Patent protection and technology transfer – help or hindrance?

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Two questions

- Two separate questions whose answers may be at odds with each other:
  - Does stronger patent protection encourage technology transfer?
    - How does it affect behavior of foreign firms?
  - Does stronger patent protection encourage technology development?
    - How does it affect behavior of domestic firms?

Two questions (cont.)

- The first question is easier to answer but the second is more important:
  1. Foreign firms: stronger IP protection in the host country should encourage (or at least not discourage) transfer of technology.
     - Note that this may or may not help local development.
  2. Domestic firms: stronger IP could encourage their innovative activities, but can also discourage imitation and inhibit learning and catchup.

Some useful surveys

- Branstetter, Lee G. 2004. Do Stronger Patents Induce More Local Innovation? *Journal of International Economic Law 7*(2), pp. 359-70.
- Maskus, Keith E. 2004. Encouraging International Technology Transfer, Geneva, Switzerland: ICTSD and UNCTAD Issue Paper No. 7.
- ICTSD and UNCTAD. 2003. Intellectual Property Rights, Implications for Development Policy Discussion Paper, Geneva, Switzerland: ICTSD and UNCTAD.

1. Technology transfer

- Takes place via
  - Technology licensing (but some tacit knowledge needs to be transferred)
  - Foreign direct investment
  - Joint ventures
- Enforceable IPRs should encourage all these activities

1. Tech transfer - empirical

- Mansfield (1994) – survey evidence that US multinationals evaluate IP enforcement before making investment abroad
- Branstetter, Fishman, and Foley (QJE 2006) – royalty payments, affiliate R&D spending, and foreign patent apps increase for US multinationals following IPR reforms in 16 foreign countries (mostly mid-level developing).
- Fosfuri (RP 2004) – country risk more important than IPRs in promoting tech transfer in chemical processing
- See Maskus survey for further evidence.

1. Tech transfer - summary

- Main conclusions from empirical work:
  - Middle income countries that already have innovative capacity or capable of imitation (e.g., Mexico)
    - Both tech licensing and FDI respond to stronger IP regimes
    - Quality of technology transferred rises, and there is a shift toward licensing (markets for technology)
  - Very low income countries see little response
  - IPRs are not very highly ranked as an influence on tech transfer, except for R&D facilities and very advanced technologies.

2. Technological development

- What is the impact of strengthened IPRs on innovation and development within the country?
  - Theory
  - Cross country evidence (some cited earlier)
  - Individual case studies of patent law changes

2. IP and Tech development - theory

- Grossman and Lai (AER 2004)
  - In general, non-cooperative equilibria choose more IP protection in developed countries than less developed
- Angeles (BE Macro 2005)
  - Welfare effects depend on relative income levels in North and South
- Scotchmer (JLEO 2004)
  - Innovation provided either by IP or public sponsorship
  - Then national treatment and harmonization both lead to too much IP protection and too little public sponsorship in all countries relative to social welfare optimum
  - Small countries will favor more extensive IP rights than large countries (c.p.) – more CS leakage
  - More innovative countries will favor more extensive IP rights (c.p.)

2. IP and tech development - empirics

- Lerner (AER 2001), Moser (AER 2005)
- Chen and Puttitanum (JDE 2004)
  - 64 developing countries 1975-2000
  - Shows that IPRs have a positive effect on innovation (patenting in US)
  - Confirms predicted U-shaped relationship between IP strength and development level (first decreases, then increases)
  - However, identification is weak: trade openness and WTO membership assumed to influence IPRs and not innovation

2. IP and tech development - empirics

- Qian (RE Stat 2007)
  - 85 countries 1978-99 – pharmaceutical patents
  - Uses matched samples and fixed effect estimation – very thorough analysis
  - Patent protection only encourages innovation and R&D at high development levels
- McCalman (JIE 2001)
  - Growth model of bilateral tech transfer
  - Shows large transfers to the US from harmonization of patent rules

2. IP and tech development – country case studies

- Evidence somewhat mixed
  - Western Europe (UK and Germany) had patent protection during industrial revolution
  - Although episodes of innovation without patents existed – chemicals in 19C Germany (process but not product); Cornish pumping equipment (response to aggressive patent enforcement by Watt); Lyons silk weaving cooperative
- 19C US – no national treatment
  - Encouraged local tech development and learning by imitation
- Japan – see next slide
- Taiwan – little use of IP until imitation strategy successful
  - Patenting in US starts in 1975 and jumps in 1985
- Korea – see Kim (2002) on technology development and weak IP rights in the early stages
  - Patenting in US jumps in 1988

