

2000

Intellectual Property Rights and Economic Development

Keith E. Maskus

Follow this and additional works at: <https://scholarlycommons.law.case.edu/jil>

 Part of the [International Law Commons](#)

Recommended Citation

Keith E. Maskus, *Intellectual Property Rights and Economic Development*, 32 Case W. Res. J. Int'l L. 471 (2000)
Available at: <https://scholarlycommons.law.case.edu/jil/vol32/iss3/4>

This Article is brought to you for free and open access by the Student Journals at Case Western Reserve University School of Law Scholarly Commons. It has been accepted for inclusion in Case Western Reserve Journal of International Law by an authorized administrator of Case Western Reserve University School of Law Scholarly Commons.

INTELLECTUAL PROPERTY RIGHTS AND ECONOMIC DEVELOPMENT

Keith E. Maskus

| | |
|--|-----|
| I. INTRODUCTION | 472 |
| II. INTELLECTUAL PROPERTY RIGHTS AND ECONOMIC DEVELOPMENT | 473 |
| A. The Purposes and Mechanisms of Intellectual Property Rights | 473 |
| B. Endogenous IPRS | 476 |
| C. Positive Impacts of IPRS on Economic Development | 478 |
| D. Negative Impacts of IPRS on Economic Development..... | 489 |
| E. Evidence on the Overall Impact of IPRS on Growth | 494 |
| III. BENEFITING FROM INTELLECTUAL PROPERTY RIGHTS..... | 495 |
| A. Implementing Procompetitive IPRS Standards..... | 496 |
| B. Enhance Capacities to Develop and Use IPRS | 497 |
| C. Promote Competitive Markets | 498 |
| D. Develop Competition Policies | 499 |
| IV. CONCLUSIONS..... | 502 |
| TABLE 1. ESTIMATES OF IMPACTS OF TRIPS PATENT CHANGES ON INTERNATIONAL FLOWS OF ECONOMIC ACTIVITY FOR SELECTED COUNTRIES | 503 |
| TABLE 2. PERCENTAGE OF FIRMS CLAIMING THAT THE STRENGTH OR WEAKNESS OF INTELLECTUAL PROPERTY RIGHTS HAS A STRONG EFFECT ON WHETHER DIRECT INVESTMENTS WILL BE MADE, BY TYPE OF FACILITY..... | 504 |
| TABLE 3. PERCENTAGE OF FIRMS CLAIMING THAT INTELLECTUAL PROPERTY PROTECTION IS TOO WEAK TO PERMIT TYPES OF INVESTMENT | 505 |
| TABLE 4. SIMULATED STATIC EFFECTS OF STRONGER IPRS ENFORCEMENT IN LEBANON | 506 |

ABSTRACT:

This paper provides an analytical overview of how economic development may be promoted or hindered by an effective system of intellectual property rights (IPRS). IPRS can play a positive role in encouraging new business development, rationalization of inefficient

industry, and inducing technology acquisition and creation. They may harm development prospects by raising the costs of imitation and permitting monopolistic behavior by owners of IPRS. The potential gains and losses depend on the competitive structure of markets and the efficiency of related business regulation, including aspects of competition policy and technology development policy. The paper reviews available empirical evidence on these issues. The evidence supports the view that product innovation is sensitive to IPRS in developing countries, while FDI and technology transfer go up when patent rights are strengthened. Overall, there is a positive impact on growth, but this impact depends on the competitive nature of the economy. The paper concludes by putting forward suggestions for integrated policy reforms.

INTRODUCTION

The question of how intellectual property rights (IPRS) affect the processes of economic development and growth is complex and based on multiple variables. The effectiveness of IPRS in this regard depends considerably on particular circumstances in each country. While economists are devoting more attention to this issue, evidence to date is fragmented and somewhat contradictory, in part because many of the concepts involved are not readily measured. As I discuss below, stronger systems for protecting intellectual property could either enhance or limit economic growth, in theory. Nevertheless, evidence is emerging that stronger and more certain IPRS could well increase economic growth and foster beneficial technical change, thereby improving development prospects, if they are structured in a manner that promotes effective and dynamic competition.¹

As the global protection regime strengthens due to implementation of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), concluded under auspices of the World Trade Organization, numerous questions arise about impacts on prospects for economic growth. For many reasons, it is impossible to claim confidently that the new regime will raise growth and improve economic development processes. Two such reasons are paramount. First, many other variables affect growth in ways that could dominate the impacts of IPRS. Such elements include macroeconomic stability, market openness, policies for improving the

¹ See Robert E. Evenson & Larry E. Westphal, *Technological Change and Technology Strategy*, in 3A HANDBOOK OF DEVELOPMENT ECONOMICS 2209, 2229-30 (Jere Behrman & T.N. Srinivasan eds. 1995); Keith E. Maskus, *The Role of Intellectual Property Rights in Encouraging Foreign Direct Investment and Technology Transfer*, 9 DUKE J. COMP & INT'L L. 109, 128-38, 149 (1998) [hereinafter Maskus, *Foreign Direct Investment*]; Carlos A. Primo Braga et al., *Intellectual Property Rights and Economic Development* (1998) (unpublished manuscript, Background Paper for the World Development Report, on file with the author).

economy's technological infrastructure, and the acquisition of human capital. Second, economic theory points out that IPRS could have many effects on growth, some positive and some negative. Further, the significance of these effects would be dependent on circumstances in each country. However, in a broad setting of appropriate complementary policies and transparent regulation, IPRS could play an important and positive role in promoting economic growth. Indeed, the system of IPRS itself may be structured in particular ways to favor dynamic competition within a system of rights and obligations.

With this background, the paper addresses two broad issues. In Section Two, I discuss theory and evidence regarding how IPRS may improve or retard economic development. The primary finding is that development is a complex process and that IPRS could have a range of impacts. The policy approach most conducive to expanding development is to implement an integrated system of both IPRS and corollary policies that strike a balance of incentives in favor of rigorous but fair dynamic competition. Thus, in Section Three, I overview these broader policy initiatives, suggesting methods by which developing countries might wish to complement their emerging IPRS regimes. Section Four provides concluding remarks.

II. INTELLECTUAL PROPERTY RIGHTS AND ECONOMIC DEVELOPMENT

Before considering how IPRS influence economic activity and growth, consider their intended roles in the economy. Economic analysis of IPRS is utilitarian, asking whether the benefits of any system outweigh its costs, both in static and dynamic terms. The anticipated benefits and costs depend on characteristics of markets, products, and social institutions. Thus, a "one size fits all" approach to harmonizing international IPRS makes little economic sense.

A. *The Purposes and Mechanisms of Intellectual Property Rights*

There are two central economic objectives of any system of intellectual property protection. The first is to promote investments in knowledge creation and business innovation by establishing exclusive rights to use and sell newly developed technologies, goods, and services. Absent such rights, economically valuable information could be appropriated without compensation by competitive rivals. Firms would be less willing to incur the costs of investing in research and commercialization activities. In economic terms, weak IPRS create a negative dynamic externality. They fail to overcome the problems of uncertainty in R&D and risks in competitive appropriation that are inherent in private markets for information.

The second goal is to promote widespread dissemination of new knowledge by encouraging (or requiring) rights holders to place their

inventions and ideas on the market. Information is a form of public good in that it is inherently non-rival and, moreover, developers may find it difficult to exclude others from using it. In economic terms it is socially efficient to provide wide access to new technologies and products, once they are developed, at marginal production costs. Such costs could be quite low for they may entail simply copying a blueprint or making another copy of a compact disk or video.

There is a fundamental tradeoff between these objectives. An overly protective system of IPRS could limit the social gains from invention by reducing incentives to disseminate its fruits. However, an excessively weak system could reduce innovation by failing to provide an adequate return on investment. Thus, a policy balance needs to be found that is appropriate to market conditions and conducive to growth.

Different forms of IPRS operate in distinct fashions and it is misleading to group them together. Therefore, it is helpful to mention briefly what the various mechanisms are. First, *patents* provide the right to prevent for 20 years the unauthorized making, selling, importing, or using of a product or technology that is recognized in the patent claim and that must demonstrate novelty and industrial utility. Related devices are *utility models*, or *petty patents*, which provide exclusive rights for a shorter period for incremental inventions, and *industrial designs*. In most countries patent applications are made public after a prescribed time period. Thus, patents establish a protected market advantage in return for revealing technical knowledge. Several aspects of patent scope affect the effective strength of protection. A similar type of industrial property is *plant breeders' rights*, which have fixed terms, novelty requirements, and disclosure rules. They are intended to encourage development and use of new seed varieties for agriculture.

Trademarks protect rights to market goods and services under identified names and symbols. Trademarks and brand names must be sufficiently unique to avoid confusing consumers, thereby playing the important role of reducing consumer search costs. These rights encourage firms to invest in name recognition and product quality. They also induce licensees to protect the value of assets by selling goods of guaranteed quality levels. If trademarks were not protected, rival firms could pass off their lower-quality goods as legitimate versions of those produced by recognized companies. This situation would diminish incentives for maintaining quality and would raise consumer search costs. Economists generally believe that the danger of market dominance through abuse of trademarks is slight in competitive economies but such marks could be accompanied by significant market power in countries with other barriers to entry.

Firms develop some technologies that might not be patentable, might not be worth the cost of applying for a patent, or might be more valuable if kept undisclosed. They prefer to keep knowledge of such processes

proprietary as *trade secrets*, or *undisclosed information*. Trade secrets are protected by legal rules against learning by rivals through dishonest means. Such protection lapses if the technologies are discovered by fair means, such as independent invention or reverse engineering. Protecting trade secrets is beneficial to the extent it encourages the development and commercial use of sub-patentable inventions. Rules protecting trade secrets thus promote adaptive innovation and encourage learning through legal means.

Literary and artistic creations and computer software are protected by *copyrights*, which provide exclusive rights for some period to copy and sell particular expressions of ideas after they are fixed in some medium. Related IPRS include *neighboring rights* of performers and broadcasters, *moral rights* of original artists, and copyrights for derivative products. Like patents, copyrights are limited in scope for various purposes of public policy. The most significant limitation is the fair-use doctrine, under which it is lawful to make limited numbers of copies for research and educational purposes.

