Issues in International Patenting

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Abstract:

This paper surveys the state of international patent systems and discusses the economic effects and problems caused by differences in international patent rights, focusing particularly on technology creation, diffusion, transfer, industry, and trade issues. The paper also evaluates the merits of harmonizing or standardizing international patent regimes so as to mitigate the adverse economic effects of regime differences. The conclusion reached is that internationally coordinating some minimum standards for patent laws and procedures would be a practical solution to some of the high transactions costs that differences in international patent regimes impose on world trade and technology diffusion.

I. Introduction

For quite some time, patent laws and policies varied widely across countries. With the recent formation of the *World Trade Organization* (WTO), however, a process of convergence in patent systems has occurred. Not only have nations, particularly developing economies, adopted new patent laws, but according to the *Trade Related Intellectual Property Rights* (TRIPs) Agreement, members of the WTO are expected to ratify further changes that will harmonize patent systems even more. In addition to the WTO proposals, the United Nation's *World Intellectual Property Organization* (WIPO) has recommended additional proposals of its own to make patent laws across countries (particularly, procedural matters) much more uniform. These proposals are outlined in the WIPO's *Patent Law Treaty* (PLT).

The purpose of this paper is to discuss whether this recent trend toward harmonization or uniformity of national patent systems is, economically or otherwise, a sensible idea. To make this assessment, the paper reviews the state of patent systems across countries and reflects on the implications of differences in national systems for international economic performance.

This paper is organized as follows: section II reviews the role and importance of patent rights in a global economy; section III describes the state of international patent rights for 44 countries; section IV discusses the economic effects of cross-country differences in patent rights; and section V concludes with an evaluation of the costs and benefits of international patent harmonization and reviews some guidelines and current proposals.

It is important to note at the outset that the discussion will be rather selective. Not all the relevant details of patent systems nor all the relevant economic effects of patent systems will be covered. It is also the case that patent rights are determined not only by patent laws but also by other laws and policies; for example, commercial law, contract law, public law, tax, trade, and industrial policy. These laws and policies in conjunction with patent laws determine the overall level of patent protection and direction of innovative (or imitative) activity. The purpose here is not to be exhaustive but to be informative enough of the issues as to make some sense of the ongoing policy debates concerning international patent harmonization.

II. Patent Rights in a Global Economy

The logic of why patent systems exist is discussed extensively in the literature.[1] It is therefore best here to focus on clarifying a few points. First, in the absence of a patent system, markets for ideas would be "missing" due to the public good nature of knowledge. A patent system therefore creates a market which would otherwise not exist. The cost, however, is that the market in question will not be competitive, but monopolistic. The innovator might not otherwise be able to *recoup* her upfront research and development (R&D) costs, given how relatively cheaply the output can be reproduced at competitive prices. Thus, a tradeoff exists between technology creation and diffusion: patent systems must provide on the one hand adequate incentives for technology creation (in the form of positive economic profits) and on the other hand opportunities for competitive, efficient diffusion.

[1] See, for example, Maskus (1993) and Siebeck (1990).

This description of the patent process sometimes creates a few misconceptions. The first is that a patent makes a firm (or inventor) a monopolist, in the traditional sense of a single firm in an industry. Rather, the patent gives the holder the right to exclude others from using the new idea commercially; it does not allow the holder to exclude other firms from the industry in which it serves. A second misconception is that the tradeoff is between technology creation and knowledge diffusion; rather it is between the former and the diffusion (or supply) of output embodying the new knowledge. Patents do not restrict the diffusion of knowledge; on the contrary, they help diffuse it. The reason is that, in exchange for patent protection, inventors must disclose their new knowledge (either some time during the application or after a patent is granted). A third misconception is that the patent holder will manufacture an output based on the idea. Patents indicate recognition of the novelty, nonobviousness, and usefulness (e.g. industrial applicability) of new ideas. They are not contracts or commissions of work. Of course, some nations can require manufacturing (called working requirements) or revoke a patent if the holder fails to do so. Other nations let the patent holder choose whether and when to manufacture.[2]

A fourth misconception is that because the inventor recouped her upfront R&D costs in her own domestic market, there is no need to provide her with exclusive protection in foreign markets. Thus, the output should be competitively supplied in foreign markets, especially in the less developed. First, inventors may seek global markets precisely because their kinds of inventions require a larger world market to help recoup their costs.[3] Secondly, knowing that they can serve a larger world market influences the scale of inventors' research projects. If it is only possible to recoup R&D costs from the (smaller) domestic markets, inventors may choose smaller than potential investments in R&D. This would be a loss to global welfare to the extent that the potential technology could have been useful in various national economies. Finally, global patent protection is increasingly necessary in a world where imitation risks are greater and more widespread (geographically).

The fact that inventors have been increasingly seeking global patent protection is evident in the data. Figure 1 shows the growth in domestic patenting during the period 1975-1990. Figure 2 shows the growth in the number of patent applications by foreigners during the same period. With the exception of Japan, there has been a far greater increase in foreign patenting. This suggests, in light of the comments above, not only an increase in the scale of current research projects but also an increase in the international diffusion of knowledge.[4]

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[2] This leads to some well-known abuses: inventors can patent merely to wait for others to infringe on their inventions so that they can collect damages or royalties.

[3] In some cases, a pecuniary externality is imposed on consumers of the domestic economy; that is, to the extent that inventors are unable to recoup their costs fully abroad, they are likely to charge higher prices to domestic consumers to compensate.

[4] Note the huge volume of domestic patent applications in Japan. Section IV provides an explanation for this phenomenon (where residents "flood" applications into the Patent Office).

This increase in global patenting activity makes the consideration of international patenting issues timely. The next section examines the process of applying for patents in a global context and compares patent laws and procedures across countries.

III. State of International Patent Rights

The features of patent regimes can be divided into two categories: **patent application** and **patent enforcement**. Some statutory factors affect the process of obtaining a patent and others the process of enforcing patent rights. These features vary across countries, and reflect the different approaches and attitudes that nations have with respect to intellectual property rights. Some nations (e.g. the U.S.) select features to weigh technology creation more heavily while others (e.g. Japan) choose to promote technology diffusion.

First, an overview of the features to consider.[5] In the patent application process, it is important to determine *priority* (who is the first to qualify for a patent) and *patentability* (whether the invention is novel, and whether the subject matter of the patent is not restricted). If the invention is not completely novel (in the sense that it was revealed publicly prior to the application), a *grace period* or exception might apply. During the application process, it is necessary to incur *fees*, undergo *examination*, and determine when public *disclosure* is to occur. Once a patent is granted, if at all, the inventor is allowed a certain *duration* of protection; there may also be third-party *opposition* to the grant, or restrictions such as a *working requirement* or *compulsory licensing* to third-parties. If global patent protection is sought, it matters whether nations are members of *international treaties* affecting priority, fees, and national treatment.[6]

In the enforcement process, the courts enforce patent rights, not the patent offices. Should infringement occur, patent holders may have recourse to the following statutory provisions: *preliminary injunction*, *contributory infringement*, *burden of proof reversal*, *discovery*, and *doctrine of equivalents*. Preliminary injunction requires the accused infringer to cease the production or use of the patented product or process during the course of the trial. Contributory infringement permits third-parties also to be liable if they contributed negligently to the infringement. Burden of proof reversals, in patent process cases, put the onus on the accused to prove innocence (that is, to show that the process used is not the patented one). Discovery permits the accuser to obtain evidence from the accused, such as documentation. Lastly, the doctrine of equivalents would find the accused infringer liable if she uses the essence of the patented invention but does not literally infringe the patent.

The rest of this section discusses how these various patent application and enforcement features vary across countries. In order to provide examples, a sample of 44 nations is selected,

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[5] The information in this section is based on Jacobs (1996) and WIPO (1997).

[6] National treatment refers to treating domestic and foreign patent applicants and holders non-discriminately. It does not refer to treating foreigners in the same way they are treated in their own countries.

ranging from developed to developing. The relevant features are summarized in Tables 1, 2A, and 2B. The tables and discussion below describe the state of rights, as of 1996. A more historical treatment is contained in Ginarte and Park (1996). A comparison between these two studies would show "convergence" among national patent systems since 1990, due mostly to the formation of the WTO.

