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INTELLECTUAL PROPERTY AND INDUSTRIAL DEVELOPMENT: A CRITICAL ASSESSMENT

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Introduction

Intellectual property rights (IPRs) are a set of legal regimes of a broad scope that range from patents that protect inventions, to copyrights, which relate to original forms of expression such as literary and artistic work, and, among others, trademarks that protect words and symbols that identify goods and services. IPRs confer an exclusive (and in the case of patents and copyright, temporary) right to the exploitation and commercialization of intangible assets [1]. Therefore, the IP regime establishes an institutional framework to manage access, exploitation and transfer of knowledge, technology and information. In the last decade, the emergence of new technological paradigms – mainly Information and Communication Technology (ICTs), biotech and nanotech, the re-shaping of world IP systems and the explosion in patenting – lead much of contemporary attention of scholars, policy makers and civil society to focus on the relationship between intellectual property and development.

A complete analysis of the changes in IP regimes and their impact on the rate and direction of inventive activity goes beyond the scope of this chapter; here we would like to stress the connection between IP regimes and industrial development. Evidence shows that IP regimes usually convolve with production transformations, as pulled by the production side. Frontier countries, particularly the US, strategically use IP regimes as mechanisms to protect certain accumulated capabilities of national production and research agents. Business methods and genetic engineering are research fields of growing importance in the US, and are sectors in which national research centers and enterprises already possess a considerable relative advantage. There is nothing accidental in the public authorities' decision to preserve national dominance in those fields by means of patent protection. This is a *de facto* industrial policy, aiming at preserving

comparative advantages in given technological trajectories for certain economic agents. IP laws are mechanisms to preserve dominant positions in given fields, not mechanisms to create them.

Our thesis is that asymmetries in technological capacities (between firms and countries) are likely to persist over rather long periods of time, beyond the legal mechanisms defying the appropriability and transferability conditions of technologies. As regards the behavioral foundations of innovative and imitative activities, we are quite skeptical about their reduction to linear and deliberate profit maximizing choices. “Getting the IPRs right” is not an optimal solution for fostering industrial development and catching up. Legal appropriability mechanisms, i.e. prevailing intellectual property norms, classify as second order effect factors, with respect to production and technological capabilities in shaping innovative and imitative conducts. The analysis of TRIPS’ flexibilities shows that any use of existing policy space is subject to decisions that go beyond the pure IP domain and that concern trade, industrial and technology policy issues. No flexibility will be used simply because it is legally feasible - national policies and priorities shape market and non market incentives and transform legal feasibility into action. Frontier countries have been using and use IP as a *de facto* industrial policy measure to sustain the competitiveness of their industries and to protect dynamic advantages in certain technological trajectories. Developing countries should learn from them and strategically fine-tune IP regimes according to their industrial development needs.

This chapter, far from being an exhaustive analysis, serves as a road map for analyzing the relationship between intellectual property and industrial development, in the light of pubic policy perspective.

In the first section we analyze the changes introduced in the US IP system beginning in the 1980s and the consequent reconfiguration of international IP regimes. In this respect, we

present a taxonomy of TRIPS's flexibilities and a synthetic analysis of TRIPS "extra" and "plus" provisions included in recent bilateral trade agreements, analyzing the relationship between industrial development strategies and IP management. Next, we examine the dynamics of patenting, stressing the relationship between IP and production structure specialization. On that basis, we present an analysis of current markets for knowledge, exploring potential participation in and exclusion from in those markets for developed and developing countries. An overview of current IP dilemmas and the analysis of the relationship between production structure and IP management are necessary steps in defining a strategic approach to industrial development. The paper concludes stressing the importance of including IP issues into the renewed debate on policies and institutions shaping industrial development, avoiding incurring oversimplified IP for development agendas.

The reshaping of intellectual property regimes

Intellectual property regimes are, as all economic and legal institutions, context and time specific, and they are subject to change. In terms of evolution of intellectual property rights, if a lesson can be derived from history, it is that systems evolved as pulled by the production side. When, in a given country, the introduction of IP protection could bring about a pecuniary gain in a given sector or area, the system was adapted, or a negotiation initiated to grant the right of appropriation of the relative rent. In contrast, sectors, lobbies (and countries) attempted to block the introduction of IP protection in cases in which they were net importers of the product or service in question[2].

The transformation of intellectual property regimes has gone hand in hand with the different phases of development of modern economies[3]. Intellectual property systems have evolved from regulations of national scope, which prevailed during the "inward" stage of

development of early industrializers, towards regimes of supranational scope. This transformation has taken place as foreign trade and interaction among countries have become more necessary and more frequent; as different technological paradigms emerged, increasing articulation and diversification of production processes, thus augmenting the relevance of know-how, technical information, knowledge and the consequent value of their appropriability.

However, since the 1980s, there has been a radical reshaping in the management and the structure of IP regimes at the global level. Such changes are occurring in a context of growing trade integration and in a system of open economies, where trade liberalization has been coupled with pressures to strengthen intellectual property rights on an international scale.

In this regard, the changes in intellectual property regimes concern two different, although related, domains: (a) the modification of prevailing norms and the generation of a new set of incentives deriving from jurisprudential rulings within the US system, and (b) the increasing relevance of intellectual property in multilateral and bilateral trade negotiations and in international disputes between countries. In this respect, the adoption of the TRIPS agreement in 1994 marked a mile stone in the big push towards the homogenization of IP minimum standards of protection.

A new set of incentives in the US IP laws and the "American preference"

Beginning in the 1980s, intellectual property protection has been (deliberately) intensified, in the United States through various channels: extension of patentable subject matter, extended time protection and increased target of subjects who can exert intellectual property rights. Subsequent to these changes, there has been an upsurge in patenting activity. A deep analysis of these issues goes beyond the scope of this chapter[4], it suffices here to recall two major changes: a) the extension of patent subject matter and b) the Bayh-Dole act, and to highlight their use as

(informal or *de facto* industrial policy) mechanisms to support technological development in national research centers and firms.

The extension of patentable subject matter

According to the US law, "Whoever invents or discovers any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereof, may obtain a patent…"[5]. Nowadays in the US, the most probable answer to the question, "Can I patent that?" is likely to be yes, as Hunt (2001) argues in his critical paper on the introduction of patents for business methods in the US economy. The above-mentioned relaxation of patentability criteria, due to some Supreme Court rulings, led to an extension of the patentable subject matter. In fact, US firms increasingly use patents to protect physical inventions as well as more abstract ones, such as computer programs or business models and methods[6].

According to US jurisprudential tradition, laws of nature, and hence mathematical formulas, could not be the subjects of a patent (cf. *Gottschalk vs Benson*, 1972). However, in 1981 the *Diamond vs. Diehr* Supreme Court decision paved the way for computer software and business methods' patentability by asserting that "a claim drawn to subject matter otherwise statutory does not become non-statutory simply because it uses a mathematical formula, computer program or digital computer".

The Court of Appeals for the Federal Circuit (CAFC), instituted in 1982, also played a decisive role in the extension of patentable subject matter through several jurisprudential rulings that reversed the prevailing doctrine. The *State Street Bank and Trust vs Signature Financial Group* (1998) CAFC decision allowed the patentability of business methods when the claimed

invention satisfies the requirements of novelty, utility and non-obviousness. This decision also made the utility requirement more lenient.

Through a re-interpretation of patentable subject matter and of previous rulings, the *State Street vs Signature* decision reversed the prevailing doctrine and allowed patenting of algorithms as long as they are "applied in a useful way", i.e. as long as they produce "a useful, concrete and tangible result". According to this decision, registrants seeking patent protection for business methods or algorithms are not required to disclose their computer methods[7]. Contrary to the previous Supreme Court, a mathematical formula and a programmed digital computer are currently patentable subject matter under the chapter 35, p. 101 of the US Code[8]. This tendency favors the engendering of what has been called the "patent thicket", considered to have negative potential effects on future rates of innovations in the context of incremental innovations: for example in the software industry, in which each application might be built upon a series of hundreds of patented algorithms (Shapiro, 2001).

The extension of the patentable domain also involved living entities. The 1980 *Diamond vs Chakrabarty* Supreme Court decision stated that "a live, human made micro-organism is patentable subject matter" [9], paving the way for a series of rulings which led to the patentability of partial genes sequences (ESTs[10]), including genes crucial to treating illnesses (Orsi 2002). Another decision worth mentioning is *Re Brana* 1995. This ruling established the presumption of utility and reversed the jurisprudence that supported the circumspect practice of the USPTO in granting patents in this field. *Re Brana* recognizes the validity on patent claims on discoveries not yet made or not yet materialized.

