Intellectual Property Rights in the Global Information Society: Too Weak or Too Strong ?

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Comments welcome

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Introduction

In the1990s digitalization and the expansion of the world wide web had unleashed the formidable hope that information and communication technologies could underpin a truly *New Economy*. After the explosion of the internet bubble in 2000, we know that this promise partly grew out of hype and misconceptions. Technological convergence and internet do bring fundamental economic and social changes, but the process is progressive. As a result, appropriate incentives and the broader supportive context need to be sustainable. Since the 1980s, the accelerating pace of innovation in the context of tough global competition has presented national policies with the major challenge to stimulate sustainable innovation. Innovation implies *creative destruction* and governments have been struggling with both the stimulation of *creation* and the social consequences of *destruction* in older or less innovative sectors. All governements in advanced and emerging economies have tried to adapt the specfic national institutions to the global challenge of innovation and the emergence of the knowledge-based economy.[1]

Institutions typically lag the evolution of technologies and economic changes. At the end of the XXth century though, governments have very actively sought to meet the global challenge of innovation and have been eager to adapt the different national systems of innovation. The evolution of IPRs constitutes a fascinating illustration of this adaptation of economic institutions to the rapid pace of innovation. In the 1980s and 1990s, intellectual property rights (IPRs) have increasingly been considered as a major component of the institutional nexus which promotes innovation and risky business, especially in biotechnology and information technologies. In the 1990s, the rapid development of internet has strongly reinforced these concerns about IPRs.

« The Web is an information resource of extraordinary size and depth, yet it is also an information reproduction and dissemination facility of great reach and capability; it is at once one of the world's largest libraries and surely the world's largest copying machine. » (National Research Council 2000).

Internet has simultaneously increased the promise and the perils of information and communication technologies. By dramatically reducing the cost of imitation and diffusion of illegal copies, it has tremendously increased stakes of IP for entertainment and software companies, as well as for various information providers such as data base producers. The main area of concern here has been copyright, with an extension of copyright to software in a large number of countries[2] and the rapidly evolving issue of implementation as new technologies enable better monitoring of diffusion on the web. Internet has rapidly acquired the dubious title of "one giant copying machine", even though it was not the main source of copyright infringement.[3] However, new technologies such as the MP3 standard have presented frightening prospect for content producers, generating both new innovations to protect content over the internet and litigation.

The notion of a « Digital dilemma » underscores the fact that the extension of access to information can undermine the production of information as it becomes free and thus unprofitable (National Research Council 2000). The same dynamics are at the root of the extension of property rights, much beyond the specific problems raised by internet. What is at stake is the balance between incentives to innovate and produce original information on the one hand, and the diffusion of knowledge on the other hand. Over the last twenty years, IPRs have been substantially strengthened in order to stimulate the production of knowledge, but some now wonder whether access has not been threatened as a result. Are fences around knowledge becoming so high that knowledge will become underused and innovation stiffled ? Are we about to experience a « tragedy of anticommons » ? The « tragedy of the commons» metaphor had been used to explain why people may overuse collective resources (Harding 1968). The mirror metaphor of anticommons underscores the fact that multiple property right holders might result in underuse of knowledge (Heller and Eisenberg 1998). Indeed, intellectual property rights impose a private control on knowledge and restrict access to this potential public good.

This paper explores this broad set of issues by focusing on IPRs in information technologies, and more specifically on the strengthening of patents and on the introduction of new *sui generis* protection for databases. It takes and economic perspective to analyze the interactions between IPR and innovation. It also deals with the issue of international harmonization and convergence of IPRs. There is a voluminous legal literature that is closely related to the economic analysis of IPRs and many of the changes since the 1980s have subtle legal nuances. This is why a companion study focuses on the issues related to copyright.[4]

[1] On this broad issue, see for example (Boyer 2001, Archibugi and Lundvall 2001, Sachwald 2001).
[2] International treaties have also recognized that existing copyright legislation cover software and digital products on the internet.
[3] Pirate CD m anufacturing plants and home duplication of music have been more significant.
[4] Which will be discussed during the Tokyo Club meeting.

1. The Role of IPRs in the Knowledge Based Economy

Patents aim both at promoting innovation by granting a monopoly to the inventor, and at enhancing diffusion through the requirement that relevant information about the innovation be made public. The balance between these two objectives proves however delicate to strike. In the context of increasingly innovation-based competition, the values associated with the market exploitation of IP have increased; patents have been strengthened by public authorities and more widely used by companies. This trend which started in the United States in the 1980s tends to spread as competition is global and foreign companies are more numerous on information technology and internet related markets. The issue of the protection of software, business methods and data bases is discussed below against this broader context.

