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**THE INTERNATIONAL REGULATION OF
INTELLECTUAL PROPERTY**

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ABSTRACT

The International Regulation of Intellectual Property

The WTO Agreement on Trade-Related Intellectual Property Rights (TRIPS) will usher in a markedly stronger global system of defining and protecting intellectual property rights (IPRs). This paper analyses TRIPS as a global regulatory device. It first discusses the concept of intellectual property and the need for its protection and regulation. It presents evidence on the wide variations in IPRs across countries and discusses how TRIPS will affect these differences. Theoretical predictions about how this stronger system will influence global trade, investment, and technology innovation and diffusion are ambiguous, but limited empirical evidence suggests a modest positive effect overall. However, the distribution of costs and benefits will vary across countries. Countries that are net importers of intellectual property should implement the agreement in ways that promote dynamic competition and should pay attention to linkages to competition policies.

Key words: Intellectual property rights; regulation; competition policy

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NON-TECHNICAL SUMMARY

The provision of rights to own intellectual assets generates both benefits and costs for society, stemming from well-known tradeoffs between static and dynamic efficiency requirements and from rent-seeking. In conjunction with various public-goods characteristics of information, these issues imply the need for regulation. Intellectual property rights – patents, trademarks, copyrights, and related devices – are the means by which society defines boundaries within which agents are provided exclusive rights to exploit their intellectual assets. Regulation consists of defining and enforcing the rights, on the one hand, and ensuring that the rights-holders do not extend their power beyond intended limits, on the other hand.

By legal tradition, intellectual property rights (IPRs) are territorial in nature, leaving such decisions to individual nations or regions. The paper presents clear evidence that protection for IPRs varies strongly across countries. For example, patent rights tend to become weaker as countries move beyond the poorest stages into development levels in which they have strong imitative capacities. Patents become markedly stronger as countries become producers of new technologies and products.

The exploitation of intellectual assets has become increasingly central to the international competitive strategies of innovative firms. The growing incongruence between territorial application of IPRs and commercial needs for stronger rights internationally underlies considerable unilateral, regional, and multilateral change in the global system in the last decade. By far the most significant change is the Agreement on Trade-Related Intellectual Property Rights (TRIPS), negotiated as a founding component of the World Trade Organisation. The paper reviews the major new requirements for stronger minimum standards required of most developing countries under terms of TRIPS. Implementation of these requirements will be phased in over a period of five to ten years.

The main question analysed is whether TRIPS makes sense as a global regulatory device. To this end, the paper first discusses potential effects of stronger minimum standards on international trade, foreign direct investment (FDI), and technology licensing. In theory, all of these effects are ambiguous because of the inherently second-best nature of IPRs. However, there is empirical evidence that stronger patents are associated with greater trade flows, particularly in high-technology goods exported to large, middle-income developing economies. Because such goods embody new technologies and additional competition, there could be a follow-on positive impact on technology learning and growth. However, there is little evidence of such impacts in small, low-income countries, who may experience slower trade growth and higher import prices.

Regarding FDI, the paper provides new econometric evidence that the international distribution of investment by American firms is sensitive to variations in patent regimes. Thus, stronger global patent rights could expand such investment via a scale effect, but also reallocate it across destination nations via a substitution effect. Finally, survey evidence indicates that the quality of technologies licensed is strongly and positively affected by IPRs.

The paper also considers prospects for additional innovation and diffusion. Global innovation should rise with TRIPS, though by an uncertain amount. Diffusion will be slowed by rising costs of imitation but could be enhanced by additional patent disclosures and licensing. A final observation is that a movement toward international harmonisation of IPRs could reduce the relative attractiveness for FDI of smaller economies with strong prior systems.

TRIPS is also assessed as a regulatory device. For example, to the extent that limited IPRs persisted in many countries because of inadequate incentives in the previous system to recognise collective interests in strengthening them, the agreement secures a cooperative

solution. Further, it could improve the allocation of R&D programs into areas with stronger global demands. However, it also markedly shifts the balance of gains to innovative firms and provides additional market power, which raises concerns about potential abuses in setting terms of access and licensing.

While such concerns are often overstated, countries that must strengthen their IPRs systems would be well-advised to implement and enforce the TRIPS requirements in a manner that promotes dynamic competition in their markets and more widely. A number of such implementation strategies are discussed in the paper. However, the observation points also to the need to consider the intimate linkages between stronger IPRs and competition policies.

The International Regulation of Intellectual Property

1. Introduction

Intellectual property (IP) is an asset, developed by inventive or creative work, to which rights to exclude its unauthorised use have been granted by law. The international exploitation of IP is central for trade, foreign direct investment (FDI) and technology licensing across borders. That such flows have increased in both absolute and relative terms is well established (Markusen, 1995; Mansfield, 1995; Maskus, 1996). Intellectual property rights (IPRs) are the formal mechanisms by which property is established in intellectual assets. These rights are territorial by legal tradition, with each country or region establishing the terms under which it will define and protect such property. Indeed, IPRs are a critical component of national business regulatory regimes.

The incongruence between the growing need for international exploitation of intellectual assets and the territorial (and often underdeveloped) nature of rights to do so resulted in enormous pressures for systemic change in recent years. These pressures underlay extensive bilateral, regional, and multilateral negotiations on IPRs, which generated a significant expansion of required minimum standards, especially in developing economies and countries in transition. The overarching achievement is the conclusion of the Agreement on Trade-Related Intellectual Property Rights (TRIPS), a foundation of the new World Trade Organisation (WTO).

The movement toward stronger and more comprehensive standards raises pessimistic concerns about the competitive behaviour of newly protected firms, including their pricing and licensing practices. It also promotes optimistic hopes that additional innovative activity will emerge on an international scale. Relatively absent in the literature are sober assessments of the implications for international commercial activity and competition, with attendant analysis of beneficial regulation.

In this paper I address these issues in the framework of emerging international regulation of IP. This is an extraordinarily complex subject and the attempt here is to provide a broad economic analysis of the most critical points, paying particular attention to interrelationships among IPRs, regulatory systems, and economic structures.