The discussion below of patent features is organized in chronological order - that is, from the start of the application process to the stage of enforcement. Each feature is compared across countries and its importance briefly discussed. The section ends by examining some sundry issues: the rights to publicly funded inventions; trends in overall patent protection; and gaps between statutory protection and actual practice.

A. Patent Application

The inventor must first decide whether to obtain a patent or keep the invention a *trade secret*. The inventor of course risks being imitated and not being able to claim damages, but some nations do provide trade secret protection - see Table 1. More than half the nations in the sample provide such protection. One noticeable country that does not provide it is Japan. In the U.S., trade secrets are protected by state, not federal, laws. In all of these countries, trade secret protection does not protect against another inventor independently developing the invention and patenting it, or against reverse engineering.

For each potential country, the inventor compares the *benefits* and *costs* of applying for a patent in that country. The benefits depend on market size, imitation risk, and how well patent rights are protected (see Eaton-Kortum (1996) and Park (1997)). The costs include official filing fees, agents' fees, and translation costs. Helfgott (1993) contains a survey of patent filing costs across countries, some of which are reported in Table 2A. The costs here refer to a 20-page patent application of an invention that claims ten things and is in English; these costs exclude hidden fees (for example, attorney fees, taxes). The costs are typically low in countries where translation is not necessary and high where it is; for example, Japan and Europe. Given these costs and benefits, the profit-maximizing inventor's decision is to patent in a particular country if the *rise* in present value profits in that country due to patent protection exceeds the cost, else the inventor chooses to keep the invention a secret.

Having decided to apply for a patent, the inventor faces the test of priority: who gets to apply for a patent for this specific invention? Is another application pending? Within each market, it is generally the first to file who gets priority. In the U.S. and Philippines, it is the first to invent. If the inventor files in several countries, priority is also governed by international treaties (provided the countries are signatories). The *Paris Convention* allows inventors in member countries up to 12 months to file an application in other member countries after first filing in one member country (usually the country of origin of the inventor). The inventor thus reserves that initial filing date, for 12 months, for purposes of establishing who was first to file.

A few other international treaties should be mentioned. The *Patent Cooperation Treaty (PCT)* permits inventors to file a single "international" patent application in as many of the

member nations they wish to designate. The PCT establishes priority, as before with the Paris Treaty, on the basis of the earliest domestic filing. The filing of a PCT application also extends the deadline for filing foreign applications in member nations to 20 months (i.e. adds 8 months to the 12 from the Paris Treaty). Some cost savings are realized by the inventor with the PCT application, for example a reduction in search costs. Eventually the inventor must file, and incur the necessary costs of, separate national patent applications in each of the designated countries within 20 months, or else forfeit patent rights in those countries. Countries that are members of *PCT II*, however, may provide a further 10 month extension, giving a total extension time of 30 months, at the end of which applicants must go to the national phase (i.e. file in the separate jurisdictions) or else forfeit patent rights. Table 2A indicates which countries are members of PCT and PCT II. Most Latin American and African countries are not members.

A single international filing procedure is also available to inventors who apply in member nations of the *European Patent Office (EPO)*. As the EPO is part of the PCT and Paris Conventions (i.e. treated as one bloc member), the previous priority rules and extension privileges continue to apply. The advantages of a single EPO application are: a) language, as the application can be made in any one of the three languages (English, French, or German), but upon grant, it must be translated into the native languages of the countries designed in the application; b) a single, centralized examination; c) filing-cost savings (provided coverage is sought in at least 3 member nations). A disadvantage of the EPO application is that the applicant puts all her "eggs in one basket." If the EPO rejects the patent application, the applicant cannot then apply directly to national patent offices. While the EPO patent has effect in each of the jurisdictions designated, it is enforced individually within the national jurisdictions.[7]

Returning to the patent application itself, countries also vary in terms of when to disclose information in the patent application. The U.S. keeps it secret until the patent is granted (which in the U.S. could be about two years from the date of filing). If it is not granted, the information is not disclosed to the public. In the EPO and Japan, the application is made public after 18 months from the date of filing, even if the patent is not granted. In most of Africa, it is made public upon acceptance of a complete application. An advantage of early disclosure is that it enables other inventors to build on new and existing knowledge, avoid infringement and costly litigation, if they desire, and avoid duplicative research projects. A drawback is that the procedure may discourage inventors who are risk averse and less than completely certain of successfully obtaining a grant.

The next important stage of the patent application process is the determination of patentability. First, the laws generally indicate subject matters that are not patentable, perhaps because certain subjects are not novel, non-obvious, and useful. For example, medical treatment is not considered patentable because it does not yield industrially applicable output.

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[7] At work is the development of the *Community Patent Convention (CPC)* which will allow for community patent courts to oversee infringement and validity proceedings of community patents.

Or, subject matters may be declared unpatentable if they are considered contrary to public order, morality, health, and national security. Prior to 1995, several countries (Argentina, Austria, Denmark, and India) did not provide pharmaceutical patent protection on national health grounds. Most now permit it. One area of future controversy, and of relevance to the future of the global biotechnology industry, is the patentability of genes, which the U.S. is alone in permitting to a limited degree.[8]

During the determination of patentability, a crucial conclusion is arrived at concerning novelty. Novelty defines the inventive step of the invention over prior art. The invention must not be in the pool of existing (prior) knowledge. The inventor therefore disqualifies herself if she publicly discloses the invention before applying for a patent.[9,10] The U.S., however, provides a 12-month grace period, allowing the invention to remain novel if the patent application is made within 12 months of public disclosure. The EPO and Japan permit grace periods of 6 months for certain types of public disclosure only (for example, public demonstrations). Grace periods are not available elsewhere.

The examiner's determination of novelty also identifies the *scope* of protection, the neighborhood in "technology" space within which others must not intrude. Only the patent holder has the right to use knowledge contained in that space. If the invention, for example, is considered very novel, the boundaries are very wide, many claims are allowed, and competitors must develop higher quality inventions to avoid infringing on the patent holder's rights. Countries have different reputations for how much scope they generally provide. U.S. examiners are considered to grant a broad scope of protection, while Japan a narrow scope. Economists have debated whether technological change is better served by a broad or narrow scope (see Merges and Nelson (1994)). On the one hand, a broad scope gives more market power to an inventor and might be a strong inducement to invent; on the other hand, it makes it more difficult for competitors to develop new inventions.

Novelty examination practices also differ across countries; in some, examination is extensive (e.g. Germany, Japan, Netherlands, and the U.S.), while in others (e.g. France, Belgium, and Italy) a patent is granted without a novelty search. Thus in countries without examination (see Table 2A), novelty is not guaranteed (nor could it really be even after an extensive search, given time, resource constraints and human error). Patent holders must face validity challenges as infringement arises. While risky for the patent holder, one rationale for this practice is that it puts the onus on potential infringers to determine whether a patented

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[8] For example, in 1988, Harvard University was issued a patent for an invention which produced a genetically altered mouse susceptible to cancer. Genetically altered animals was considered patentable because they are non-naturally occuring.

[9] Even under a system where priority is based on "first to invent," the inventor must keep the invention undisclosed till an application is filed.

[10] This definition of novelty especially affects university researchers who tend to publish their results widely.

invention is worth challenging. Thus the system shifts the burden of examination on private parties.

The next phase of the patent application process to consider is the granting of a patent. There are a number of post-grant features that also vary across countries. First, the length of protection (or duration) used to vary much more widely, but with the formation of the WTO, a vast majority of countries now provide 20 years of protection from the date of first filing (or date of priority claim).[11,12] However, the actual or effective duration of protection can differ since the *patent pendency* period (i.e. time it takes to obtain a patent) varies across countries. For example, in Japan, it takes an average of 5-7 years from the date of filing to obtain a patent. Thus the real duration of protection is 13-15 years. (Table 2A, Column 3 provides the patent pendency for other nations.)

Another major difference across countries is that most allow third parties to oppose a grant, for a limited time after a patent grant is announced. The U.S. does not provide for opposition, and in Japan, opposition takes place before the patent is granted - that is, during the application period. This explains why Japan's patent pendency is the longest among nations. As discussed in a related point under novelty examination, an advantage of third-party oppositions to a grant might be that it spreads the cost or burden of fully determining validity or novelty to competitors. The disadvantage is that an expensive obstacle is placed in the path of a patent applicant. Competitors could especially try to delay, if not prevent, the applicant from getting the patent.