Several technologies do not fit comfortably into these traditional categories of protection. Because computer programs may contain elements of industrial utility in addition to their expressive elements, some countries make programs eligible for patents. The designs of integrated circuits typically are awarded exclusive rights for shorter time periods than patents, recognizing that semiconductor designs often embody elements of expression and that technology changes quickly in that industry. Electronic transmissions of internet materials, broadcasts, and databases may not be adequately protected by standard copyrights and two recent treaties reached in the World Intellectual Property Organization call for stronger protection in certain dimensions.²

Particularly controversial, especially in developing nations, are patents for biotechnological inventions and plant breeders' rights. It could be argued that patents generate strong and unwarranted protection in the biotechnology industry, because such inventions may not embody a truly inventive step. However, representatives of biotechnology firms claim that patents are required to encourage investment in these risky technologies. There are significant concerns that providing exclusive rights in seed varieties without significant limitations for farmers' use and competitive research could raise costs in agriculture and reduce biodiversity over time.

² See MARC BACCHETTA, WORLD TRADE ORG., ELECTRONIC COMMERCE AND THE ROLE OF THE WTO 61-62 (1998) (stating that two new treaties, the WIPO Copyright Treaty and the WIPO Performances & Phonograms Treaty, will afford increased "protection of authors", performers' and phonogram producers' rights . . . of communication, circumvention of technological measures and integrity of rights management information" relating to the Internet).

A final element of an intellectual property system is its enforcement. Such enforcement entails two opposing tasks: punishing infringement by free riders and disciplining enterprises that try to extend their rights beyond intended levels by acting in an anti-competitive manner. These objectives require the development of extensive legal and scientific expertise.

B. Endogenous IPRS

A first analytical point to recognize is that national regimes of intellectual property protection strongly depend on the level of economic development. Thus, the causation between IPRS and development operates in both directions. Indeed, that governments strengthen their IPRS systems as their economies become wealthier and attain a deeper basis of technological sophistication is well established. The claim that strong IPRS promote technical change and development is more debatable.

The determinants of intellectual property protection have been the subject of empirical investigation. For example, consider the index of patent rights developed by Ginarte and Park.³ They studied the patent laws of a comprehensive set of countries every fifth year from 1960 to 1990, considering five components of the laws: duration of protection, extent of coverage, membership in international patent agreements, provisions for loss of protection, and enforcement measures. Each of these components was broken down into characteristics determining its effective strength. For example, patent coverage incorporated the eligibility for patents of pharmaceutical and chemical products and the availability of utility models. Enforcement measures included the availability of preliminary injunctions, contributory infringement actions, and reversal of the burden of proof in process patent cases. These classifications were based solely on the laws as written; the authors could not assess how stringently the laws were actually enforced. Each sub-component was assigned a value of one if present and zero if absent, with the component score being the sum of these values as a percentage of the maximum value. Thus, the minimum possible national score was 0.0 and the maximum was 5.0.

To illustrate the index, across all countries in 1985 it averaged 2.44, indicating that roughly half the various sub-components in patent rights existed in the average nation.⁴ The developed economies had indexes that were both considerably higher and less variable than those of the middle-income and low-income developing economies. The increase in average protection from poor countries to middle-income countries was considerably less than that from middle-income countries to rich countries. Over time, there was a marked increase in the average index across nations. However, there was not much evidence of convergence between developing

³ See Juan C. Ginarte & Walter G. Park, *Determinants of Patent Rights: A Cross-National Study*, 26 RES. POL'Y 283, 285-86 (1997).

⁴ See *id.* at 286.

and developed countries until the 1990s, as shown in a follow-up study by Park and Ginarte from 1997.⁵

Ginarte and Park undertook an econometric study of the empirical determinants of their index.⁶ They found that the strength of patent rights across countries and over time depended positively on real GDP per capita, the share of R&D in GDP, openness to international trade, and a measure of the freedom of markets from arbitrary and non-transparent government regulation. Human capital, measured by the secondary school enrollment ratio in an earlier period, was a positive and marginally significant contributor to patent rights. Their results therefore suggest that the development of patent rights responds to rising demands for protection, because countries with higher R&D intensities and human capital inputs have higher indexes. The positive effect of trade openness is intriguing though subject to various interpretations. It could be that people are willing to provide stronger protection in open economies because IPRS help preserve access to greater consumer choice. It could also be that in open economies international trade interacts positively with innovative effort, raising the demand for intellectual property protection.

I extended this work through an extensive regression analysis of the determinants of the patent index in 1985 and 1990 for 72 countries.⁷ The results were largely consistent but my specification discovered two additional features. First, market size (aggregate GDP) had no significant impact on patent rights. This finding is potentially important for understanding policy evolution. It suggests that an economy's absolute size itself is not a strong determinant of IPRS reform, in contrast with per-capita income and economic development. Because U.S. trade authorities are concerned with the strength of IPRS protection in large but poor economies, such as India and China, they have mounted considerable pressure for change. This finding suggests that, despite such pressure, effective patent rights may remain limited until incomes grow beyond current levels.

Second, controlling for other influences, there is an inverted-U relationship between patent strength and real per-capita income. In other words, the apparent strength of patent rights first falls as incomes rise above their lowest levels. After reaching a minimum at some intermediate income level, patent laws are strengthened as development proceeds. Indeed, the strength of patents seems to accelerate at high income levels. The computations suggested that the per capita real income at which patent protection becomes weakest is approximately \$2,000 in 1985 international

⁵ Cf. *id.*, at 291 (stating that over thirty years, the average index increased by 15.5%).

⁶ See *id.* at 293-99.

⁷ See KEITH E. MASKUS, *INTELLECTUAL PROPERTY RIGHTS IN THE GLOBAL ECONOMY*, tbl. 4.7 (2000).

dollars.⁸ Moreover, the patent index consistent with the regression is the same for economies with percapita GDP of \$500 and \$7750.⁹ It follows that there is a significant range of incomes before protection becomes stronger than its levels in the poorest countries.

These findings may be explained by the nature of technological development. Least-developed countries devote virtually no resources to innovation and have little intellectual property to protect. As incomes and technical capabilities grow to intermediate levels, some adaptive innovation emerges but competition flows primarily from imitation. Thus, the majority of economic and political interests at this stage prefer weak protection. As economies mature to higher levels of technological capacity and demands shift toward higher-quality products, domestic firms come to favor protective IPRS. Finally, the strength of IPRS shifts up sharply at the highest income levels as these latter processes are cemented.¹⁰

Not only do legislated IPRS become stronger as economies develop, but enforcement and compliance also rise with income levels. Weak enforcement in developing nations reflects both an unwillingness to pay the high costs of administering an effective IPRS system and an inability to manage the complex legal and technical issues such a system entails.

C. Positive Impacts of IPRS on Economic Development

Consider now the opposite direction of causation. Economists recognize several channels through which IPRS could stimulate economic development and growth. These processes are interdependent and it is appropriate to adopt a comprehensive view of the incentives associated with intellectual property protection.

Intellectual property rights could play a significant role in encouraging innovation, product development, and technical change. Developing countries tend to have IPRS systems that favor information diffusion through low-cost imitation of foreign products and technologies. This policy stance suggests that prospects for domestic invention and innovation are insufficiently developed to warrant protection. However, inadequate IPRS could stifle technical change even at low levels of economic development. This is because much invention and product innovation are aimed at local markets and could benefit from domestic protection of patents, utility models, and trade secrets. In the vast majority of cases,

⁸ See *id.*, at ch. 4.2.

⁹ See *id.*

¹⁰ See Evenson & Westphal, *supra* note 1, at 2244-45; cf. Sumner J. Lacroix, *The Political Economy of Intellectual Property Rights in Developing Countries*, in *THE ECONOMICS OF COOPERATION: EAST ASIAN DEVELOPMENT AND THE CASE FOR PRO-MARKET INTERVENTION* 79, 84 (James A. Woumasset & Susan Barr eds. 1992) (discussing the incentives for countries who are net technology importers to maintain weak IPR systems).

invention involves minor adaptations of existing technologies and products. The cumulative impacts of these small inventions can be critical for growth in knowledge and productive activity. To become competitive, enterprises in developing countries typically must adopt new management and organizational systems and techniques for quality control, which can markedly raise productivity. Such investments are costly but tend to have high social returns because they are crucial for raising productivity toward global norms.¹¹ They are more likely to be undertaken in an environment where risks of unfair competition and trademark infringement are small. Moreover, IPRS could help reward creativity and risk-taking among new enterprises and entrepreneurs. Countries that retain weak standards could remain dependent on dynamically inefficient firms that rely on counterfeiting and imitation.

An example of this process is that protection for utility models has been shown to improve productivity in countries with lagging technologies. In Brazil, utility models helped domestic producers gain a significant share of the farm-machinery market by encouraging adaptation of foreign technologies to local conditions.¹² Utility models in the Philippines encouraged successful adaptive invention of rice threshers.¹³

Maskus and McDaniel (1999) considered how the Japanese patent system (JPS) affected postwar Japanese technical progress, as measured by increases in total factor productivity (TFP).¹⁴ The JPS in place over the estimation period 1960-1993 evidently was designed to encourage incremental and adaptive innovation and diffusion of technical knowledge into the economy. Mechanisms for promoting these processes included early disclosure of, and opposition proceedings to, patent applications, an extensive system of utility models, and narrow claim requirements in patent applications. The authors found that this system encouraged large numbers of utility model applications for incremental inventions, which were based in part on laid-open prior applications for invention patents. In turn, utility models had a strongly positive impact on real TFP growth over the period, while patent applications had a weaker but still positive effect. They concluded that utility models were an important source of technical change and information diffusion in Japan, while patent applications provided both a direct and an indirect stimulus to productivity. It is interesting to note that as Japan has become a global leader in technology creation, its patent

¹¹ See Evenson & Westphal, *supra* note 1, at 2249-50.