1.1 Markets for Technology in the KBE

In the emerging knowledge-based economy, the economic value of productions, services and technologies is primarily a function of the creativity that goes into them and how they apply to market needs. However, whether such value is appropriated by the original creators or by others depends on the market and policy mechanisms that protect it. This is probably why firms, especially in high tech industries have been asking for stronger IPRs since the 1980s. A second major explanation is the increasing division of innovative labor, which requires that technologies be much more broadly traded.

1.1.1 Innovation-based competition

Since the 1980s, globalization and innovation have interacted to change the competitive paradigm. Increasing trade liberalization and domestic deregulation have combined to sharpen competition on most markets. Privatization has also played an important role in numerous countries as public monopolies have been replaced by private oligopolies. In this context, the new competitors have adopted much more aggresive commercial practices. The international scope of competition has been broadened by lower transportation and communication costs.

In this context, emerging countries have become world competitors in a number of manufacturing sectors and firms from advanced countries have increasingly turned to innovation to build competitive advantages. Competition has been further stimulated by the increasing pace of innovation in new technologies. As a result of these converging tendencies, competition has become tougher and has relied ever more on the ability of firms to come up with new, innovative products and services. Since technologies and knowledge are the underlying assets of this ability, their value is likely to have increased, and firms are likely to want to appropriate this value even more than before. They have thus asked for stronger IPRs.

Stakes and claims by firms have varied across industries. In the pharmaceutical indsutry, firms have asked for patents to last longer as the development process before they can market their product has lengthened since the 1960s. In information technologies and biotechnology, recent advances have strained the classical categories of intellectual property because new forms of creative activity do not easily fit into them. Finally, in the context of globalization, firms from advanced countries have lobbied in order to get effective IPRs in developing countries.[5] The latter have become substantial markets for products such as consumer electronics, media and pharmaceuticals, but local firms often have the technical capability to reverse-engineer and imitate products from global leaders.

1.1.2 The division of innovative labor

The increasing role of innovation has had a strong impact on R&D management. Firstly, innovation has attracted increasing resources within firms, with rising R&D budgets across sectors. Secondly, innovation has been drawing on ever more diversified sets of knowledge. As a result, innovation practices have progressively turned away from the dominant paradigm, where R&D and complementary assets in manufacturing and marketing were all integrated inside the firm. From the 1980s on, firms have been testing the separation of various sections of the value chain. In particular, manufacturing has been partly or wholly outsourced in a number of sectors. More recently, firms have also started to outsource some R&D activities.

The evolution of R&D management by firms is embedded in broader evolutions of research and innovation processes. As research has become more complex and draws on a larger number of knowledge fields, cooperation has become pervasive. Numerous public and private actors now routinely cooperate to conduct scientific research and technological development. Collaboration between public institutions and companies has also been promoted as part of innovation policies in order to enhance technology transfer between universities and firms. At the same time, firms have increasingly funded targeted research conducted in universities. Overall the innovation process now involves much more knowledge flows between different types of organizations. Only part of these flows involve IPRs, but their share may have increased, in comparison with informal exchanges between scientists or exchanges of tacit uncodified knowledge. The role of IPR may have grown precisely to facilitate knowledge exchanges, since pro perty rights ease the quantification and control of these flows of intangibles.[6]

Markets for technology and knowledge are typically plagued with failures in relation to asymetrical information in particular.[7] As a result, knowledge is rarely exchanged at arm's length. Transactions tend to involve detailed contracts and may be embedded in alliances between the partners.[8] This very general characteristic of markets for technology remains true, but a number of factors have lowered transaction costs.

One major source of evolution has been the increasing use of general and abstract knowledge in industrial research. This trend itself has resulted from better theoreitical understanding of problems, more use of sophisticated instrumentation and increasing computational capability (Arora and Gambardella 1994). When innovation depended primarily on trial-and error procedures, much of the knowledge accumulated by firms was experienced-based and tacit. It was thus very much context dependent. As knowledge becomes more theoretical and codified, it also becomes much more relevant to other firms and the scope for exchanges enlarges. Besides, as firms increasingly use data bases and universal categories the costs of contracting to exchange knowledge decrease. Finally, information and telecommunication technologies have lowered the costs of exchanging knowledge. Arora and Gambardella (1994) thus argue that the diffusion of general and abstract knowledge has greatly encouraged the division of labor in the process of innovation.