2. IP and tech development – case study evidence

- Japan – story not so clear
  - Postwar system of one claim per patent, utility models, pre-grant opposition, early disclosure – designed for incremental/adaptive invention
  - MITI's role in negotiating tech transfer licensing agreements
- Introduction of pharma product patents in 1970 did increase R&D in that sector (La Croix and Kawaura, IEJ 1996)
- Branstetter and Sakikabara (2001)
  - Strengthening of system in 1988-93 did not result in increased R&D
- Branstetter and Nakamura (2003)
  - Further reforms in the 1990s did not increase innovative performance (R&D productivity) either

Conclusions

- Stronger patents encourage patenting in general
- Stronger patents encourage tech transfer to mid-level developing countries
- Difficult to find clear evidence of positive impacts of stronger patents on innovation, except in chemical-related sectors
  - Many other factors matter, so the experiments are often not clear
    - we don't see enough variation in patent systems, and it takes time for firms to adjust
  - It is rare to have an independent measure of innovation (other than patents) so ingenuity is required
- Historically, IP systems have developed in parallel with the innovative part of the economy

A question

Is the marginal scientist or engineer in a developing country better employed examining patents or doing R&D?

Does patent protection help or hinder technology transfer?

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1. Introduction

The worldwide challenge of climate change mitigation has lead to an increased interest in the mechanisms that encourage the development and adoption of new technologies. In particular, the recent rapid economic growth in several large developing economies has focused policy attention on the role of technology transfer and technology development in countries that are not necessarily on the technology frontier in facilitating the use of clean technologies. In addition to the obvious fact that raising the standard of living in such countries to levels enjoyed in the West without a great deal of innovation in this area would have negative consequences for global warming, it is also true that rapid growth means a great deal of new investment, and new investment is an opportunity for substantial upgrading of technologies.

This policy focus on technology and diffusion of technology directs our attention again to a fairly well studied topic, but one that has not led to clear and unambiguous conclusions in the past: In brief, what is the role of Intellectual Property protection, specifically patent protection, in encouraging or discouraging technology transfer to developing economies? The recent introduction of the TRIPS agreement at the WTO has meant some harmonization of patent rights worldwide, largely in the direction of strengthening them in developing countries, and many economists (and others) have critiqued this step as negative rather than positive for the economic development of these countries. If anything, the available evidence suggests that "one-size-fits-all" harmonization of patent rights and IPRs in general is not welfare-enhancing for less developed countries, and possibly not even for developed countries. This paper reviews the economic evidence on this topic and draws some inferences for the progress of clean technology development in low income countries.

If we unpack the question about the relationship between the strength of the patent system and innovation in developing countries, we find that there are at least two separate but related questions whose answers may be at odds with each other. The first is whether stronger patent protection in a host country encourages technology transfer to that country. In particular, how does the presence of patent protection affect the behavior of foreign firms that may potentially invest in the country, sell technology to firms in the country, or form joint ventures with domestic firms? The second question is whether stronger patent protection encourages technology development in the country itself. That is, how does it affect the behavior of domestic firms? The first question has been easier to answer but the second is probably more important for the development of the country in question.

With respect to the first question, *a priori* it seems clear that stronger IP protection in the host country should encourage (or at least not discourage) the transfer of technology by

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foreign firms to their subsidiaries and possibly to domestic firms, either via partnership or simple sale or licensing. Note that this argument presumes that the intellectual property rights are enforceable, which is not an innocuous assumption. Also, note that such transfer may or may not help the local development of innovation skills and human capital. With respect to the second, it also seems clear that stronger IP protection could encourage the innovative activities of domestic firms, but could also discourage learning via imitation and therefore inhibit technological catch-up.

Of course, IP protection comes in several different forms: patents, copyright, trademarks, trade secrecy, and some specialized forms such as semiconductor mask protection, and these might be expected to have different effects. The primary focus of the present paper will be patents, as these are arguably the most important form of protection for technological innovations. However, the other forms of IP protection can be important for securing returns to innovation and diffusion, and are often used in tandem with patents. Where appropriate, notice will be taken of their impact.