In the US patent law, "utility" is an essential criterium for patentability. "Utility" refers to the industrial and commercial advances, "useful arts", enabled by the invention. Relaxing the

meaning of "utility" transforms non-patentable subject matters into patentable ones. Again, the *re Brana* Court decision is remarkable. Partial sequences of ESTs were classified as useful due to their potential contribution to future advances in knowledge, and this sufficed for these entities' patentability, despite their value as research tools[11]. Disavowing a previous Supreme Court ruling that explicitly warned against inhibiting future research by restricting access to knowledge, *Re Brana* allowed patent applicants the right to make extensive claims with reference to "virtual" inventions, i.e. inventions that have not yet been made and that can not be predicted. Patents were transformed from a "reward" granted to the inventor in exchange for the disclosure of the invention into a veritable hunting tool[12]. Patents might result in a *monopolistic right of exploration* granted to the patent holder even before any invention has been made and *a fortiori* disclosed.

Subsequent rulings and Supreme Court decisions engendered a new patent regime that creates conditions for transforming research advantages into competitive advantages, guaranteeing an upstream protection of the "research product," which results in the right to exclude rival firms from benefiting from "basic" discoveries (Coriat and Orsi, 2002). The resulting fear is that the system is moving toward the dissipation of the traditional "open science" paradigm (Dasgupta and David, 1994). The new regime covers, areas for software and living entities, key inputs, research tools and raw materials for other areas of innovation (Arrow, 1962; Shapiro, 2001). In a context in which innovation is increasingly cumulative in nature, the progressive enclosure[13] of technical knowledge, which is at the basis for subsequent advancements in science and innovation, may induce a sort of "lock-out" of potential innovators that are not yet in a dominant position, or, on the contrary, may give excessive bargaining power to small, technology-intensive firms with no physical processing or distribution capacity.

A complete analysis of the changes in the US IP law and their impact on the rate and direction of inventive activity is beyond the scope of this paper, however, we would like to stress the connection between the reshaping of IP regimes and the dynamics of research and industrial development in the US. Business methods and genetic engineering are research fields of growing importance in the US, and are sectors in which national research centers and enterprises already possess a considerable relative advantage. There is nothing accidental in the public authorities' decision to restrict access to a discovery in order to preserve it by means of patent protection in those fields. This is clearly a *de facto* industrial policy, intended to preserve comparative advantages in given technological trajectories for certain economic agents.

The Bayh-Dole Act

The inclusion of provisions that allow granting patents through *exclusive licenses* only to US manufacturing firms, as it is stated in section 204 of the Bayh Dole Act, which sets the conditions for the "American industry preference", responds to the same *de facto* industrial policy strategy. In 1980, the US Congress adopted the Bayh-Dole Act, which is embedded in title 35, chapter 18, of the US Code under the label of "patent rights in inventions made with federal assistance". This Act sets the principles for patenting inventions realized by institutions receiving federal funds for R&D, and introduced two basic changes in the US IP regime: i) it established a new principle that gives to institutions (universities and public research laboratories) receiving public funding the right to patent their discoveries and ii) it affirmed the right to license the exploitation of those patents as *exclusive rights* to private firms, and/or to engage in "joint ventures" with them. The literature has already extensively analyzed the impact of this act on the

rate and direction of innovative activities. Scholars have stressed the fact that the enactment of the Bayh-Dole Act established a new IP regime that threatens the previously dominant open science principle[14]. The possibility of granting exclusive licenses on research findings obtained by the main centers of scientific knowledge, such as like universities and public laboratories, creates a basis for appropriating basic knowledge, which should, by definition, constitute the knowledge base available to all national innovation system agents. Dasgupta and David (1994) emphasize the fact that this appropriation of knowledge is achieved through a series of "bilateral monopolies" that universities and public laboratories share with private for-profit organizations, thus contributing to the commoditization of research outcomes (Eisenberg, 2000; Orsi, 2002).

The literature stressed the fact that this act introduced a fundamental shift in the way in which patenting is justified. In incentives theory, the inventor's "reward" justification fades since, as Mazzoleni and Nelson (2000) noted, the invention is made with federal financial assistance, hence inventors receive an *a priori* reward. The rewarding function of the patent weakens when the inventor is the beneficiary of financial assistance. In contrast, shifts in the US patent system introduced a different (and new) type of incentive: the inducement to transfer from public research to marketable products, favoring the appropriation of research results to firms that have not been engaged in fundamental research. Firms are induced, through the benefit of exclusive licenses, to commercialize outcomes of publicly funded research even before those outcomes are obtained. In this respect Mazzoleni and Nelson (2000) discuss an "induced commercialization theory". Patents no longer reward the inventor *ex post* – instead, the *ex-ante* reward transmogrifies the patent's status from an exploitation right to an exploration right.

The extension of patents' domain and the 1980 Bayh-Dole act modified the academy-enterprise links in knowledge generation and diffusion. From 1991 to 2000 patents applications

from universities grew about 240%. In reality, the "public nature" of basic knowledge is shifting towards the private and club goods domain, where access is ruled by market mechanisms. The Bayh-Dole Act, especially paragraph 204, reversed the previous system under which free access to basic research outcomes was granted equally to all firms that profited differently from the available knowledge pool depending on their specific assets and capabilities.

However, beyond the debate on access and commercialization of knowledge, there is an additional provision, scantly addressed by the literature, which we believe deserves consideration: the "preference for the United States industry" stated in section 204 of the Bayh-Dole Act, according which, the right to patent and sell discoveries as exclusive licenses does not apply "unless ... any product embodying the subject invention or product through the use of the subject invention will be manufactured substantially in the United States"[15]. In this way, intellectual property management has entered clearly the domain of strategic industrial and trade policy[16]. Exclusive licenses of outcomes of inventions made with federal assistance are, with no surprise, strategically reserved to US industries. Moreover, this "preference" is granted as early as the exploration phase, helping to create entry barriers to foreign firms. The US administration seems to deliberately provide domestic firms with an opportunity to develop a whole set of legally guaranteed rents, even before the investment in R&D took place, thus reverting the traditional patent logic of rewarding a prior effort *ex post*. A virtual *rent market* at bargain basement prices is being setting up for American companies[17].

Internationalization of IP protection and management

The use of IP mechanisms as strategic tools for promoting industrial and technological development also characterizes international IP management. Historically, the territorial scope of intellectual property protection extended through time from national boarders to the international

arena as international trade increased and economies became interdependent[18]. The 1883 Paris Convention on protection of industrial property and the 1886 Berne Convention, which regulates the protection of original forms of expression such as artistic and literary works, represented the first stages of the internationalization of intellectual property protection[19]. Those agreements responded to the lack of effective protection felt by foreign IP rights holders from countries in the technological frontier in countries with less strict IP regimes. In this way, IP laws were used as mechanisms to preserve dominant positions in given fields (not as mechanisms to create them).

The 1994 adoption of the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement and the various chapters on IP included in the bilateral trade and investment agreements are the major factors reshaping IP regimes at the international level lasting recent decades. The US stance towards IP protection is strictly related to trade balance concerns, production structure specialization and the lobby of certain industries and corporations (usually knowledge intensive sectors such as pharmaceuticals, software, microelectronics, entertainment, and biotechnology and chemicals; Cottier, 1991). The increasing connection between trade and IP issues led to a shift in the international arena in matters related to industrial development (i.e. those *de facto* industrial policy issues related to IP and innovation incentives). Increasingly, intellectual property issues enter into the multilateral and bilateral controversies[20]; countries should recognize the implicit component of industrial policy in IP decisions in order to push for resolutions that support their national development interest.

International harmonization of IPRs prevents free-riding by competitors and levels the playing-field, both of which favor the technological leaders, so it is by no means unintentional that developed countries advocate for international harmonization and rising standards of

protection. However, much is yet to be understood regarding the position of developing and emerging economies in this sphere. On the one hand, IP negotiations suffer from strong imbalances in negotiating capacities and preparedness between developed and developing economies. Likewise, noone can deny the asymmetric bargaining power of the US, for example, with respect to small developing economies. On the other hand, developing countries share some responsibilities in the current international management of IPRs. Although it is undeniable that developed economies' interests are shaping the international management of IP, there are cases in which developing countries, and especially countries with certain industrial capabilities, are not creating opportunities or profiting from flexibilities which actually exist or might be exploited. Countries that recognize the relationship between industrial capabilities and IP issues can strategically use and tailor the IP systems to their needs - having a national strategy for industrial and technological development lays the foundations for using IP for development. In this light, there are two aspects worth noting: (a) TRIPS as a base line agreement setting minimum standards and the flexibilities included in it; and (b) the TRIPS plus and extra provisions in bilateral agreements.