In the next section I introduce basic concepts of intellectual creations as property and discuss implications for social regulation at the national and international levels. The ensuing section analyses the scope of the new global IPRs system, especially as it has emerged through the TRIPS accord. I further discuss how the system could affect international commercial flows and innovation, diffusion, and growth. A fourth section contains treatment of potential regulatory responses to anticipated gains and losses from the system, responses that will vary across countries. The defining principle is that countries engaged in strengthening their IP systems should do so in a fashion that is as pro-competitive as possible. A final section concludes with brief remarks.

2. Intellectual Assets as Property

Intellectual property rights define the extent to which their owners may exclude others from activities that infringe or damage the property. Thus, IPRs set out and protect the boundaries of legal means of competition among firms seeking to exploit the value of creative assets. Efforts to extend the rights beyond these boundaries are denied, in principle. In this context, it is more fruitful to conceive of IPRs as rules regulating the terms of static and dynamic competition, rather than mechanisms for creating legal monopolies, which is the

standard economic conception. While IPRs do create market power, the impact on competition varies as widely across products, technologies, and countries as it does across the scope of protection.

2a. The Concept of Property in Creative Activity

The need for IPRs arises from the fact that, without them, a piece of potentially valuable information would suffer from overuse, to the extent that access to it is not costly, from the standpoint of its development and improvement. This use would rapidly deplete the economic value of the information, limiting incentives to create it. This congestion problem, arising from free-riding behaviour, imposes the dynamic costs of limited cultural creation and product development, and reduced growth, on economies that fail to recognise it adequately. The problem is acute for intellectual assets because the public-good nature of information makes free-riding through copying particularly simple in many instances. An additional complexity related to the nature of information is that its social value may differ from its private value due to an inability to appropriate the full social gains from an invention. Examples include network efficiencies from computer systems or software standards and spillover cost reductions to users of technical inputs.

However, property rights in information also generate costs. Rent-seeking may be a serious problem because the information is being invented anew and bears no defined ownership until its creation is successful. Thus, a strong IPRs system can encourage both costly duplication of investment in R&D through patent races and wasteful efforts to assert ownership rights and to extend them beyond the intention of the original grant. Further, enforcement costs may be high because it is costly to exclude potential free riders from exploiting the information. Moreover, excluding prospective users imposes static deadweight costs because the marginal cost of provision is often small. Finally, the costs of transferring rights to intellectual property may be significant because of contracting difficulties related to uncertainty about the value of information, problems in monitoring licensees, and the like.

Thus, a complicated set of tradeoffs exist in devising rights to intellectual property. In theory, the appropriate balance of incentives would depend on numerous market characteristics in each product or artistic area. These characteristics include prospective demand, potential spillovers, the costs of R&D, impacts on market structure, and competitive aspects of the economy. Many of these factors are uncertain at the time IPRs decisions are made, suggesting that finely tuned policies are unworkable. Rather, IPRs must be based on generally applicable standards rather than on a case-by-case grants system.

Certain principles guide the development of an appropriate system. First, it should allow sufficiently market-based incentives for creation while minimising the costs of innovative activity. Second, it should provide for timely disclosure of new information and permit reasonable fair use with economic and social goals in mind. Third, the scope of protection should be limited in order to strike a balance between competing needs for development and dissemination. Fourth, there should be coherent interaction with other regulatory and economic systems, including competition policy, trade and FDI regimes, and technology-development programs.

2b. The Regulation of Intellectual Property

Broadly stated, an IPRs system consists both in the rights created and their regulation. Under classical intellectual-property doctrine, two forms of property could be created, industrial property and artistic property, with limitations placed on the exploitation of each.

Rights to exploit inventions of demonstrated industrial utility are awarded through patents, utility models or petty patents, and industrial designs. Most important are patents,

which provide the right to exclude, for a fixed time, all others from making, selling, or using the product or process described without authorisation. Patents are not intended to protect new knowledge, but rather its embodiment in new products or industrial processes. Thus, the breadth of patent coverage extends to uses of the novelty claimed by the inventor and recognised by patent examiners. The patent claim must meet technical criteria for novelty, or non-obviousness, and industrial utility. It must also survive any opposition procedures based on competing claims of prior invention or insufficient novelty. For this purpose, patent applications are laid open for inspection by interested parties. Thus, the core social bargain of patents is to create a protected market position, which may or may not involve considerable market power, in return for disclosure of technical advances. Governments may place limits on the power of patents, including exclusions of particular subjects from patentability and the provision of anti-monopoly remedies to discipline licensing and marketing abuses.

Rights to market goods and services under an exclusive name are established by trademarks and service marks, which uniquely identify a firm or its assignees. Such marks provide incentives for firms to invest in brand-name recognition and product quality, with beneficial impacts on product differentiation and innovation and on consumer search costs. The grant of a mark is subject to opposition by others who may have registered it, or a similar mark, at an earlier time. Because protection of well-known marks provides some scope for strong licensing advantages, their use is subject to limitations based on preservation of competition. An important related device is a geographic indication, which allows the use of a place name where a product was made to convey certain characteristics of its region.

A final form of industrial property protection is breeders' rights, which allow developers of new plant varieties to control their marketing and use. These rights operate much like patents, in that they are provided for fixed terms and carry novelty requirements. Their intent is to generate incentives for the development of new strains for agricultural and horticultural purposes. They are controversial in developing countries with significant farming sectors but little capacity for innovation in the area.

Often firms develop industrial processes that have value but may not be patentable, may not be worth incurring the expense of patenting, or may have greater strategic advantages if they are not revealed through the patenting procedure. Such processes are termed trade secrets, which are protected not by formal property rights but by legal liability rules against unfair expropriation. There exists no exclusive right to use the information if it is learned by fair means, such as independent creation or reverse engineering. Thus, a trade secret bears no statutory time limit but can run out in the regular course of competition.