As the division of labor becomes more extensive, markets for information and knowledge services become larger and more sophisticated. The number of buyers and sellers increases, uncertainty and prices tend to decrease. At the same time, firms become more specialized, following the typical pattern of market expansion. One specific aspect of this specialization is the division of labor between large and small firms. In a number of sectors, small new firms have been particularly important as a source of new ideas and

[5] International negociations are mentioned below (section 1.2.3).
[6] This hypothesis is discussed in the ETAN (1999) report, which relates the role of IPR to the way policy makers and innovation researchers understand and represent the process of innovation.
[7] See for example, Teece (1986)
[8] For definitions of markets for technology and for intellectual property, see Arora *et al*. (2000).

inventions. In high tech sectors such as biotechnology and information technologies, they have proved extremely efficient as part of the division of labor in the process of innovation. In particular, they are well adapted at pursuing commercial applications for emerging ideas coming directly from the academic community.

The full development of markets for technology and increasing division of innovative labor depends on a nexus of institutions, including reliable IPRs. In particular, young innovative firms tend to be more dependent on IPRs than large incumbents for their very existence. Large firms can channel their innovations to their production and distribution processes since they can afford the costly related investment. They also have the required know how to rapidly benefit from any potential learning effects. By contrast, small firms need patents either as a means to appropriate returns through licensing or as means to keep control of their technology while they build a manufacturing and sales capability (Mazzoleni and Nelson 1998). Patents have also been useful in the process of funding start-ups since they constitute an indicator of the potential value of projects for venture capitalists.

1.2 Policy Responses

In the United States, policy makers had been considering that intellectual property rights (IPRs) should be strengthened since the 1980s. They had come to define IPRs as a problem under the influence of US companies which were faced with mounting R&D expenses and increasing imitation on foreign markets. Pressures for stronger patent protection have been coming from high tech industries because firms saw that their competitiveness and their profits increasingly depended on technological assets as argued above. Pressures for stronger IPRs have also come from the entertainment industries as they expanded into new activities and foreign markets. Besides, policy makers have been keen to foster innovation in the context of the emerging knowledge based economy. As a result, they have sought ways to strengthen and broaden IPRs. The United States have logically spearheaded the movement as the main contributor to global innovation and home to numerous start-ups and major entertainment businesses.

1.2.1 U.S. reforms in the 1980s

Patenting by American inventors in the U.S. had been constant or declining for much of the 1970s and early 1980s. Patent intensity, with respect to either the US population or R&D spending declined significantly over the 1970s (Jaffe 2000) and private R&D intensity was stagnating. At the same time, productivity growth slowed down and American firms were losing market shares, in particular to Japanese competitors. These factors, as well as the deep evolutions outlined above, prompted a re-examination of the American system of intellectual property law. As a result, the American patent system changed substantially and has been granting broader and stronger rights to patent holders since the mid-1980s.

The case of semiconductors is quite interesting as it combines the different sources of concern which transformed the issue of property rights into a policy problem. From its beginning in the 1950s until the 1970s, the Amrican companies were dominating the semiconductor industy. Within U.S. semiconductor industry, reverse-engineering was a well-established practice, which may have stimulated rapid cumulative improvements. The liberal licensing policy of AT&T, which was a major source of inventions in the industry, also contributed to the minor role of IPRs (Grindley and Teece 1997). By the late 1970s, Japanese firms had become formidable competitors in the strandardized products such as computer memories. American firms then decided to strengthen their competitive advantage in R&D. In turn, this strategy implied that Japanese firms be prevented from reverse-engineering American products. In this perspective, American companies lobbied Congress to increase intellectual property protection for semiconductors. In 1984, the Semiconductor Chip Protection Act created *mask rights*, a new form of IPR specially tailored to address the needs articulated by the industry (Hunt 1999). Semiconductor topography cannot be considered as a literary expression,[9] but is relatively easy to copy. At the same time, patent protection of layout designs would have been excessive because the designs may not meet the novelty requirements.[10] As a consequence, chip totpographies have been granted their own form of *sui generis* protection that requires some originality and provides only 10 years of exclusive rights.