A taxonomy of TRIPS' flexibilities

TRIPS establishes homogeneous minimum standards of protection among WTO Members, introducing two basic principles in IP management: the national treatment and the most favored nation treatment (TRIPS, article 3 and 4). According to these principles, each WTO member is required to treat nationals of other member states at least as well as its own nationals, and to treat all other member states on an equivalent basis in relation to the protection of intellectual

property. TRIPS resulted in the expansion and the strengthening of IPRs, thus pushing for foreign countries' establishing a system that reflects the priorities of the US regime.

The adoption of TRIPS raised concerns regarding its implications for developing countries including the risks of homogenizing IP systems among countries with asymmetric technological capabilities and at different development stages[21]. For the purposes of this chapter, it suffices to recall some basic features of this agreement and highlight the relationship between its provisions and industrial development. Though the interest today has shifted from the multilateral to the bilateral level, it is worth identifying some (although scant) flexibilities that exist in the TRIPS agreement and to identify the effective policy spaces which might allow countries to strategically use IP management according to their industrial development priorities. In fact, TRIPS includes some special and differential treatment provisions and flexibilities that might be used to pursue industrial development objectives (See Table 19.1 for a taxonomy of flexibilities and effective policy spaces allowed by TRIPS).

First, Special and differential treatment provisions (SDT) confer specific rights to developing and least developed countries (LDC) in the framework of TRIPS, recognizing their status as "developing economies". However, SDT do not eliminate the one-size fits all nature of the agreement; SDT simply grant a time lag for implementing the homogeneous minimum standards established by TRIPS. SDT do not confer the right to implement an IP regime in accordance with the stage of development of the economy, but simply recognize the right to benefit from transitional periods for the implementation of the agreement (transitional periods, art. 65 and 66). The provisions related with technical and financial cooperation and technology transfer open a window of opportunity, but they are not legally binding, with minimal effectiveness, unless countries decide to exert it.

Second, Article 31 establishes the conditions under which the governments of member states are allowed to issue a compulsory license. A government may authorize a party other than the patent holder of an invention to use that invention, even without the consent of the patent holder, when that party has unsuccessfully tried to obtain such a license on "reasonable commercial terms within a reasonable period of time". I conditions under which it is possible to issue a compulsory license restrict the potential use of this flexibility, being difficult to fulfill and subject to subjective interpretation of "reasonable". However, the quite restrictive *a priori* effort requirement does not apply in the cases of national emergencies, extreme urgency and public non-commercial use.

Developing countries make scant use of compulsory licensing, because of its restrictions as well as serious industrial limitations. In the case of pharmaceuticals, most developing countries lack the know-how and the production and technological capabilities to carry out the reverse engineering. In many cases, a lack of market incentives precludes use of this flexibility in absence of a more long term industrial policy supporting their engagement in such productive effort[22]. In fact, until 2005, no use was made of these flexibilities. However, if a compulsory license is granted to remedy to an anticompetitive practice, then the pre-requisites established by art. 31 need not be met. If the country in question does not have the manufacturing and technological capabilities, then the Doha declaration and its 2003 implementation provide for a compulsory license that would enable export from countries that have such manufacturing capabilities (Basheer, 2005). Canada and Rwanda recently exploited this space for Triavir, an HIV drug. Further, Thailand, soon followed by Brazil, recently issued compulsory licenses to produce some key drugs for the treatment of the HIV pandemic.

Third, Parallel imports, which refer to the different exhaustion regimes of patent protection (national, regional or international), are products purchased in one market and subsequently sold on a second market without the authorization of the right holder. Thus, prior to a patent's expiration, countries can take advantage of products manufactured under license in other countries or for other markets and profit from international price differentials. Developing countries make scant use of this mechanism, in part due to the lack of qualified technical personnel and institutional apparatus needed to carry out this practice. Further, this policy space is at risk as banning parallel imports is often a pre-requisite for entering into a bilateral trade negotiation with the US.

Finally, Article 30 of TRIPS established the "exceptions to rights conferred". Member countries "may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties". In the cautious language of TRIPS, this article recognizes the right to provide limited exceptions to the rights conferred by a patent, including the Bolar exception, also known as "early working", which allows generic producers to import, manufacture and carry out experiments on patented products before the patent expires. In other words, it allows firms to carry out experimental R&D to produce generic products without violating the patent. Certain thresholds of technological and production capacities, as well as public and private incentives to engage in such research efforts, are needed to engender a demand for using this flexibility, and most developing countries lack the first, i.e. the production capacities, or the second, i.e. the incentives and the appropriate sets of policies.

Table 19.1: SDT, Flexibilities And Self-Determination Provisions. A Taxonomy Of Trips' (Effective) Policy Spaces

Provision	Article of reference	(Effective) Policy Spaces
Special and Differential Treatment (SDT)		
Transitional Periods	**TRIPS, art. 65, par. 2-5** Developing countries are entitle to delay for a given period the date of application of (given) provisions of the agreement **TRIPS, art. 66.1** Least Developing countries (LDCs) are entitled to delay for a period of 10 years the application of TRIPS provisions, other than Articles 3,4 and 5. Upon motivated request by a LDC the Council for TRIPS may accord extensions of this period	The Dhoa Declaration on TRIPS Agreement and Public Health extended the window for LDC's even beyond what the original TRIPS allowance.
Technical and Financial Cooperation	**TRIPS, art. 67** On request and on mutually agreed terms and conditions, developed countries shall provide technical and financial cooperation to developing and LDCs	Non-legally binding provision
Technology Transfer	**TRIPS, art. 66.2** Developed countries should provide incentives to enterprises and institutions in their territory to promote and encourage technology transfer to LDCs **Doha Declaration, art.7** Reaffirms the commitment of developed countries to provide incentives to promote and encourage technology transfer	Non-legally binding provision
Flexibilities		
Compulsory Licensing (CL)	TRIPS, art. 31 Governments are allowed to authorize a party other than the holder of a patent on an invention to use that invention without the consent of the patent holder, on the condition that efforts have been made to obtain the authorization from the right holder on reasonable commercial terms within a reasonable period of time. In case of national emergency, other circumstances of extreme urgency and public non-commercial use the requirement of prior efforts does not apply.	Only countries with a certain production and technological capacity may make use of this provision. If the country is credible (in terms of industrial capacities, market structure and public policy) this instrument can be used as a negotiation threat. Strong political will and commitment is necessary. TRIPS does not stipulate the grounds upon which a compulsory license should be granted. Thus member countries can make provisions for CL on any ground. TRIPS only mandates certain procedural pre-requisites such as voluntary negotiation prior to the grant of a license etc. In the case of national emergencies, or if the CL is being granted to remedy an anticompetitive practice, then these pre-requisites need not be met. If the country in question lacks the necessary manufacturing and technological capacities, the Doha declaration and its

		2003 implementation provide for a CL that would enable export from countries that have such manufacturing capabilities.
Exhaustion (national, regional and international exhaustion) **(Parallel Imports)**	**TRIPS, art .6** For the purposes of dispute settlement under this Agreement, subject to the provisions of art.3 and 4, nothing in this Agreement shall be used to address the issue of the exhaustion of IPRs. This article addresses the exhaustion of IPRs that is crucial in international trade because it addresses the point at which the IPR ceases. This provision implicitly addresses the issue of parallel imports (i.e. products placed on the market in one country and subsequently imported into a second country without the permission of the owner of the intellectual property right in the second country)	The only obligations under the TRIPS Agreement that can be used by one country to challenge another country's position on parallel imports are those relating to national treatment (Article 3) and most-favored-nation treatment (Article 4). The exhaustion regime of IPRs depends on national laws.
Exceptions to rights conferred	**TRIPS, Art.30** Members may provide limited exceptions to exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.	National law can introduce exceptions according to art. 30.
Bolar Exception	The Bolar exception was first introduced in the US Drug Price Competition and Patent Term Restoration Act in 1984 following the court ruling Roche vs Bolar Pharmaceuticals. The US law enables testing to establish bio-equivalency of generic drugs before patent, expiration. This mechanisms allows generic producers to place their products on the market when the original patent expires	According to a WTO dispute settlement in April 2000 Canadian law conforms to TRIPS in allowing manufacturers to exploit this exception. (WTO case “Canada: Patent Protection for Pharmaceutical Products”). This exception has been explicitly adopted by Canada, Australia, Israel, Argentina and Thailand. In the EU it has been used in case by case to solve disputes. In the Canadian case, the WTO upheld the “Bolar” provision but struck down the “stockpiling” provision, stating that this contravened Article 30

Source: authors’ elaboration

Ultimately, any use of existing policy space is subject to decisions that go beyond the pure IP domain and concern industrial development issues. No flexibility will be used simply because it is legally feasible; national policies and priorities shape market- and non-market incentives and transform legal feasibility into action.