¹² See *id.* at 2257 (citing S. Dahab, *Technological Change in the Brazilian Agricultural Implements Industry* (1986) (unpublished Ph.D. dissertation, Yale University)).

¹³ See *id.* at 2261 (citing K.W. Mikkelsen, *Inventive Activity in Philippine Industry* (1984) (unpublished Ph.D. dissertation, Yale University)).

¹⁴ See Keith E. Maskus & Christine McDaniel, *Impacts of the Japanese Patent System on Productivity Growth*, 11 JAPAN & WORLD ECON. 557 (1999).

system has shifted away from encouraging diffusion and more toward protecting fundamental technologies.

Recent studies suggest that innovation through product development and entry of new firms is motivated in part by trademark protection, even in poor nations. A survey of trademark use in Lebanon provided evidence on this point.¹⁵ Lebanon has an extensive set of intellectual property laws but they are weakly enforced.¹⁶ Firms in the apparel industry claimed to have a strong interest in designing apparel of high quality and style aimed at Middle Eastern markets. Such efforts have been frustrated by trademark infringement in Lebanon and in neighboring countries. This problem was yet larger in the food products sector, where legitimate firms suffered from rivals passing off goods under their trademarks. The problem has seriously hampered attempts to build markets for Lebanese foods in the Middle East and elsewhere. Related difficulties plagued innovative producers in the cosmetics, pharmaceuticals, and metal products sectors. Thus, local product development and establishment of new firms have been stifled by trademark infringement targeted largely at domestic enterprises.

Similar problems exist in China, as found in a second survey.¹⁷ While the information was anecdotal, it suggested that trademark infringement negatively affected innovative Chinese enterprises. Many examples were cited of difficulties facing Chinese producers of consumer goods, such as soft drinks, processed foods, and clothing. The establishment of brand recognition in China requires costly investments in marketing and distribution channels. Enterprises that achieved this status quickly found their trademarks applied to counterfeit products. Such products were of lower quality and damaged the reputation of the legitimate enterprise. Furthermore, this problem was difficult to overcome and, in some cases, forced enterprises to close down or abandon their trademarks. According to survey respondents, this situation had a deterrent effect on enterprise development and effectively prevented interregional marketing. In turn, enterprises were less able to achieve economies of scale. Chinese trademark infringement was concentrated on products with low capital requirements and high labor intensity. These are sectors in which China has strong comparative advantages. On this evidence, the authors concluded that trademark violations may be particularly damaging to enterprise development in poor nations.

¹⁵ See Keith E. Maskus, *Strengthening Intellectual Property Rights in Lebanon*, in *CATCHING UP WITH THE COMPETITION* (Bernard Hoekman & Jamel E. Zarrouk, eds., forthcoming 2000) [hereinafter Maskus, *Strengthening Intellectual Property Rights in Lebanon*].

¹⁶ See *id.*

¹⁷ See Keith E. Maskus et al., *Intellectual Property Rights and Economic Development in China* (July 29, 1998) (unpublished manuscript, on file with the author) [hereinafter *China Survey*].

Similar comments apply to copyrights. Copyright industries, such as publishing, entertainment, and software, are likely to be dominated by foreign enterprises (which can absorb temporary losses and afford the costs of deterring infringement) and pirate firms in countries with weak protection and enforcement. Thus, lower-quality copies would be widely available but the economy's domestic cultural and technological development would be hampered. This situation was clear in the Lebanon survey.¹⁸ Lebanon has a small but vibrant film and television industry that could successfully export to neighboring economies if those countries engineered stronger copyright protection. In China, the domestic software industry has grown rapidly in the area of particular business applications, which did not suffer extensive unauthorized copying, but has faced obstacles in developing larger and more fundamental programs. Thus, domestic commercial interests in stronger copyrights have emerged and are now playing a role in promoting enforcement.

Intellectual property rights also could stimulate acquisition and dissemination of new information. Patent claims are published, allowing rival firms to use the information in them to develop further inventions. This learning process takes place in 10 to 12 months in the United States.¹⁹ Knowledge formation is cumulative and as new inventions build on past practices the process of technical change could accelerate.²⁰ Patents, trademarks, and trade secrets also afford firms greater certainty that they face limited threats of uncompensated appropriation. This certainty could induce them to trade and license their technologies and products more readily, enhancing their diffusion into the economy.

In strengthening their IPRS regimes, either unilaterally or through adherence to TRIPS, developing countries hope to attract greater inflows of technology. There are three interdependent channels through which technology is transferred across borders. These channels are international trade in goods, foreign direct investment (FDI) within multinational enterprises, and contractual licensing of technologies and trademarks to unaffiliated firms, subsidiaries, and joint ventures. Economic theory finds that technology transfers through each channel depend in part on local protection of IPRS, albeit in complex and subtle ways.²¹

It is widely recognized by economists that imports of goods and services could transfer and diffuse technology. Imports of capital goods and technical inputs could directly reduce production costs and raise productivity. The extent of this benefit would depend on the technological

¹⁸ See Maskus, *Strengthening Intellectual Property Rights in Lebanon*, *supra* note 15.

¹⁹ See Edwin Mansfield, *How Rapidly Does New Industrial Technology Leak Out?*, 34 J. INDUS. ECON. 217, 219-21 (1985).

²⁰ See Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 29, 31 (1991).

²¹ See Maskus, *Foreign Direct Investment*, *supra* note 1, at 109-52.

content of imports, suggesting that close trade linkages with innovative developed economies could engender considerable productivity gains through trade flows. For example, Coe, Helpman, and Hoffmaister (1997) found that a one-percent increase in imports of machinery and equipment from OECD countries tended to raise total factor productivity in developing countries by around 0.03% on average.²²

Thus, an important question is whether IPRS affect such trade flows. Maskus and Penubarti (1995) pointed out that variable IPRs across countries could influence imports in a number of ways.²³ The essential trade-off from strengthening patents would be between a contraction of trade as protected firms exercise stronger market power and an expansion of trade because such firms would experience higher demand for their products.

Thus, the issue is empirical and it is worthwhile to present key results here. The second and third columns of results in Table 1 report calculations of changes in imports that could be induced by stronger patent rights, updated from a general-equilibrium trade model estimated by Maskus and Penubarti.²⁴ The calculations in column two are for total manufacturing imports. These figures apply elasticities of imports with respect to patent rights, computed from an econometric analysis of bilateral 1984 trade data, to 1995 import volumes. The patent index used was a version of that developed by Rapp and Rozek (1990).²⁵ This index was increased in various amounts for different countries, reflecting rough estimates of the extent of commitments in patent laws required by TRIPS.

The anticipated impacts on trade volume depend on the extent of patent revisions, market size, and the degree of the imitation threat that would be relaxed by adherence to TRIPS. Estimated effects on trade range from small impacts in the United States and Switzerland, which are not required to undertake much legal revision, to substantial increases in imports in China, Thailand, Indonesia, and Mexico, which must adopt

²² See David J. Coe et al., *North-South R&D Spillovers*, 107 *ECON. J.* 134, 147 (1997).

²³ See Keith E. Maskus & Mohan Penubarti, *How Trade-Related Are Intellectual Property Rights?*, 39 *J. INT'L ECON.* 227, 241 (1995).

²⁴ See *infra* Table 1, available in Keith E. Maskus, *Intellectual Property Issues for the New Round*, in *THE WTO AFTER SEATTLE* (Jeffrey J. Schott ed., forthcoming 2000) [hereinafter Maskus, *New Round*].

²⁵ See generally Richard T. Rapp & Richard P. Rozek, *Benefits and Costs of Intellectual Property Protection in Developing Countries*, 3 *NERA WORKING PAPER SERIES* (1990) (illustrating the benefits to developing countries from intellectual property protection, such as economic and technological development, more competition, and lower prices for consumers).

stronger rights.²⁶ In the case of Mexico, it updated its IPRS regime in an accelerated fashion because of commitments made under NAFTA.²⁷ The result here suggests that a substantial component of its increase in manufacturing imports in the 1990s may be attributed, other things equal, to stronger patent protection. It is interesting that many of the largest predicted impacts are in nations with strong imitation capacities, such as Argentina and Brazil. In contrast, India and Bangladesh would experience relatively weak, though positive, trade impacts.²⁸

The third column reports similar computations for imports of high-technology manufactures, defined as pharmaceuticals, electrical machinery, and professional instruments. The sectoral regression estimates in the original study implied that stronger patent rights in developed economies would actually reduce such trade because of a market-power effect and a diversion of trade to developing countries. The latter nations had strongly positive import elasticities in these goods.

Overall, the trade volume impacts estimated here are significant for developing economies that undertake extensive patent revisions. For example, the anticipated increase in manufactured imports for Mexico of \$5.7 billion amounts to 9.4% of its manufactured imports in 1995.²⁹ It is important to note that this impact would take years to emerge because the patent obligations are to be phased in over time. In that context, even if the trade impacts are overestimated the evidence suggests the long-run impacts could be substantial. The estimated increase in China's high-technology imports of \$2.6 billion amounts to just under two percent of its imports in 1995.³⁰ Applying the result from Coe, Helpman, and Hoffmaister (1997), this finding suggests that the stronger patents required by TRIPS could raise Chinese TFP by perhaps 0.6 percentage points per year. This would represent a significant bonus to productivity performance.

The second main channel of technology transfer is FDI. Such investment exists because firms with ownership advantages employ them through internal organization of multinational activity, with the location of production depending on local market characteristics. Thus, IPRS should

²⁶ China has largely met TRIPS requirements in its legislation in anticipation of joining the WTO. Cf. John J.P. Howley & Antonino B. Roman, *Assessing Enforcement Status of Intellectual Property Rights in Asia*, N.Y. L. J., Apr. 26, 1999, at S8 (discussing the steps China has taken to protect and enforce intellectual property rights).