Artistic and literary properties are protected largely by copyrights, which provide exclusive rights to copy and disseminate the particular expression of an idea for a fixed term. Since it is the expression that is protected, rather than the idea, copyrights are provided without reference to quality of the work. Related mechanisms include neighbouring rights and moral rights. Copyrights also generally extend to control over derivative products. As with other IPRs, copyrights may be subject to limitations for social purposes. Foremost among these is the fair-use doctrine. Scientific progress and education require reasonable access to prior research and literature in order to promote learning and follow-on invention.

Recent advances in technology have strained this classical conception of intellectual property because new forms of creative activity do not easily fit into it. For example, computer software embodies elements of both expression and industrial utility, leading to questions about whether it should be subject to copyright or patent protection and to what extent decompilation of programs should be allowed in order to develop competing applications (Reichman, 1994). Similar comments apply to aspects of semiconductor chip designs, which have attracted their own hybrid forms of *sui generis* protection. Electronic

transmissions of broadcasts, internet materials, and databases also raise questions regarding whether copyright protection is adequate to encourage them (Reichman and Samuelson, 1997). There is also concern over whether patents generate excessive protection for biotechnological inventions, many of which involve a simple application of recombinant DNA technology rather than a true inventive step but nonetheless require significant expenditures on research. In short, technological change has established a continuum of invention types in the presence of discrete forms of protection, placing stresses on the latter.

Enforcement of IPRs embodies two tasks: preventing their infringement by free-riders and disciplining attempts by the rights-holders to extend them beyond the terms of the grant. Most systems rely on private enforcement, meaning that it is the responsibility of interested parties to oppose a grant in the examination or registration procedures, to inform authorities of infringing activity or abuse of rights, and to initiate legal action. Actions against basic infringement are straightforward, including provisions for seizure of goods at the port, clamping down on unauthorised copying and distributing facilities, and levying fines and criminal penalties. As competing claims become more complicated, however, courts must decide on their legality within the framework of accepted regulations. Such claims may be about infringement or appropriation of an invention by means that are not clearly illegal and require judicial interpretation. Equally they may be allegations that a right-holder has exceeded the scope of protection by engaging in anti-competitive activity in its exploitation. Clearly, there is a strong link between IPRs and competition policy, with regulatory authorities and the courts empowered to manage this linkage.

While the rights granted and the vigour and terms of enforcement determine the direct framework for intellectual property regulation, it must equally be recognised that there are significant collateral measures that influence the effective scope and economic value of IPRs. Key among these are trade and investment policies, industrial policies, including research and production subsidies, public-health and environmental regulations, and commercial controls. For example, a patent takes on greater market power in the presence of an import quota on similar goods, which limits consumer substitution possibilities. Similarly, it is common practice in some nations to mandate that a foreign firm must operate through a single local distributor, which markedly expands opportunities for abusive price-setting in the presence of strong trademark protection. A final example is the prevalence in many countries of strict price controls in pharmaceutical products, which limit the value of patents but also reduce the attractiveness of supplying those markets. In this regard, it is inadequate to analyse the implications of IPR systems without also considering their position in the general regulatory structure.

2c. International Differences in Regulation

It is evident that countries with widely varying levels of economic development and abilities to engage in technology development and imitation would have disparate interests in IPRs protection. That there are considerable differences in the strength of laws and enforcement is well-documented. For example, Rapp and Rozek (1990) developed a discrete index across countries of the strength of patent laws in 1984, with zero indicating an absence of protection and five indicating very strong protection. Maskus and Penubarti (1995) corrected this index for measurement error and endogeneity, resulting in a continuous index useful for empirical work. There is a strong positive relationship between the index of patent strength and real per-capita income. A simple regression computes:

$$\text{Patent} = -0.51 + 0.49^* \ln Y \qquad R^2 = 0.37$$

The income coefficient is significant with more than 99% confidence. In fact, the relationship appears to be non-linear:

$$\text{Patent} = 10.5 - 2.63 \ln Y + 0.21 (\ln Y)^2 \quad R^2 = 0.50$$

While there are numerous difficulties with this index, the regressions persuasively argue that national interests in IPRs protection are endogenous to growth in per-capita income, among other variables. The second regression suggests that patent protection tends to decline in strength as economies move beyond the poorest stage into a middle-income stage in which they have greater abilities to imitate new technologies. The political economy behind this situation is not hard to explain (Siebeck, 1990; Primo Braga, 1996; La Croix, 1992). Evenson (1992) refers to these middle-income countries as being in the “technology draught,” because they tend to focus R&D efforts on adaptation, imitation, and reverse engineering. As economies become more innovative at the highest levels of income, patent protection increases sharply.

Further, there is a strong correlation between the strength of patents and other forms of IPRs, such as trademarks and copyrights (Rapp and Rozek, 1990), although there are some interesting individual exceptions to this rule, especially in copyrights. Finally, the strength and effectiveness of enforcement efforts also vary with economic development levels. This reflects both an unwillingness to absorb the costly administrative expenses associated with enforcement and an inability to manage many of the complicated technical and judicial issues associated with the use and infringement of IPRs.

The largest differences in intellectual property protection occur along North-South lines. From the standpoint of information developers in the innovative countries of the North, there are several primary shortcomings in the regimes of many developing countries. First is inadequate copyright and trademark protection, allowing extensive copying of entertainment and software products and unauthorised use or misrepresentation of well-known trademarks. Second is the exclusion from patent protection of pharmaceutical products and chemical products and food additives. Third is the absence of patent protection for biotechnological inventions and patents or *sui generis* rights for plant varieties. Fourth is the practice of issuing compulsory licenses with inadequate compensation to firms that are perceived to be exercising their patent or trademark insufficiently to achieve desired consumer benefits or technology transfer. Fifth is the weak or poorly defined system of rules protecting trade secrets. A final significant problem is inadequate procedures for administrative and judicial enforcement of defined rights.