I also note that there are already a number of useful surveys of this general topic available in the literature: see Branstetter (2004), Maskus (2004), and ICTSD and UNCTAD (2003). However, new work has appeared since these surveys and it seemed useful to have another look at the problem.

2. Technology transfer

Technology transfer typically takes place via foreign direct investment, joint ventures with local partners, or simple technology licensing, although in the latter case, some tacit knowledge probably also needs to be transferred. In all of these cases, foreign firms run the risk that imitation by local firms may erode some of their profits from these activities, so the presence of enforceable IPRs should encourage all these activities. Obviously, in the cases of more advanced technology, the imitation risk is highest when the host country has the capacity to adopt and develop such technology, which implies that the risk is generally greater in middle income countries.

How true is this in practice? That is, what is the evidence that local IP protections matter when a firm considers transferring its technology to another country? The first author to look at this empirically was Edwin Mansfield in a 1991 survey of approximately 100 U.S. multinational firms (Mansfield 1994) and their experiences with 16 countries drawn from all over the world. Broadly speaking, his findings were that most US multinationals evaluate the strength of IP protections in the host country before making investments abroad; the effects varied by industrial structure and were especially strong in the case of R&D facilities and in the chemical/pharmaceutical sector, not surprisingly. In assessing the evidence, Mansfield was careful to point out the three factors that led to the firm's perception of IP strength: 1) does the law protect their technology?; 2) is there adequate legal infrastructure in the country to enable enforcement?; and 3) do the relevant government agencies treat foreign entities the same as domestic in this area? All three were to be taken into account in answering the survey.

In Lee and Mansfield (1996), these data are augmented with data on actual foreign direct investment by U.S. firms in the countries during 4 years from 1990 to 1993 and simple regressions are used to show that FDI does indeed vary with the perceived strength of IP

protection. Mansfield (2000) performs a similar exercise using data on firms in Japan and Germany as well as the US and finds even larger effects. Given the relatively small sample size in the U.S. study (effectively 16 countries, although there are 48 observations due to the time dimension), this result is reassuring.

Heald (2003) critiques the strong conclusions that have been drawn from this study by others as making too little distinction among the different kinds of IP rights that might be used. In particular, although the study is often cited to show that patents are important for technology transfer, Heald argues that trade secrecy may have been equally important in the eyes of the survey participants. The original Mansfield article cites a number of comments by survey participants that suggest that disclosure of proprietary information is what they fear most. As Heald points out, this information is already disclosed if the invention has been patented elsewhere, so the presence or absence of local patent protection may be irrelevant. Turner and Heald (2004) propose a new survey that distinguishes among the various kinds of IP rights, but unfortunately their survey achieved response rates that were too low for valid analysis (Turner, 2010, private communication).

In a major study of U.S. multinational firm behavior in response to the strengthening of patent systems in 16 middle income countries during the 1990s, Branstetter, Fishman, and Foley (2006) found that royalty payments received for technology, R&D spending by the firm's local affiliates, and foreign origin patent applications at the USPTO all increased following these changes, especially if the firm in question was already a heavy patent user. This study is noteworthy for the care with which they attempt to rule out explanations for the finding that rely on reverse causality (where the strengthening of local patent systems is driven by U.S. multinational desire to invest in the country).

Fosfuri (2004) looks at investment by large North American, Western European, and Japanese chemical firms via 3 channels (wholly owned operations, joint ventures, and technology licensing) in 75 countries during the 1981-1996 period. Controlling for income per capita, population, education level in the destination country, he finds that a country risk index (Institutional Investor Credit Rating for the country) is highly significant in predicting investment of all kinds, but that IP strength as measured by Ginarte and Park (1997) has no impact, with the possible exception of destination countries in the upper half of the scientist and engineer population share distribution, where there is a small positive effect. This is consistent with the idea that IP protection matters when the country in question has a certain level of absorptive capacity.