²⁷ See North American Free Trade Agreement [NAFTA], Dec. 17, 1992, U.S. – Can. – Mex., 32 I.L.M. 296 (1993).

²⁸ Cf. Pamela J. Smith, *Are Weak Patent Rights a Barrier to U.S. Exports?*, 48 J. INT'L ECON. 151 (1999) (providing empirical evidence that increased patent rights protection in developing countries will lead to an increase in U.S. exports to that country).

²⁹ See *infra* Table 1; Maskus, *New Round*, *supra* note 24.

³⁰ See *infra* Table 1; Maskus, *New Round*, *supra* note 24.

have varying importance in different sectors with respect to encouraging FDI. Investment in low-technology goods and services should depend relatively less on the strength of IPRS and relatively more on input costs and market opportunities. Investors with products or technologies that are costly to imitate would pay little attention to local IPRS in their decision making. Firms with easily copied products and technologies, such as pharmaceuticals and software, would be quite concerned about the ability of the local IPRS system to deter imitation. Firms considering investing in a local R&D facility would pay particular attention to local patent and trade-secrets protection.

This perspective was borne out by Mansfield (1994), who surveyed 100 U.S. firms with international operations in 1991.³¹ Intellectual property executives in enterprises covering six industries were asked their views of the importance of IPRS in their FDI and licensing decision and their assessments of the adequacy of IPRS in 16 countries. Table 2 reproduces his results regarding type of investment facility.³² In no industry was there much concern about IPRS protecting the operation of sales and distribution outlets. In the chemical industry, which includes pharmaceuticals, 46% of firms were concerned about protection for basic production and assembly facilities, 71% for components manufacture, 87% for complete products manufacture, and 100% for R&D facilities.³³ This tendency to be more concerned with IPRS the higher the stage of production carried over to all sectors. Overall, the chemical industry was the most affected in its decisions to invest, while in all sectors there was a strong concern about local IPRS in locating R&D operations. In a companion paper, Mansfield (1995) demonstrated that these findings held also for Japanese and German firms considering foreign investments.³⁴

Table 3 presents additional results for selected countries with weak IPRS at the time of the survey. India engendered the greatest concern about IPRS, as 80% of the chemical firms surveyed indicated they could not engage in joint ventures or transfer new technologies to subsidiaries or unrelated firms in that nation.³⁵ Interestingly, in chemicals there was little difference between joint ventures and subsidiaries in this regard. Both investments evidently provided foreign firms with approximately the same level of security about their technologies. However, across all countries licensing to unrelated firms was seen as riskier in the face of weak IPRS.

³¹ See Edwin Mansfield, *Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer*, World Bank Discussion paper No. 19, at 1 (1994).

³² See *id.* at 1-3.

³³ See *id.* at 3.

³⁴ See Edwin Mansfield, *Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer: Germany, Japan, and the United States*, World Bank Discussion paper No. 27, at 2, 4, 22 (1995).

³⁵ See *id.* at 5-6.

This situation seemed to hold also in the machinery industry. In other sectors, however, there was little difference in the willingness to transfer technology through various channels according to weakness in intellectual property rights.

The finding that licensing was viewed as insecure compared with FDI in the high-technology sectors illustrates a subtle aspect of intellectual property protection. In theory, firms are more likely to undertake FDI than licensing when they own a complex technology, produce highly differentiated products, and face high licensing costs.³⁶ Under these circumstances, it is efficient to internalize the costs of technology transfer through direct investment in a majority-owned subsidiary. As IPRS are upgraded, licensing costs should fall because it becomes easier to discipline licensees against revelation or misappropriation of proprietary technology and against misuse of a trademark. Furthermore, international firms should become more willing to develop vertically integrated relationships with input suppliers and distribution networks.

From this analysis it is possible to conclude that the strength of IPRS and the ability to enforce contracts should have important effects on decisions by multinational firms on where to invest and whether to transfer advanced technologies. Returning to Table 1, I report the results of econometric estimation of a model of FDI and IPRS.³⁷ The figures in column four use coefficients developed in a four-equation simultaneous decision framework, which incorporated the impacts of patent rights on patent applications, affiliate sales, exports, and affiliate assets. The model was estimated with data over 1986-1994 for the foreign operations of U.S. majority-owned manufacturing affiliates in several developed and developing countries. The assets equation had a negative coefficient on patent rights, suggesting that on average across countries stronger patents would diminish the local asset stock. However, there was a large positive coefficient on patents interacted with an indicator variable for developing countries, resulting in a net positive and significant impact in those nations. This result likely means that at low protection levels internalization decisions encourage FDI as patents get stronger. However, as protection exceeds some level there emerges a substitution effect favoring licensing over investment. In brief, there was a negative elasticity of FDI with respect to patent rights in high-income economies but a strongly positive elasticity among developing economies.

Applying these impacts to anticipated changes in patent rights engineered by TRIPS generates the estimated impacts on asset stocks in

³⁶ Cf. Ignatius Horstmann & James R. Markusen, *Licensing Versus Direct Investment: A Model of Internalization by the Multinational Enterprise*, 20 CAN. J. ECON. 464, 466 (1987) (discussing the fact that FDI is more cost-effective than licensing where a firm can produce products of differing quality).

³⁷ See Maskus, *Foreign Direct Investment*, *supra* note 1, at 153.

Column 4.³⁸ Reductions in asset stocks in Japan and Canada would amount to over \$2 billion each, though these impacts would be less than one percent of 1994 U.S.-owned assets in those nations. However, FDI assets would rise significantly in Brazil, Mexico, Thailand, and Indonesia as a result of stronger patents. Indeed, the increase in the Mexican FDI asset stock would be 2.6% of 1994 U.S.-owned assets in that country and that in Brazil would be 7.4%. On this evidence, it seems that FDI decisions are highly responsive to decisions to strengthen intellectual property rights.

Technology licensing was the subject of one recent study.³⁹ The figures in the fifth column of Table 1 update their results of estimating the impacts of international variations in patent rights on the volume (in 1990 dollars) of unaffiliated royalties and licensing fees (a measure of arm's-length technology transfer) paid to U.S. firms. They used the Ginarte-Park index in a panel of 26 countries in 1985, 1990, and 1995. In their preferred specification the patent index had a significant and positive impact on licensing.⁴⁰ The elasticity of licensing with respect to patent rights was estimated to be 5.3, indicating a highly significant sensitivity of technology trade to IPRs protection. Applying this elasticity to anticipated changes in patent rights, using existing fees in 1995, generated the predicted changes in volume in the final column. Japan had a large absolute response, reflecting the importance of licensing in the Japanese economy. However, large responses were also discovered in Korea, Mexico, Brazil, and Indonesia. Indeed, the analysis suggested that licensing volumes in Mexico and India would double and would go up by a factor of nearly five in Indonesia.

The findings discussed here are predictions of long-run impacts of patent reforms, as required by the TRIPS agreement, on imports, FDI, and market-based technology transfer. The figures are not definitive and additional analysis would be useful in refining the conclusions. However, they are sufficiently robust to conclude that stronger IPRs could have potentially significant and positive impacts on the transfer of technology to developing countries through each of these channels. This result is especially pertinent in middle-income developing countries with significant

³⁸ See *infra* Table 1; Maskus, *New Round*, *supra* note 24.

³⁹ See Guifang Yang & Keith E. Maskus, *Intellectual Property Rights and Licensing: An Econometric Investigation* (May 1999) (unpublished manuscript, on file at the University of Colorado, Boulder).

⁴⁰ They also detected a positive impact on licensing of industrial processes and a weaker but positive effect on affiliated royalties and licensing fees. See *id.* at section 2: Intellectual Property in Licensing. It is impossible to disentangle the extent to which this response entailed higher licensing charges on given technologies, higher-quality technologies, or higher contract volumes. However, the response was so elastic that there was a considerable amount of additional technology being transferred. See *id.* at section 5: Estimation Results.

imitative capabilities. The results are less striking for the least developed economies, where the impacts would be positive but small.

There are important practical implications of this analysis. First, countries with weak IPRS could be isolated from modern technologies and would be forced to develop technological knowledge from their own resources, a difficult and costly task. Second, those countries would obtain fewer spillover benefits and demonstration effects of new technologies in their economies. Third, technologies available to such nations would tend to be outdated. Finally, nations with weak IPRS would experience both limited incentives for domestic innovation and relatively few inward technology transfers.

Recent survey evidence from China supported these arguments.⁴¹ When interviewed, managers of many foreign enterprises expressed reluctance to locate R&D facilities in China, citing fear of misappropriation and patent infringement. Nearly all reported that their enterprises transferred technologies that were at least five years behind global standards, unless other means could be found to protect them, or brought in technologies that would be obsolete in a short time. Note that the importation of lagging technologies is not necessarily inappropriate for China's cost conditions and such knowledge could help encourage follow-on innovation. However, as China moves toward best practices in technology the problem could become more restraining. Moreover, concerns about weak IPRS discouraged foreign enterprises from fully integrating their Chinese operations. Instead they tended to divide production processes among facilities in order to avoid revealing the full nature of their technologies in any one location.

Indeed, IPRS should encourage the development of interregional and international distribution and marketing networks that are critical for achieving economies of scale. Weak IPRS could limit incentives for such investments because rights owners would be unable to prevent their marketing outlets from debasing the quality of their products, nor could they readily deter counterfeiting of their trademarks. Thus, IPRS should permit effective monitoring and enforcement of activities throughout supply and distribution chains, providing both innovators and distributors an incentive to invest in marketing, service, and quality guarantees.