While these substantial differences in North-South IPRs standards have dominated recent efforts to strengthen the global system, significant controversies persist over IPRs in developed countries as well. For example, the United States remains dissatisfied with aspects of the Japanese patent system, claiming that it encourages excessive filing of narrow patent claims and discourages patenting by foreign firms. The United States and the European Union have moved toward patenting software with demonstrated industrial utility, but they differ considerably in their rules concerning acceptable decompilation of programs for purposes of reverse engineering. Negotiations continue over the scope of protection for geographic indications, about which there are strong differences of opinion. Developed countries also differ markedly in their treatment of various aspects of copyrights.

3. The New Global System of IPRs

The weaknesses of the international system became progressively clearer as the forces of globalisation expanded and means for low-cost copying proliferated. Indeed, the protection of IPRs is inherently a dynamic process, involving both a secular evolution within each country over time and the need for new standards of protection as technologies and marketing strategies change.

Thus, in the 1990s the world has moved sharply toward an international system of IPRs that, while continuing to recognise the national or regional application of rights, requires stronger minimum standards and a greater emphasis on non-discrimination. The system embodies elements of cooperation and a narrowing of practices, though it remains far from being fully harmonised.

An important component of the shift has been unilateral adoption of stronger laws and enforcement procedures in numerous developing nations. These decisions were taken because of both external pressure and a growing perception, however valid, that strong IPRs are important in attracting investment and technology. Also significant are various regional initiatives in intellectual property, such as the IPRs component of NAFTA. The proliferation of regional standards that may differ from national practices or global minimum standards raises interesting analytical questions that require further examination (Maskus, 1997a). For example, to the extent that investment flows are responsive jointly to trade preferences and IPRs, regional agreements bear some unknown potential for investment creation and diversion.

3a. The TRIPS Agreement

The most significant change is the TRIPS Agreement, which has been extensively analysed elsewhere (Primo Braga, 1996; UNCTAD, 1996; Maskus, 1997a). It is useful to list those provisions that will require significant legal and institutional changes. The standards discussed are minimum requirements in all WTO members without reservations, but nothing in the Agreement precludes countries from adopting stronger procedures. An important general obligation is the introduction of MFN treatment into IPRs.

Regarding patents, WTO members no longer can exclude any area of technology, such as pharmaceutical products, from patent eligibility and the burden of proof in process infringement cases is placed on the accused. Patent protection must extend for at least 20 years from the application filing date. Patent holders cannot be obliged to work their patents with local production (imports are sufficient). The issuance of compulsory licenses, while still available, is subject to limitations and must bear adequate, "market-based" compensation. There is a complicated interim procedure for providing exclusive marketing rights for pharmaceutical products and agricultural chemicals during transition periods to new patent regimes. Countries must protect new plant varieties, either within their patent systems or with a separate system of breeders' rights. Original industrial designs must be protected for a minimum of ten years.

Countries must recognise, in their laws, protection for well-known trademarks and protection is extended to service marks and collective marks. Registration may be cancelled for non-use but only under tightly limited circumstances; in particular, an absence of imports due to local trade restrictions is no longer cause for cancellation. Compulsory licenses of

trademarks are prohibited. WTO members must protect geographical indications of origin and prevent producers from misleading the public about the geographic origin of goods.¹

Copyright owners are given rental rights in order to earn royalties for commercial rental of their works. Minor exceptions from MFN are allowed in copyrights, based on existing reciprocity provisions. Computer programs and databases must be protected (at a minimum) as literary devices, meaning that they are given copyright protection for at least 50 years. In most countries this obligation means that literal copying must be ended, while the scope for fair-use decompilation remains open to discussion.

Integrated circuits designs must be protected for a minimum of ten years. Rights owners have the right to prevent imports and sales of products that incorporate the unauthorised devices, even if the merchants are unaware of the infringement.

Each WTO member must develop a system for protecting trade secrets from unfair competition, according to specified minimum standards. Commercial data submitted for regulatory approval of chemical products must be protected against unfair use and premature disclosure.

Countries must develop effective enforcement measures, including border controls, to prevent international and domestic transactions in counterfeit goods. Such measures must include the potential for paying damages to rights-holders and for criminal sanctions against wilful counterfeiting and copying. At the same time, the agreement recognises the potential for abusive practices in the exercise of IPRs and gives member countries discretion over controlling such abuses. The competition rules used for this purpose cannot be inconsistent with other provisions of TRIPS and the agreement also calls for opportunities for consultation in this area.

Finally, in recognition of the large and expensive institutional and legal changes these provisions require in countries with limited IPRs systems, transition periods are provided. General obligations (national treatment and MFN) were to be in force immediately upon the adoption of the WTO. Developing countries and countries in transition must meet the detailed obligations within five years (that is, by January 1, 2000) and least-developed countries must meet them within eleven years (by January 1, 2006). The latter countries may, upon appeal to the TRIPS Council, receive extensions for an unspecified period, suggesting that they have been given an opt-out procedure. Countries are free to accelerate their adherence to TRIPS.

Disputes in intellectual property will be subject to the integrated dispute settlement mechanism agreed in the WTO. However, there is a five-year moratorium on the use of dispute settlement against indirect violations of TRIPS, allowing nations to select implementation strategies without interference through this route. In systemic terms, one of the primary benefits of TRIPS in establishing a broad set of multilateral disciplines over IPRs is that it will move future conflicts into an established forum for settling disputes. These conflicts likely will expand due to increasing global economic integration and growing importance of IP-sensitive goods and services in international commerce.

3b. Economic Implications

The TRIPS Agreement ushers in a new global framework for IPRs. It markedly strengthens minimum standards for protection, moving the system closer to harmonisation, and tilts the balance of economic rewards toward innovative interests and away from imitation and copying. It also expands the choice sets available for high-technology firms in

¹ Additional scope for global protection of geographic indications for wines and spirits remains subject to negotiation.

deciding how best to service international markets – through inter-firm or intra-firm trade, investment, joint ventures, licensing, patent pooling or cross-licensing agreements with competing foreign firms, and pricing to market. Little is known about how this change will influence resource flows and the distribution of benefits and costs across countries and over time. However, it is useful to characterise briefly the evidence to date. Consider first a functional breakdown.

