four measures of IPRs. The main highlights are as follows: enforcement effectiveness is an important factor in the licensing of books, broadcasting rights, franchises, industrial processes, pre-recorded performances, general software, and trademarks. However, patent rights are important for all but two of them – namely books and franchises. Patent strength is especially important for licensing software, pre-recorded performances, and broadcasting. Note that overall, industry gross product per worker is not a significant factor explaining licensing at the firm level. The heterogeneity among firms might be such that it is not as easy to tie their licensing propensities to an industry measure of productivity.

51. In general, copyrights and trademark rights are less significant once patent rights are included (or controlled for). Without the index of patent rights as an explanatory variable, copyrights and trademark rights pick up the effects of patent rights. But these three measures of IPRs tend to be positively correlated across countries, so that their joint inclusion does tend to create multi-collinearity problems.[33] Thus a practical way of examining the importance of copyrights and trademarks is to do so without the inclusion of the patent rights index. Hence in part B, it is seen that copyrights are a significant determinant of the licensing of books, trademarks, and pre-recorded performances and a modest determinant of the licensing of broadcasting rights and franchises. (For the regression on licensing fees from pre-recorded performances, the patent rights variable is included to illustrate that copyrights are important in this

[31] Data after 1999 are preliminary.

[32] This refers to the gross product per worker of the industrial group to which the firm belongs.

[33] In such a case, it is difficult to disentangle the effects of the different measures of IPRs on licensing. Model estimation is poorer and the effects of IPRs are measured with imprecision.

particular case, even with patent protection controlled for.) Trademark protection is a modest determinant of the licensing of pre-recorded performances, but an insignificant factor in the decision to license other intangible assets, including (surprisingly) trademarks. Either trademark strength is not a factor in the decision to license business names and symbols (which is not very plausible), or the market power and market expansion effects of stronger trademark protection cancel out.

52. Table 6 considers licensing behaviour by industry group. The dependent variable again is total licensing fees (aggregating across the different sources). Enforcement effectiveness is a very significant determinant of the licensing fees of firms in the chemicals, electrical and electronic, and services industries. Patent rights are an important determinant in the electrical and electronic, transportation, and services industries. These results may be explained by the fact that the services industry includes software products and consulting, finance, and research and development services. A number of high-tech innovations are in the electrical and electronics industry (such as semi-conductors) and in the transportation industry (such as aircraft technology). Enforcement is important to chemicals where innovations are relatively easy to imitate and distribute. Machinery is in general more difficult to imitate and capital intensive, making this industry relatively less reliant on IPRs. The wholesale industry's focus is on the distribution of goods, so that the focus is not explicitly on technological innovations and R&D. Thus firms in the wholesale industry tend generally to license rights to market goods rather than the rights to manufacture, use, or exploit a proprietary technology.

(iii) Joint Ventures and Strategic Alliances Data

53. Another perspective on licensing activities at the firm level can be gleaned from international joint ventures and strategic alliances. The hypothesis is that intellectual property reforms increased the extent of international alliances (particularly those involving developing countries where IPRs were historically weak). Cross-border alliances would benefit from the strengthening of intellectual property laws and enforcement 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.

54. This section focuses on international licensing transactions between firms in a developed country (*e.g.* U.S., Japan, or a European country) and firms in a developing or emerging economy (*e.g.* Korea, Singapore, Brazil).[34] In the *Joint Ventures and Strategic Alliances* database, the unit of analysis is the transaction (between firms or public agencies). The database has records of over 100 000 transactions from the mid-1980s to the present.[35] For this section, those licensing transactions were selected where firms in a developed region licensed intellectual property to firms in a developing region during the period from 1989 to 2002. In other words, licenses granted by a developing country firm to a developed country firm or to another developing country firm were excluded.[36] The reason for doing this is to focus on the impact of changes in developing country patent regimes on inward technology inflows (via licensing agreements with developed countries); that is, to focus on the incentive developed nation firms have to transact with

[34] Note that the definition of developing country is not as restrictive as in the previous sections where developing countries were referred to as countries whose GDP per capita averaged less than USD 10 000 U.S. (in real 1995 terms) during the sample period. With that strict definition, the sample size would be extremely small since there are very few licensing alliances between the poor economies and richer economies. Moreover, in the late 1980s, economies such as Korea, Chinese Taipei, and Singapore were considered to be developing, emerging markets. The alliances data here help to track their developments throughout the 1990s.

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

[36] The vast majority of international technology alliances are within or among developed nations.

developing nation firms (which traditionally operated in environments that permitted imitation of developed nation technologies). These selection criteria produced a dataset of about 1 000 transactions.

55. Each of these transactions was classified into one of the following high-tech groups (as the primary business activity of the alliance): Biotechnology, Computers, Communications, Electronics, and Other. Some transactions were none of the above, and thus were excluded. These, for example, would include licensing agreements involving food and textiles (for example, the right to make and sell fast foods or clothing). Biotechnology pertains to genetically engineered products, in-vitro diagnostic products, vaccines, general pharmaceuticals, medical lasers, medical and surgical instruments, laboratory and rehabilitation equipments, artificial organs, blood derivatives, and healthcare services. The computer sector pertains to mainframes, workstations, microcomputers, turnkey systems, printers, graphic systems, disk drives, network systems, utilities, monitors, terminals, scanning devices, modems and other peripherals, software, data processing and programming services, and computer consulting. Communications pertains to alarm systems, messaging, internet service and software, facsimile, data communications (excluding networks), microwave and satellite communications. Electronics pertains to semiconductors, superconductors, printed circuit boards, process control systems, precision and measuring test equipment, search/detection and navigation, and other electronics. The Other group pertains to robotics, lasers (excluding medical), nuclear technology, propulsion systems, satellites (non-communications), advanced materials, defence related products, and advanced manufacturing.

56. Overall, there were 28 developing/emerging market nations that had firms which were licensees of firms in developed nations. Table 7 shows some examples of licensing agreements between developed and developing nation firms, along with the licensing fees involved and the high-tech classification of the alliance. The licensing fees refer to the initial flat fees or costs of the deal. The stream of future incomes or payments associated with royalties or profit sharing arrangements is not included in this initial estimate. As the table illustrates, the deals range in initial values from USD 300 000 to USD 200 million dollars. Due to the fact that these fees are not widely reported, it is difficult to use them consistently to study the value of transactions. Less than 10% of the transactions report the initial licensing fee. Thus, in the rest of this paper, the focus instead is on “counts” or numbers of licensing deals concerning intellectual property.