Towards a TRIPS plus world

Nowadays TRIPS' flexibilities are threatened by the elevation of minimum standards caused by IP provisions in bilateral trade agreements. All bilateral agreements (FTAs and BITs) signed between the US and developing economies after the ratification of TRIPS engendered higher IP standards of protection than those included in TRIPS. (Fink and Reichenmiller, 2005)[23].

Section 301 of the 1974 Trade Act allows the US "to impose trade sanctions against foreign countries that maintain acts, policies and practices that violate, or deny US rights or benefits under trade agreements, or are unjustifiable, unreasonable or discriminatory and burden or restrict US commerce". Section 301, as amended by the trade and tariff act of 1984, includes a set of specific provisions, the Special 301[24], that were intended to promote and ensure international compliance with intellectual property rights. The 1988 Omnibus Trade and Competitiveness Act reinforced this provision, especially strengthening unilateral trade retaliation instruments, in particular Section 301[25]. The Special 301 requires the United Stated Trade Representative (USTR) to identify foreign countries denying adequate and effective protection of IPRs or fair and equitable market access for US nationals that rely on IP protection. Thus, the US benefits from the unilateral right of reprisal against countries that are deemed as denying adequate and effective protection to US firms' IPRs, even when these countries are complying with international agreements in this area. In particular, the right of the USTR to

undertake unilateral action ensues when an "unjustifiable, unreasonable or discriminatory" behavior is detected in trading partners. Paradoxically it can happen that, according to Bayard and Eliot, an action is deemed "unreasonable" when it appears to be "inequitable and unfair in some way or another, even if it does not necessarily violate the United States' international rights, or even if it isn't incompatible with them" (Bayard and Eliot, 1994).

In 2005, the USTR declared that the US was "committed to a policy of promoting increased intellectual property protection" and that it will use "all statutory tools to improve intellectual property protection in countries where it is inadequate" in order to protect its industries. Even though the policy language has softened in the last three years, the US still makes no mystery of its strategy for securing fair and equitable market access for US products. "This Administration is committed to using all available methods to resolve IPR related issues and ensure that market access is fair and equitable for U.S. products (…), requiring authorized use of legal software by government ministries, proper implementation of the TRIPS Agreement by developed and developing country WTO members, and full implementation of TRIPS Agreement standards by new WTO members at the time of their accession" (USTR, 2007)[26]. IP issues are shaped to protect national interest (i.e. national firms).

A shift in the US trade diplomacy (Fink and Reichenmiller, 2005) focuses now on bilateral trade and investment agreements, which reduce many of the flexibilities that were available in TRIPS[27], especially including TRIPS extra and plus provisions[28]. The strategic protection of US industry through different channels has been at the hub of the US approach towards development and competitiveness. For example, free trade agreements (FTAs) extend patent terms beyond the 20 years established by TRIPS by introducing extensions for delays caused by the regulatory approval process or delays in the patent granting process itself. This is

particularly relevant in the case of pharmaceuticals because, as the process for approval of marketing a new drug can last years, patent protection can be extended far beyond the standard 20-year term[29]. In certain cases, the requirement of novelty is relaxed, and patenting of new uses for existing products is allowed. FTAs also restrict TRIPS' flexibilities, often used as a means to ban parallel imports (Maskus and Chen, 2002). Usually, FTAs include provisions which create obstacles to compulsory licensing, such as the requirement to obtain the consent of the patent holder to market a generic drug before patent expiration and the data test exclusivity.

In bilateral agreements, "intangibles" seem to be the counterweight for "tangibles". Developing countries engage in these negotiations seeking privileged market access for their products (especially agricultural and textiles) and concede on the US request on IP. This is a risky business for a number of reasons. First, bilateral FTA IP provisions raise welfare concerns because they affect key issue such as public health, as many relate to the pharmaceutical industry and generic production of patented drugs. Further, the advantages of the privileged market access will tend to decrease as more countries enjoy that privilege. Finally, other restrictive IP regimes reinforce the technological dominance of frontier economies, hampering the structural change required to develop new products and processes for which enjoying preferential market access could really make the difference.

The US monitoring activity and negotiating strategy are empowered by the threat of reprisals and the counterweight concessions in other areas of international trade[30]. Though the various activities are formally labeled as trade policy intended to foster competition and free trade, it is evident that these instruments are tailored to maintain the competitiveness of national firms in given priority sectors. Hence again, IP issues enter into the *de facto* industrial policy space. This might be legitimate from the point of view of the US, but from that of developing

countries? The US strategically manages all policy space in order to defend its national interest and "prefers" its industries. Developing countries, in turn, often appear to prioritize blaming the aggressive US attitude over designing and implementing industrial policies to strengthen the economic and academic actors, or in pursuing myopic negotiating strategies privileging static comparative advantages, rather than dynamic ones, adversely affecting long-term industrial development.

Identifying the changes in IP management within the US system and at the international level is only the first step in proposing a pragmatic development agenda capable of going beyond good intentions and declarations. Clarifying the relationship between patenting and production structure specialization and recognizing that the rationale for patenting is moving away from the traditional interpretation of markets for technologies are the necessary next steps.

The relationship between production structure specialization and patenting

Patenting has intensified in the last decades. Year after year, patent offices receive a growing number of applications, and they are granting more patents. In the United States Patent and Trademark Office (USPTO), the number of granted patents exponentially increased since the 1960s, showing a remarkable jump in 1998; in 2006 the USPTO granted 173,771 utility patents[31].

The increase in patenting activity is registered occuring globally. Though the leading economies in terms of technological and industrial capabilities still are major players, activity had also intensified in emerging economies and developing countries, paving the way for a reconfiguration of the traditional knowledge club. Nevertheless, the three major patent offices remain in North America, Japan and Europe, which collectively have the highest share of patents at the global level[32].

According to USPTO data the United States, Japan and Germany accounted for almost 80% of total granted patents in the USPTO since the 1970s. Nevertheless, when considering the total number of patents granted in the United States to non-residents, we note that whereas in the 1960s the three main countries were Germany, England and France, which had 58.8% of the total patents issued to non-residents, in 2003 the three main stakeholders were Japan, Germany and the Chinese province of Taiwan, which accounted for 67.3% of total patent granted to non residents. If we consider the five major patenting economies, excluding the US, we note that, from the 1970s, Taiwan and Korea replaced France and Canada.

This *sorpasso* is not surprising given the structural changes experienced by those countries. In the last few decades those economies have radically transformed their production structures by intensifying their specialization in knowledge-intensive sectors (Amsden, 1989; Wade, 1990; Jomo, 1997; Cimoli et al., 2005). The combination of selective industrial, technological and trade policies in support of domestic industries and the gradual opening-up to foreign trade as production sectors achieved international competitiveness had generated the technological capacities that lie at the root of the intensification of patenting activity. In fact, once a production system has been transformed into a knowledge generator and disseminator, patents become necessary in order to appropriate the rents stemming from innovative efforts.

Despite the patenting dynamism of emerging countries, the knowledge club persists. The North-South asymmetry in the dynamics of patenting activities corresponds to the North-South asymmetry in technological intensity of production structures and specialization patterns. That is, countries' participation in world patenting depends on the dynamics of their production structures and their processes of structural change.

Developing countries spend few financial resources in R&D[33], as they are in general specialized in low knowledge intensive activities, especially natural resources and labor intensive industries, and their domestic innovation efforts are basically adaptive in nature and rarely encompass inventions and scientific discoveries. Consequently their patenting activity is scarce. In contrast, industrialized countries are more specialized in knowledge and technology intensive sectors and they invest more resources in R&D; it therefore comes as no surprise that they are also leaders in number of patents applied for and granted (Aboites and Cimoli, 2002; Cimoli, 2005; Montobbio, 2006)[34].