Quality assurance is important for safeguarding the interests of consumers. However, widespread distribution of counterfeit products can ruin reputations achieved at considerable cost, a problem that can be overcome only with additional investments. For example, in food products, beverages, cosmetics, and medicines, counterfeit products can be hazardous for consumers. Indeed, field research in China suggested that despite the benefits to poor consumers of low-cost product knockoffs, they were

⁴¹ See China Survey, *supra* note 17, at 23-24.

becoming resentful that market saturation by unauthorized goods diminished the available range of legitimate goods.⁴²

A further potential benefit of strengthened intellectual property protection is that it could induce greater R&D aimed at meeting the particular needs of developing countries. Inventive firms in developed economies tend to orient their research programs toward products and technologies for which they expect a large global demand and that may be protected through IPRS and trade secrets. This means that a disproportionately small amount of global R&D is focused on the needs of developing economies with low incomes and weak IPRS. For example, the World Health Organization (1996) claims that of the \$56 billion spent globally on medical R&D in 1994, only 0.2% was aimed at pneumonia, diarrheal maladies, and tuberculosis, which together account for 18% of global illness.⁴³

It is possible that the new patent regimes introduced by TRIPS could change this situation. The total market size for pharmaceuticals of the countries that must upgrade their patent protection over the medium term is sufficiently large that, even at current shares of drugs patented elsewhere, the rise in demand could be as much as 25% of global spending.⁴⁴ Thus, the incentives generated for R&D focused on diseases of poor countries could be significant. While this is a crude calculation, it suggests that pharmaceutical firms could anticipate higher profits in developing nations, some portion of which could be devoted to research on their endemic diseases.

Nonetheless, there is considerable uncertainty about this outcome and it is possible to doubt its practical significance. Even with stronger patents (the enforcement of which would be problematic), the ability of impoverished people to buy protected treatments would not rise much for a long period of time. In this context, a strong argument for public promotion and international procurement and distribution of new drugs may be made.⁴⁵

⁴² See *id.* at 18-19.

⁴³ See AD HOC COMMITTEE ON HEALTH RESEARCH RELATED TO FUTURE INTERVENTION OPTIONS, WORLD TRADE ORGANIZATION, INVESTING IN HEALTH RESEARCH AND DEVELOPMENT at xxiv, xxiv-xxv, xxviii (1996) (Document TDR/Gen/96.1).

⁴⁴ See JEAN O. LANJOUW, THE INTRODUCTION OF PHARMACEUTICAL PRODUCT PATENTS IN INDIA: "HEARTLESS EXPLOITATION OF THE POOR AND SUFFERING?" 24 (Nat'l Bureau of Econ. Research Working Paper No. 6366, 1998).

⁴⁵ See Jeffrey Sachs, *Helping the World's Poorest*, ECONOMIST, Aug. 14, 1999, at 17, 20 (stating that rich countries, such as the United States, possess the technology to invent treatments to cure diseases which primarily affect poor countries, but because it is not economically profitable for U.S. drug companies, they will not find treatments for the world's health problems).

D. Negative Impacts of IPRS on Economic Development

While strengthening IPRS bears potential for enhancing growth and development in the proper circumstances, it might also raise difficult economic and social costs. Indeed, developing economies could experience net welfare losses in the short run because many of the costs of protection could emerge earlier than the dynamic benefits discussed above. This situation explains why it is often difficult to organize interests in favor of reform in developing countries.

In most developing economies there are significant amounts of labor employed in copying unauthorized goods. As these nations upgrade their laws and enforcement activities, these workers must find alternative employment. This displacement problem should pose the initial challenge for policymakers in introducing stronger IPRS.

Some evidence on this point is available from a recent survey of the Lebanese economy in 1996.⁴⁶ Table 4 presents simple calculations of the potential static employment and price impacts of stronger IPRS in several Lebanese industries. These calculations reflect the total impacts of various aspects of IPRS. For example, copyrights in software were assumed to reduce piracy by 50%, which would lower infringing employment by 717 workers. However, it would shift demand toward products offered by legitimate producers and distributors, who claimed that they did not anticipate any rise in licensing costs from foreign software firms. As a result, legitimate employment would go up by 426 workers, leaving a net employment loss of 291 workers. However, workers in legitimate firms made far higher wages on average than those involved in copying. Moreover, interview evidence suggested that many of the skilled and partially skilled displaced workers would find employment in the non-infringing firms or would start their own enterprises. The analysis also predicted a rise in software prices of 18.5% and in personal computer prices of 17.8%. These were sizeable increases, reflecting rising markups to legitimate producers as copyrights came to be enforced. However, they likely would be higher in Lebanon than in many other nations because Lebanon had a small market (preventing scale effects) and restrictive sole-distributorship laws. Thus, the additional market power generated in Lebanon by copyrights could be considerably stronger than might be experienced generally.

The remaining copyright sectors may be read similarly. There would be net employment losses in printing and publishing and in music, video, and film as illegal copying was reduced. Book prices were predicted to rise only by 7.3% because the legitimate publishing sector was competitive in Lebanon. However, copyright enforcement would be expected to raise video prices by around 10%.

⁴⁶ See Maskus, *Strengthening Intellectual Property Rights in Lebanon*, *supra* note 15.

The situation was different in food products, cosmetics, and pharmaceuticals, which were subject both to trademark and patent infringement. The pharmaceuticals sector, for example, was built on copying and marketing active ingredients that could be patented elsewhere but were not patented in Lebanon. In the analysis new patents were assumed to raise patent licensing fees by 50% and to eliminate imports and exports of infringing products, while trademark enforcement was assumed to reduce counterfeiting by 50% and to raise licensing fees by 20%. These impacts not only would reduce infringement but also would raise costs for legitimate firms. Accordingly, employment would fall in both activities, with a total employment loss of 550 workers and a price increase of 10%. Employment impacts in the food products sector were bigger because it was a larger industry, but price impacts were small because there were many competitive firms.

Overall, these static calculations suggest that employment in IPRS-sensitive Lebanese sectors could fall by some 5,459 workers, which was 0.5% of the formal labor force in Lebanon. In that sense the problem is small in relation to the overall labor market. However, the adjustment problems would be concentrated in industries and areas in which piracy was common. Thus, there could be difficulties in finding alternative employment or cushioning adjustment costs. In general, such costs would be minimized in economies with flexible labor markets and rapid economic growth, making it easier to shift workers and firms into legitimate activities.

A second major concern is the potential for IPRS to support monopoly pricing. The provision of product patents in pharmaceuticals, agricultural chemicals, and biotechnology, along with plant breeders' rights, should confer greater market power on rights holders. Such firms might then reduce sales to establish monopolistic prices in key medical therapies and industrial and agricultural inputs. There is evidence that patents generate considerably higher prices for protected drugs than for copied and generic drugs.⁴⁷ In 1996, Watal computed that static price impacts of patent coverage in India could raise average patentable drug prices by perhaps 50% from a 1994 base.⁴⁸

However, the extent to which such price increases would emerge depends on several variables, such as the competitiveness of the local pharmaceutical market, the share of drug production that is copied from

⁴⁷ See Keith E. Maskus, *Price Effects and Competition Aspects of Intellectual Property Rights in Developing Countries* (Jan. 12, 1998) (unpublished manuscript, background paper for The World Bank, *World Development Report*). Cf. LANJOUW, *supra* note 44, at 9 (stating that in India it is difficult to gain high prices without patent protection, and that brand names have a market advantage).

⁴⁸ See Jayashree Watal, *Introducing Product Patents in the Indian Pharmaceutical Sector – Implications for Prices and Welfare*, *WORLD COMPETITION: L. & ECON. REV.*, Dec. 1996, at 5, 8, 18.

patentable drugs, and the elasticity of demand for medicines. Evidence from India suggests that pre-patent market structures are relatively competitive because there are significant imitative capacities. Moreover, there could well be a significant degree of market power engendered in the pharmaceutical industries in developing economies, after the introduction of patents, through product differentiation and marketing. In this context, it seems likely that the introduction of patents could place pronounced upward pressure on patented drug prices. In one example, uncontrolled prices of protected drugs at small pharmacies in Beijing and Shanghai may have risen by a factor of three or four on average since the introduction of exclusive marketing rights in 1991 and patents in 1993.

There is little empirical information available on the economic impacts of plant breeders' rights. One recent study was performed in Argentina, Chile, and Uruguay, which have established such systems.⁴⁹ The study looked only at qualitative indicators of the effects on private investments in plant breeding, plant breeding policies of public research institutes, international transfer of germplasm, and seed diffusion among farmers. The systems of rights adopted have had mixed effects on these Latin American economies. First, they have markedly improved the ability of private breeders to control local seed markets and prevent unauthorized trade in protected varieties. The controlled share of seed supply was above 55% in wheat and around 40% in soybeans, figures that compared favorably with those in the United States. As a result, seed prices have risen, though the extent of these increases was unreported. Second, these rights have increased access to privately developed foreign seed varieties, because their developers became more willing to market their products there. Third, the systems retained farmers' privileges, or the right of farmers to keep sufficient seeds from the harvest for replanting. In consequence, farmers have not been much disadvantaged. However, unauthorized seed dealers have seen their costs rise and some have been pushed out of the market. Over time this rising concentration of the market in the hands of private seed dealers could result in further price increases.

There are no systematic studies of how computer software prices vary across countries with differing levels of copyright protection. It is often claimed that program prices would be much higher in light of comparisons between retail prices of legitimate and copied programs. For example, in December 1997 it was possible in Hong Kong to purchase a pirated copy of Microsoft Office 97 for approximately \$6, while the retail price for a legitimate copy was around \$1,500. In the summer of 1998 the same product sold for approximately \$1,000 in Beijing.⁵⁰ Thus, if strong

⁴⁹ See UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, THE TRIPS AGREEMENT AND DEVELOPING COUNTRIES at 63-64, U.N. Doc. UNCTAD/ITE/1, U.N. Sales No. 96.II.D.10 (1996) [hereinafter UNCTAD].

⁵⁰ Field research, on file with the author.

enforcement were to support the substantially higher price of legitimate programs, the price impact on computer users would be severe.

However, it may be that software firms prefer to sell in countries like Hong Kong and China at low volumes with substantial markups, reflecting inelastic demand from corporate and government users. The markups would accrue partially to local distributors, who may be protected also by restrictive distributorship laws. Thus, in a dynamic sense, it is likely that as markets develop under copyright protection, software firms would supply more legitimate copies of programs at considerably lower prices. Indeed, prices of copyrighted software have fallen sharply in Taiwan since the aggressive crackdown on counterfeiting in the mid-1990s, in part because of additional competition from local developers.⁵¹

In summary, concerns about monopoly prices supported by IPRS could be valid. However, if IPRS were introduced into competitive markets, such impacts should be limited. Indeed, it makes little sense to protect market positions both with strong IPRS and barriers to competitive entry.