57. A large number of these deals involves Asian economies. Table 8 shows the top twenty country pairs in terms of numbers of licensing deals. The U.S. and Korea pair is the most frequently cited. There were 73 recorded deals over the 13 year period where U.S. firms licensed technologies to Korean firms (particularly to firms like Samsung, Goldstar, and Daewoo). In second place is the U.S. and China pair, which produced 51 deals between U.S. licensors and Chinese licensees, and in third place is the U.S. and Taiwan pair, with 42 deals. The leading country pair not involving the U.S. is the Japan and Korea pair with 18 deals, followed by Canada and China (and Canada and Korea) with 13 deals.

58. In the analysis of the relationship between patent reform and licensing deals, the key issue of interest is whether patent reform on the part of developing nations (or emerging economies) increased their access to foreign, developed nation technologies (via licensing agreements). To analyze this, the 28 developing partner nations were sorted into three groups depending on how radically they reformed their patent systems 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 a *medium* patent reform. The cutoffs (7% and 20%) were chosen where there was a noticeable enough break and where the resulting group sizes could be roughly balanced. There were 9 countries each in the high and low reform groups and 10 in the medium reform group.

59. For each of these groups of countries, the following analysis examines the number of licensing deals their firms had with developed nations 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.[37] 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). The analysis below 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.

60. Table 9, Part A, shows the change in deals for the pooled sample (in the sense of pooling across licensor nations and high technology groups). Firms in developing countries which least strengthened their patent regimes had experienced an overall reduction in licensing deals (by 2) over this time period. In contrast, firms in developing countries which most strengthened their patent regimes had 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, so far, there appears to be a positive correlation between changes in licensing deals and changes in patent regimes.

61. Part B of Table 9 breaks down the sample by licensor nation. Since the U.S. is the dominant licensor nation, it was decided to separate out the U.S. from the rest of the world. The data show that firms in countries with low patent reforms had seven fewer deals with U.S. firms over this period, while firms in countries with a high degree of patent reform gained 13 more deals with U.S. firms. The pattern is somewhat different between developing nations and the rest of the world licensor nations. While firms in countries with the strongest patent reform gained more deals than those in countries with the lowest degree of patent reform, the firms in countries with a medium degree of patent reform actually had four fewer deals over time. In other words, firms in countries that had small patent reforms did better in attracting new technologies from non-U.S. licensor firms than firms in countries that had medium patent reforms.

62. One possible interpretation is that non-U.S. 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-U.S. firms have had with low patent reform nations which gave the latter some advantages (in attracting licensing deals) over the medium reform nations. Regardless, it is not the case that weaker patent systems attract more technologies (via licensing activities).

63. Part C of Table 9 breaks down the data by technological group. For this, all the licensor nations are pooled again. In the case of biotechnology and electronics, there has been a declining trend in licensing deals, but firms in those countries that reformed their patent systems the most had the smallest decline in number of licensing deals. The declining trend is likely due to the cyclical downturns in both sectors during the late 1990s.

64. In the communications sector, there is a nonlinear relationship: while there is an overall positive correlation between patent reform and licensing deals, the medium reform nations have actually

[37] Vonortas (2003) finds 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.

experienced a decline in deals. In fact the difference is not trivial. Firms in countries with a low degree of patent reform actually experienced an increase of 15 deals, despite the fact that their patent systems were not strengthened significantly during this period. Again, other things are not held constant. Nonetheless, one possibility is that communications products may benefit from both very strong and weak patent rights, one for innovation and the other for diffusion. Weaker or modest patent rights might be more conducive for technologies where the innovation process is sequential and complementary (that is, building upon past and concurrent innovations).[38] Stronger patent rights might be more conducive for the more pioneering innovations. To the extent that communications products and technologies exhibit either types or characteristics, the above findings may be more understandable.

65. The computer sector seems to have varying perspectives as well. There is not a significant difference in licensing gains among countries with low, medium, or high degrees of patent reform. Like the communication sector, the computer sector may depend on adequate incentives for innovation as well as opportunities for diffusion and knowledge sharing. Stronger patent rights may raise the transaction costs of conducting complementary research. Interestingly, it is those firms in countries with a medium degree of patent reform that experienced the most gains in licensing agreements.

66. Nevertheless, the overall perspective is that stronger patent rights are generally associated with increased technology inflows. While there are some exceptional cases where either low patent reform nations obtained more licensing deals than the medium reform nations, or where the medium reform nations obtained more than the high reform nations, it is never the case that low reform nations dominate high reform nations in attracting deals. Thus there is at least no finding that stronger patent systems significantly inhibit technological inflows.

6. Conclusion

67. The empirical analysis presented in this study provides general support for the proposition that the strengthening of intellectual property rights - as measured by the selected indicators - has had a net positive effect on technology transfer via licensing during the 1990s. The empirical evidence is based on licensing activities of U.S. multinationals as well as on international licensing alliances between firms in developing and developed nations. Both aggregate level data as well as firm level data have been examined. This section highlights the main findings and discusses some of the key development related issues. Suggestions for further research in this regard are presented in Box 3.

68. Foreign affiliates of U.S. multinational firms account for most of the world's international licensing activities. The bulk of their licensing income is derived from developed countries. Two-thirds of their income is derived from affiliated firms. The share of income from affiliated sources is higher (namely 85%) in developing regions. It is likely that weaker IPRs in developing countries lead firms to deal with affiliates rather than engage in arms-length transactions. Furthermore, most of the U.S. royalties and licensing fees come from licensing industrial processes, pre-recorded performances, and software. The U.S. is also the leading participant licensor nation in global licensing alliances. Among the emerging market economies, the leading participant licensee nations are the Asian countries (Korea, Taiwan, Singapore, Hong Kong, and China). Securing licensing contracts with developed country partners (such as those in the U.S., U.K., and Japan) appears to be an important strategy in the developmental catch up process.

69. The regression analyses indicate that controlling for other factors (like gross product, corruption, tariff rates, and country risk), patent rights are a statistically significant determinant of licensing while trademark and copyright protection are weak influences on licensing. Stronger patents increase the ability

[38] See Bessen and Maskin (2001).

of agents to appropriate the returns to their innovation and hence increase the value of the intangible asset to be licensing. Hence this generally leads to a positive association between patent strength and licensing income. Effective enforcement of statutes also matters strongly to licensing. Patent rights are especially important to licensing with unaffiliated parties, and enforcement effectiveness to licensing with affiliated parties.

70. The results show that trademark protection and reduced country risk increase licensing relative to FDI. Patent rights and enforcement effectiveness, however, are seen to have a weak influence on the ratio of licensing to FDI. This could suggest that patent protection and enforcement have proportional effects on foreign direct investment and licensing. However, splitting the developed and developing country samples shows that stronger patent rights tend to increase licensing relative to FDI in the developed region but increase FDI relative to licensing in the developing region. This may be a reason why the overall effects seem to balance out (although the developed country sample size is much larger). Nonetheless the difference in response of licensing relative to FDI between the developed and developing country samples could suggest that a critical level of patent protection is needed before foreign firms have an incentive to license (or shift towards licensing). Developing economies generally have weaker patent systems. Thus the initial increases in host country patent strength help to increase technology transfer, but through FDI rather than licensing. As the strength of patent rights increases sufficiently enough, foreign firms may then be receptive to relinquishing direct control and engage in licensing.