Finally, upon grant, patentees may face conditions regarding working and licensing, neither of which the U.S. imposes. Working requirements, from the point of view of the inventor, are restrictive. The patentee might either be financially unable to work the invention or find the market to be such that working is not profitable at the time. In the case of holding a foreign patent, the patentee might prefer to manufacture in her home country and then market her products abroad. On the other hand, some patent regimes operate on the premise that the purpose of a patent is not to profit inventors but to bring economic value to the community. For this reason, in some countries (see Table 2A, column 4), if a patent is not worked within a certain time, the patentee is required to give a license to a third party willing and able to work the patent (in exchange for a "reasonable" royalty).

Compulsory licensing may also be imposed if inventions relate to food and medicine, or if another patent is being blocked. Blocking patents are patents that contain enough subject matter that manufacturing one item would involve infringing the other. They usually arise when one patent is an improvement over the other. Without a patent, the improver would infringe on the core technology. But even with a patent, the improver needs a license to use the core technology without which the improvement cannot work. The solution to this dilemma is

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[11] Before WTO, Canada and the U.S. used to provide 17 years of protection from grant, Australia and New Zealand 16 years from the date of filing, and Taiwan 15 years from the date of filing.

[12] In the U.S., the priority is still the first-to-invent.

to have improvers and pioneers approach each other with licensing agreements. Otherwise, the authorities can issue compulsory cross-licensing. France, Italy, Japan, Sweden, and China have provisions for compulsory licensing in the event of blocking patents; however, authorities have rarely imposed this. In most cases, voluntary bargaining tends to resolve blocking. Needless to say, blocking especially arises in situations where the scope of protection is narrow.

To summarize, from the host country's view, compulsory licensing might be justifiable if the patent holder would otherwise enjoy excessive market power, fail to let the invention be worked, block new technology, and thus prevent the host country from enjoying the benefits of new inventions to the necessary extent. Thus, this feature of patent practice is one example where the social benefits might outweigh private losses. However, to the extent that compulsory licensing discourages ex ante research and innovation, society loses. That is, compulsory licensing may stimulate current technology diffusion, but discourage future technology creation.

B. Patent Enforcement

Table 2B summarizes the availability of the enforcement mechanisms across countries. These features, if available, better enable patent holders to enforce their rights should infringement occur. However, they are not without controversy. Preliminary injunctions and discovery are expensive procedures which smaller inventors are not likely to be able to afford and avail themselves of their use. Discovery may not even be necessary in the case of process patents if a burden of proof reversal is available (for example, in France and Germany) since the onus of proving non-infringement rests with the accused. The doctrine of equivalents remedy presumes the desirability of a broader scope since it renders technologies slightly outside the "fence" enclosing the scope of a patented invention to be considered infringing. To the extent that broader patents cause on net excessive market power and slower technological change, the doctrine of equivalents protects the private patent holder at the expense of social welfare.

C. Publicly Funded Inventions

Thus far the focus has been on private inventions. Many inventions, however, are government funded. In most countries, the government funds nearly half the nation's R&D. The issue is who gets the rights to publicly funded inventions? Typically, these rights are spelled out in contracts between government agencies and the performers of research, and thus are not explicitly mentioned in the national patent laws, except in the case of Canada, France, Germany, USA, UK, and Japan. The pattern is very similar to employee-employer arrangements, which often are specified in national patent laws. The general idea is that if an employee works for hire and develops an invention, the exploitation of which falls under the business of the employer, the rights to a patent rest with the employer; else, the rights go to the employee, with the employer having the right to obtain a license. In the case of government funded research, inventions made by a contractor or public servant in the course of public service belong to the public entity; else, the contractor or public servant retains title and allows the public entity to obtain a license, usually non-exclusive, irrevocable, and royalty free.

A few remarks about the treatment of government funded research in different countries.

In the U.S., the Bayh-Dole Act of 1980 permits academia, industry, and others to elect to retain title to inventions produced with federal government support. The reason was that when the research output remained in public domain, few got commercialized. This was viewed as being adverse to U.S. competitiveness and productivity. Consequently, for example, universities, which are traditionally open institutions for exchanging ideas, were encouraged to be more "commercially-oriented" about their output or to team up with private industry. In turn, the policy of the government was to receive from university or industry a royalty-free license for governmental purposes. Universities in turn have their own policies regarding the sharing of revenues from inventions between the institution and the individual inventors involved. Foreign companies in the U.S., however, cannot hold patent rights arising out of government funded research. They can, however, license the technologies free of charge as long as they were participants in the research project.

In Japan, it used to be the case that the government held all patent rights to projects funded by the Ministry of Trade and Industry (MITI); the Japanese or foreign company participants were required to pay license fees in order to use the very technology they helped create. This changed in 1994, motivated also by the desire to (a) increase international competitiveness, (b) attract foreign companies, and (c) promote Japanese-international research collaboration. The arrangement now is for the government to retain at least 50% of the ownership rights and the private companies (including foreign) at most 50% of the rights. In the U.K., the government retains title to inventions arising out of contract research, but companies can retain title if the government provided only subsidies. Whichever party does not retain title has the right to license the technologies for free.

D. Trend in Overall Patent Protection

As indicated earlier, due to the formation of the WTO and plans for ratification of the TRIPs agreement, national patent regimes have begun to converge. This can be seen using the Ginarte-Park (1996) Index of Patent Rights. The index summarizes the patent application and enforcement features of a nation and gives this nation a score for its overall patent rights. The score ranges from 0 (no protection) to 5 (maximum protection).[13] Table 3 shows the index values for the countries in 1990 and 1996. The standard deviations show that the overall differences in levels of protection have narrowed. Two factors are primarily responsible for the narrowing: (a) the fact that more countries now provide durations of 20 years; (b) the fact the more countries now permit pharmaceutical and chemical inventions to be patented.

E. Statutory Protection versus Actual Practice

[13] The index consists of five categories: duration; enforcement; coverage (patentability); protection against loss of rights (like compulsory licensing); and membership in international treaties. Each of these five categories is given a score out of 1, indicating the percentage of features in that category that a country has. For example, a 0.33 score for enforcement indicates that a country has only a third of the desired enforcement features. The unweighted sum of the scores of the five categories gives the overall index value.

Thus far only the statutory provisions were described (that is, the laws on the books). In reality, the actual practice of laws can deviate substantially from what the statutes provide. This is quite the case in Latin America, Africa, and the former socialist economies. The U.S. ITC (1988) and Sherwood (1997) find inadequate enforcement in Argentina, Brazil, Chile, and Mexico owing to: a lack of judicial independence; patterns of undue influence from corruption; unreliable prosecutors, police, and customs officials; ineffective sanctions; and undue delays in enforcement proceedings. There is also inadequate administration owing to: a lack of transparency in decision-making; poor examiner knowledge; failures to process decisions in a timely manner; and burdensome regulations (i.e. demands for excessive documentation). These factors are hidden from the statutes.

The USTR's (1995) compilation of complaints also suggests that in practice certain patent laws are not as strong as they appear. Though Korea and Taiwan have fairly good statutory provisions, U.S. firms have reported that data provided to regulatory authorities responsible for approving the marketing of pharmaceutical products were not kept confidential. China, Russia, Poland, Hungary, and Venezuela, all have enacted new Patent Laws, but have weak "transitional" protection; that is, until their systems are fully intact, products protected by foreign patents are not well protected in those economies. Latin American economies like Colombia and Venezuela permit *parallel importing* (the imports of legally manufactured products ordered by firms other than those with exclusive distribution rights). In Singapore, government procurement policy is exempt from liability of infringement in cases where national interests are at stake. For example, the government can purchase patent-infringed goods for use in public sector medical facilities. While many countries have similar provisions in the event of national emergency, the Singaporean government uses this provision quite often in its pharmaceutical purchases so as to keep costs down.

In summary, patent laws and practices vary across countries, but during the past few years, there has been some convergence in statutory provisions, but not necessarily in the actual execution and administration of the laws. Thus while there still remain differences in patent regimes globally, much also remains to be done to make the execution of laws consistent with the statutory provisions. The next section discusses the economic impacts of international differences in patent laws and enforcement.

IV. Economic Effects of Cross-Country Differences in Patent Rights

This section begins by distinguishing two types of differences in patent rights, makes some general remarks about the economic impacts of differences in international patent rights, and examines some specific impacts of those differences on macroeconomic performance, trade, technology transfer, industries, and small inventors.