Trade and Investment

This significant change in global IPRs protection could have a strong impact on international trade in goods and services. In theory, however, the direction of impact is ambiguous. For example, limited protection against counterfeit goods raises deterrence costs for firms in supplying markets, suggesting that stronger IPRs would expand trade (Stern, 1987). However, there is a fundamental tradeoff between the market power generated by stronger IPRs, which tend to enhance the ability of firms to segment markets and limit trade, and the market-expansion impact of raising the costs of imitative activity.

Maskus and Penubarti (1995) study this issue most carefully. In estimating a reduced-form econometric model of bilateral trade flows between OECD countries and developing nations, they incorporate measures of market size and trade protection in addition to an index of patent strength in 1984. The results indicated that, across nearly all 3-digit ISIC manufacturing sectors, a strengthening of a country's patent law would attract a significantly positive, although small, increase in trade. This effect is particularly strong in large developing economies with significant imitative capabilities, indicating that trade would both displace local infringers and undergo a net expansion. The effect was weaker in small developing countries with low incomes, suggesting a greater tendency toward the use of market power. Smith (1997) updates this work with more refined data and discovers considerably stronger trade impacts. Thus, there is evidence that IPRs do affect trade flows and that TRIPS could have a positive allocative impact.

Incentives for FDI arising from stronger IPRs are also ambiguous, in theory. To the extent that trade and FDI are substitutes, the preceding results suggest the latter would decline. However, it is likely that trade in goods and FDI are largely complementary in products in which knowledge-based assets give rise to investment, an observation that is consistent with rapidly growing intra-firm trade. By directly raising the economic value of ownership advantages, stronger patents, trademarks, and trade secrets should expand the profitability of FDI, particularly in conjunction with expanded market demand as imitators are discouraged. On the other hand, strengthened IPRs could reduce the contracting costs in arm's-length licensing arising from uncertainty about the true value of an invention and the potential for monitoring and disciplining the activity of licensees (Horstmann and Markusen, 1987; Teece, 1986). Thus, there could be a substitution effect into licensing as TRIPS is implemented.

It is evident that IPRs should have varying impacts on FDI in different sectors. Investment in lower-technology goods and services depends relatively little on the strength of property rights and relatively much on input costs and market opportunities. Investors with a product or technology that is hard to imitate may pay little attention to IPRs as well. Firms with easily copied products, such as software and pharmaceutical products, would be interested in the strength of IPRs, as would firms considering investments in local R&D facilities. These comments are consistent with survey results presented by Mansfield (1994).

Econometric work in this area is scarce. Early studies could not find any relationship between crude measures of IPRs and the international distribution of FDI (Ferrantino, 1993; Maskus and Eby-Konan, 1994). However, Lee and Mansfield (1996) regressed the volume of U.S. direct investment in various countries over the period 1990-1992 on an index of

perceived weaknesses of IPRs in destination countries, discerning a significantly negative impact. Further results suggested that both the volume and technological quality of investment are diminished in countries with limited IPRs.

This analysis did not account for many other potential influences on FDI. It is important to account for the joint decisions made by multinational enterprises (MNEs) in reaction to stronger patent rights. In Table 1 I present results of a simultaneous set of equations designed to capture these joint impacts, controlling for market size, tariff protection, the level of local R&D by affiliates, distance from the United States, and investment incentives and disincentives provided by local governments. This is done for a panel of 46 countries using data from 1989-1992. The index of patent strength is taken from Maskus and Penubarti (1995).

All four commercial flows – patent applications, sales, exports, and level of affiliate investment assets – are strongly attracted by large markets, as measured by real GDP. A high average tariff rate tends to diminish FDI, as measured by assets. Local R&D performance is positively associated with each commercial flow as well. It also appears in this specification that investment incentives have a positive impact, and disincentives a negative impact, on the level of FDI assets deployed across destination nations.

The level of average patent strength across countries is strongly associated with patent applications, though the sum of the coefficients on Patent and Patent*DD suggests that the effect is fairly weak in developing countries. Exports to affiliates are strongly positively affected by patent strength in developing economies. While the average patent strength has little evident effect on affiliate sales, the impact is significantly positive in developing countries. It is also interesting to note that the coefficient of the patent variable is negative and significant in the assets equation, but the impact in developing countries is significantly positive. While precise interpretation of this outcome is difficult, it is possible that multinational enterprises, in allocating their investment funds, are sensitive to improvements in IPRs in developing countries, even if they choose not to incur the expense of local patents to the same degree as in developed countries. However, the substitution effect between FDI and licensing noted earlier may be dominant once patent protection exceeds a particular level. In conjunction with the results in Lee and Mansfield (1996), these findings indicate that levels of FDI are responsive to intellectual property rights in developing economies.

Technology Licensing and Joint Ventures

Transferring technology is a costly activity, whether done through FDI, arm's-length licensing contracts, or joint ventures. Licensing tends to be more expensive because aspects of the technology that are tied up in a firm's human capital, management, know-how and corporate culture are not easily transmitted (Teece, 1986). Transfer costs depend also on the recipient country's ability to absorb the technology efficiently, suggesting that additional licensing should emerge as the human-capital base of the economy rises. Also important are the transparency and certainty of the legal and regulatory systems.

There is survey evidence that IPRs affect the quality of technology transferred (Davies, 1977; Contractor, 1980; Mansfield, 1994). The reasons that technology and product licensing should be particularly sensitive to IPRs are evident. First, stronger IPRs should reduce the costs of licensing by lowering the licensor's expense of deterring defection from contracts. Second, they should expand security over the protection of proprietary information in licensing deals. Third, stronger IPRs give the licensor greater ability to set and monitor terms under which licensees operate. Again, however, the sensitivity of technology licensing to IPRs varies with other factors as well, including the local supply of technical and managerial personnel, market factors, and collateral regulation.