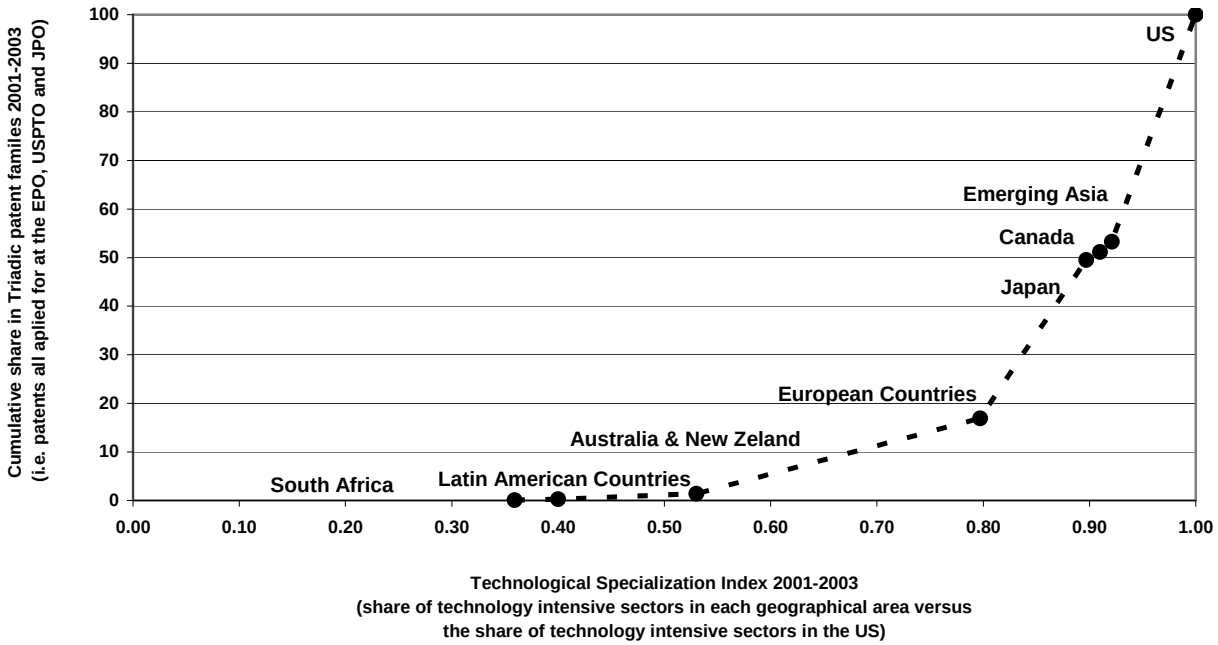
R&D efforts do not depend exclusively on the specialization pattern, but a minimum efficient scale of industries specializing in key sectors is a precondition for generating a system that is willing to invest in R&D. The specialization pattern and R&D efforts are, on in turn, related to patenting activity. It seems to be a self-reinforcing circle: those who specialize in more technology intensive sectors display more patent-intensive activity and, of course, host the more relevant patenting offices.

Contrary to the argument championed by the TRIPS' advocates, stronger and homogeneous patent regimes did have accelerated the pace of innovation in developing countries. Asymmetry between developed and developing countries in patenting activity, reflecting diverging specialization structures, also emerges when considering *who* patents in given sectors. In the USPTO, patents in the electronics-related sectors show the highest dynamism during the 1990s, correlated to the information technology revolution. The leading patentees in those sectors are the US and the South East Asian countries. On the other hand, European countries' patent pattern persists in its traditional field of expertise, chemistry, while Latin America continues to file applications in mechanical technologies. In fact, developing

countries concentrate their occasional patenting in traditional sectors, while developed and emerging economies concentrate their patenting patterns in new technological paradigms. This, of course, is not independent of the fact that these countries have been shifting their specialization patterns towards these dynamic areas.

Ranking countries according to their technological production capacities and to their innovative performance helps to clarify our point. In Figure 19.1 we order countries along the horizontal axis according to the intensity of their technological specialization with respect to the frontier (which in this case is proxyed by the US). At the same time, we measure their patenting activity: for each country or group of countries, we plot on the vertical axis the cumulative share of all patents applied for at the three major world-patenting offices (Europe, Japan and North America). The figure portrays what we call a *knowledge curve*, showing the comparative technological intensity of production structures of countries and their relative patenting behavior.

Fig 19.1: The Knowledge Curve: Production Structure Specialization And Patenting



Source: own elaboration. OECD Patent Database 2006, ECLAC-Padi and OECD-Stan.
Note: Emerging Asia includes India, The Republic of South Korea and Singapore. Latin American countries include Argentina, Brazil, Chile and Mexico. European countries include: Finland, France, Ireland, Israel, Norway, Sweden and the UK. The specialization index for each group of countries is calculated as the simple average of the index value for each member country.

First, we observe a clear differentiation between industrialized and industrializing countries. The US, Japan, Canada, Emerging Asia and the European countries all show similar production structures as regards the share of technology intensive sectors within total manufacturing value added. The share of those sectors varies between 45% for the average of European countries considered and 65% in the US. Asian countries were successful in fostering the development of technology intensive industries by combining selective import substitution policies with an aggressive export oriented strategy (Amsden, 1989; Wade, 1990 Jomo, 1997). On the contrary, in Latin America and in most African countries, the opening-up process of the

1990s and the increasing exposure to external competition pushed developing countries to further specialize according to their static comparative advantages. In addition, trade negotiations frequently led developing countries to cede on intellectual property as a counterweight to market access for their produce - textiles and agriculture. Consequently, in industrializing countries the share of technology-intensive sectors does not exceed 30% on average, with the balance of production concentrated in labor- and natural resource-intensive sectors.

Second, reading through the vertical axis, the figure shows the asymmetry in innovativeness - as measured by patent applications - which corresponds to and derives from the specialization pattern. Patenting results from innovation and defensive strategies are not homogenous across sectors. Behavioral microfoundations of innovation activities, patenting, and rent appropriation through patents are strictly industry specific. Corresponding to the relative intensity of production specialization, the US, Japan and the European countries show the highest shares in the triadic patent family, respectively accounting for 46.7%, 32.5% and 15.56% of total patent applications[35]. Emerging Asia accounts for 2% of that total, while South Africa, Latin America and Australia and New Zealand, in accordance with their low-tech specialization pattern, account for residual international patent activity. The timing effect is interesting: South East Asian countries first reoriented their production structures towards technology-intensive sectors, and then their patenting activity skyrocketed, although they are still residual actors in the global patent game. When and if emerging economies will erode the position of major IP players is still an open question.

Participation and exclusion in the (new) markets for knowledge[36]

When The Economist entitled its special issue "A market for ideas" on October, 20th 2005, it was clear that firms (and countries) were facing a reconfiguration of traditional markets for technologies, and that patents were moving away from their usual domain of "temporary monopolies" granted to inventions with industrial applicability.

According to the literature, when the right to produce some artifact, or the knowledge and the know-how required to produce it are clearly separated from the product or the service they are destined to produce, a line emerges between the market for tangibles and the market for the technologies necessary to produce them (Eaton and Kortum, 1996; Arora, Fosfuri and Gambardella, 2001).

The idea of *markets for technologies* implies that there are firms that are specialized in providing technologies and enterprises able - and wiling - to use these technologies to produce and sell artifacts to consumers. In this view, patents allows for specialization and division of labor between technology providers and users, fostering efficiency in markets for technology. The primary function of this market is to favor the diffusion and the transferability of innovation through licensing. The value of patents mainly derives from its usability in tangible production, and it is strictly related to the subjacent technology.

A number of studies show the growing importance of patents and the increase in the use of technology licenses in transfers, acquisitions and cross-licensing among companies (Grindley and Teece, 1997; Thurow, 1997; Grandstrand, 1999; Guellec, Martínez and Sheenan, 2004)[37]. At the same time, global cross border transactions in intangibles are increasing (see figures 19.2a an19.2b). Payments and receipts for royalties and licencing fees can be interpreted as good proxies, respectively, for global demand and supply of knowledge. The share of global payments for royalties and licenses fees in world imports of goods and services tripled from the mid-1980s

to 2006 (WDI, 2007). The concentration of the market for intangibles, in demand and supply, showed a decreasing pattern beginning in the 1970s now on, reflecting the repositioning of countries in international specialization and the virtuous structural changes of some emerging and dynamic economies.

Figure 19.2a: Markets for Technologies: Trends In Intangible World Exports Of Selected Economies