Changes related to patents have had a similar effect of strengthening the position of patent holders, which was considered as very weak in the 1970s. In particular, federal courts often invalidated patents because the claimed invention was found to be obvious in light of the prior art (Jaffe 2000, Hunt 2001). Moreover, different courts in the U.S. seemed to follow different criteria. The Court of Appeals for the Federal Circuit (CAFC) was created in 1982 to hear all appeals of patent cases. A single appeal court aimed at homogenizing and specializing the treatment of patent cases. But the CAFC has also been deciding patent cases differently, especially with respect to nonobviousness. The practical result is that patents are more difficult to invalidate and patent holders benefit from stronger protection

[9] So that copyright does not apply.
[10] The requirement of « nonobviousness » of patent law.

(Hunt 1999, 2001). Other measures and decisions taken in 1980-82 also contributed at strengthening patents. For example, in 1980, the Supreme Court reversed its stance on the patent-antiturst interface by recognizing that monopoly power was the purpose of the patent grant (Hall and Ham 1999, Jaffe 2000).

The 1980 Bayh Dole Act constitutes another important step in the evolution of the American nexus of IPRs. The Bayh-Dole Patent and Trademark Amendments Act provided a general permission for performers of federally funded research to file for patents on their results. The act also allows universities and government-operated laboratories to grant licenses to other parties, including exlcusive licenses.

In the case of a university or a public laboratory, patents are not necessary as an incentive to invent. Inventions are constantly being achieved with public funding, but they may not serve any economic purpose unless they are developed to be commercialized. This point has been the focus of the political debate that led to the passage of the Bayh-Dole Act. It was argued that a company would commit funds to develop a university invention and commercialize the new technology only if it had proprietary rights over that invention. This in turn called for the possibility for the university to sell exclusive licenses, which provide assurance that the returns from the investment in development can be appropriated. This rationale for the new legislation presumes that firms get a further incentive to develop inventions, on top of what they would perceive anyway from publication by academic researchers (Mazzolini and Nelson 1998). As suggested above, this argument might be most relevant for small firms or academics since large firms generally possess most of the complementary ressources needed to develop and commercialize their products.

1.2.2 Protecting Software and Data Bases

The expansion of patentability of software and financial service products and processes for offering them has been particularly controversial. Here again, the United States have been the leading country. At the beginning of the 1980s, a number of Court decisions have extended patentability to new subject matters such as genetically engineered bacteria, surgical methods, computer sofware or financial methods. As suggested by Jaffe (2000), it is "*probably not accidental that these expansions in the realm of patentability prevented patents from being irrelevant to several of the most important and dynamic technological sectors of the current era*" (p. 535). At the same time several new patentable subjects have been controversial, and in particular software and business methods.

Historically, software was deemed unpatentable because computer programs were considered as abstract formulas without technical effects. This perspective was roughly shared in the United States and Europe.[11] Computer software embodies elements of both literary expression, in the form of its binary code, and industrial utility, to the extent that programs are integral to production processes. This is why, software has first been protected with copyright and could only be patented when it was part of a technical process and could thus be considered as having technical effects.

In the United States the software market expanded earlier and reached a much larger scale than in Europe. As companies started to sell more standardized products on larger markets, trade secret became less efficient as a way to protect their inventions, and they asked for legal protection.[12] Congress explicitly extended copyright protection to computer programs in 1980.

During the 1980s, the USPTO and Courts granted a larger number of software patents which were claiming physical effects. Since the 1990s, patentability depends on a utility-based test in which a computer-related process does not need to have a physical transformation outside the computer. Over the last decade, the number of software patents issued increased dramatically (figure 1)., especially after 1996, when specific USPTO guidelines clarified the use of the utility-based test.[13] As a consequence, their share in total US patents doubled to about 5% at the end of the 1990s.

The evolution in the U.S. has been comparable with respect to business methods, which were never considered as unpatentable, but the number of which surged at the end of the 1990s. This is related to rapid development of applications in this field along with Internet and e-business at the end of the 1990s. The explosion of business method patents (figure 1) is also due to the explicit recognition of the patententability of computer-implemented business methods by a Court decision in 1998.[14]

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[11] US Patent and Trade Office had been granting software patents since the 1970s. There had been judicial disputes over the validity of some of these patents (Tang *et al*. 2001)

[12] Firms in the software business still rate lead time over competitors highly as form of protection though, including small firms (Tang et al. 2001).