It is useful to distinguish two ways of conceptualizing differences in patent regimes: one, differences in overall *levels* of protection (i.e. strong versus weak regimes); two, differences in the *specification* of protection (i.e. the *details* of patent regimes). For example, two countries may be considered to have the same overall level of patent protection, but one provides a broad scope of protection with short duration, while the other provides a narrow scope of protection

with long duration; or one may determine priority based on first-to-file while the other on first-to-invent. The literature has focused on both types of patent regime differences. As discussed below, international differences in both the level and the specification of protection have particular legal and economic implications.

A. General Remarks:

Differences in *overall levels* tend to affect global innovative activity. Weak patent protection levels which result in losses of profits to inventors (due to imitation) feed back adversely to innovative activity. In a world where patent protection levels are weaker than optimal, there are insufficient incentives to do innovate R&D and excessive incentives to copy (or do imitative R&D). Thus, global R&D decisions would tend to be distorted. Furthermore, research and manufacturing decisions may be made more heavily on the basis of available protection (legal factors) rather than of economic factors (such as demand and cost). This has two consequences: (a) an international misallocation of manufacturing resources as firms shun areas where they should be taking advantage of lower wages (particularly in developing regions) were it not for inadequate protection; and (b) firms underinvest in technologies useful to regions with relatively weak protection (typically the less developed regions) - technologies such as environmentally safe irrigation systems or drugs to treat indigenous maladies. Finally, to the extent that global patent protection is weak and discriminatory, inventors will rely increasingly on trade secrets. This has a social cost since international knowledge diffusion will be reduced, and a private cost since guarding secrets is costly for the firm (or inventor) that is without patent protection.

Differences in the *specification* of patent laws across countries tend to affect international trade and impose transactions costs. Differences in regulations affect business decisions about whether and where to trade, invest, or transfer technology. It is costly to apply for and enforce patent rights in many different countries with differing procedures. For example, it is quite costly to apply if nations (where patents are sought) are not members of the PCT and it is a disadvantage in establishing priority if nations are not members of the Paris Treaty. As another example, the lack of consistency in the subject matter of patentability affects global patent applications, particularly in new technology areas such as computer software and biotechnology. Firms or inventors need some consistency in what to expect.

Differences in the specification of patent systems are also seen as a source of trade disputes, since they treat, or appear to treat, foreign and domestic firms differently. The use of compulsory licensing and weak enforcement of patent rights by one country against another are viewed as restrictions to trade. A repercussion of trade disputes is that nations will adopt retaliatory trade policies, which will not only restrict and raise the cost of world trade but also threaten the stability of the international rule-based trading system.

B. Specific Impacts

The remainder of this section turns to more specific problems caused by differences in national patent systems. While not exhaustive, the following areas impacted by international patent differences are of interest in light of the attention given in the recent academic and policy

literature. The five areas considered are: (a) macroeconomic performance; (b) non-tariff barriers to trade; (c) technology transfer; (d) general industry; and (e) small inventors.

(a) Macroeconomic Performance

The following studies focus on the first type of patent regime difference - that is, on the overall levels of protection. Using cross-country data, Park-Ginarte (1997) find that patent rights indirectly affect growth via stimulating R&D investment. This suggests that, controlling for other factors of growth and investment, weaker patent protecting countries have on average lower rates of R&D activity and growth performances.[14]

Cross-country studies have also focused on the effects of patent rights on international technology diffusion. Maskus-Penubarti (1996) focus on exports as the conduit for technology diffusion, while Eaton-Kortum (1996) and Park (1997) focus on international patenting as the vehicle for technology diffusion. Patent rights have two opposing effects on technology diffusion: on the one hand, stronger patent protection has a market expansion effect (inducing greater technology diffusion); on the other hand, it also has a market power effect (causing technology diffusion to be restricted). The evidence from these studies is that the market expansion effect tends to dominate since many countries in the sample provide relatively weak overall protection. The implication of these studies is that countries, particularly the less developed ones, would greater attract new technologies if they were to strengthen their patent rights.

(b) Non-tariff barriers to trade

Even between developed economies, where overall patent protection levels are high, there are disputes between countries over differences in the specification of protection. These differences can often result, intentionally or not, in patent policies being employed as part of an *industrial strategy* to promote domestic firms vis-a-vis foreign. In other words, patent policies can act as non-tariff barriers to trade or as instruments of managed trade.

According to a U.S. GAO (1993) survey, U.S. corporate officials expressed their difficulties in obtaining adequate protection in Japan. Japanese competitors are seen as "using the Japanese patent system as a weapon against foreign firms to appropriate their technologies." (p. 2). Three key features of the Japanese patent system tend to allow this to happen: i) pre-grant opposition; ii) narrow scope; and iii) early public disclosure of the patent application. In allowing firms to oppose a grant before the patent is even or ever granted, the opposing firms can create a long delay in the patent application process. During this time, of course, the patent application is made public (i.e. 18 months after filing), and Japanese competitors can invent around the applicant's patent, taking advantage of the narrow scope examiners accept to make minimal changes without infringing on the applicant's patent.

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[14] Gould and Gruben (1996) also find evidence of the importance of patent rights to economic growth. Their study finds that the growth effects of patent rights are strongest in countries more open to trade.

Japanese competitors also engage in what is known as "patent flooding." Here, competitors surround a foreign company's (or in some cases domestic company's) core patent with numerous patent applications representing minor improvements. It is as if the competitors take the core technology "hostage." These flooded patents come so close to "blocking" the core patent (that is, they are all so close to infringing upon each other in use) that all the firms are forced into cross-licensing (thus exchanging each other's technology). Hence the patent procedures here enable domestic firms to appropriate the technologies of foreign firms. Patent flooding, by clogging up the patent examination office, itself contributes to lengthy delays in patent granting. It also explains why Japan leads in domestic patenting (see Figure 1).

The U.S. GAO (1993) survey also reported that the Japanese Patent Office, a branch of MITI, "does not provide broad protection for emerging technologies until Japanese industry is well established in the field or unless there are no Japanese competitors." (p. 30). For example, *Allied Signal*, a U.S. firm, developed an amorphous metal technology useful as a transformer in power utilities. This was targetted by MITI as a critical technology. Using the pre-grant privilege, Japanese firms opposed Allied Signal's patent application in concert. Eventually, Allied Signal did get protection, but the pre-grant opposition consumed much time (10 years). Consequently, Allied Signal received only 10 years of effective protection. As another example, in the early 1980s, *Dow Corning* sought a patent for optical fiber cables in Japan, but MITI deemed that telecommunications was a vital national interest. Dow Corning was compelled to license the technology to Japanese firms. Subsequently the technology leaked and Sumitomo developed a very similar technology which it then tried to export to the U.S. Dow Corning requested the U.S. Trade Representative to ban the imports of Sumitomo's cables; Sumitomo sued to have the patent invalidated, but the U.S. courts rejected it on the grounds that its technology was developed in substantially the same way (this is an example of the use of the doctrine of equivalents).

A consequence of Japan's strategic use of the patent system has been to reduce the number of patents filed in Japan. As Figure 2 shows, non-resident patenting in Japan grew the slowest during 1975-90 among the seven countries. Many companies gave up on patenting anything but the crucial, large step inventions. Startup companies (like biotechnology firms) were discouraged from patenting due to the narrow scope, which allowed competitors to develop close substitutes without incurring the substantial R&D expenditures that the startup companies have.

(c) Technology Transfer

Patent protection levels may also affect technology transfer activities, such as direct foreign investment and international joint research ventures.

i. Foreign Subsidiaries.

There is actually weak evidence to support the fact that patent rights matter to direct

foreign investment (DFI).[15] Other variables seem to matter more, for example market size, tax and transfer pricing policies. One reason that the effect of patent rights may not show up in empirical work is that many multinationals do not conduct R&D abroad in regions where rights are weakly protected or where research resources are inadequate. Indeed, Mansfield's (1994) firm-level survey indicates that DFI was affected by intellectual property rights only in those sectors where DFI was intensive in R&D (e.g. chemicals (including drugs)).