71. Firm level data confirm the importance of patent protection and enforcement effectiveness to a firm's licensing activities abroad. Copyrights are also seen to be a positive influence, but trademark rights can be seen to be a negative influence. The market power effect of trademark protection seems to overwhelm the economic returns effect.

72. Most sources of licensing income (*e.g.* industrial processes, software, pre-recorded performances) respond positively to patent protection, except for books and franchising. Enforcement effectiveness is important to each of the sources of licensing income. Copyrights are important for the licensing of books, trademarks, franchising, and broadcasting. 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.

73. 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, and services industries.

74. The growth in international licensing alliances between developed nation licensor firms and developing nation licensee firms also seem 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 U.S. or a non-U.S. country.

75. However, the correlation between international licensing alliances and patent reforms varies by high-technology group. There has been a declining trend in deals in the biotech and electronics groups, but the developing countries that reformed their patent regimes the most lost the least number of deals. In the computer group, the "medium" reformers attracted the greatest increase in deals, whereas in the communications group, both the high and low reformers had the most gains in deals. These patterns would be consistent with the co-existence of both pioneering innovations and cumulative, sequential innovations in a high-tech group. The former requires adequate incentives to cover for the usually high set-up costs.

The latter requires opportunities for knowledge diffusion and sharing of common pool resources (such as internet tools and data networks). Both computer and communications technologies involve capital-intensive, high fixed cost investments as well as interdependent innovations (necessary for the interoperability of component innovations).

76. 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. In particular, patent rights and effective enforcement 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.

Box 3. Development dimensions of international licensing: possibilities for further empirical research to assist in policy refinement

From the research to date, it is clear that variation in the strength of intellectual property rights plays a role in shaping international licensing and the associated technology transfer. Several OECD member country delegations have suggested further exploration of this issue through an expansion of the type of analysis contained in the present paper. For example, depending on the availability of data, a follow-on study may be able to provide more detailed treatment of licensing practices of European and Japanese enterprises.

The finding that IPR policy has influenced licensing suggests that there may be possibilities to further enhance the process and its contribution to economic development. The efficacy or efficiency of international licensing in the development process might be explored along several promising new lines suggested below with a view to refining IPR policy.

First, what is the quality level of technologies that developing nations tend to access through international licensing agreements? To what extent are advanced technologies being transferred? Do developed country firms tend to transfer less complex technologies in order to take advantage of the existing conditions in developing nations (such as low labour costs)? These issues influence the degree to which licensing agreements contribute to dynamic change in the host country. Questions remain as to what policy measures would be most effective in boosting the level of technology received and to what extent such policies should be pursued (*i.e.* what are the trade-offs?).

Secondly, what are the returns to licensing for developing countries (as opposed to other channels for technology transfer such as foreign direct investment)? The present empirical analysis has examined how IPRs in host countries affect licensing transactions, as measured by the fees and royalties paid to the source (or licensor) country. From the host country's perspective, these payments are "costs" of licensing. It would be useful to measure some of the benefits that developing countries derive directly from using licensed foreign technologies (for example, the productivity benefits or the value of goods and services produced). These benefits can be then compared to the costs in order to derive a rate of return to licensing. An empirical perspective on this issue can also help in determining developing country policy priorities.

Thirdly, what options are available to developed nations in fulfilling their TRIPS obligations to promote technology transfer to developing nations? For example, Article 66.2 of the TRIPS Agreement stipulates that "developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members." The objective is to enable LDCs to create a sound and viable technological base. To the extent that Article 66.2 remains less than fully implemented, it may be possible for international licensing to contribute towards addressing the shortfall. Empirical research has provided an indication that host country policies influence the inflow of technology via license agreements; but the potential for source country policies to influence technology transfer behaviour remains relatively unexplored from an analytical perspective.

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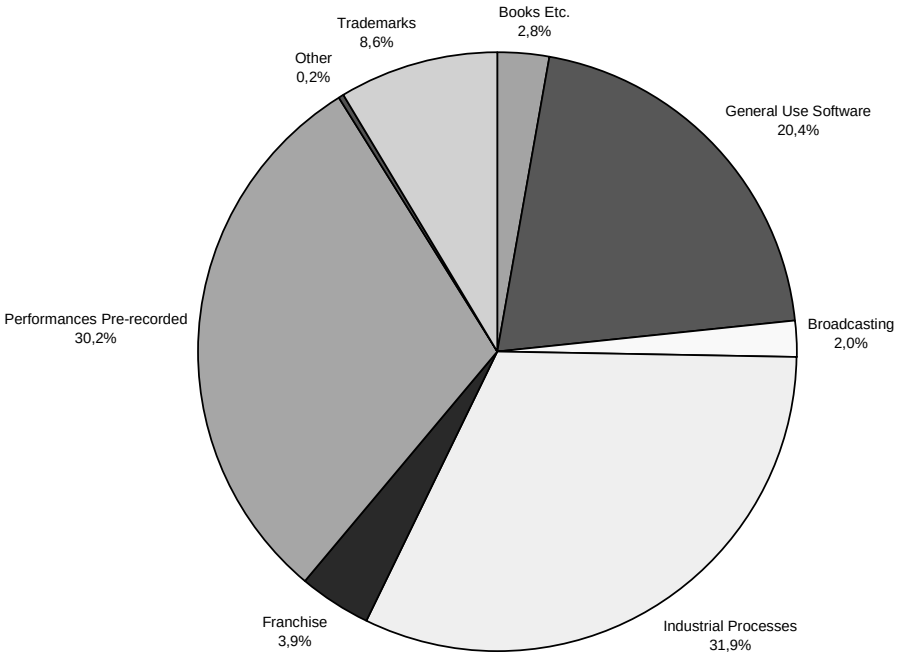
Chart 1. Sources of U.S. royalty & licensing fees from intangible assets, 1992-99



(*Source*: U.S. BEA Survey BE-93)

Table 1. Sample statistics

Part A. Royalty & licensing fees for the use of intangible assets received by foreign affiliates of U.S. multinationals

	Average annual value of fees (in millions of real 1995 US dollars)	Percentage share from affiliated sources	Percentage share from unaffiliated sources
All countries	USD 2727.3	61.8%	38.2%
Developed nations	USD 2666.1	61.2%	38.2%
Developing nations	USD 61.2	86.2%	13.8%