Innovation and Diffusion

While technology and information developers have attained stronger strategic advantages from TRIPS, the agreement's ultimate benefits in global terms must come from inducing further technical innovation and enhancing its diffusion within and across borders. It is impossible to assess the prospects for this outcome with confidence, given the complications of the innovation and diffusion processes and the international variety of market structures.

Some key observations are worth making, however. First, surveys indicate that patents are important inducements to inventive activity in some sectors, including pharmaceuticals, chemicals, instruments, and automotive equipment (Levin, et al, 1987). Patents or related devices also matter in plant varieties and basic biotechnological inventions. In these sectors, the TRIPS agreement should promote technology development and have the further benefit of inducing additional research into the product and technical needs of developing countries, including tropical medicines. Further, many firms currently undertaking R&D for purposes of imitating unpatented products should find opportunities for shifting into small-scale innovation for local markets. Possibilities for the privatisation of agricultural research in resource-abundant countries may expand as well as breeders' rights are protected (Primo Braga, 1996).

In other industries, patentable innovation seems more associated with natural market advantages. Here, the TRIPS agreement more likely raises the return to patenting, adding rents to existing invention processes, with little net gain in innovation.

Second, these basic tradeoffs exist with respect to other forms of IPRs as well. It is doubtful that firmer global copyright protection will result in significant additional amounts of literary, music, and entertainment production. Similarly, better protected trademarks in developing countries seem unlikely to expand incentives for product and brand development in the developed countries. However, there is potential for innovation to increase in developing countries as they raise their levels of IPRs. The development of legitimate local products under trademark and copyright protection seems to be an elastic process in developing countries with a viable base of skills and entrepreneurship (Maskus, 1997b).

The potential impacts of TRIPS on diffusion of technical information are also unclear. Copying of unpatented products is the core of the pharmaceutical industries in many developing countries. Imitation and literal copying also directly increase the supply of other products, perhaps of lower quality. Arguably, such imitation is the most important form of diffusion in many markets. These activities will be phased out globally, removing this channel of technology transfer. It is possible that this gap would be filled only partially and at high cost as foreign firms receive stronger protection.

This view ignores the strong spillover impacts into local productivity that occur through the patenting process, which requires disclosure of technical information that may be used for follow-on invention (Eaton and Kortum, 1997). Even stronger gains in productivity emerge through imports of capital goods and technical inputs embodying advanced knowledge (Coe, Helpman, and Hoffmaister, 1997). As noted above, stronger international patents should increase the volume of this trade. Additional FDI would also bear potential for technology spillovers into local economies (Lai, 1997).

Scale and Substitution Effects

To the extent that trade, investment, and technology respond positively to the strength of property rights, all countries adopting tighter systems would experience some growth in them, implying a global scale effect. However, if they respond to international variations in IPRs, the significant narrowing of those differences envisioned in TRIPS would ultimately reduce their importance. In this sense, those high-wage nations with relatively strong

systems, such as Australia and Canada, that currently receive IPRs-sensitive investment may suffer from a substitution effect toward lower-wage nations. Similarly, many developing nations may be frustrated in their expectations about the investment-enhancing impacts of adopting stronger minimum standards.

4. TRIPS as Regulation and Regulating TRIPS

These complexities in the economic effects of IPRs point out that there are no simple rules about optimal regulation because they are inherently second-best policies at the national and international level. The question that remains is how operation of the new global system will affect static and dynamic incentives and the distribution of costs and benefits across countries. Time will tell whether the agreement is biased toward generating and diffusing pro-competitive growth or toward anti-competitive rent transfer on behalf of intellectual property developers.

4a. TRIPS as an International Regulatory Device

Benign purposes of regulation include correction of market failures and the pursuit of social and economic goals. Malign purposes include government favouritism and the satisfaction of rent-seeking activity. Extended to the level of international cooperation, the purposes of regulation include the correction of cross-border spillovers and the development of institutions that prevent national governments from taking unilateral actions that may harm both their own countries and foreign partners.

By markedly raising minimum standards of intellectual property protection, TRIPS eliminates the ability of governments to use weak IPRs as devices for both beneficial and harmful purposes. Weak protection might be thought to enhance possibilities for imitation and diffusion, enhancing growth in technologically lagging countries. There is little systematic evidence on this point.² Poor countries have weak systems and IPRs tend to strengthen as development proceeds, but the direction of causation is not established and many other factors influence growth. Limited IPRs are also seen as a means for disciplining the pricing decisions of firms with technological or marketing advantages. In short, the absence of IPRs in many developing countries itself has been regarded as a form of regulation emphasising access over domestic innovation. Whether it has worked effectively or was the best means for doing so is doubtful.

Widespread absence of effective IPRs in many developing countries may constitute a low-level, non-cooperative equilibrium from which they will be extracted by adherence to TRIPS. Many countries had already defected from this position in response to the forces of globalisation, but TRIPS could help deter additional regulatory competition. Again, however, there is no objective standard by which to assess whether the TRIPS standards reflect an efficient level at which to concentrate IPRs regimes.

Seen as a program of international regulation, the agreement must be given a mixed scorecard. It is not clear that, on balance, it corrects domestic market failures more than exacerbates them. However, it disciplines governments that promote copying, which may be

² Gould and Gruben (1996) perform cross-country regressions of growth on various determinants, including the Maskus-Penubarti patent index, and find no strong effects of patents on growth. However, there is a significantly positive effect when the index is interacted with a measure of openness, suggesting that trade liberalisation in conjunction with stronger IPRs could be growth-enhancing.

inefficient in a growth sense. It likely will shift the balance of lobbying power within countries toward local innovative firms. It re-channels the international information spillovers coming through uncompensated imitation into protected routes, which may embody higher prices but improved quality of technologies and products. To the extent that these spillovers were limiting global innovation, the agreement promises more growth.

4b. Regulating TRIPS

Despite these potential systemic gains, many countries view TRIPS as a means of denying them cheap access to foreign technical services. These countries will seek means of offsetting the potential anti-competitive effects of stronger property rights. In this sense, TRIPS has scope for safeguards by being vague on implementation and competition issues.