When patent rights are weak, there is risk in having the title to important assets of the parent company held by a foreign subsidiary, even if it is wholly owned or controlled. In the event of nationalization, war, or other emergency, governments may seize assets, including patents owned by a local subsidiary. Furthermore, if subsidiaries are in jurisdictions outside of international treaties, parents would not want to file patents there first, since there is no protection against disclosure. Thus weak patent protection is likely to be a factor in limiting the research and patenting activities of subsidiaries.

ii International Joint Research Ventures.

Differences in patent regimes are also likely to affect international research collaboration. The effects are somewhat ambiguous because on the one hand, joint research ventures are likely to form when overall protection of property rights is weak and spillovers are hard to contain. Firms therefore have an incentive to do research joint ventures in order internalize knowledge spillover externalities (see Katz-Ordover (1990)). In countries where patent rights are weak, joint ventures or licensing may be the only way to penetrate a market, i.e. to pre-empt compulsory licensing. Indeed in Japan, foreign firms find that joint ventures with a Japanese firm help to facilitate the process of obtaining patents. Thus, strengthening or harmonizing patent rights might reduce the incentive for foreign firms to collaborate with domestic firms in research.

On the other hand, research ventures must establish property rights on two fronts: background knowledge (i.e. pre-existing knowledge held by co-venturers) and foreground knowledge (i.e. new knowledge created by the venture). Typically, the joint venture could license the background knowledge to the co-participants, if it is necessary to the venture, which is the arrangement under the EC project ESPRIT. The venture could also own all the patents to new knowledge and license them to the participants. This is the arrangement in Japan's Very Large Scale Integration project and the U.S.'s Microelectronics and Computer Technology Corporation. Better patent protection would strengthen incentives to share background and foreground knowledge, and make licensing more profitable by the putting the licensor (the venture) in a better bargaining position. That is, outsiders would not be able to rely on leaks.

In the international context, the leaking of background knowledge is of concern. The concern is that joint ventures with foreign firms would give away national technological information, particularly if the venture is situated in a weak patent regime. Through compulsory licensing and other means, rights to background knowledge may not be secure.

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[15] See, for example, Ferrantino (1993) and Mansfield (1994).

(d) Industries in General

International differences in patent regimes do not affect industries similarly. The well-known study of Levin et. al (1987) shows that patent rights matter very importantly for pharmaceuticals, but moderately for petroleum, machinery, and fabricated metals, and in a limited way for office equipment, instruments, motor vehicles, primary metals, rubber, and textiles. Most large companies in sectors such as aircraft, aircraft engines, computers, and semiconductors, were found to be able to depend on trade secrets or their long lead times to recoup their investments. Patenting for them imposes a large opportunity cost of time which could be used to practice or sell their inventions. Thus, any impact analysis of patent rights on industries should be selective, focusing on those whose technologies are relatively easy to imitate, such as the chemical and pharmaceutical industries.

Differences in the specification of patent protection may also affect industry growth. Consider, for example, the issue of patentability. Before 1995, many countries declared pharmaceutical inventions to be unpatentable. In light of the importance of patent rights to pharmaceutical firms, this restriction served to restrict the growth of the pharmaceutical industry. Currently, the controversial subject matter is DNA research. Many nations have declared such subject matter to be unpatentable. A technical matter is that the DNA fragments fail the test of "usefulness" since the fragments are of unknown application. A non-technical matter is that some countries consider the patenting of this subject matter contrary to morality. The proponents of patenting would argue that the patentability of DNA is critical to the future development of the biotechnology industry. Thus, this industry's growth will be heavily dependent on international patent law specifications and other related developments.

(e) Small Inventors

Unlike the very large corporations that may not have to depend on patents because of their size, long lead times, and brand name reputation, the small inventors would like to obtain patents but are unable to because of the costs of application, litigation, and other disadvantages, unless they arrange to license their technologies to, or form joint ventures with, a larger partner.

Outside of the U.S., small inventors, including those from academic institutions and small to medium enterprises (SMEs), and independent inventors are likely to be disadvantaged by the "first-to-file" provision (see MacCordy (1994)). The reason is that a first-to-file system encourages a race to file, and smaller inventors usually have limited resources to prepare and file applications quickly. This need to file early, before the invention becomes public knowledge, also reduces the time smaller inventors have to refine and explore the commercial feasibility of their ideas.

University researchers are also hindered in applying for patents in regions that do not have grace periods since these researchers tend to disclose their research findings through peer review processes. Even where grace periods are given, the smaller inventor is allowed only to have her invention be public knowledge without it being disqualified for lack of novelty. It does not guarantee priority in a world where fast patent filing is required.

The current costs of litigation and weak enforcement mechanisms also deter the small inventor, particularly since it is up to the patentee to check if infringement occurs. The lack of discovery provisions abroad mean that small plaintiffs have a more difficult time gathering evidence. Future harmonization treaties should thus have provisions for safeguarding the interests of smaller inventors in a world where priority is based on first-to-file.

IV. Conclusions: Policy Options

The previous section showed that differences in international patent regimes can affect technology creation, diffusion, and trade adversely. The question is whether the elimination of these differences should be a policy goal. That is, should nations harmonize their patent systems? This section discusses arguments against and in support of harmonization, describes some guidelines for international patent reform, and reviews and evaluates some current patent reform proposals.

A. Harmonization: Pro or Con?

The first argument against harmonization is uncertainty: along which aspects of patent laws should nations harmonize? There are controversies in the literature over which of the various aspects of patent laws are best for economic welfare or efficiency. For example, is a broad or narrow scope of protection the more conducive to technological change? It is possible, therefore, for the international community to converge on inferior standards.

Another argument against uniformity is that countries differ in their ability to absorb, adapt, and generate technology (see Frischtak (1991)). Differences in country characteristics and stages of development make it unlikely that the same laws will be optimal for each nation's growth or welfare objectives.

While the need to recognize that countries are at different income stages is a point well-taken, it is important to clarify an often overlooked factor. Typically less developed economies provide weaker protection, if any protection. Their being less developed does not, however, in and of itself imply that they should permit imitation, infringement, or resort to compulsory licensing. If anything, the evidence discussed in the previous section suggests that those developing countries stand more to benefit from fostering a domestic innovation base or from attracting foreign technologies, objectives which are generally difficult to achieve in weak patent regimes. However, less developed economies generally do not have the resources to process and examine patent applications efficiently nor the resources to enforce rights.[16] Indeed their judicial infrastructure is likely to be under developed because of their income constraints. It is in this sense that there is a connection between being less developed and providing poor protection, not that providing poor protection (and thus permitting imitation and infringement) is a development strategy. It is more likely to be an inferior strategy (see Park-Ginarte (1997)).

[16] For example, the patent office of Bangladesh, until 1990, had only one examiner.

But, given limited resources, the less developed economies will allocate fewer resources to patent protection than necessary to provide protection at industrial country standards. Less developed economies need also to allocate resources to other activities, such as education and health.

The key point of the first two arguments is that it is more likely to be optimal to allow countries to have their own (different) patent systems to reflect national needs. But this view does not adequately incorporate the growing importance of international trade. Nations exchange goods and services, technologies, and knowledge, which contribute to one another's productivity and well-being. International trade, it shall be argued below, complicates the above picture.

Proponents of harmonization argue that uniformity would reduce transactions costs and facilitate trade. With globalization, there is increasing demand by corporations for more internationally standardized regulatory policies so as to keep transactions costs low (see Sherwood (1993)). It would be much simpler to conduct international business if inventors were to deal with one basic legal code rather than several from different countries (sometimes conflicting). The current non-uniform, non-standardized system makes it complicated and expensive to apply for multiple patents. To the extent that harmonized rules encourage international patenting, inventors will rely less on trade secrets, and international knowledge diffusion could become more widespread.

A second argument in favour of harmonization is that it would help check the trend towards managed trade, where governments can use trade or non-tariff barriers (like R&D subsidies or regulations) to "shift" profits to domestic firms. (The examples from the previous section showed how patent policies can be used as non-tariff barriers to trade.) There is some need for restraint in these practices since with retaliation, global trade as a whole and income growth will be reduced.

Thus, having international patent standards would help minimize the use of the patent system for strategic trade purposes. The alternative is that countries will undertake unilateral actions against infringing nations. These actions will tend to undermine the integrity of the international trading system.

B. General Guidelines for International Patent Reform

The point of the previous subsection is that while harmonized patent systems are not *a priori* optimal for each and every nation, a globally harmonized patent system might, in a world of increased trade and technological interdependence, produce trade and transactions benefits which more than offset any efficiency losses nations incur by deviating from what is optimal for their own specific national innovation needs.