Part B. Intellectual property rights indexes

	Patent Rights	Copyrights	Trademarks	Enforcement effectiveness
All countries				
Mean	2.71	0.56	0.52	0.43
Std. deviation	(0.98)	(0.19)	(0.17)	(0.37)
Coef Var	*0.361*	*0.339*	*0.327*	*0.860*
Developed nations				
Mean	3.64	0.71	0.61	0.79
Std. deviation	(0.64)	(0.13)	(0.13)	(0.27)
Coef Var	*0.361*	*0.339*	*0.327*	*0.860*
Developing nations				
Mean	2.36	0.51	0.47	0.22
Std. Deviation	(0.85)	(0.17)	(0.16)	(0.25)
Coef Var	*0.361*	*0.339*	*0.327*	*0.860*

Part C. Correlation matrix

	Licensing fees	Patent rights	Copyrights	Trademark rights	Enforcement effectiveness
Licensing fees	1				
Patent rights	0.402	1			
Copyrights	0.324	0.491	1		
Trademark rights	0.342	0.497	0.660	1	
Enforcement Effectiveness	0.488	0.719	0.444	0.509	1

Notes: Developed nations refer to those whose average per capita GDP exceeded USD 10 000 real U.S. dollars during the sample period. Coef Var refers to the coefficient of variation (= the ratio of standard deviation to mean). The sample period for Part A is 1989-1999 and for Part B is 1990-2000. The source of data for Part A is the BE-10 survey of the U.S. Bureau of Economic Analysis. The source of data for Part B is Ginarte and Park (1997), Park and Wagh (2002), Reynolds (2003), and USTR *Report on Foreign Trade Barriers*, various issues.

Table 2. Intellectual property rights and licensing, all industries

Panel A	**(1) Lic/ Emp**	**(2) Lic/ Emp**	**(3) Lic/ FDI**	**(4) Lic/ FDI**
Constant	-6.023***	-17.44*	-6.557***	-24.15***
	(1.469)	*(9.964)*	*(1.371)*	*(9.733)*
Log (Patent Rights)	1.491**	1.242	1.458**	1.208
	(0.669)	*(0.870)*	*(0.630)*	*(0.858)*
Log (Copyrights)	0.913		0.727	
	(0.962)		*(0.849)*	
Log (Trademark Rights)	0.914		1.436***	1.096**
	(0.645)		*(0.596)*	*(0.550)*
Log (Gross Product Per worker)	0.869***	0.622**	-0.012	-0.456
	(0.305)	*(0.305)*	*(0.308)*	*(0.339)*
Enforcement Index		2.175***		1.034
		(0.664)		*(0.759)*
Log (Tariff Rate)		-0.278		-0.806
		(0.289)		*(0.695)*
Log (Country Risk Index)		2.940		5.071**
		(2.439)		*(2.467)*
Log (Corruption Index)		-1.039		-0.923
		(0.708)		*(0.694)*
Adjusted R^2	0.46	0.61	0.38	0.55
Number of Observations	73	72	67	61
Panel B	**(5) Lic^A/ Emp**	**(6) Lic^A/ Emp**	**(7) Lic^U/ Emp**	**(8) Lic^U/ Emp**
Constant	4.343***	-9.862	-7.837***	0.324
	(1.468)	*(11.929)*	*(1.915)*	*(10.374)*
Log (Patent Rights)	1.286**	0.698	2.492***	3.653***
	(0.678)	*(1.005)*	*(0.946)*	*(1.338)*
Log (Copyrights)	0.792		0.412	
	(0.961)		*(0.967)*	
Log (Trademark Rights)	0.654		0.309	
	(0.649)		*(0.609)*	
Log (Gross Product Per worker)	0.329	0.285	0.532	0.863*
	(0.314)	*(0.351)*	*(0.425)*	*(0.505)*
Enforcement Index		2.062***		0.618
		(0.754)		*(0.818)*
Log (Tariff Rate)		-0.281		-0.083
		(0.306)		*(0.343)*
Log (Country Risk Index)		1.526		-2.502
		(2.907)		*(2.696)*
Log (Corruption Index)		-0.977		-0.431
		(0.862)		*(0.939)*
Adjusted R^2	0.26	0.40	0.42	0.36
Number of Observations	64	60	50	47

Notes: Lic denotes the value of licensing & royalty receipts or fees (in real 1995 U.S. dollars) received by foreign affiliates of U.S. multinationals; LicA denotes that portion of fees from affiliated parties and LicU that portion from unaffiliated parties; Emp denotes affiliate employment (number of workers). FDI is the stock of foreign direct investment. All dependent variables are in natural logs. Data sources are discussed in an Appendix. FDI and affiliate gross product are also in real 1995 U.S. dollars. The equations are estimated by GLS (generalised least squares) allowing for random country-specific effects, over a panel of three periods (1990, 1995, and 1999). In this table, the licensing values are an aggregate across all industries. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level. Standard errors are in parentheses and italicised.

Table 3. Intellectual property rights and licensing, all industries, by region

Part A: Developed country sample

	(1) Lic/ Emp	(2) Lic/ FDI	(3) Lic^A/ Emp	(4) Lic^U/ Emp
Constant	-13.75***	-12.23***	-7.038	-13.20***
	(3.793)	*(3.029)*	*(4.899)*	*(3.821)*
Log (Patent Rights)	4.262***	4.198***	3.305*	2.899**
	(1.626)	*(1.444)*	*(2.059)*	*(1.509)*
Log (Copyrights)	-0.208	-0.096	1.174	0.258
	(1.336)	*(1.085)*	*(1.619)*	*(1.217)*
Log (Trademark Rights)	0.596	0.906	0.052	0.488
	(0.802)	*(0.653)*	*(1.007)*	*(0.707)*
Enforcement Effectiveness	1.555	1.082	1.006	2.692**
	(0.995)	*(0.813)*	*(1.511)*	*(1.303)*
Log(Gross Product Per Worker	1.388**	0.142	0.109	1.099*
	(0.654)	*(0.533)*	*(0.879)*	*(0.692)*
Adjusted R^2	0.44	0.36	0.18	0.58
Number of Observations	43	41	36	34

Part B: Developing country sample

	(5) Lic/ Emp	(6) Lic/ FDI	(7) Lic^A/ Emp	(8) Lic^U/ Emp
Constant	-5.148***	-8.880***	-4.001*	0.615
	(1.948)	*(2.733)*	*(2.342)*	*(3.652)*
Log (Patent Rights)	-0.548	-1.577**	-0.136	0.738
	(0.578)	*(0.771)*	*(0.775)*	*(0.687)*
Enforcement Effectiveness	1.547**	0.540	1.511*	-1.150
	(0.728)	*(1.027)*	*(0.965)*	*(0.818)*
Log (GDP per Worker)	0.249	0.324	0.057	-0.559
	(0.245)	*(0.340)*	*(0.292)*	*(0.436)*
Adjusted R^2	0.12	0.11	0.09	0.14
Number of Observations	41	37	35	20

Notes: A country is in the developed sample if its average GDP per capita exceeds $10,000 real 1995 U.S. dollars during the sample period. See also notes to Table 2. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level. Standard errors are in parentheses and italicised. Additional Note: The sample size for the developing country region decreases considerably if the indexes for copyrights and trademark rights are included. Due to limited data on gross affiliate product per worker for the developing region, gross domestic product per worker is used.