Section 3 of the technology transfer literature survey by Maskus (2004) presents a large amount of additional evidence that I will not recount in detail here. He summarizes the evidence as follows:

i. "Within those middle-income and large developing countries that pose an imitative threat to IPR holders and have some domestic innovative capacity, enforceable patents do attract significantly more tech transfer…..
ii. Within the group of middle-income and large developing countries, as IPR regimes become more protective and are more clearly enforced there is a tendency for international firms to substitute their transfer decisions at the margin toward licensing and away from FDI…….

iii. The quality of technology transferred rises with the strength of IP protection and domestic technological capabilities…….
iv. Whatever the role of IPRs, they seem not to rank very highly on the list of factors that influence tech transfer, except for advanced technologies and R&D facilities…….”[2]

Work done since the Maskus survey was written has only confirmed these conclusions. Summing up, the strength of IP protection does seem to facilitate technology transfer to middle income countries that already have innovative capacity or are capable of imitation. Both technology licensing and foreign direct investment in these countries responds to stronger IP regimes. The quality of the technology transferred rises, and there is a shift towards licensing rather than simply importing the technology via FDI. In contrast, very low income countries see little response in technology transfer when they introduce stronger IP protection. These conclusions seem consistent with the idea that a certain level of absorptive capacity is necessary to make use of and learn from imported technology, but that if a country has the capacity to do so, they are more likely to receive the technology if the foreign firm from which it comes feels that its ownership rights will be protected. However, it should be remembered that although IP protection is considered a favorable factor, firms typically do not rank it very highly as an influence on technology transfer, except for R&D facilities (Thursby and Thursby, 2006) and advanced technologies.

Finally, with few exceptions (notably the original Mansfield survey) the studies surveyed here rely mostly on indexes of IP strength that rest on the law as written rather than as enforced. In many developing countries this distinction may matter, and one reason for weak or inconclusive results may be that the measure of IP strength is inadequate.

3. Technological development

The results on IP and technology transfer seem sensible and consistent with a priori intuition. However, as suggested in the introduction, the more important question for policy is the question of the impact of strengthened IPRs on innovation and development within a developing country. Does stronger patent protection help to enable and increase that country’s own innovative capacity? This question has been approached by economists in three very different ways: using theoretical analysis, looking at the relationship between IP and innovation across countries, and using individual case studies of changes in patent law.

Theory

Grossman and Lai (2004) look at the choice of levels of IP protection among groups of countries that are subject to knowledge spillovers. They find that, in general, non-cooperative equilibria among these countries result in stronger IP protection in developed countries than in the less developed countries. Angeles (2005) uses a simple North/South model with IPRs in the North and finds that the welfare effects of adding IP protection in the South depends on the relative income levels in the North and South; the larger the gap, the less desirable is IP protection in the South for total social welfare.

Scotchmer (2004) considers a case where each country can choose to have innovation provided either by IP protection for innovators or by public sponsorship of innovation. In

[2] Maskus (2004), p. 26.

this case, national treatment of innovators and harmonization across countries both lead to too much IP protection and too little public sponsorship in all of the countries relative to the social welfare optimum. Small countries will favor more extensive harmonization of IP rights than large countries (c.p.), because the consumer surplus they generate is in other countries for the most part. In addition, more innovative countries will favor more extensive IP rights (c.p.)

Empirical cross country evidence

Few well-designed natural experiments exist for the study of IP protection and innovative activity, and most are not specifically addressed to the development question. There are however a fairly large number of simple cross country studies, both contemporary and using historical data. These studies vary in quality due to the presence of simultaneity between the development of an economy and the development of an IP system, although some of the authors have attempted to find instrumental variables to mitigate this problem.

There are two large scale historical studies, both of which take advantage of the variability of patent systems around the world in the 19th century and both of which are creative in finding an indicator of innovative activity other than local patenting (which usually does increase when patent systems are strengthened, but not necessarily because innovation has increased). Lerner (2002) compares patenting activity in the UK across countries with various strengths of the patent system and finds that patenting by domestic entities at the UK patent office actually declines when their patent system is strengthened, whereas patenting by foreign entities increases. Moser (2005) uses Crystal Palace exhibits as a proxy measure of innovative activity and finds that countries with stronger patent systems do not product more innovation, but that innovation in countries with weak or no patent systems tends to favor technologies that can be protected by trade secrets. So both of these investigations fail to find strong overall effects of patenting on innovation during the 19th and early 20th centuries, although Moser does find an influence on the direction of innovation.

In the first study of this kind using contemporary data, Park and Ginarte (1997) uses aggregate data for 60 countries during from 1960-1990 and an index of the strength of IP rights (subject matter coverage, term length, etc.) which they developed. Using a simultaneous equations model of economic growth, investment, schooling, and R&D investment, they found that the strength of IP rights was positively associated with investment and R&D investment in countries with above median income but not for the less-developed countries. IP rights had no independent effect on growth above and beyond that contributed by investment and R&D. However, Ginarte and Park (1997) also shows that the strength of IP rights in high income countries (but not in low income countries) can be predicted by prior R&D intensity, which raises some questions about the simultaneity of IP protection and a country's orientation towards R&D and innovation. That is, it is possible that the demand for IP protection increases when a large share of the industrial base is engaged in innovative activities.