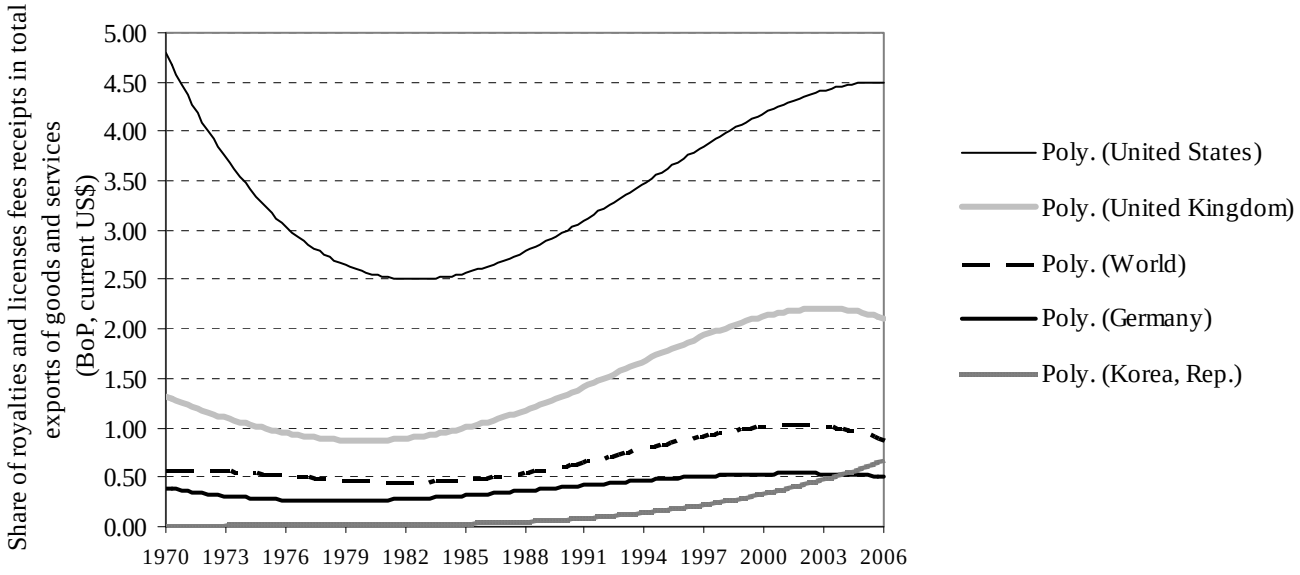
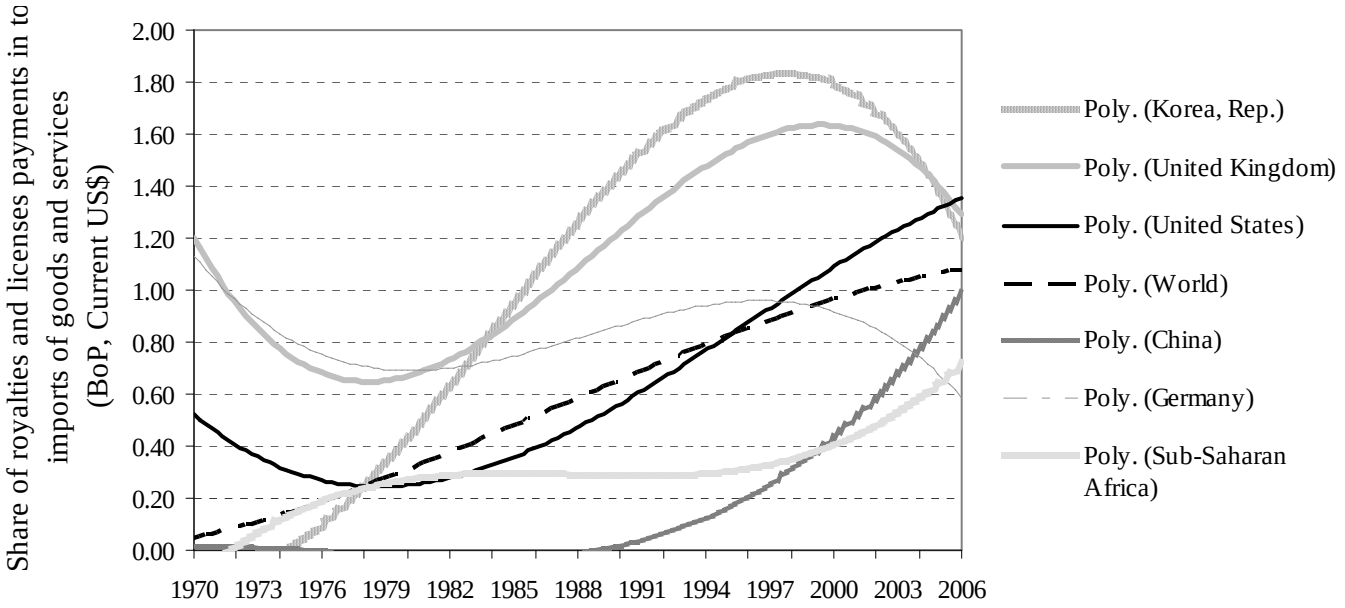


Figure 19.2b: Markets For Technologies: Trends In Intangible World Imports Of Selected Economies



Source: own elaboration of the basis of WDI database. Curves show the tendency of the share of royalties and licenses fees receipts (payments) as percentage of total exports (imports) of goods and services.

In the early 1970s, the US accounted for 80% of world receipts for royalties and licenses fees, followed by the UK with 12%. In 2005, 46% of world receipts for royalties and licenses fees accrue to the US, followed by Japan with 14% and the UK with 12%. Knowledge supply is more concentrated than knowledge demand, meaning that there are more countries that increasingly demand knowledge than countries that supply it, but this is not extraordinary: as a matter of fact knowledge production is sticky. As economies develop they are likely to extend their knowledge demand more rapidly than their capacity to produce it. In 2005, we must include 12 countries in order to reach the 80% of global demand for knowledge[38]. However, the importance of technology markets and the increase in worldwide transactions of intangible goods explain only some of the dynamics related to the recent explosion in patenting and the new

trends in firms and universities' patenting strategies. The answer to the questions "why do firms patent? "and "what do firms do with patents?" goes beyond the logic provided by the market for technology approach. Patents today are peculiar kinds of strategic assets, whose value is increasingly disentangled from the subjacent technology, and increasingly dependent on non-rational expectations regarding possible future technological conditions.

The emergence of new technological paradigms entail a redefinition of *innovation*, how it is generated and through what means it can be diffused and appropriated. In new technological paradigms, primarily ICT, biotech and nanotech, innovation is increasingly incremental and cumulative in character, intensive in interrelations between firms (countries and institutions), and entails an increasing relevance of science. The concepts of replicabilty, usability and copying are constantly re-defined, the potential technological interrelations are multiple, and uncertainty regarding future possible outcomes is even higher than under past technological paradigms. In this scenario, the traditional vison of markets for technologies is reconfigured into what we might call *new markets for knowledge*.

On one hand, the redefinition of boundaries between science and business engendered by new technological paradigms and the expansion of patent subject matter modified the traditional open science conception engendering the generation of a *market for science* where R&D labs and universities patent (and commercialize) their inventions. The adoption of the Bayh Dole Act in 1981 represents a critical turning point in this area (Jaffe 2000, Mowery et al. 2004). The increase in patenting activity of universities challenges the traditional open science paradigm according to which publicly funded research was supposed to increase the pool of available knowledge, since the "filter" to use and exploit this knowledge rested on technological and production capacities of agents, routines and tacit knowledge beyond any legal effort to protect it

(Rai, 2001, Dasgupta and David, 1994; Mowery et al. 2004). This market results in an *anterior* market, to which firms have to revert when results of universities research are subject to proprietary regimes. The rationale for the market derives from the latent and diffused demand for science induced by new technological paradigms (which increasingly rely on pure science for their inventions) and by the changing-behaviors that seem to have pushed forward the frontier of private knowledge.

At the same time, increasing cumulativeness and uncertainty in the nature of technical change and the re-shaping of legal frameworks that rule the knowledge domain towards more extensive IP protection induce firms to play with patents in additional arenas. These dynamics lead to the generation of what we call *secondary markets for science and technology*. Firms might benefit from patents beyond the monetary (or non-monetary) rents deriving form technology licensing. Firms might patent to block the entrance of competitors, to secure their dominant position in given technological trajectories, to increase their bargaining power in cross licensing or, among other reasons, to protect themselves in case of infringement trials. The rationale behind the patenting behavior is primarily strategic, defensive or blocking. In this case, the value of patents is, to a major extent, a function of uncertain expectations regarding future non-deterministically foreseeable technological scenarios.

This market is liquid in the sense that patents are easily tradable without requiring firms to have the necessary technological and production capacities to translate the invention into practice (at the time of transaction). Patents "monetize" because they loose the weight and the density of the technological component and they easily "circulate" without having to be necessarily entangled in any final artifact. At the same time, a given share of patents is not evenly traded and it remains dormant. Just as in derivative financial markets the value of the

transaction is disentangled from the present value of the share object of transaction, in this case patents are valued according to their potential future value. The decision to patent goes beyond the expectation of incorporating the patented invention into (direct or indirect) production. Firms patent to create barriers to competitors, and to create the possibility to participate in oligopoly rents that will be generated in the future by potential additional discoveries or incremental innovations based on their patents (Levin at al. 1987; Cohen at al. 2000).

Patents enter into firms' portfolios as a signal of (technological) reputation. Patents acquire a value *per-se,* independently from that of the subjacent technology and they might be kept dormant in firms' portfolios[39]. The utility of patents goes beyond the appropriability function. The willingness to patent can be assimilated to the decision to buy a lottery ticket. Even though the probability of winning is extremely low, the winning prize or the value assigned by each individual to the eventual win is high enough to encourage the patenting behavior (Scherer 2001; Lamely and Shapiro 2005). The difference in the current scenario is that uncertainty concerns not only the possibility to win, but also the prize itself. When a firm patents an invention with the idea of engaging in the secondary market, there is no guarantee that the invention, i.e., the patent, will reach a certain value in the future.