Table 4. Intellectual Property Rights and U.S. Royalty & Licensing Fees, Firm Level

Dependent Variable: log (TOTAL)	(1)	(2)	(3)	(4)
Constant	4.136***	4.037***	-3.587***	5.914***
	(0.136)	*(0.158)*	*(1.074)*	*(0.198)*
Log (Patent Rights)	0.409***	0.342***	0.334***	0.187**
	(0.066)	*(0.069)*	*(0.132)*	*(0.087)*
Enforcement Effectiveness	0.443***	0.479***	0.577***	0.263***
	(0.061)	*(0.064)*	*(0.096)*	*(0.091)*
Log (Industry Gross Product Per Worker)		0.038*	0.037	0.044
		(0.023)	*(0.029)*	*(0.029)*
Log (Tariff Rate)			0.028	
			(0.042)	
Log (Country Risk Index)			1.991***	
			(0.267)	
Log (Corruption Index)			-0.449***	
			(0.085)	
Log (Copyrights)				1.289***
				(0.134)
Log (Trademark Rights)				-0.173**
				(0.089)
Industry Group Fixed Effects	Yes	Yes	Yes	Yes
Country Region Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R-squared	0.104	0.096	0.099	0.091
Number of Observations	17408	16430	12424	12659

Notes: TOTAL denotes the sum of royalty and licensing fees of U.S.-based firms from all sources (*e.g.* books, broadcasting, franchising, industrial processes, pre-recorded performances, software, trademarks, and other), and is in real 1995 U.S. dollars. All variables are defined in the Data Appendix (along with data sources). The model is estimated across U.S.-based firms over three time periods: 1992, 1995, and 1999. Industry Gross Product per worker is also in real U.S. dollars and represents the industry group to which the firm belongs. Standard errors are in parentheses and italicised. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Intellectual property rights and U.S. royalty & licensing fees: by source of fees, firm level data

	Dependent Variables:						
Part A	log (BOOK)	log(BROAD)	log(FRAN)	log(INDUS)	log(PERF)	log(SOFT)	log(TM)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	1.388***	4.612***	4.627***	4.314***	3.903***	3.396***	3.000***
	(0.442)	(0.925)	(0.343)	(0.337)	(0.316)	(0.338)	(0.351)
Log (Patent Rights)	-0.078	0.515***	-0.0002	0.283**	0.992***	0.542***	0.338**
	(0.245)	(0.435)	(0.170)	(0.127)	(0.153)	(0.132)	(0.157)
Enforcement Effectiveness	0.529***	0.247***	0.358**	0.330***	0.278**	0.747***	0.382***
	(0.194)	(0.393)	(0.165)	(0.121)	(0.145)	(0.121)	(0.142)
Industry Group Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.108	0.060	0.149	0.070	0.085	0.102	0.041
Number of Observ	1666	437	1518	4501	3052	4985	2662

	Dependent Variables:				
Part B	log (BOOK)	log(BROAD)	log(FRAN)	log(INDUS)	log(PERF)
	(1)	(2)	(3)	(4)	(5)
Constant	4.037***	7.327***	5.832***	3.396***	6.252***
	(0.473)	(0.928)	(0.408)	(0.338)	(0.451)
Log (Patent Rights)					0.768***
					(0.198)
Log (Copyrights)	1.747***	1.473*	0.568*	0.806***	1.144***
	(0.343)	(0.791)	(0.344)	(0.291)	(0.308)
Log (Trademark Rights)	-0.245	0.321	-0.249	-0.024	0.342*
	(0.259)	(0.581)	(0.254)	(0.199)	(0.216)
USTR Intell. Prop Enf. Effectiveness	0.234	0.256	0.249	0.364**	0.123
	(0.212)	(0.452)	(0.216)	(0.179)	(0.199)
Industry Group Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Region Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.120	0.037	0.177	0.043	0.077
Number of Observ.	1334	337	1079	2000	2271

Notes: BOOK denotes fees from books etc., BROAD from Broadcasting, FRAN from Franchises, INDUS from industrial processes, PERF from pre-recorded performances, SOFT from general use software, and TM from Trademarks. All dependent variables are in real 1995 U.S. dollars. See also notes to Table 4. Standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Intellectual property rights and licensing: by industry and all regions, firm level data

	Dependent Variable: log (Lic)							
Industry Group:	**Food & Kindred**	**Chemicals**	**Metals**	**Machinery**	**Electrical, Electronics**	**Transport**	**Wholesale**	**Services**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	4.86***	3.99***	3.76***	3.29***	3.82***	3.02***	4.92***	3.38***
	(0.66)	*(0.57)*	*(0.75)*	*(0.93)*	*(0.80)*	*(1.09)*	*(0.78)*	*(0.25)*
Log (Patent Rights)	-0.09	-0.14	0.09	0.32	0.79**	1.44**	0.09	0.79***
	(0.31)	*(0.22)*	*(0.47)*	*(0.49)*	*(0.37)*	*(0.63)*	*(0.42)*	*(0.14)*
Enforcement Effectiveness	0.48	0.54***	0.53	0.05	0.70**	-0.15	-0.12	0.30***
	(0.34)	*(0.22)*	*(0.41)*	*(0.39)*	*(0.36)*	*(0.47)*	*(0.42)*	*(0.12)*
Country Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.05	0.04	0.09	0.03	0.06	0.04	0.04	0.04
Number of Observations	333	1283	278	504	636	399	396	5067

Notes: The dependent variable is the log of real licensing & royalty fees in real 1995 dollars. See also notes to Table 4. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level, respectively. Standard errors are in parentheses and italicised.