The study by Kanwar and Evenson (2003) looks at the variation across country in R&D spending as a function of the Ginarte-Park index over the 1981-1995 period and finds similar results, with stronger IP protection related to higher R&D intensity. Although well done in many respects, this study makes no attempt to explore the potential endogeneity of the

relationship nor does it control completely for the level of development of the countries, which arguably drives both R&D and the development of IP institutions.

Chen and Puttitanum look at 64 developing countries during the 1975-2000 period, using a two equation model where the strength of IPRs is a function of the development level, trade openness, economic freedom, and membership in the WTO) and innovation (proxied by patenting at the US Patent Office) is a function of IPR strength, development level (GDP per capita), economic freedom, and population. Thus the instruments for IPR strength are confined to trade openness and WTO membership, which makes identification rather weak. Nevertheless, they show that IPRs have a positive effect on innovation and also that there is U-shaped relationship between IP strength and the level of development, with IP strength first decreasing and then increasing. Because they included a quadratic for GDP per capita in the IPR equation but not in the innovation equation they cannot say whether the innovation-IP relationship is also U-shaped.

Qian (2007) does a thorough analysis of the effects of introducing pharmaceutical product patents in 85 countries 1978-99 using matched samples and fixed country effect estimation. She finds that national patent protection does not stimulate domestic innovation activities, except at higher development levels, and that above a certain level of patent protection, innovation activities are actually reduced.

McCalman (2001) develops a growth model of bilateral tech transfer and tries to quantify the welfare effects of patent harmonization due to the TRIPS agreement. He finds large transfers to the US from developing countries, and also from Canada, the UK, and Japan.

A few conclusions have emerged from this body of work. First, introducing or strengthening a patent system (lengthening the patent term, broadening subject matter coverage or available scope, improving enforcement) unambiguously results in an increase in patenting and also in the use of patents as a tool of firm strategy (Lerner, 2002; Hall and Ziedonis, 2001). Second, it is much less clear that these changes result in an increase in innovative activity (Lerner 2002), although they may redirect such activity toward things that are patentable and away from those than can be kept secret within the firm (Moser, 2005).

A third finding from the empirical literature is that if there is an increase in innovation due to patents, it is likely to be centered in the pharmaceutical, biotechnology, and medical instrument areas, and possibly specialty chemicals. This conclusion relies mostly on survey evidence from a number of countries which shows rather conclusively that patents are not among the important means to appropriate returns to innovation, except perhaps in pharmaceuticals, medical devices, and some specialty chemicals (Mansfield, 1986; Levin *et al.,* 1987; Cohen *et al.,* 2001; Arora *et al.*, 2001).

Fourth and finally, the existence and strength of the patent system affects the organization of industry, by allowing trade in knowledge, which facilitates the vertical disintegration of knowledge-based industries and the entry of new firms that possess only intangible assets (Hall and Ziedonis 2001; Arora et al 2003; Arora and Merges 2004). The argument is that, by creating a strong property right for the intangible asset, the patent system enables activities that formerly had to be kept within the firm because of secrecy and contracting problems to move out into separate entities. Although limited, research in this area supports this conclusion in the chemical and semiconductor industries. Note that the evidence cited in

the previous section on the shift from FDI to technology licensing that accompanies stronger IP rights is consistent with this interpretation.

Case studies

The case study evidence on innovation and development is somewhat mixed. For example, Western Europe, and in particular the UK and Germany, had patent protection during most of the industrial revolution and there were some episodes where such protection appeared to slow rather than hasten technological change (Kanefsky 1978, as cited by Nuvolari 2001). Episodes of invention and innovation without patents also existed. For examples, see Foray and Hilaire-Perez (2001) on the Lyons silk weaving cooperative, Allen (1983) on the iron industry of Cleveland (UK) over the period 1850-1875, and Nuvolari (2001) on the cooperative incremental development of Cornish pumping equipment (a policy that was a response to the mine owners' experience with aggressive patent enforcement by Watt). Also note that the 19th century German chemical industry developed strongly during a period when patents were available on processes but not on products (Murmann 2003).