Moreover, the value of a patent can directly depend upon the value of other patents to which it can be linked through patent-pools, for example. This might contribute to explain why firms carry out extensive patenting strategies even though it is widely acknowledge that patents have a highly skewed value distribution, (i.e. in every technological field there is a limited number of valuable patents and an enormous number patents with much less value). Given high entry barriers determined by risk propensity and high enforcement and legal capacities, the secondary market is a highly concentrated one where the value of patents is increasingly

disentangled from the subjacent technology and increasingly related to their potential (future) value.

Production structure specialization, technological capabilities, institutions and legal infrastructure shape participation and exclusion in these new markets for knowledge.

First, in the case of the markets for technologies, developing countries lack production and technological capabilities that would enable them to participate in those markets. It is difficult for them to play the role of specialized technology providers. At the same time, they face serious constraints as demanders of technology, due to production specialization and to scant technological capabilities necessary to decode and productively use patent information. Socio-institutional factors, infrastructure, and current scientific and technological capabilities strictly shape the arena of production possibilities. Even in an extreme scenario in which all patent information is freely available to developing countries it is unlikely that this would generate increased activity by local manufacturing firms. Typically, industrial and technology policies would be necessary in order to create the incentives for entrepreneurial efforts.

The same discourse applies to the case of the markets for science. Developing countries in general lack scientific and technological capabilities. Beyond legal frameworks, those countries suffer from a chronic deficiency in researchers and quality of infrastructure and systemic environment for science and scientific research. Obviously the current debate regarding proprietary versus open science is of concern for developing countries, but they should avoid blaming patents as the only barrier to their scientific catching-up. Public support for research and development, the recognition of the profession of researchers, capacity building in scientific research and development, and investment in top quality infrastructure for research are more

important factors than patent protection for developing countries to play a role in scientific research.

Finally, considering the emerging dynamics of what we have called secondary markets for knowledge and the kind of speculative patenting behavior that is taking place, it is clear that this arena is for the leading innovative actors who recognize and value innovation as a strategic asset for future competitiveness. In these markets the value of patents is increasingly disentangled from the subjacent technology. Hence, production and technological capacities are not seen as major entry barriers, but this means that main barriers here are the capacity and the capability to carry out a strategic management of intellectual property, which stems from and exceeds production and technical capacities. Without those capacities it is difficult to participate in these markets; agents might not even recognize the rationale for them. The explosion of patenting activity deriving from competitive behaviors of agents coping with uncertain future outcomes and extensive patenting may induce a slow-down in the rate of technical change which is already alarming actors in the frontier - consider the self-evident negative consequences of patent thickets in the context of incremental innovations. These issues will be of concern in developing countries as well.

Secondary markets for knowledge in which firms bet on future uncertain outcomes shape firms' patenting behavior. In this context, costs and barriers to entry for new actors (firms and countries) are high, litigation and enforcement costs may be prohibitive, and different forces press towards concentration. Barriers to entry in the secondary market go beyond production and technological capabilities; they derive from firms' risk-propensity and size, as well as the existence of needed complementary markets and institutions to make this secondary market

work. Although there are spaces for the entrance of new actors into certain technological trajectories, in developing countries this would not easily happen though market forces.

Concluding reflections on policies and strategic IP management

Many voices in the US have pressed for the perverse dimensions of the new IP and innovation system. Likewise, some rulings have contributed to a slight moderation of the original aims of the pro-patent movement. The relaxing of the patentability criteria has led to a proliferation of patent grants that piqued skeptics who see the counter-innovative incentive potentiality of the patent thicket (Shapiro, 2001) and has brought the patent debate into a hypersensitive field, dealing with basic research issues such as health concerns (Rai, 2001). Preeminent scholars, as well as influential public and private institutions, have tried to introduce some limits to the patenting fury. Among them Nelson (2003) stresses the importance of keeping the scientific commons outside any form of IP protection in order to maintain strong and creative innovative activities. On the institutional side, a report written by the National Research Council (Merril et al, 2004) leveled a series of serious critiques of the new US IPR regime and called for a general reform of the US patent system focused on the restoration of more seriously-grounded standards of patentability.

In the countries on the technological frontier, especially the United States, the discussion on intellectual property follows a dual track. On one hand, foreign policy defends the strengthening of intellectual property standards of protection abroad. Weak protection and the asymmetry between the systems of the developed countries and those of the developing countries resemble a systemic fault which prevents the potential disclosure of knowledge and technical

progress derived from trade liberalization. Investing and marketing in a context of scarce protection of intellectual property is a risk that few are prepared to take. On the other hand, the debate surrounding domestic concerns is polarized between the powerful groups, (i.e., big corporations in sectors such as pharmaceuticals and chemicals, as well as the courts), which advocate growing standards of protection, and the academics and civil society, who are concerned about the proliferation of patenting activities and its effect on the long-term innovating capacity of the economic system. At the same time, voices of concern are arising even from the business side, when big firms envisage the possibility of small firms controlling up- and downstream patents, thus increasing their bargaining power.

In developing countries, particularly in Latin America, the inclusion of protection of intellectual property in trade negotiations has brought the topic into political debates. However, the discussion is primarily characterized by the paradox of adopting favorable positions on trade liberalization in tangible sectors and, at the same time, accepting the adoption of protection measures in the area of intellectual property and intangible goods. The Latin American stances are varied but, in general, a lack of strategic perspective on the role that the protection mechanisms for intellectual property in general, and patents in particular, can play in the generation of endogenous technological capacities prevails. Most discussions conclude by prioritizing the technology transfer potential of IP, without considering the structural capacities of transferring *what* to *whom*. However, some countries, such as Brazil and India, are beginning to strategically manage IP issues, in accordance with the transformation of their production structures and their national industrial development strategies.

In general, the capacity to innovate, though partially the result of a random process concerning something new and unexpected, entails a degree of stickiness shaped by scientific,

technological and production capabilities. However, technological dominance is not a permanent feature. History demonstrates that with the right combination of (formal and informal) policies and innovation potential among other assets, a firm or sector can take off. Lack of strategic vision and short-term demands jeopardize learning processes and the development of scientific and technological capabilities, which are localized and gradually built up in a continuous process of trial, error and feedback (Atkinson and Stiglitz, 1969).

Ultimately, countries differ in production structures, technological capabilities, development stages, and in the structure of their national systems of innovation (Cimoli and Dosi 1995). However, the center-periphery relationship between countries with a first class membership in the knowledge club and those who are at the margins also exists within countries. Structural heterogeneity is, unfortunately, a persistent feature of developing and industrializing countries, where islands of excellence (of foreign or national firms) coexist with the rest of the economy which usually shows extremely low productivity and organizational levels and which is primarily oriented inward. Dual economies require dual policy models in order to orient their industrial development. This also holds true in the intellectual property domain, where developing countries face the challenge of strategically managing IP systems in order to use them as complementary tools in their industrial development strategy.

"Getting the IPRs right" is far from being the solution; there is too much variation in the meaning of *right* in intellectual property regimes across countries with profound differences in technological and production capacities. Our suggestion is that first, countries should have a clear vision for their industrial development, and second, countries should balance IP regimes in order to cope with the needs of the different segments and stages of their production and scientific structures. Awareness and political will in these fields are the keys for moving forward.

We do not presume in this chapter to propose a solution for the IP and industrial development debate. It would suffice for us to call the attention of those concerned with the innovation for development discourse to the need to avoid converting the patent debate into a *much ado about nothing* discourse.

The existence of unexploited technological opportunities, together with the relevant knowledge base and a set of appropriability conditions, combine to define the boundaries of the set of potential innovations: those which are actually explored might critically depend on socio-economic traits of production and organizational systems and on a set of formal and informal policy interventions in support of the generation of certain scientific, technological and production capacities. Considering that technology is highly specific and embedded in routines and procedures, that knowledge has a strong tacit component, and that learning is a trial and error process which entails non-substitutable experiences, those enmeshed in the patent controversy who often blame or bless patents for their effects on innovative conducts are losing their relevance. We hope that our reasoning contributes to an inclusion of intellectual property management in the current renewed discourse on policies and institutions shaping industrial development. Seeking more balanced and tailored IP systems is necessary, and emphasis should be placed both on industrial policies for crating technological and production capabilities and on strategic IP management to uphold the industrial development effort.

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[1] The origins of the protection for intellectual property trace back to medieval times, when *guildes* used to grant exclusive property rights. "Patent" literally means open letter, emphasizing the disclosure function of the special privilege, but the British monarchy used patents as a reward mechanism which conferred an exclusive right to commerce specific commodities - a means for creating artificial monopolies. The first of this type of patent law is said to be the Venetian one of 1474. While the English Statue of Monopolies of 1623 allowed only the monopolies made by "true and first inventor" and regarding "method of manufacture".