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

Date	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 (Taiwan) Ecogen Inc (USA)	0.3	BIOTECHNOLOGY
1991	Energy Conversion Devices Inc (USA) Samsung Electronics Co Ltd (Korea)	2.5	OTHER
1991	Akkumulatorgyár (Hungary) Furukawa Battery Co Ltd (Japan)	0.1	OTHER
1992	Intl Power Machines Corp (USA) Allis Electric Co Ltd (Taiwan)	2.1	ELECTRONICS
1992	Aura Systems Inc (USA) Daewoo Electronics Co Ltd (Korea)	1.5	ELECTRONICS
1993	Western India Group (India) Interline Hydrocarbon Inc (USA)	1	OTHER
1994	Saliva Diagnostic Systems Inc (USA) Orgenics Ltd (Israel)	0.2	BIOTECHNOLOGY
1994	Battery Technologies Inc (Canada) Young Poong Corp (Korea)	10	OTHER
1995	Derma Sciences Inc (USA) PT Tempo Scan Pacific (Indonesia)	1.5	BIOTECHNOLOGY
1995	Daewoo Corp (Korea) PBR Automotive (Australia)	10.8	OTHER
1995	Oracle Systems Corp (USA) Tata Consultancy Services (India)	3	COMPUTER
1995	Ziran Electronics (Canada) Gaozhou Dong Ling Electronics (China)	3.5	COMPUTER
1997	Hughes Corp (USA) Nippon Denro Ispat Ltd (India)	11	COMMUNICATIONS
1998	Compositech Ltd (Taiwan) Fidelity Venture Capital Corp (USA)	1	ELECTRONICS
1998	Kia Motors Corp (Korea) LucasVarity PLC (USA)	200	OTHER
2000	Chongqing Municipal Authority (China) Phoenix Technology Corporation (Australia)	15	OTHER
2000	Nuance Communications Inc (USA) Skynet(Intl Grp)Hldgs Ltd (Hong Kong)	3.2	COMMUNICATIONS
2000	Horizon.com Ltd (USA) EVCI Career Colleges Inc (Singapore)	4	COMPUTER

Note: Licensing fees are in nominal U.S. dollars and refer to initial fees.

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.	USA	Korea	73
2.	USA	China	51
3.	USA	Taiwan	42
4.	USA	India	28
5.	USA	Singapore	26
6.	USA	Hong Kong	19
7.	Japan	Korea	18
8.	USA	Russia	15
9.	USA	Brazil	14
10.	USA	Mexico	14
11.	Canada	China	13
12.	Canada	Korea	13
13.	USA	Israel	11
14.	USA	Malaysia	10
15.	USA	Argentina	9
16.	Germany	Korea	7
17.	Japan	China	7
18.	USA	Indonesia	7
19.	USA	Thailand	7
20	UK	China	6

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

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. U.S. sources

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

ii. Non-U.S. sources

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

Notes: 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. All deals are "high-tech" licensing transactions (involving computer equipment & software, communications (including telecommunications), biotechnology, and electronics).

Part C. Breakdown by high-tech group, all licensor nations:

i. Biotechnology

Strengthening of patent regime		*Number of licensing deals* *1989-94*	*1997-2002*	*Change:*
	Low	12	3	-9
	Medium	11	4	-7
	High	9	7	-2

ii. Communications

Strengthening of patent regime		*Number of licensing deals* *1989-94*	*1997-2002*	*Change:*
	Low	5	20	15
	Medium	7	5	-2
	High	8	32	24

iii. Computer

Strengthening of patent regime		*Number of licensing deals* *1989-94*	*1997-2002*	*Change:*
	Low	10	18	8
	Medium	5	16	11
	High	6	14	8

iv. Electronics

Strengthening of patent regime		*Number of licensing deals* *1989-94*	*1997-2002*	*Change:*
	Low	28	12	16
	Medium	1	1	0
	High	10	8	2

APPENDIX A. INTELLECTUAL PROPERTY RIGHTS - SUMMARY OF CRITERIA AND MEASUREMENT

This appendix summarises the components of each IPR index employed in the present study and the corresponding methods for scoring the strength of protection. Explanatory notes follow the capsule summaries.

I. Patent Rights Index

1. Membership in International Treaties	Signatory	Not Signatory
-- Paris Convention and Revisions	1/3	0
-- Patent Cooperation Treaty	1/3	0
-- Protection of New Varieties (UPOV)	1/3	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 microorganisms	1/7	0
-- Patentability of utility models	1/7	0

3. Restrictions on Patent Rights	Does Not Exist	Exists
-- "Working" Requirements	1/3	0
-- Compulsory Licensing	1/3	0
-- Revocation of Patents	1/3	0

4. Enforcement	Available	Not Available
-- Preliminary Injunctions	1/3	0
-- Contributory Infringement	1/3	0
-- Burden-of-Proof Reversal	1/3	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

6.	1) Coverage	Score:
	a. General (Literary and Artistic Works)	Duration of protection as percentage of 70 years
	b. Performances	Duration as protection as percentage of 70 years
	c. Sound Recordings	Duration as protection as percentage of 70 years
	d. Films	Duration as protection as percentage of 70 years
	e. Broadcasts	Duration as protection as percentage of 70 years
	f. Droite de Suite (Shares in Resale)	Share as percentage of max (top censored at 5%)
	g. Computer Programmes	1 if available, zero otherwise
	Sub-Score (out of 1, average of a – g)	

7.	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

8.	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)		

9.	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
	b. 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

10.	1) Coverage	Available	Otherwise
	a. Service marks	1	0
	b. Certification marks	1	0
	c. Collective marks	1	0
	d. Colors	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)		

11.	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 first-to-use)	0 (first-to-file)
	Sub-score (out of 1, average of a – i)		

12.	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

1. This index is a qualitative measure of the effectiveness of IPR enforcement in practice. It is based on reports filed with the U.S. Trade Representative (USTR) which document the experience of IP enforcement in countries outside the U.S.

2. 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. Thus, the index is given by:

Enforcement effectiveness =

0 if enforcement measures are not available or inadequate (*e.g.* weak deterrents);

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

1 otherwise.

V. Explanatory Notes:

(A) Patent Rights

The numerical value of each component ranges from zero to one and indicates the fraction of legal features in that sub-index available in the particular country. For example, a value of 1/3 for membership in international treaties indicates that a country is a signatory to one-third of the international treaties listed under that component. A value of ½ for duration implies that a country grants protection for half the international standard time (of 20 years from the date of application or 17 years from the date of grant). The value for coverage indicates the fraction of invention classes the country allows as patentable subject matter. Fourthly, several conditions exist under which authorities can revoke or reduce patent rights (such as compulsory licensing). The value for the 'restrictions' category indicates the fraction of those restrictions which are not exercised in the country.

The enforcement component consists of the availability of *preliminary injunctions*, *contributory infringement pleadings*, and *burden-of-proof reversals*. A country that provides all three receives a value of 1 for this category. While litigation, arbitration, and settlement comprise different enforcement 'routes' should infringement occur, patent holders may have recourse to a number of statutory provisions which can aid in enforcement. Preliminary injunctions, for example, are pre-trial actions that require the accused infringer to cease the production or use of the patented product or process during the course of the trial. Preliminary injunctions are a means of protecting the patentee from infringement until a final decision is made in a trial. Contributory infringement refers to actions that do not in themselves infringe a patent right but cause or otherwise result in infringement by others. Thus, contributory infringement permits third-parties also to be liable if they contribute negligently to the infringement. Burden of proof reversals put the onus on the accused to prove innocence. Given the difficulty IP owners may have in proving that others are infringing on their patentable ideas, the shift in burden can be a powerful enforcement mechanism.