Several authors have pointed to the fact that a number of successful cases of technological development appear to have taken place in the absence of strong patent protection until a certain level of development had been reached. The United States did not have national treatment of foreign patent applicants until the signing of the Paris convention in 1883, and domestic inventors were therefore free to copy inventions from the UK among others during most of the 19th century. This clearly encouraged local technology development and learning by imitation. Taiwan has followed a similar pattern, with little use of IP protection, especially internationally, until innovators in the country had developed a successful imitation strategy. Taiwanese inventors only began patenting at the USPTO in 1975 and then significantly increased their patenting in 1985.

As Kim (2002) says in summarizing his review of Korean technological and development,

> "….strong IPR protection will hinder rather than facilitate technology transfer and indigenous learning activities in the early stage of industrialization when learning takes place through reverse engineering and duplicative imitation of mature foreign products." It is "only after countries have accumulated sufficient indigenous capabilities with extensive science and technology infrastructure to undertake creative imitation in the later stage that IPR protection becomes an important element in technology transfer and industrial activities."[3]

It is noteworthy that Korea joined the Paris convention only in 1981, greatly strengthened its patent and copyright laws in 1986 and that Korean inventor patenting in the United States jumps up in 1988 (Kumar 2003).

In Japan, the story is not as clear. Japan has had a patent system since the 19th century. After defeat in World War II, a patent system of one claim per patent that allowed for utility models, pre-grant opposition, and early disclosure, clearly designed for incremental/adaptive invention, was in place. In addition, MITI took an active role in negotiating technology transfer licensing agreements from foreign firms and during the

[3] Kim (2002), p. 6.

same period incoming FDI faced difficulties (Maskus 2004). After the country had reached a high level of development, during the late 1980s and 1990s, many features of the Japanese patent system were modified to bring it more in line with those in the United States and Western Europe (Sakakibara and Branstetter, 2001; Nagaoka, 2006).

La Croix and Kawaura (1996) point out that the introduction of pharmaceutical product patents in 1975 in Japan did increase R&D in that sector. Sakakibara and Branstetter (2001) show that the strengthening of the Japanese patent system in 1988-93 did not result in increased R&D spending by Japanese firms, and Branstetter and Nakamura (2003) report that the further reforms in the 1990s did not increase innovative performance (measured as the productivity of R&D) either.

Kumar (2003) provides a useful overview of the historical relationship between IPRs, technology, and economic development in the East Asian countries and reaches much the same conclusions as Kim: "Japan, Korea, and Taiwan have absorbed substantial amount of technological learning under weak IPR protection regime during the early phases."

4. Conclusions

To summarize the results of this research:

1. Stronger patents encourage patenting in general.
2. Stronger patents encourage technology transfer of all kinds to mid-level developing countries.
3. Stronger patents have little effect on technology transfer to the lowest income countries.
4. It is difficult to find clear evidence of positive impacts of stronger patents on innovation, except in chemical-related sectors. Many other factors matter, so the experiments are often not clear, we don't observe enough variation in patent systems, and it takes time for firms to adjust. It is also rare to have an independent measure of innovation (other than patents) so ingenuity is required.
5. Historically, IP systems have developed in parallel with the innovative part of the economy, so there are feedback effects.

Maskus (2004) offers some useful general policy suggestions both for source and for destination countries to encourage technology transfer. For developing countries facing the problem of adapting their technological strategies to the TRIPS environment, he suggests some ways in which patent fees might be structured to encourage local firm patenting and limit the term during which large foreign firms would command substantial market power. These include lower fees for small entities and rapidly rising renewal fees to encourage placing technology in the public domain, while still allowing a period of exclusivity. Evidence from van Pottelsberghe and Rassenfosse (2007) clearly demonstrates that fees matter for the decision to keep a patent in force.

In thinking about the results of this literature and the adoptions of TRIPS in developing countries, an important question arises - Is the marginal scientist or engineer in a developing country better employed examining patents or doing R&D? That is, does the benefit of having a patent-issuing authority exceed the cost of taking resources away from the innovative sector of the economy, especially in countries where scientists and engineers are

a scarce resource? It is not clear that the answer to this question is yes. See Aranha (2002), at that time the head of INPI in Brazil, on the subject of the cost of patenting for small offices and small entities.

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