There is some similarity with the European Monetary System's proposal to adopt a single currency. While this is a subject beyond the scope of this paper, the parallel is instructive. For

instance, there is no a priori reason member nations should have the same currency.[17] The argument in favour of it is that a single currency would reduce transactions costs (for example, exchange rate conversion costs) and facilitate trade. The same type of arguments may apply to international patent harmonization.

The following guidelines for patent reform suggest that four factors be emphasized: (i) minimum standards; (ii) shared global infrastructure; (iii) international compensation; and (iv) international enforcement.

In light of the remarks that patent harmonization's strength lies in reducing international transactions costs, harmonization efforts should be kept modest. This means that the ideal approach to harmonization is to select minimal features of patent laws on which to incorporate uniformly into national laws. These rules should directly focus on removing barriers to trade, reducing transactions costs, and increasing transparency in decision-making. The goal should be to develop a set of *minimum standards* that is convenient for the typical inventor from different parts of the world, such that there is enough uniformity in the regulations to sustain the multilateral rule-based system.[18]

A second guideline for harmonization is to seek economies of scale from certain *shared infrastructure*, such as a single international searching or examining authority. This prevents the duplication of searches and examinations. Searching and examining are primarily technical exercises (e.g. determining what is the state of the prior art and the inventive step of a new technology) which should not vary by nation.

A third guideline is to institute mechanisms by which the new system can make *compensation* to those who, in the short run, lose from the global patent reforms. For example, technical, administrative, research, and financial assistance can be given to less developed countries that have agreed to undergo costly revisions in their legal infrastructure. (Assistance and expertise are also likely to be needed in these regions to ensure that the new statutes are actually carried out.) If the idea is that reducing international patent differences will create global efficiency benefits on net, a case could be made for such international compensatory assistance or transfers.

A last guideline is to emphasize *enforcement*. The enforcement of patent rights will be more successful if it is an international effort. That is, patent rights would be better supported if infringement were recognized as being internationally illegal as opposed to being only nationally

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[17] If anything, given the relative lack of labour mobility in the EMS, each member nation should have its own currency. The currency fluctuations would substitute for labour mobility in insulating each member from outside economic shocks.

[18] This would imply that matters like the patentability of DNA be left out of harmonization talks, and be at the discretion of individual countries or be brought up in separate treaties.

illegal. Some agreements will need to be reached on international enforcement mechanisms; for example, whether discovery and injunctions can be ordered outside national boundaries. Historically, most treaties have lacked effective means for enforcing rights and resolving disputes.

C. International Patent Reform: Current Proposals

Currently, there are two major multilateral proposals for harmonizing patent regimes: the TRIPs agreement initiated by WTO and the Patent Law Treaty (PLT) initiated by WIPO. In general, the WTO's focus is on strengthening the overall *levels* of protection in developing countries, while the WIPO's focus is on ironing out differences in the *specification* of protection. The TRIPs agreement awaits ratification and implementation by countries that are members of the WTO. The PLT has not yet been signed into treaty. Each of these agreements will be reviewed. The TRIPs requires international cooperation in monitoring, resolving disputes, and if necessary, imposing sanctions. The TRIPs also requires international cooperation to the extent that international financial and technical assistance will be involved. The PLT requires international cooperation to the extent that one member (say the U.S.) will not sign unless another (say Japan) agrees to make changes, and vice versa.

Some highlights of TRIPs are:

1) dispute settlement, using that is the WTO's dispute settlement procedure, including the use of trade sanctions.
2) transparency. A Council on TRIPs must be made aware of all laws and regulations, and will monitor compliances.
3) enforcement mechanisms. The following must be available: contributory infringement, burden of proof reversal, discovery, injunctions, remedies and seizure.
4) limitation on use of compulsory licensing, that is, after voluntary means sought and adequate remuneration provided.
5) transitional arrangements to allow developing countries time to make changes in their laws.

These on balance focus on making less developed economies' statutes and enforcement provisions stronger. Progress has been made in getting countries to agree. However, a lack of resources and poor administration make the actual excecution of laws in those countries quite different from the statutory provisions.

The WIPO agreement is based on the view that certain procedural and statutory differences between countries act as trade barriers and as impediments to inventors interested in obtaining global patent protection. For example, the U.S.'s first to invent priority rule, Japan's pre-grant opposition practice, and Europe's lack of a 12-month grace period are all seen as discriminatory to foreigners. Some highlights of the PLT are:

1) Accept filing in any language
2) Publication with Search Report after 18 months
3) Doctrine of Equivalents

4) Twenty year patent term from the date of first filing
5) Priority goes to the inventor who is first to file
6) 1 year International Grace Period
7) Examination must take place within 2-3 years
8) Post Grant Opposition

The prospects are good that the PLT will be acceptable to members of WIPO. It is relatively easiest for the EPO and the U.S. to adopt since they have most of the features proposed. The U.S. needs to abandon its first-to-invent priority rule and to allow publication after 18 months. Japan has the most to change. It must, for example, abandon its pre-grant opposition practice. It is likely that Japan would be agreeable to this since the patent flooding resulting from such a practice imposes an enormous cost on its patent system.

The main barrier to PLT's adoption might be U.S. opposition to abandoning the first-to-invent priority rule. Foreigners find this rule to be discriminatory since evidence from outside North America (showing someone to be the first to invent) is rarely accepted. The defenders of the first-to-invent rule argue that it protects small inventors (such as university researchers) and the independent inventors. However, a new system could easily accommodate small inventors by providing cost allowances (e.g. progressive fees and taxes) and provisional, inexpensive patents (permitting them to file again once they can commercialize). Also, in practice, only less than 1% of total patent applications involve a conflict between an inventor who was first to file and another who was first to invent; less than one-tenth of 1 percent of all patents are awarded to an inventor other than the first to file.[19] Furthermore, the current system is cumbersome for the small inventor to apply globally, so that she would be better off attempting to be the first to file under the proposed system.

In conclusion, the outlook for the PLT is good: it has fairly minimal requirements. However, its chief weaknesses are its lack of provisions for international enforcement or of provisions for compensating countries that incur losses during the transition.

[19] See U.S. GAO (1993), note 4, p. 14.

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Figure 1. Patent Applications
by Residents