(B) Copyrights Index

Coverage again refers to the subject matter that is protected. This includes general works (such as literary, artistic, and dramatic works), neighbouring rights (such as performances, sound recordings, and broadcasts), films, and computer programs.[39]

The duration of protection is tied to the subject matter. Hence this component incorporates duration factors by scoring the availability of protection not as a binary policy decision (*e.g.* 1 if available, zero otherwise) but as a fraction of the international standard of duration. For example, if a country provides 35 years of protection for sound recordings, and 70 years of protection is the international standard, a country scores ½ for sound recordings coverage.

Droit de Suite are the resale rights of copyright holders; that is, the right of artists to obtain a share of the proceeds from the resale of their works. The score for resale rights is also expressed as a percentage of the international norm. The "norm" is that authors or artists be entitled to at least 5% of the resale proceeds. In some countries, the rate is higher than 5%. Thus, if a country specifies a share of 3%, the score this country receives for resale rights is 0.6 (= 3/5).

Coverage for computer programs remains a binary score, since this is a relatively new subject area and the issue is whether countries protect and recognise computer programs as a copyrightable work.

The usage component addresses the degree to which copyright holders have control over their copyrights. The first consideration is whether *private use by third parties* is allowed. Weak copyright systems, for instance, would allow full private use without permission. Medium strength systems would permit private use without permission in particular cases (for private study or research). Stronger systems would prohibit private use without permission. Another way in which copyright use is affected is through *collective licensing bodies*. These bodies represent groups of artists who license and distribute their work through a collective. Typically the collective exercises some market power and thus countries where collective licensing is practiced earn a score for it in the index.

The enforcement component includes provisions for preliminary injunctions and the availability of criminal penalties (in addition to civil) and procedures for the seizure and destruction of infringing goods. Enforcement of copyrights is also aided by provisions which protect against *anti-circumvention devices* (that is, devices that can be used to bypass or disable any copy protection systems). The availability of each of these enforcement features earns a point for a country. The score for the enforcement component is the average score across these features.

The treaties covered by the index include the Berne Convention of 1886. This convention sets minimum standards, and covers reproduction rights, adaptation, and moral rights (in addition to economic rights).[40] The Universal Copyright Conventions (UCC) of 1952 and 1971 further strengthens the copyrights afforded by Berne, to include scientific work, nondiscriminatory treatment of foreign nationals, and the right to register a copyright regardless of whether the work is registered in the home country. The UCC is not to interfere with Berne. In fact, countries that withdraw from Berne would lose protection under the UCC. The other treaties in the copyright index are the Rome Convention (which covers neighboring rights), Geneva Convention (which covers sound broadcasting), and Brussels Convention (which covers the retransmission of satellite broadcasts to protect against, for example, the interception of satellite

[39] *Neighboring rights* (or related rights) refer to the copyrights of entrepreneurs. Copyright laws generally distinguish between "authorial works" (such as books) and entrepreneurial works (such as performances).

[40] That is, the right of a copyright holder to derive non-economic, non-pecuniary benefits (such as the right to be properly attributed for a work that the copyright holder produced).

transmissions and the re-broadcasting of them without permission). Membership in each of these treaties earns a point for a country. The score for the treaty component is the average score across treaties.

The overall score for the copyright index is the average of the four components. The implicit assumption here is that each component is weighted equally (as is the case with the patent rights index). Reynolds (2003) experiments with different weighting schemes[41] and finds that in general the overall rankings of countries are insensitive to the choice of weights. Using the Spearman rank correlation and Pearson Method of Moment tests, Reynolds (2003) finds the rankings of variables to be statistically insignificantly different. An advantage of equal weighting is its transparency and simplicity.[42]

(C) Trademark Rights Index

The coverage component includes features that help contribute to variation of information across countries. For instance, the trademarking of general names and symbols of goods is not covered in this index since all countries (that have trademark laws) provide for this. However, not all countries provide trademark protection for services. Hence the first feature in the coverage component is the protection of service marks. The second area is collective marks which pertain to organisations such as unions. The third is certification marks (including appellations of origin) which identify the location of goods and services as well as the adherence to particular standards (for example, wireless network equipment certification standards, such as Wi-Fi). The coverage component also looks to see whether legal systems protect color marks, 3-dimensional shapes, and well-known marks (namely marks with an international reputation, in which case the original holder or owner has prior rights). For each of these six features, a country scores a 1 if the coverage is available, and zero otherwise. The score for this component is the average across these features. A country scoring ½ means that only half the features are covered under the law.

The second component is procedures. This component consists of nine features. The score a country receives for procedures is the fraction of features provided. One of these features is the availability of criminal penalties (such as prison terms) in addition to civil penalties in regards to trademark violations. Civil penalties are generally provided and hence do not contribute much international variation in the data (and thus are not incorporated under penalties). Another feature is 'bona fide use prohibition' which prevents the trademarking of common terminology (leaving it in the public domain); this rule affords greater clarity to trademark seekers. Countries also receive a score for prohibiting the trademarking of generic terms (or to previous trademarks that have become generic terms), for requiring that marks be used or protection is voided,[43] for requiring the use of a local lawyer to enforce trademarks, and for providing a grace period (typically six months) after an international exhibition so that the right to register a trademark is not forfeited for lack of novelty.

Procedural statutes can contain provisions which restrict the exercise of a trademark. For instance, trademark licensing agreements may be required to contain conditions such as mandating quality standards or requiring that the transfer or sale of trademarks to another party must be accompanied by the transfer of the business with which the mark is identified. Countries that do not impose these limitations are viewed as providing for stronger trademark rights (and are given scores of 1 for not having them).

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[41] One formal way to choose weights is through "principal components analysis" which seeks the weighted averages of the components which yield the highest variance. Another way is to specify ad-hoc weights (such as 40% to one component, and 20% to the other three).

[42] With these indexes (patent rights, copyrights, and trademark rights), individual researchers or users are able to choose their own weights should they desire.

[43] The trademark index evaluates the strength of individual holders' rights vis-à-vis the *community* of rights holders and potential rights holders.

The procedures component also provides a score of 1 for countries that adopt a first-to-use priority rule for trademark registration. Otherwise, the right to register a trademark would go to the firm or person who files first. The first to use is granted more time to develop a design and business without the concern that someone else could take away priority.

The reason for incorporating enforcement into the procedures component here is that trademark laws are very detailed about procedures for obtaining, maintaining, and defending rights such that the enforcement aspects are intertwined with the procedural laws. Separating the procedures and enforcement aspects into different components could lead to "double counting."[44]

Finally, the trademark rights index takes into account membership in international treaties as a signal of how strongly such rights will be provided and defended. Countries score a 1 for each treaty to which they are signatories. The Paris Convention, Madrid Agreement I (False and Deceptive Indications of Sources), and Trademark Law Treaty govern standards for trademark rights. The Nice and Vienna Agreements govern classification standards (which facilitate the search and retrieval of trademark information). The Lisbon Agreement and Madrid Agreement II (International Registration of Marks) govern the global protection aspects (for example, how trademark registrations in one member state are recognised in other member states).