A fundamental concern raised about IPRS is that their exploitation could result in diminished access to technological information. As suggested above, pharmaceutical and biotechnological patents could raise imitation costs and place considerable pressures on imitative enterprises in developing economies. Improving trade secrets protection should make it more difficult to acquire technologies through misappropriation. Copyright protection would make it more difficult to copy computer software.

Such potential costs explain the reluctance of many developing economies to strengthen their regimes. However, they must be placed into broader perspective. First, these costs would be counterbalanced by greater incentives for technology transfer through trade, FDI, and licensing as discussed earlier. Indeed, it is likely that many local pharmaceutical firms would find it advantageous to reach production and technology-sharing agreements with international enterprises. Second, stronger IPRS would improve prospects for innovative enterprises in developing nations to enter markets and develop new products. Third, rising imitation costs need not be damaging if IPRS are introduced into a competitive economy in which firms have the ability to choose among many potential suppliers of technology and products.

A paramount worry for developing countries is that protection for intellectual property could result in higher costs for the use of new technologies, with the bulk of those costs being transferred to foreign patent owners as economic rents (profits). Interesting evidence of this possibility is provided in the first column of Table 1. These figures update the results

⁵¹ Interviews conducted in Taipei (December 1997) (transcript on file with the author).

of McCalman,⁵² who in 1999 estimated the impacts of stronger patent rights required in TRIPS on the value of patents in place in 1988. Firms own patent portfolios in various countries, the values of which depend on the strength of local protection. McCalman worked out the required changes in patent laws, as measured by the index developed by Ginarte and Park⁵³ in 1997 for 29 countries, some of which appear in the table. He applied these changes to 1988 international patent portfolios owned by each country in order to investigate the implied changes in rents if the stronger laws had been in place. Thus, the analysis held patenting constant at its pre-TRIPS level and did not account for any induced changes in innovation. The effects on rent transfers depended on patent stocks in place and the extent of the legal changes required.

I have updated his calculations to millions of 1995 dollars through the use of national GDP deflators and exchange rates. While this increased the magnitudes somewhat it did not affect the central message. Overwhelmingly the United States would gain the most income in terms of static rent transfers, with a net inflow of some \$5.8 billion per year. This reflected the fact that U.S.-headquartered firms owned numerous patents in many countries that were required by TRIPS to upgrade their intellectual property protection, while U.S. law was subject to virtually no change. Germany would earn an additional net income of \$997 million on its patent portfolio. Most countries would experience a rising net outflow of patent rents, both because of significant changes in their laws and because they tended to be net technology importers. The largest net outward transfer of some \$1.3 billion accrued to Canada, in which many U.S.-owned patents would receive stronger protection. Developing countries also would pay more on their patent stocks, with Brazil experiencing a net outward transfer of around \$1.2 billion per year.

These calculations are inherently zero-sum and static. They ask solely what the additional income on existing patents would have been under TRIPS.⁵⁴ In that sense, one might characterize TRIPS as an outstanding example of “strategic trade policy” on behalf of the United States, though it is equally possible to characterize weak IPRs as a mechanism employed by other governments for appropriating rents from American inventors. The figures are interesting because they suggest that TRIPS could have a significant impact on net incomes earned from foreign patents. To put the

⁵² See Phillip McCalman, *Reaping What You Sow: An Empirical Analysis of International Patent Harmonization* (1999) (unpublished Ph.D. dissertation, University of Wisconsin (Madison)) (on file with the author).

⁵³ See Ginarte & Park, *supra* note 3, at 285-86.

⁵⁴ In principle the column should sum to zero but it does not because of the updating and the exclusion of some countries.

result in perspective, net royalties and licensee fees earned by U.S.-resident firms amounted to \$20.9 billion in 1995.⁵⁵

Finally, it should be noted that costs of administration and enforcement could be burdensome as developing economies implement stronger IPRS systems. In 1996, UNCTAD provided some rough estimates of the administrative costs of complying with TRIPS in various developing countries.⁵⁶ In Chile, additional fixed costs from this upgrade were estimated at \$718,000 and annual recurrent costs at \$837,000.⁵⁷ An Egyptian expert thought the fixed costs would be perhaps \$800,000, with additional annual training costs of around \$1 million.⁵⁸ Bangladesh anticipated one-time costs of administrative TRIPS compliance (drafting legislation) amounting to \$250,000 and over \$1.1 million in annual costs for judicial work, equipment, and enforcement efforts.⁵⁹ These estimates do not include training costs.⁶⁰ Note that Egypt and Bangladesh have extreme scarcities of trained professional administrators and judges, suggesting that these estimated costs could be low. In an economic sense, one of the largest costs of implementing an effective administrative system is that it would divert scarce professional and technical resources into such administration and out of other productive activities.

The existence of considerable fixed costs means that small and poor countries are unlikely to develop a significant commitment to adequate institutional reform. Countering this problem are three factors. First, intellectual property offices may charge fees for examination and registration procedures to defray their costs. Second, poor countries may petition for technical and financial assistance from industrial countries and WIPO and the WTO to help absorb the fixed costs of implementing new administrative and enforcement procedures. Third, developing country authorities may avail themselves of cooperative international agreements to help cut their costs. Membership in the Patent Cooperation Treaty, for example, provides significant economies because examiners may read the opinions made by major patent offices about novelty and industrial applicability, rather than undertake such technical examinations themselves.

E. Evidence on the Overall Impact of IPRS on Growth

The analysis reviewed here claims that strengthening IPRS systems could raise or lower economic growth, though the relationships would be

⁵⁵ See 48 INTERNATIONAL MONETARY FUND, BALANCE OF PAYMENTS STATISTICS YEARBOOK, PART 1: COUNTRY TABLES 848 (1997).

⁵⁶ See UNCTAD, *supra* note 49, at 23-26.

⁵⁷ See *id.* at 23.

⁵⁸ See *id.* at 23-24.

⁵⁹ See *id.* at 25.

⁶⁰ See *id.*

complex and dependent on circumstances. Two recent studies have considered this question empirically. First, Gould and Gruben related economic growth rates across many countries to a simple index of patent strength and other variables.⁶¹ They found no strong direct effects of patents on growth, but there was a significantly positive impact when patents were interacted with a measure of openness to trade.⁶² That is, the impact of stronger patents in open economies was to raise growth rates by 0.66% on average, suggesting that market liberalization in combination with stronger IPRS increases growth.⁶³

Their argument was that open economies tend to experience greater competition, higher amounts of competitive FDI, and enhanced needs to acquire advanced technologies for purposes of raising product quality. Moreover, firms in such countries would be more likely to undertake the costs of effective technology transfer and adaptation to local circumstances. However, such innovation would be more prevalent in economies with adequate IPRS. This finding implies that as countries strengthen their IPRs, pursuing market liberalization would procure a more affirmative path to economic growth.

In 1997, Park and Ginarte studied how IPRs affect growth and investment. They found no direct correlation between patent strength and growth, but there was a strong and positive impact of patents on physical investment and R&D spending, which in turn raised growth performance.⁶⁴ This result was consistent with that in Borensztein, De Gregorio, and Lee, who found that FDI had a significantly positive impact on growth, but only in countries that had attained a threshold level of secondary education within their populations.⁶⁵ In this sense, IPRs, openness, FDI, and human capital accumulation work jointly in raising productivity and growth.

III. BENEFITING FROM INTELLECTUAL PROPERTY RIGHTS

The adoption of stronger IPRS in developing countries is often defended by claims that this reform will attract significant new inward flows of technology, a blossoming of local innovation and cultural industries, and a faster closing of the technology gap between themselves and developed countries. It must be recognized, however, that improved IPRS by themselves are highly unlikely to produce such benefits. Consider

⁶¹ See David M. Gould & William C. Gruben, *The Role of Intellectual Property Rights in Economic Growth*, 48 J. DEV. ECON. 323, 334-35 (1996).

⁶² See *id.* at 324.

⁶³ See *id.* at 341.

⁶⁴ Cf. Ginarte & Park, *supra* note 3, at 298 (discussing the correlation among patent rights, R&D spending, and openness to foreign trade).

⁶⁵ See E. Borensztein et al., *How Does Foreign Direct Investment Affect Economic Growth?*, 45 J. INT'L ECON. 115, 127 (1998).

the differences between countries in sub-Saharan Africa, with longstanding and relatively strong laws on the books (albeit a limited ability to enforce them), and countries in East Asia, many of which have reformed their regimes only quite recently. The prior group attracts little FDI and receives few patents at home or abroad. The latter group attracts the bulk of FDI in the developing world and is experiencing rising use of intellectual property protection.⁶⁶ Expectations that stronger IPRS alone will bring technical change and growth are likely to be frustrated.

The evidence presented above suggested that IPRS could generate more international economic activity and greater indigenous innovation, but such effects would be conditional on circumstances. Circumstances vary widely across countries and the positive impacts of IPRS should be stronger in countries with appropriate complementary endowments and policies. Countries face the challenge of ensuring that their new policy regimes become pro-active mechanisms for promoting beneficial technical change, innovation, and consumer gains.

A. Implementing Procompetitive IPRS Standards

Developing nations are overwhelmingly importers of technology, suggesting that they should establish standards that encourage learning and follow-on innovation within their IPRS system. For example, patent examiners could follow the highest reasonable standards for non-obviousness in invention patents, require early disclosure of technological information, limit protection to narrow patent claims, and establish a narrow doctrine of equivalents. The last approach, exemplified by an effective system of utility models, could be significant for encouraging the development of local capacity to invent legitimately around patents. An effective system of opposition to patent grants is important for interested parties to make available information about prior art.