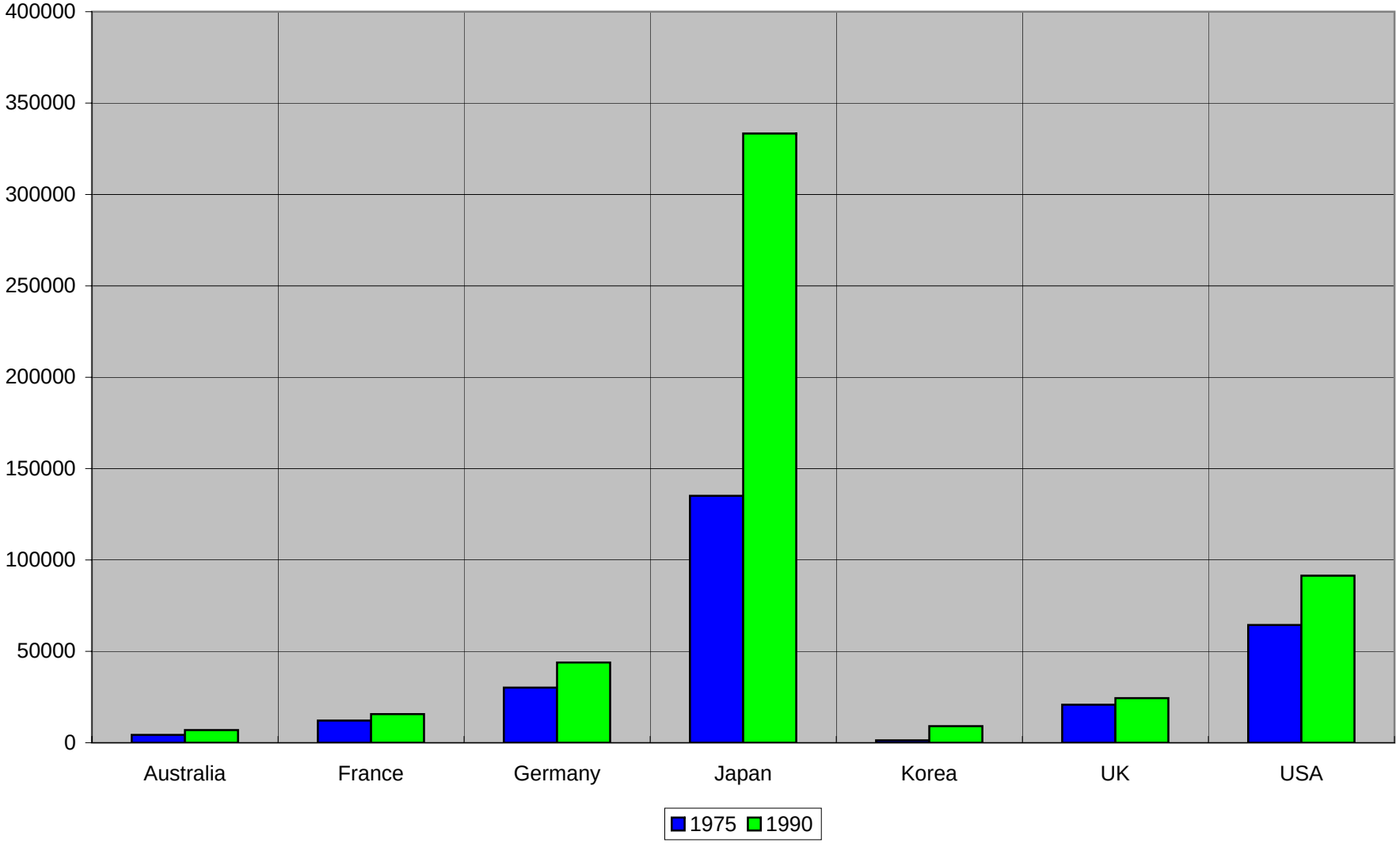

Figure 2: Patent Applications by Non-Residents

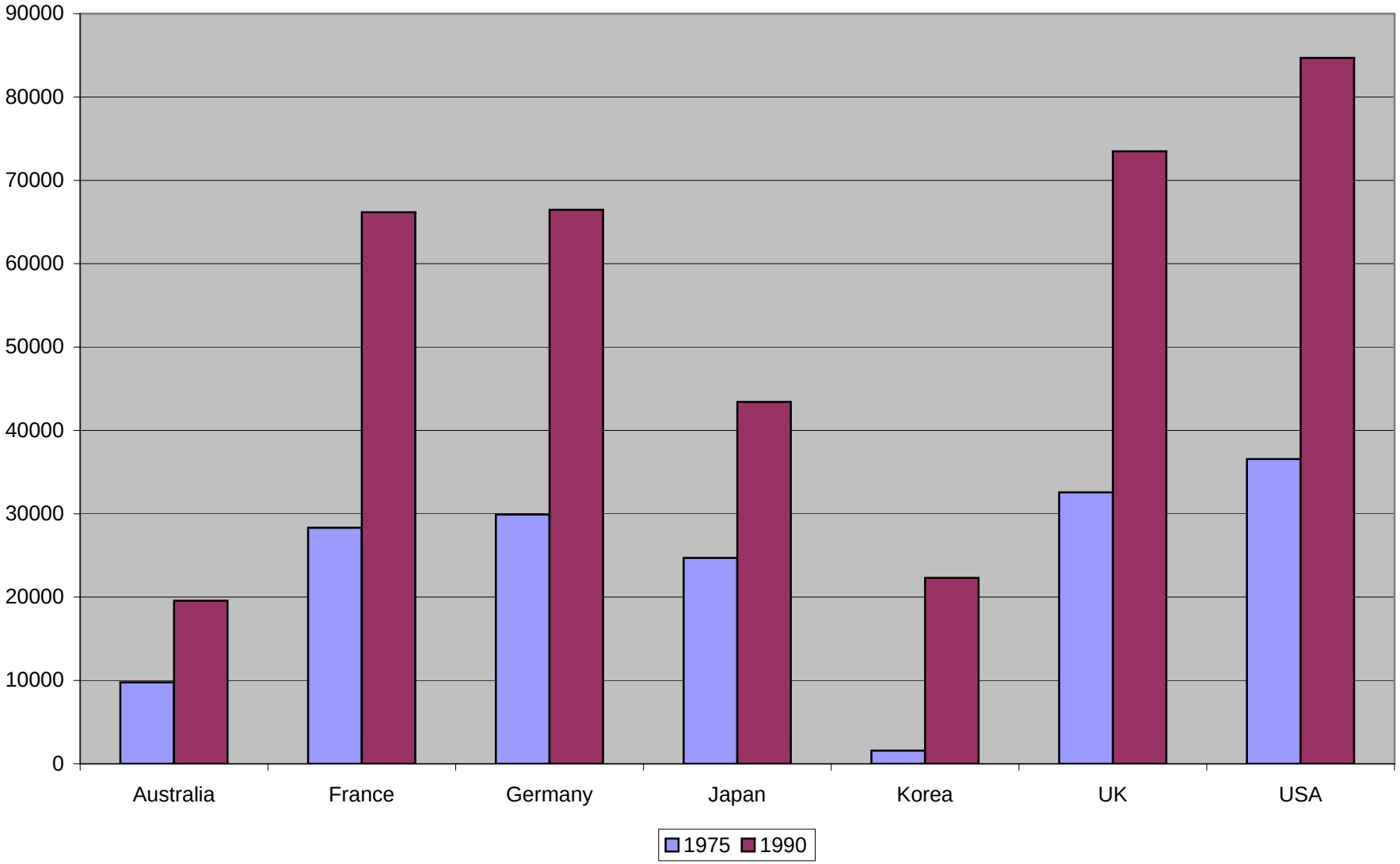

Table 1. Trade Secrets

Countries	Protection Available	Indefinite Duration
Argentina	yes	yes
Austrailia	yes	yes
Austria	yes	no
Belgium	limited	no
Botswana	n/a	n/a
Brazil	yes	no
Canada	yes	yes
Chile	sometimes	varies
China	n/a	n/a
Colombia	no	n/a
Czech	n/a	n/a
Denmark	n/a	yes
France	yes	yes
Germany	yes	no
Hong K.	yes	yes
Hungary	n/a	n/a
India	yes	yes
Israel	yes	no
Italy	yes	n/a
Japan	no	no
Jordan	n/a	n/a
Kenya	n/a	n/a
Korea	yes	n/a
Kuwait	n/a	n/a
Malawi	n/a	n/a
Mexico	yes	n/a
Netherl	yes	yes
New Zeal	yes	no
Nigeria	n/a	n/a
Poland	n/a	n/a
Russia	n/a	n/a
Sau	n/a	n/a
Singapore	yes	yes
South Africa	yes	varies
Spain	yes	yes
Sweden	n/a	n/a
Switzer	yes	yes
Taiwan	yes	no
Thailand	yes	yes
Uganda	n/a	n/a
UK	yes	yes
USA	yes	yes
Venezuela	yes	n/a
Zimbabwe	n/a	n/a