The overall score for the trademark index is an average of the three components. Again, Reynolds (2003) experiments with different weighting schemes (including principal components) and finds that the rankings of countries' scores are not significantly different across the different weighting schemes (based on the Spearman and Pearson tests). Again, the straightforward averaging method is simpler and more transparent.

(D) Enforcement Effectiveness

The enforcement effectiveness index does not focus on the extent of infringement activity. IP violations occur not only because of weak laws and enforcement, but also because imitators or infringers are very capable of copying. Therefore it is important to control for the capacity of a nation's "imitative" sector to make copies. In nations where the capacity for imitation is low, weak enforcement may not be an important factor to innovators. The weak capacity for imitation itself acts as a protection against imitation. On the other hand when a strong capacity for imitation exists, even if strong laws exist (on the books) and enforcement is strong (that is, the authorities are both willing and able to protect rights), there will always be some infringement. Thus the level of infringement activity is not in and of itself a good indicator of whether the laws are lax or ineffective. While lax laws and poor enforcement do contribute to IPR infringement, there are other factors that drive IPR infringement activity (including capacity for imitation, such as the level of technology for copying, and quantity of innovations and creations).

Thus, for purposes of this index (which is to try to measure the actual enforcement of IPR laws), the focus will be on how the authorities enforce or carry out the laws in practice – not on the actual extent of infringement activity. This particular index looks first for whether enforcement mechanisms are available or adequate; secondly, whether laws are enforced; and thirdly, how effectively laws are enforced. For instance, if enforcement measures are not available or are inadequate, the enforcement of laws is not going to be effective. Thus, countries in this situation would score 0. Countries also score 0 if they have the enforcement mechanisms but are not enforcing the laws (as a policy choice or because certain other policy choices make enforcement ineffective, *e.g.* weak fines or sentences). However, if countries are deemed to

[44] Restrictions (as a separate component) are also dropped because in trademark law and practice the restrictions tend to reflect the comprehensiveness of laws rather the reduction in the strength of rights (*e.g.* restrictions on misleading, immoral, and religious symbols).

be enforcing the laws, but not effectively because of barriers to enforcement (*e.g.* resource constraints) or because of delays in the implementation of policy (that is, an intellectual property law goes into effect six months or a year later), they would score ½. Essentially countries should score a half point if they are trying to enforce the laws (but are less successful because their capacity to enforce needs to be strengthened). For countries without enforcement problems, a score of 1 is given. Note that complaints about the lack of laws (other than enforcement provisions) are not counted in this index since the previous indexes (*e.g.* patent rights, copyrights, and trademark rights) have already incorporated information about the absence of laws.

APPENDIX B: DATA SOURCES

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.

Licensing and Related Data

- Firm Level: Bureau of Economic Analysis, U.S. 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 U.S. and Unaffiliated Foreign Persons.
- Aggregate Industry Level: Bureau of Economics Analysis, U.S. Department of Commerce, International Investment Division, (BE 10 Survey) U.S. Direct Investment Position and Related Balance of Payments Flows, Benchmark Surveys:

  Year 1999: Licensing (Table 3J7), Foreign Direct Investment (Table 2X2)
  Employment (Table 3H3), Gross Product of Affiliates (Table 3G3)

  Year 1994: Licensing (Table 3J7), Foreign Direct Investment (Table 2W3)

  Employment (Table 3H3), Gross Product of Affiliates (Table 3G3)

  Year 1989: Licensing (Table 3I7), Foreign Direct Investment (Table 2U3)
  Employment (Table 3G3), Gross Product of Affiliates (Mataloni and Goldberg (1994))
- Licensing Deals: Securities Data Corporation (SDC) Platinum Version 2.3: Joint Ventures and Strategic Alliances Database, Thomson Financial Inc. (by subscription).

  http://www.thomson.com/financial/fi_contact_sales_support.jsp?character=s

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).

APPENDIX C: REGRESSION METHODOLOGY

1. Consider the following equation or model:

$$y_{it} = \alpha + \beta\, x_{it} + \gamma\, z_{it} + \eta_i + \varepsilon_{it},$$

where y is the variable to be explained (*e.g.* licensing fees), and x and z the variables to explain y. For instance, let x be the level of IPRs, and z the control variables. The subscripts refer to the values of y, x, and z for country i at time t, where i = 1, ..., n and t = 1, ..., T. In other words, the data set consists of n countries for T years, giving a total of nT observations. In the above equation, ε represents the error term and η the individual country effect. The latter refers to some unobservable, random or fixed country-specific factor (such as culture, environment, or quality of institutions).

2. The objective of the regression analysis is to choose the values of α, β, and γ (called coefficients) that best fit the data. The estimated model is unlikely to capture the data perfectly – hence the presence of errors, ε. Fitting the data well requires essentially choosing the coefficient values to minimise the sum of the squared errors.

3. The estimated coefficient values indicate the nature of the relationship between y, x, and z. A positive coefficient on x indicates that y responds positively to IPRs. If y, x, and z are expressed in logarithms, the coefficient indicates the "elasticity" of response. For example, if y is the log of licensing fees and x the log of IPRs, a 1% increase in IPRs results in a β% increase in licensing fees, holding other factors constant. The regression analysis also provides the level of statistical significance of a coefficient estimate (again, a p-value). The issue is whether the coefficient estimate is significantly different from zero. The p-value indicates the probability of incorrectly rejecting the assumption of a zero coefficient value (or of a zero effect). A high p-value suggests that there is a strong probability that β is statistically insignificantly different from zero. The reason would be that the underlying variance (or standard deviation) of the estimate of β is wide. Thus, the lower the p-value, the more confidence one has that the explanatory variable in question (x or z) can account for y. Three conventional p-values used as criteria for indicating statistical significance: 1%, 5%, and 10%. The empirical results report these significance levels with asterisks ***, **, and * respectively.

4. In the aggregate data analysis, the dependent variable, y, is the natural log of royalties and licensing fees received by foreign affiliates of U.S. multinationals from country i per affiliate worker in country i at time t (in real 1995 dollars). The fees are divided by the number of workers in order to control for the scale of operations of abroad (as proxied by the size of employment among U.S. foreign affiliates). In some cases, earnings from licensing rise merely because of the expansion in the scale of operations. In the firm level analysis, the dependent variable is the natural log of a U.S. firm's royalties and licensing fees from country i at time t. Due to an inability to find a concordance with employment data, the dependent variable is in levels and not ratios.