[13] *Examination Guidelines for Computer-Implemented Inventions*, USPTO 1996.

[14] *State Street vs. Signature Financial Group.*

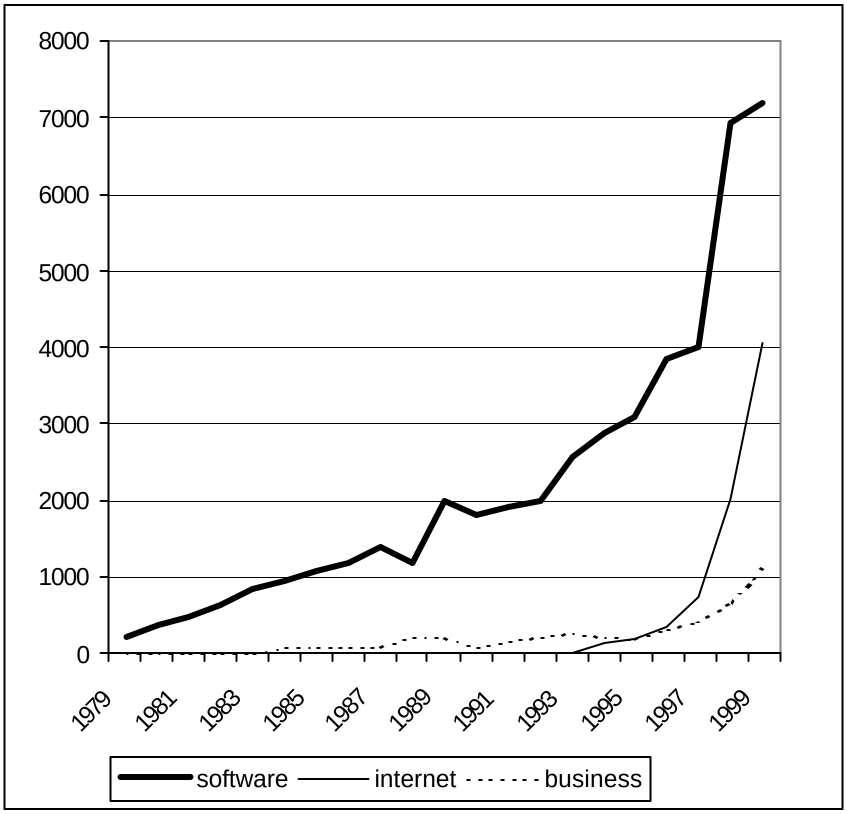

Figure 1. Boom in patenting in software and Internet-related fields

Source: Hunt 2000

In Europe, software is still not patentable *as such*. It is the case in a number of countries and at the European level in the legislative framework of the European Patent Convention (EPC). The exclusion to patentability is contained in Article 52(2) which identifies explicitly what cannot be patented. The underlying reason for exclusion was initially based on the belief that computer programs are not of a "technical nature", as mentioned above. In this perspective, computer program-related inventions can be patented. Moreover, at the end of the 1990s, decisions have somewhat eroded the position of the European Patent Office on the issue of the technical effects of software (Tang *et al*. 2001). As a result, the position of the EPO has come closer to the U.S. and Japanese standards for software-related patents. Since software is not patentable as such, there is no explicit identification for software related patents and the number of European software patents is uncertain. According to the European Commission, 13,000 software related patents had been granted by the late 1990s

(EU 1999). A recent estimate by the Federation for a Free Information Infrastructure (FFII) counts between 20 and 30,000 software patents.[15] Different sources nevertheless agree on the fact that most of these patents are held by large US and Japanese firms. According to the FFII estimate, 12,550 patents are held by US companies, 11,666 by Japanese companies, 4,831 by German companies, 1,518 by French companies and 1,210 by British companies.

The issue o f business method patents has also been discussed, even if they are still not permissible in Europe. Firms have been filing an increasing number of such business methods with "technical effect", but very few patents have been granted (Tang *et al*. 2001). The contrast with the US thus remains very clear (figure 1 shows the evolution of patenting of business methods in the US).