[2] One well-known example may suffice. The US was a net importer of literary and artistic work in the nineteenth century, and its copyright statute of 1790 only granted protection to US residents. The US managed to delay the extension of copyright protection to foreign residents until 1891; at that time, when the US amended its copyright act, it was registering a surplus in the trade balance for literary works. (see Scherer 2005, whose work has clearly insisted on this point).

[3] On this topic see Machlup and Penrose, 1950; David, 1993 and Moncayo, 2006, among others.

[4] There is a conspicuous body of literature analyzing the changes in IP laws and court rulings, and the boom in patenting activity. See Kortum and Lerner, 1999; Hunt, 2001; Gallini, 2002, among others.

[5] US Code, title 35, part II, chapter 10, paragraph 101

[6] The Amazon's "one click" patent granted in 1999 by the USPTO is a clear example.

[7] Smets Solanes (2000) presents evidence on several cases of patented business models that do not disclose the computer processes and algorithms involved.

[8] Regarding software patentability, see Liotard (2002), Samuelson (1998) and Mergès (2001). See the Besen and Raskind (1991) survey on IP, as well.

[9] In Europe, in spite of the 1998 EU Directive, this process of extension of the new right regarding living entities met serious opposition

[10] *Expressed Sequence Tags* or "partial sequences" of genes. The utilization of this process constitutes an advance in the methods that can be used to identify complete sequences of genes.

[11] It is worth noting that this evolution of the American law would have been impossible *per se* under the Continental European law, according to which a key distinction separates "discoveries" (pertaining to knowledge) and "inventions" (pertaining to applied arts), the latter being the only patentable subject matter. We should,

however, further specify that even under the American law, the observed changes were neither grounded in objective fact nor even foreseeable. On this point, see the discussion in Orsi (2002).

[12] This is despite the fact that the Supreme Court had specifically warned that "*a patent is not a hunting license*" in its *Brenner vs. Manson* ruling. (c.f., on this point, see Orsi, 2002 and R. Eisenberg, 1995).

[13] The idea that the new IP regime can be analyzed as a new "enclosure" movement is at the heart of a series of works and studies first introduced by Boyle. For a restatement of the issues at stake, see Boyle (2003)

[14] See Mowery at al. 2004; Mazzoleni and Nelson, 2002; Mowery et al., 1999 and Dasgupta and David, 1994 for interesting analyses regarding the effects of the introduction of the Bayh-Dole Act in the US IP regime.

[15] A dispensation is given in case "unsuccessful efforts have been made to grant licenses to potential licensees that would be substantially likely to manufacture in the USA, or where under the circumstances domestic manufacture is not commercially feasible" (section 204 of the Bayh-Dole Act).

[16] For an unmitigated argument in favor of such a strategic industrial policy thesis, see the collection of articles published by L. Tyson (1996), former Head of the Council of Economic Advisers under President Clinton.

[17] Entry costs are reduced since the discovery has already been funded publicly.

[18] In the nineteenth century, as industrialization proceeded and costs and time of replicating literary works declined, net producers of such, primarily England, pushed for international recognition of intellectual property protection. In 1883 there were 69 international agreements on IP, mainly related with trademark protection (Ladas, 1975).

[19] These two conventions were followed by the 1891 Madrid agreement on industrial trademarks and the 1925 The Hague agreement on industrial design, and other similar international agreements. In 1893 the Office for the Protection of Intellectual Property (BIRPI) was created; it was an antecedent of the World Intellectual Property Office, established in 1967, under whose current administration are various international treaties for the protection of intellectual property.

[20] The Glivec case is emblematic: in 2006 Novartis, the Swiss multinational company, challenged the contentious Section 3(d) introduced via the 2005 Amendments to India's Patent Act, claiming it in breach of India's obligation under the TRIPS agreement. According to section 3d, the mere discovery of a new form of a known substance which does not result in the enhancement of the known efficacy of that substance, is not patentable. The Chennai high court dismissed the contention, saying that the issue should be settled by the WTO's dispute settlement board.

[21] See Aboites and Cimoli, 2002; IPRC (2002), Drahos, 2002. For an analysis of TRIPS and development see UNCTAD-ICTSD 2005.

[22] See Coriat, Orsi, d'Almeida, 2006 for a detailed presentation of the international controversies concerning TRIPS and Health.

[23] FTAs and BITs are country specific, but common elements are present, especially with reference to IP protection strengthening.

[24] The Special 301 Report is an annual review of the global state of intellectual property rights (IPR) protection and enforcement, conducted by the Office of the USTR pursuant to Special 301 provisions of the Trade Act of 1974 (Trade Act).

[25] A more detailed analysis is offered in Coriat (2000). On this topic, see also Zhang (1994).

[26] According to the 2007 Special 301 report main priorities are counterfeiting and piracy and other critically important issues, including "internet piracy, counterfeit pharmaceuticals, transshipment of pirated and counterfeit goods".

[27] Agreements concluded in recent years include "the Republic of Korea FTA (KORUS FTA), Panama Trade Promotion Agreement, Bahrain FTA, Oman FTA, Morocco FTA, the Peru Trade Promotion Agreement, the Colombia Trade Promotion Agreement, and the Central America-Dominican Republic Free Trade Agreement (CAFTA-DR) which covers Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and the Dominican Republic. In regions such as the Middle East and Asia, the United States has used an increasing number of trade and investment framework agreement (TIFA) negotiations to enhance intellectual property protection and enforcement"(USTR, 2007).

[28] Fink and Reichenmiller (2005) provide a clear and extensive revision of IPRs provisions included in US FTAs.

[29] Some FTAs also extend the term for copyright protection up to 70 years after the death of the author, in contrast with the 50-year term of the TRIPS agreement.

30 The first USTR action under the Section 301 dates back to 1985, carried out against Brazil, with respect to the Brazilian Computer Law. The second action regarded Korea in 1986. The same unilateral approach can be found in the trade treaty, signed in 1983 with the Caribbean countries, entitled the Caribbean Basin Economic Recovery Act, which allowed to the President of the US the right to assess whether the signatory Caribbean countries were complying with the treaty's requirements and implementing satisfactory IPRs policy, being these the mandatory

preconditions for enjoying the tariff preferences (Bayard and Eliot, 1994) Finally, NAFTA required Canada and Mexico to base their legislation on the US law as a precondition to benefit from free trade preferences.

[31] This are USPTO data; the pattern is the same if we consider the case of triadic patent families; from 1985 to 2005 triadic patent applications grew from 22,879 to 52,864, showing a cumulative increase of 230% in twenty years (OCED Patent Database). Several studies analyze this increase in patenting activities. See Kortum and Lerner, 1997; Hall, 2004; Guellec, Martínez and Sheehan, 2004, among others.

[32] The relationship between patents granted to residents and to non-residents usually shows asymmetric patterns in developed and in developing economies. In the former, patents granted to residents usually outweigh those granted to non-residents, whilst in the latter, the ratio is the other way round. This is obviously related to the asymmetry in technological capabilities and specialization patterns between developed and developing economies.

[33] The US and Canada account for 41.9% of world R&D expenditure, Europe 28.2% and Asia for 27.3%, while Latin America and the Caribbean (accounts for 1.3% of world expenditure), Oceania (1.1%) and Africa (0.2%) evidently play a more residual role (RICYT, 2004). Data refers to 2003 OECD, UNESCO and RICYT estimates, based on current US dollars.

[34]There is consensus on the fact that R&D expenditures are positively correlated with patenting activity, though the relationship between patenting activity and innovation is not deterministic. For an interesting evaluation of the effectiveness of patents as innovation indicators, see Grilliches, 1990.

[35] This affirmation can appear tautological given that we are considering patents all applied for in the US, Europe, and Japanese; however, the home country bias effect is not relevant for our analysis, as we are interested in comparing the intensity of patent application across world countries in a general way. Calculating the share of triadic patent families for all countries exuding the US, the Europeans and Japan would not alter the order: South Africa still accounts for the lowest share and emerging Asia the highest.

[36] This section is mainly drawn from Cimoli, M. and Primi, A. (2007), "Technology and intellectual property: a taxonomy of contemporary markets for knowledge and their implications for development," ECLAC-UN

[37] Grindley and Teece (1997), for example, analyze the growing use of technology licenses by large corporations such as IBM, Hewlett-Packard and AT&T during the 1990s.

[38] In order of decreasing contribution to total demand, these countries are: United States, Ireland, Japan, United Kingdom, Singapore, Germany, Canada, China, Korea, Rep., Netherlands, France, Spain.

[39] Following a survey of the EU regarding the value and the use of invention patent in Germany, France, Italy UK, Holland and Spain sleeping and blocking patents account for 18% in the case of SMEs and 40% of big firms and universities (Cesaroni and Giuri, 2005).