The construction of particular standards requires careful thought. For example, TRIPS requires patents for biotechnological microorganisms and special protection for plant varieties. However, there is room to vary from U.S. standards in this regard. It is possible to erect strict standards of novelty, non-obviousness, and disclosure in biotechnology in order to promote dissemination and limit broad protection. However, the stricter are these standards the more they discourage fundamental invention by the emerging local biotechnology industries. In protecting plant varieties it is advisable to provide a breeders' exemption, a farmers' privilege, and mechanisms for conserving biodiversity. Again, however, such limitations may deter exploitation of plant rights by foreign enterprises and discourage invention in agricultural public research institutes. Regarding the latter, it

⁶⁶ See Keith E. Maskus, *Strengthening Intellectual Property Rights in Asia: Implications for Australia*, 37 AUSTL. ECON. PAPERS 346, 346-51, 354-57 (1998); Maskus, *Foreign Direct Investment*, *supra* note 1, at 128-29.

is important to ensure that mechanisms for moving research results from the laboratory to farmers' use are transparent and efficient.

In copyrights, countries could allow wide exceptions to protection under the fair-use doctrine for research and educational purposes. Particularly significant would be a liberal stance on reverse engineering of computer programs, with the intent of encouraging indigenous software development. Thus, while wholesale copying must be prohibited, developers could use functional components of protected programs in independently developed programs. The extension of patents to computer programs is of dubious value in development terms and is not required by international norms.

B. Enhance Capacities to Develop and Use IPRS

The dynamic benefits countries accrue from IPRS depend on their abilities to develop and absorb technologies and new products. In this context, three issues are critical for development purposes. First, it is clear that the ability to adapt new technologies to local industrial uses is improved by strong levels of educational attainment and sizeable endowments of human capital.⁶⁷ Thus, there are important payoffs to providing access to technical training and secondary or university education.

Second, productivity in absorbing foreign technologies depends critically on the R&D performance of local enterprises.⁶⁸ This observation points to the importance of developing an effective technology policy for promoting technical change in domestic enterprises. Such programs could include technology demonstration projects, information sharing through conferences, the encouragement of research joint ventures, and improved linkages between public research institutes and enterprises. Indeed, an important problem in many countries is the inability of research institutes to bring their inventions to market in a useful way, in part because property rights to those inventions are unclear. Stronger IPRS alone would help in this context, but so also would development contracts between institutes and enterprises with defined ownership shares and increased flexibility for researchers to form new business concerns.

Third, it is also important for countries to encourage the development of financial markets that are capable of managing the significant risks involved in technology development. Nations could learn from the experience of American venture capital firms.

⁶⁷ See Coe et al., *supra* note 22, at 137.

⁶⁸ See Sean M. Dougherty, *The Role of Foreign Technology in Improving Chinese Productivity* 13 (1997) (unpublished manuscript on file with the author).

C. Promote Competitive Markets

Ultimately, perhaps the most important determinant of the success of an IPRS regime is the competitive nature of the markets within which it operates. Put briefly, the dynamic gains from IPRS are larger, and the costs of abuse are smaller, in economies with competitive market structures. Thus, it is important for countries to liberalize their markets to the deepest extent possible as they strengthen their protective systems. This observation calls for further opening to international trade and investment, including relaxing restrictions against service providers. Domestic deregulation initiatives to make enterprises more competitive are also important here. Such reform needs to be accompanied by mechanisms to ensure that potential entry of new firms is not blocked by public regulations.

Evidence mentioned above showed that economies that are more open to trade and FDI should experience a growth premium from strengthening their IPRS in comparison with closed economies. Stronger property rights create market power, which is more easily abused in economies that are closed to foreign competition. An important impact of trade liberalization is to inject foreign goods and techniques, which compete with previously protected oligopolies. These pro-competitive gains have been shown to be significant in a variety of contexts and at different levels of development.⁶⁹ In that regard, to strengthen IPRS, on the one hand, but to maintain closed markets, on the other hand, is to work at cross-purposes. For example, a patent takes on greater market power in the presence of an import quota on similar goods, which limits consumer substitution choices. Competitive markets help limit the effective scope of intellectual property rights to their intended function, which is to foster investments in competition but not to prevent fair entry.

There are additional reasons why IPRs and open markets are complementary policies. First, a liberal stance on inward trade and FDI improves a country's access to available international technologies, intermediate inputs, and producer services, all items that can raise domestic productivity. However, the evidence above demonstrated that such flows are discouraged by weak patent rights and trade secrets. Second, a critical purpose of IPRS is to encourage investments in improved product quality, which is often a pre-condition for breaking into export markets. Similarly, IPRS can support investments in marketing that raise product demand and

⁶⁹ See Richard Harris, *Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition*, 74 AM. ECON. REV. 1016,1030-31 (1984) (discussing the welfare gains of trade liberalization in small open economies. See generally, e.g., Dani Rodrik, *Imperfect Competition, Scale Economies, and Trade Policy in Developing Countries*, in TRADE POLICY ISSUE AND EMPIRICAL ANALYSIS 109 (Robert E. Baldwin, ed., 1988) (analyzing domestic market structures and the benefits of trade liberalization to developing countries).

permit economies of scale in production. These processes pertain as much to domestic entrepreneurs as they do to incoming foreign competitors.

D. Develop Competition Policies

Because intellectual property rights create market power, their use is potentially subject to anticompetitive abuses. Such concerns are often overstated. Intellectual property rights define the boundaries within which an inventor or creator has exclusive use rights. Such rights rarely create strong monopoly positions unless they are combined with restrictions on competitive entry by other firms. Indeed, IPRS are critical for promoting R&D that generates dynamic competition.

Nonetheless, the scope of IPRS is limited in order to promote access, dissemination, and competition. Attempts by rights holders to extend their use of IPRS beyond permitted limits are abuses of the competitive system. It is useful to review the forms in which such abuse may occur. For example, monopoly pricing represents one potential abuse, although in competitive markets there are usually market substitutes that discipline the ability of IPRS to support monopoly prices. Therefore, pricing decisions are rarely regulated by public authorities in industrial countries except for purposes of limiting the costs of maintaining public health and nutrition.

Perceived abuses of IPRS typically relate to strategic business decisions, including selling practices and licensing restrictions. There is a large literature on the competitive effects of market power created by patents, trademarks, and protected know-how.⁷⁰ There are few concrete guidelines in the area because of the complex nature of markets for information and technology. Vertical licensing agreements, for example, could serve the purpose of ensuring downstream product quality, which improves competition. However, tie-in sales of unrelated products to technology purchasers may represent an attempt to extend the scope of a property right, which damages competition.

Potential competitive problems raised by the exploitation of IPRS include the following. First, horizontal cartels of competing firms may occur through licensing agreements that fix prices, limit output, or divide markets. Actual and potential competitors could be both licensees and licensors, either in the market for the product or technology itself or in extended markets. For example, patent-pooling and cross-licensing agreements between competing licensors may reduce competition in downstream product markets that use the licensed technologies as key

⁷⁰ See generally Organisation for Economic Co-operation [OECD], *Competition Policy and Intellectual Property Rights* (1989) (providing a review of competition policies relating to patents and licensing agreement by examining case law, statutes and regulations of OECD nations). See generally UNCTAD, *supra* note 49 (reviewing the economic and legal implications faced by developing countries under the TRIPS Agreement).

inputs, particularly where the agreements set prices or restrict territories, customers, and fields of use.

In industrial countries competition authorities have found it difficult to set general rules covering such licensing contracts. Instead, investigations are undertaken to determine whether an agreement presents the potential for cartelization of a significant share of a particular market. Concerns also arise over agreements requiring resale price maintenance of distributors' prices, which could result in vertical price-fixing unrelated to the need to monitor and enforce quality assurance. Clearly such risks are greater the more regulated is entry into distribution contracts, a common problem in developing countries.

Second, licensing agreements for intellectual property could anticompetitively exclude rival firms from competing in particular markets by raising barriers to entry. This could be the case with tie-in sales, in which a licensor gains a dominant position for the tied good. Potential competitors would be forced to enter in both the markets for the protected technology and the tied good, raising costs. Similar problems exist if licensees are required only to use the licensor's technology, which may also require use of future technologies. Such restrictions could result in a dominant position for licensors in secondary markets and limit competitive entry by rival firms. A related difficulty arises when licensors block the development of competing new technologies through exclusive grant-back provisions and exclusivity arrangements in future technology purchases. Competition policy must try to assess the potential anticompetitive impacts of licensing arrangements before deciding whether and how to regulate them. Note that such impacts depend crucially on the structure of the markets in which licensing contracts operate, the share of markets they cover, and the difficulty of entry for rival enterprises.

A third general class of problems relates to attempts to acquire excessive market power by purchasing exclusive rights to competing technologies and products, with the intention of preventing their commercial use. Such efforts effectively are horizontal mergers, which must be analyzed in terms of their impact on market concentration. A final problem is non-price predation, in which IPRS may be used to bring bad-faith litigation and opposition proceedings in order to exclude and harass competitors. This may be particularly damaging in cases where potential rivals are small and new and therefore lack the resources needed to defend themselves in court. In turn, this problem could stifle the development and introduction of competing technologies and products. The task for competition authorities is to distinguish predatory behavior from legitimate enforcement of IRPS. For example, firms may refuse to license technologies in particular markets or to particular firms, which could be interpreted either as legitimate business practice or unfair competition.

The message is that there are complex relationships between IPRS and their potential abuse. Property rights support market power, the exercise of

which does not necessarily constitute an abuse. Competition policy makers need to distinguish various forms of behavior in terms of potential impacts on competition and consumer welfare. In this view, it is likely advisable for countries developing competition rules to follow some form of the American “rule of reason” approach, rather than attempting to codify rules covering specific actions, which is the EU approach. More specifically, a rule of *per se* illegality might apply to attempts to monopolize horizontal production and distribution channels, while the rule-of-reason standard might apply to vertical arrangements and tied sales. Patent licensing and pooling arrangements, while not necessarily anticompetitive, might warrant some scrutiny. Note further that the TRIPS agreement permits use of non-exclusive compulsory licenses under prescribed circumstances to overcome abusive practices, so long as adequate compensation is paid.