The agreement sets minimum standards in a wide range of functional areas but leaves open numerous means for implementing the standards in a pro-competitive fashion, provided that they do not unduly frustrate the intentions of TRIPS (UNCTAD, 1996). For example, countries are free to adopt the highest reasonable standards for non-obviousness in patents, to require adequate disclosure of technological information, and to limit protection to narrow patent claims. The last approach may be important for encouraging the development of local capacity to invent around patents, which remain overwhelmingly owned by firms in developed nations. Judicious use of non-exclusive compulsory licenses is allowed to overcome abusive practices by patent holders, so long as adequate compensation is paid. Little is said in the agreement about fair-use exceptions in copyright for research and educational purposes. Thus, wide exceptions of this kind may be allowed. Particularly important would be a liberal stance on decompilation of computer programs, with the intent of encouraging follow-on software development. Nothing requires the patenting of software. Finally, there are no restrictions on the use of pricing regulations in drugs for purposes of supporting public health, which is a common policy in both developing and developed countries.

Most significantly, Article 40 of TRIPS provides wide latitude for competition policies. The agreement allows measures to control such practices, presenting a non-exhaustive list of three examples: exclusive grant-back conditions, conditions preventing challenges to validity, and coercive package licensing. Thus, while TRIPS envisions licensing abuses as key sources of anti-competitive behaviour, the definition is not limited in that regard.

Though several developing countries and countries in transition have recently upgraded or adopted competition regimes, this policy area is open to considerable transformation (OECD, 1996). The implementation of TRIPS affords an opportunity to consider the intimate linkages between intellectual property protection, trade liberalisation, and competition policy. It is possible that stronger IPRs could interact with inadequate competition rules to render particular markets less competitive. This would be true, for example, where imports are subject to mandatory local distributorships. Patents and trademarks would raise the implicit monopoly privileges awarded such distributors.

In consequence, as the new TRIPS regime is phased in, countries need to ensure that firms do not extend its stronger protection beyond intended limits. While this area is complex, two issues stand out. First, a decision must be taken with respect to exhaustion of IPRs and the treatment of parallel imports. Denying parallel imports through legislation or exclusive-dealer requirements provides unrestrained opportunities for market segmentation and protects monopoly pricing, particularly in small markets. Second, a determination of whether particular licensing procedures are to be subject to administrative or judicial contest

is required, whether on the basis of *per se* illegality or a rule of reason. The former standard may apply to clear attempts to monopolise horizontal production and distribution channels, while the latter standard might apply to vertical arrangements and tied sales. As TRIPS suggests, patent licensing and extensive pooling arrangements, while not necessarily anti-competitive, might be subject to scrutiny.

5. Concluding Remarks

The emerging global system of protection for intellectual property, as embodied primarily in the TRIPS agreement, strongly re-balances global policies in favour of information developers. Economic arguments cannot conclusively demonstrate that this change will encourage additional innovation and international dissemination of technologies and products. The preponderance of econometric and survey evidence tentatively supports this conclusion, however.

At the same time, concerns persist that protected firms will choose to exercise their stronger rights in anti-competitive ways, raising prices and license fees and reducing international access to technology. There is some truth to this position, though the extent of these costs is dependent on numerous aspects of market structure and regulation. The TRIPS agreement provides wide discretion for enacting pro-competitive implementation strategies and competition rules.

In pursuing such a route, however, countries must recognise two dangers. First, a delicate balance needs to be struck between maintaining competition and promoting local innovation, on the one hand, and encouraging commercial activity from abroad. Second, over-enthusiastic pursuit of means to limit the benefits of TRIPS will invite future trade disputes. This may be especially true in that the high costs of enforcement may discourage some governments from administering their obligations effectively. A notable systemic benefit of TRIPS is that it folds intellectual property disputes into the recognised multilateral dispute-settlement mechanism.

REFERENCES

- Coe, David T., Elhanan Helpman, and Alexander W. Hoffmaister (1997), "North-South R&D Spillovers," *The Economic Journal*, Vol. 107, 134-149.
- Contractor, Frank J. (1980), "The Profitability of Technology Licensing by US Multinationals: A Framework for Analysis and an Empirical Study," *Journal of International Business Studies*, Vol. 11, 40-63.
- Davies, Howard (1977), "Technology Transfer through Commercial Transactions," *The Journal of Industrial Economics*, Vol. 26, 161-175.
- Eaton, Jonathan and Samuel J. Kortum (1996), "Trade In Ideas: Patenting and Productivity in the OECD," *Journal of International Economics*, Vol. 40, 251-278.
- Evenson, Robert E. (1992), "Intellectual Property Rights for Appropriate Invention," in James A. Roumasset and Susan Barr, eds., *The Economics of Cooperation: East Asian Development and the Case for Pro-Market Intervention*, (Boulder, CO: Westview Press), 51-78.
- Ferrantino, Michael J. (1993), "The Effect of Intellectual Property Rights on International Trade and Investment," *Weltwirtschaftliches Archiv*, Vol. 129, 300-321.
- Gould, David M. And William C. Gruben (1996), "The Role of Intellectual Property Rights in Economic Growth," *Journal of Development Economics*, Vol. 48, 323-350.
- Horstmann, Ignatius and James R. Markusen (1987), "Licensing Versus Direct Investment: A Model of Internalization by the Multinational Enterprise," *Canadian Journal of Economics*, Vol. 20, 464-481.
- Lai, Edwin J. (1997), "International Intellectual Property Rights Protection and the Rate of Product Innovation," *Journal of Development Economics*, forthcoming.
- La Croix, Sumner (1992), "The Political Economy of Intellectual Property Rights in Developing Countries," in James A. Roumasset and Susan Barr, eds., *The Economics of Cooperation: East Asian Development and the Case for Pro-Market Intervention*, (Boulder, CO: Westview Press).
- Lee, Jeong-Yeon and Edwin Mansfield, (1996), "Intellectual Property Protection and U.S. Foreign Direct Investment," *Review of Economics and Statistics*, Vol. 78, 181-186.
- Levin, Richard C., Alvin K. Klevorick, Richard R. Nelson, and Sidney G. Winter (1987), "Appropriating the Returns to Industrial Research and Development," *Brookings Papers on Economic Activity*, 783-831.
- Mansfield, Edwin (1994), "Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer," International Finance Corporation, Discussion Paper 19.