Note: n/a- information not available

Table 2A Patent Application Features

Countries	1 Novelty	2 Opposition	3 Time Pendency	4 Working Required Within	5 Complusory License	6 Member in Treaty	7 Duration (yrs)	8 Unpatentables	9 Publication	10 Filing
USA	X		1-2yrs			a,c,d,e	20	b	upon grant	1390
Japan		pre-grant	5 yrs	3 yrs	X,XX	a,c,d,e	20	b	18 months	4772
EPO										
Austria	X	4 months		3 yrs	X,XX	a,b,c,d,e	20	b,d	18 months	2419
Belgium			18 mon	3 yrs	X,XX	a,b,c,d,e	20	b,d	18 months	1800
Denmark	X	3 months		3 yrs	X	a,b,c,d,e	20	b,d	18 months	3930
France			2-3 yrs	3 yrs	X,XX	a,b,c,d,e	20	b,d	18 months	3042
Germany			1.5-5yrs		X	a,b,c,d,e	20	b,d	18 months	3066
Hong K.			6-8 wk			a,c,e	20	see UK	upon accept.	
Italy			2.5-3 yrs	3 yrs	X,XX	a,b,c,d,e	20	b,d	18 months	3662
Nether	X	4 months	3-4 yrs	3 yrs	X,XX	a,b,c,d,e	20	d	18 months	2303
New Zeal	X	3 months	2-3 yrs	3 yrs	X	a,c,d,e	20		upon accept.	853
Spain	X	N/A	18 mon	3 yrs	X,XX	a,b,c,e	20	b,d	18 months	3504
Sweden	X	3 months		3 yrs	X,XX	a,b,c,d,e	20	b,d	18 months	3325
Switzerland	X	3 months	2 yrs	3 yrs	X,XX	a,b,c,e	20	b,d	no time	2995
UK	X		3-4 yrs	3 yrs	X,XX	a,b,c,d,e	20	b,d	18 months	1220
Latin America										
Argentina	X		2-4 yrs	2 yrs		a,e	20		18 months	2415
Brazil			3.5-4 yrs	3 yrs	X	e	15	a,b,d,e	18 months	1770
Chile	X		2 yrs			e	15	b,d	60 days	1170
Colombia	X		2-3 yrs	3 yrs	X	e	20	b,d,f	18 months	2216
Mexico	X		3 yrs	3 yrs		a,c,d,e	20	b,d	18 months	2605
Venezuela		60 days	4-5 yrs	2 yrs		e	20	b,d,f	18 months	2282
Africa										
Botswana				3 yrs	X	e	20	see UK	no time	
Kenya	X	N/A		1 yrs	X	a,e	7-27		no time	
Malawi		3 months		3 yrs	X,XX	a,c,d,e	16	a	upon accept.	
Nigeria				3 yrs	X,XX	a,e	20	b,d	upon grant	
South Africa			12-18 m	3 yrs	X,XX	a	20	b,d	3 months	918
Uganda						a,c,d,e	20	see UK	upon grant	
Zimbabwe		3 months		3 yrs	X,XX	a,e	20	a	upon accept.	
Former Socialist										
Czech Rep	X	3 months				a,c,d,e	20	b,d	18 months	
Hungary	X			3 yrs	X,XX	a,c,d,e	20	b,d	18 months	
Poland	X	6 months		3 yrs	X,XX	a,c,d,e	20	b,d,h	18 months	

Russia				5 yrs	X	a,c,d	20	d	18 months	
Mid East										
Israel	X	3 months	4-5 yrs	3 yrs	X,XX	a,c,e	20	b,d	upon accept.	770
Jordan		2 months		3 yrs	X,XX	a	16		no time	
Kuwait		2 months		3 yrs	X	e	15	a	upon grant	
Saudi Arabia							15	b,c,d	upon grant	
Asia										
China	X	3 months			X	a,c,d	20	b,d,h	18 months	
India	X	4 months	2-3 yrs	3 yrs	X		14	d,g,h	upon accept.	460
Korea	X	2 months	2.5-3.5yr	3 yrs	X,XX	a,c,d,e	20	b	18 months	2467
Singapore	X		3-9 mon	3 yrs	X	a,c,d,e	20	b,d	no time	355
Taiwan	maybe	3 months	8-12 mon	3 yrs	X		20	b	upon grant	2406
Thailand	X	180 days	3-5 yrs	3 yrs	X	e	15	a,d,g	no time	610
Other										
Austrailia	X	3 months	2 yrs	3 yrs	X	a,c,d,e	20	d	no time	970
Canada	X		3-4yrs		X	a,c,d,e	20	b,	18 months	690

notes:

1. Examination required
2. Length of time to oppose patent request
3. Average time to obtain patent
4. Time to use patent
5. X = Complusory License owner
   XX= Lisbon Agreement- sufficient work completed with
   4ys of patent filing date or 3 yrs of grant

6. a. Paris Convention
   b. European Patent Office
   c. PCT
   d. PCTII
   e. WTO
7. Duration
8. Unpatentables:
   a. chemical, food, or pharmaceutical products
   b. surgical, therapeutic treatment of animal or human bodies
   c. medical devices, machines
   d. plant and animial varieties, biological processes
   e. microbiological processes
   f. pharmaceutical products on WHO's list of essential medicines
   g. agriculture
   h. atomic (nuclear) inventions

9. Filing Costs

Table 2B. Enforcement Features

	1. Preliminary Injunction	2. Contributo: Infringment	3. Burden of Proof Reversal	4. Discovery	5. Doctrine of Equivalents
Argentina			No	Yes	
Australia			Yes	Yes	Yes
Austria		Yes	Yes	No	Yes
Belgium	Yes	Yes	Yes	Yes	No
Botswana					
Brazil	No	No		Yes	No
Canada		Yes	Yes	Yes	Yes
Chile				Yes	
China			Yes		Yes
Colombia	Yes			No	
Czech					
Denmark	Yes	Yes		Yes	Yes
France	Yes	Yes	Yes	No	Yes
Germany		Yes	Yes	No	Yes
H. Kong		Yes		Yes	
Hungary	Yes		Yes		Yes
India					
Israel		Yes	Yes	Yes	Yes
Italy	Yes	Yes	Yes	No	
Japan		Yes	Yes	No	No
Jordan	No	No	No		
Kenya		Yes		Yes	
Korea	Yes	Yes	Yes	No	
Kuwait					
Malawi			Yes		
Mexico		Yes		No	
N. Zealan(	Yes	Yes		Yes	
Netherl.	Yes	Yes	Yes	No	No
Nigeria			Yes	Yes	
S. Africa	Yes		Yes	Yes	Yes
Saudi Ar.				No	
Singapore	Yes	No	No	Yes	No
Spain	Yes			Yes	

cont'd	1. Preliminary Injunction	2. Contributo: Infringment	3. Burden of Proof Reversal	4. Discovery	5. Doctrine of Equivalents
Sweden	Yes	Yes		Yes	Yes
Switzerl.		Yes	Yes	No	Yes
Taiwan		Yes			No
Thailand		Yes			
U.K.		Yes		Yes	Yes
U.S.A.	Yes	Yes		Yes	Yes
Uganda		Yes			
Venezuela				No	
Zimbabwe			Yes		

Notes: For definition of terms, see Text; 'blank' indicates information not available

TABLE 3. Ranking of Patent Rights (Park-Ginarte Index)

RANK	1990		1996	
1	USA	4.52	USA	4.52
2	Austria	4.24	Austria	4.34
3	Netherl	4.24	Japan	4.33
4	Italy	4.05	Netherl	4.24
5	Japan	3.94	Germany	4.05
6	Korea	3.94	Korea	4.05
7	France	3.90	Italy	4.05
8	Sweden	3.90	France	4.05
9	Denmark	3.90	Denmark	3.99
10	Belgium	3.90	Belgium	3.99
11	Switzer	3.80	Sweden	3.90
12	Germany	3.71	Switzer	3.80
13	Spain	3.62	Austral	3.63
14	S. Africa	3.57	Spain	3.62
15	Israel	3.57	Israel	3.57
16	UK	3.57	UK	3.57
17	Austral	3.32	S. Africa	3.57
18	NewZeal	3.32	NewZeal	3.42
19	Malawi	3.24	Malawi	3.24
20	Nigeria	3.05	Canada	3.05
21	Zimbabwe	2.90	Nigeria	3.05
22	Canada	2.76	Zimbabwe	2.90
23	Uganda	2.57	Argen	2.86
24	Singap	2.57	Kenya	2.71
25	Kenya	2.57	H. Kong	2.71
26	H. Kong	2.57	Chile	2.61
27	Chile	2.41	Uganda	2.57
28	Argen	2.26	Singap	2.57
29	Saudi	2.05	Colombia	2.10
30	Botswan	1.90	Botswan	2.07
31	Jordan	1.86	Saudi	2.05
32	Thailand	1.85	India	1.96
33	Brazil	1.85	Mexico	1.95
34	Mexico	1.63	Venez	1.90
35	India	1.48	Jordan	1.86
36	Venez	1.35	Thailand	1.85
37	Kuwait	1.32	Brazil	1.85
38	Colombia	1.12	Kuwait	1.46
39	China	n/a	China	n/a
40	Russia	n/a	Russia	n/a
41	Poland	n/a	Poland	n/a
42	Hungary	n/a	Hungary	n/a
43	Taiwan	n/a	Taiwan	n/a
44	Czech	n/a	Czech	n/a
Standard Deviation		0.98	Std Dev	0.89

n/a -- denotes country not in original Park-Ginarte (1996) Index