Thus, there is scope for nations to promote competition in the operation of patent and trademark licensing. In this context, however, note that many foreign enterprises remain frustrated by the intrusive examination procedures employed by licensing authorities in approving technology contracts.⁷¹ Thus, some balance must be struck between encouraging competition and discouraging entry.

Countries must also consider their position on the exhaustion of IPRS. Countries generally observe a “first-sale doctrine” under which domestic sale of a protected good eliminates rights to prevent its further sale, which helps promote competition. The issue is more controversial internationally, where recognizing exhaustion implies allowing parallel imports or exports of protected goods. There are again complicated tradeoffs here. Generally an exhaustion principle promotes market integration and disciplines monopoly pricing, suggesting that it is procompetitive. However, poor countries may benefit from market segmentation if it encourages foreign firms to sell their goods at lower prices than in rich countries. Until further information is developed on this score, governments might be advised to pursue a policy of international exhaustion.

Finally, public-health authorities might follow the lead of many developed economies in establishing a regime of price regulation in patented pharmaceuticals for purposes of limiting prices paid by patients and hospitals and restraining the costs of public provision of health care. Evidence shows that such regulation significantly restrains prices but also discourages pharmaceutical innovation in countries that follow them, so again a balance between objectives needs to be struck.⁷²

⁷¹ See China Survey, *supra* note 17, at 20.

⁷² See PATRICIA M. DANZON, PHARMACEUTICAL PRICE REGULATION: NATIONAL POLICIES VERSUS GLOBAL INTERESTS 4 (1997).

IV. CONCLUSIONS

Economic theory demonstrates that IPRS could play either a positive or negative role in fostering growth and development. The limited evidence available suggests that the relationship is positive but dependent on other factors that help promote benefits from intellectual property protection. In brief, IPRS could be effective and market-based mechanisms for overcoming problems that exist in markets for information creation and dissemination. However, their existence could pose problems in terms of their potential for costs and anticompetitive abuse.

Accordingly, modern IPRS systems are not sufficient by themselves to encourage effective technology transition. Instead, they must form part of a coherent and broad set of complementary policies that maximize the potential for IPRS to raise dynamic competition. Such policies include strengthening human capital and skill acquisition, promoting flexibility in enterprise organization, ensuring a strong degree of competition on domestic markets, and developing a transparent, non-discriminatory, and effective competition regime.

Table 1. Estimates of Impacts of TRIPS Patent Changes on International Flows of Economic Activity for Selected Countries (millions of 1995 dollars)

| Country | Net Patent Rents ^a | Mfg. Imports ^b | High-Tech Mfg. Imports ^b | FDI Assets ^c | Unaffiliated Royalties & License Fees ^d |
|---------------|-------------------------------|---------------------------|-------------------------------------|-------------------------|--|
| USA | 5760 | 233 | -3 | na | na |
| Germany | 997 | 2304 | -18 | -1084 | 92 |
| Switzerland | 28 | 35 | -1 | -94 | 0 |
| Australia | -28 | 102 | -2 | -256 | 2 |
| Ireland | -61 | 100 | -2 | -245 | 13 |
| New Zealand | -68 | 45 | -1 | -76 | 4 |
| Portugal | -110 | 605 | 95 | 89 | na |
| Greece | -149 | 382 | 53 | 47 | na |
| Netherlands | -222 | 133 | -3 | -1380 | 29 |
| Spain | -436 | 2070 | 319 | -313 | 43 |
| Japan | -555 | 918 | -21 | -2326 | 719 |
| UK | -684 | 272 | -5 | -1257 | 26 |
| Canada | -1294 | 754 | -12 | -2188 | 63 |
| Panama | 0.4 | 16 | na | 284 | na |
| Israel | -83 | 30 | 5 | 6 | 0.6 |
| Colombia | -97 | 2927 | 479 | 1093 | na |
| South Africa | -143 | 154 | 21 | 23 | 10 |
| Rep. of Korea | -326 | 2732 | 588 | 248 | 356 |
| Mexico | -562 | 5749 | 1519 | 3182 | 136 |
| India | -665 | 1465 | 146 | 128 | 58 |
| Brazil | -1172 | 3125 | 627 | 3219 | 114 |
| Argentina | na | 1150 | 196 | 662 | 59 |
| Bangladesh | na | 130 | 14 | na | na |
| Chile | na | 2017 | 276 | 975 | na |
| China | na | 15379 | 2585 | 631 | na |
| Indonesia | na | 6628 | 667 | 1805 | 166 |

Reprinted with permission from Keith E. Maskus, *Intellectual Property Issues for the New Round*, in *THE WTO AFTER SEATTLE* (Jeffrey J. Schott ed. 2000).

Table 2. Percentage of Firms Claiming that the Strength or Weakness of Intellectual Property Rights Has a Strong Effect on Whether Direct Investments Will Be Made, by Type of Facility, 1991

| <i>Sector</i> | <i>Sales and Distribution</i> | <i>Basic Production and Assembly</i> | <i>Components Manufacture</i> | <i>Complete Products Manufacture</i> | <i>R&D Facilities</i> | <i>Average</i> |
|----------------------|-------------------------------|--------------------------------------|-------------------------------|--------------------------------------|---------------------------|----------------|
| Chemicals | 19 | 46 | 71 | 87 | 100 | 65 |
| Transport Equipment | 17 | 17 | 33 | 33 | 80 | 36 |
| Electrical Equipment | 15 | 40 | 57 | 74 | 80 | 53 |
| Food Products | 29 | 29 | 25 | 43 | 60 | 37 |
| Metals | 20 | 40 | 50 | 50 | 80 | 48 |
| Machinery | 23 | 23 | 50 | 65 | 77 | 48 |
| Average | 20 | 32 | 48 | 59 | 80 | 48 |

Source: Edwin Mansfield, Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer, World Bank Discussion paper No. 19 (1994).

Table 3. Percentage of Firms Claiming that Intellectual Property Protection Is Too Weak to Permit Types of Investment, 1991

| Country | Chemicals | Transport Equip. | Electrical Equip. | Food | Metals | Machinery | Average |
|--|-----------|------------------|-------------------|------|--------|-----------|---------|
| <i>Panel A: Joint Ventures with Local Partners</i> | | | | | | | |
| Argentina | 40 | 0 | 29 | 12 | 0 | 27 | 18 |
| Brazil | 47 | 40 | 31 | 12 | 0 | 65 | 32 |
| India | 80 | 40 | 39 | 38 | 20 | 48 | 44 |
| Indonesia | 50 | 40 | 29 | 25 | 0 | 25 | 28 |
| Mexico | 47 | 20 | 30 | 25 | 0 | 17 | 22 |
| Korea | 33 | 20 | 21 | 12 | 25 | 26 | 23 |
| Thailand | 43 | 80 | 32 | 12 | 0 | 20 | 31 |
| Average ^a | 49 | 34 | 30 | 19 | 6 | 33 | |
| <i>Panel B: Transfer of Newest or Most Effective Technology to Wholly Owned Subsidiaries</i> | | | | | | | |
| Argentina | 44 | 20 | 21 | 12 | 0 | 14 | 18 |
| Brazil | 50 | 40 | 24 | 12 | 0 | 39 | 28 |
| India | 81 | 40 | 38 | 38 | 20 | 41 | 43 |
| Indonesia | 40 | 20 | 31 | 25 | 0 | 23 | 23 |
| Mexico | 31 | 20 | 21 | 25 | 0 | 22 | 20 |
| Korea | 31 | 20 | 28 | 12 | 40 | 22 | 26 |
| Thailand | 60 | 80 | 31 | 12 | 0 | 18 | 20 |
| Average ^a | 48 | 34 | 28 | 19 | 9 | 26 | |
| <i>Panel C: Licensing of Newest or Most Effective Technology to Unrelated Firms</i> | | | | | | | |
| Argentina | 62 | 0 | 26 | 12 | 0 | 29 | 22 |
| Brazil | 69 | 40 | 29 | 25 | 0 | 73 | 39 |
| India | 81 | 40 | 38 | 38 | 20 | 50 | 44 |
| Indonesia | 73 | 20 | 33 | 25 | 0 | 37 | 31 |
| Mexico | 56 | 20 | 28 | 25 | 0 | 36 | 28 |
| Korea | 38 | 20 | 34 | 12 | 40 | 29 | 29 |
| Thailand | 73 | 80 | 36 | 12 | 0 | 25 | 38 |
| Average ^a | 65 | 31 | 32 | 21 | 9 | 40 | |

Source: Edwin Mansfield, *Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer*, World Bank Discussion paper No. 19 (1994). Note: ^aAverage over the seven countries listed.

Table 4. Simulated Static Effects of Stronger IPRS Enforcement in Lebanon, 1996

| Sector | Infringing Employment | Legitimate Employment | Net Employment | Weighted Price (%) |
|-----------------------|-----------------------|-----------------------|----------------|--------------------|
| Software | -717 | +426 | -291 | |
| Software | | | | +18.5 |
| Personal Computers | | | | +17.8 |
| Printing & Publishing | -642 | +298 | -343 | |
| Printing Services | | | | +13.2 |
| Books, etc. | | | | +7.3 |
| Music, Video, & Film | -500 | +119 | -381 | |
| Music & Video | | | | +10.1 |
| Film | | | | +2.3 |
| Food Products | -2681 | -479 | -3160 | +3.8 |
| Cosmetics | -614 | -119 | -733 | +4.3 |
| Pharmaceuticals | -315 | -235 | -550 | +10.0 |
| TOTALS | -5469 | +10 | -5459 | na |

Source: Keith E. Maskus, *Strengthening Intellectual Property Rights in Lebanon*, in *CATCHING UP WITH THE COMPETITION* (Bernard Hoekman & Jamel E. Zarrouk, eds., forthcoming 2000).