- Mansfield, Edwin (1995), *Innovation, Technology and the Economy: The Selected Essays of Edwin Mansfield, Volume II*, (London: Edward Elgar).
- Markusen, James R. (1995), "The Boundaries of Multinational Enterprises and the Theory of International Trade," *Journal of Economic Perspectives*, Vol. 9, 169-189.
- Maskus, Keith E. (1996), "Intellectual Property Rights in the Global Information Economy," in Thomas J. Courchene, ed., *Policy Frameworks for a Knowledge Economy*, (Kingston, ON: John Deutsch Institute for the Study of Economic Policy), 231-270.
- Maskus, Keith E. (1997a), "Implications of Regional and Multilateral Agreements for Intellectual Property Rights," *The World Economy*, forthcoming.
- Maskus, Keith E. (1997b), "Intellectual Property Rights in Lebanon," report to the International Trade Division, The World Bank.
- Maskus, Keith E. and Denise Eby-Konan (1994), "Trade-Related Intellectual Property Rights: Issues and Exploratory Results," in Alan V. Deardorff and Robert M. Stern, eds., *Analytical and Negotiating Issues in the Global Trading System*, (Ann Arbor: University of Michigan Press).
- Maskus, Keith E. and Mohan Penubarti (1995), "How Trade-Related are Intellectual Property Rights?" *Journal of International Economics*, Vol. 39, 227-248.
- Organisation for Economic Cooperation and Development (1996), *Trade and Competition: Frictions after the Uruguay Round*, OECD/GD(96)105.
- Primo Braga, Carlos A. (1996), "Trade-Related Intellectual Property Issues: the Uruguay Round Agreement and Its Economic Implications," in Will Martin and L. Alan Winters, eds., *The Uruguay Round and the Developing Countries*, (Cambridge: Cambridge University Press), 341-379.
- Rapp, Richard T. and Richard P. Rozek (1990), "Benefits and Costs of Intellectual Property Protection in Developing Countries," *Journal of World Trade*, Vol. 24, 75-102.
- Reichman, J. H. (1994), "Legal Hybrids Between the Patent and Copyright Regimes," *Columbia Law Review*, Vol. 94, 2415-2485.
- Reichman, J. H. and Pamela Samuelson (1997), "Intellectual Property Rights in Data?" *Vanderbilt Law Review*, Vol. 50, 51-166.
- Siebeck, Wolfgang E., ed. (1990), *Strengthening Protection of Intellectual Property in Developing Countries: A Survey of the Literature*, World Bank Discussion Paper no. 112.
- Smith, Pamela J. (1997), "Are Weak Patent Rights a Barrier to U.S. Exports?" *Journal of International Economics*, forthcoming.

Stern, Richard (1987), "Intellectual Property," in Michael Finger and J. Olechowski, eds., *The Uruguay Round: A Handbook on the Multilateral Trade Negotiations*, (Washington, DC: The World Bank).

Teece, David J. (1986), *The Multinational Corporation and the Resource Cost of International Technology Transfer*, (Cambridge: Ballinger).

UNCTAD (1996), *Economic and Legal Implications for the Developing Countries of Implementing the TRIPS Agreement*, (Geneva: UNCTAD).

Table 1. Simultaneous Equations Model of the Impact of Patent Strength on The International Exploitation of Intellectual Assets (46 Countries; 1989-1992)

Variable	Applications	Sales	Exports	Assets
Constant	0.27 (2.77)	0.46 (5.13)	0.60 (7.51)	0.14 (1.46)
GDP	3.66 (26.79)	31.19 (27.23)	1.07 (10.02)	26.26 (10.13)
Tariff Rate	-6.34 (-4.89)	-3.19 (-0.26)	-3.95 (-4.92)	-108.88 (-3.34)
Affiliate R&D	1.78 (3.42)	42.80 (19.42)	1.74 (23.86)	40.76 (6.17)
Distance	0.012 (3.08)	-0.057 (-2.32)	-0.008 (-5.01)	-0.95 (-9.02)
Patent	1703.15 (10.24)	-76.05 (-1.26)	-21.23 (-5.19)	-1585.41 (-6.70)
Patent*DD	-1690.37 (-10.13)	319.53 (4.50)	53.99 (8.63)	3516.62 (11.62)
Incentives	43x10 ³ (12.2)	340x10 ³ (13.85)	15x10 ³ (11.14)	1389x10 ³ (16.29)
Disincentives	-3489.02 (-4.41)	-23x10 ³ (-2.32)	2423.17 (4.29)	-354x10 ³ (-7.80)
R ²	0.90	0.97	0.97	0.90

Variables: Applications is number of U.S. patent applications filed in host country; Sales is total sales of foreign affiliates of U.S. parents (US\$ millions); Exports is U.S. exports shipped to affiliates (US\$ millions); Assets is total assets, foreign affiliates of U.S. parents (US \$millions); GDP is real GDP in host country (US\$ billions); Tariff rate is import revenues divided by total dutiable imports; Affiliate R&D is expenditure on R&D by foreign affiliates of U.S. parents (US\$ millions); Distance is distance from U.S. to host country (kilometres); Patent is instrumented patent index; Patent*DD is the index interacted with a dummy variable for developing countries; Incentives is number of affiliates that received tax concessions in host country divided by the number of affiliates that received tax concessions in any of the countries; Disincentives is the number of affiliates that employ a minimum amount of local personnel in host country divided by the number of affiliates that employ a minimum amount of local personnel in any of the countries.

Equations are run in a SUR framework corrected for heteroskedasticity and autocorrelations. t-statistics are in parentheses.