European countries and the EU patent system have nevertheless been seriously considering the consequence of new technologies and related products for IPRs. In the case of software, a number of studies and broad consultation with all parties have been organized. Such an approach is necessary to assess the need for lifting statutory exlusionary provisions. Similar provisions do not exist in the US system, which is thus much more flexible. In the meantime, the European Commission has promulgated two important Directives in response to the emergence of new technologies, namely the Biotechnology Directive (1998) and the Database Directive.(1996).[16]

The Database Directive establishes a new, *sui generis*, type of intellectual property right in order to take into account the complex composite structure of databases. They include copyrighted materials such as texts, photographs or maps, which may or may not be copyrightable, and also use software, which may itself be protected. The originality of the Directive is that it allows for the protection of the structure of the database itself, even if it is not original enough to benefit from copyrights. The underlying rationale is the protection of investment by the producers of databases, rather than the promotion of innovation or intellectual creation (Smets-Solanes 2000, Warusfel 2001). The Directive allows for the interdiction of extractions and use of parts of databases which represent large investments

[15] FFII has examined all patents from EPO which matched certain keywords like internet, server, client or virtual into a database. Each was assigned a probability of being a software patent, again by checking for keywords in the title and abstract. Words related to algorithms and programming raised the probability, those related to physical or mechanical things lowered it. According to FFII, this procedure does not totally exlude true hardware patents (.
[16] Member States have adapted their legislation at the end of the 1990s.

over a period of 15 years.[17] As a result, work involved in the constitution and updating of a database is protected, even when it is easily accessible on line. In this case, it can thus be argued that protection of databases may ease the development of internet and some related commercial applications. Some argue on the contrary that too much protection may inhibit access to information, including scientific databases which are essential to the advancement of research, both in developed and developing countries.[18]

In the United States, data bases do not yet enjoy such a protection. U.S. copyright law protects databases provided that there is sufficient originality in the selection and arrangement of the data, and only for the original portion of the base. The U.S. courts have followed this stand and rejected “sweat of the brow” arguments for making collections of facts and data copyrightable (Cockburn and Chwelos 2001, David 2001). This issue has nevertheless been discussed in the United States, including through legislative proposals. The argument about the need to have sufficient incentives to invest in large compilations, which has been raised by data base producers and providers of on-line databases, has nevertheless not been accepted in the United States.

1.2.3 Knowledge diplomacy

A number of debates over patent policy have been framed by the issues of international competitiveness that have come to the fore since the 1980s. As mentioned above, competitiveness issues have loomed large in some of the changes in the U.S. patent law. They have been even more central to the deployment of a veritable American “knowledge diplomacy” in the 1980s.[19]

The use of IPRs in international commece is nearly universal and hardly new. In the 1980s however, the system of highly variable national rights had become increasingly incompatible with the globalization of markets, where firms exploit their technical and product advantages on an international scale. Countries and firms increasingly exchange information, technologies and creative goods and services around the world. Exchanges of knowledge and technologies have increased rapidly in the context of globalization, including through foreign direct investment.

[17] With possible extensions.
[18] These arguments are discussed in more details below.
[19] This notion is due to Ryan (1998), who discusses the obejctives and development of the US knowledge diplomacy in detail.

During the 1980s, US Governments met with intense pressure for reform from enterprises in industries like pharmaceuticals, software and recorded entertainment that are particularly attuned to multinational activity and vulnerable to imitation. These sectors are large exporters in the United States and they have successfully lobbied to induce a massive shift in emphasis in US trade policy toward encouraging and forcing reform in IPRs in a large number of countries.[20] The remarkable success of this extensive lobbying effort has more broadly depended on the perceived "American decline" during the 1980s. In this context, competitiveness concerns have animated a number of policy changes. In a number of traditional manufacturing sectors, the United States were faced with stinging competition from Japan and Asian emerging countries. As a result, American companies focused more and more on service and knowledge intensive sectors. Against this background, firms from the IP intensive sectors have skillfully packaged their ideas as pro blem-solvers, arguing that support for their export industries would help the US solve its trade woes (Sell 2001).

The Office of the U.S. Trade Representative (USTR) has first responded to lobbying by patent and copyright interests with bilateral diplomacy to seek reforms, mostly in emerging countries.[21] In 1984, the United States designated inadequate protection of patents, trademarks and copyrights as an unfair trade practice that could invoke retaliation under Section 301 of the Trade Act of 1974. "In the ensuing 16 years, intellectual property rights have moved from an arcane area of legal analysis and a policy backwater to the forefront of global economic policy making'" (Maskus 2000, p. 1). In parallel to bilateral negociations, the US engaged a formidable diplomatic effort as part of the multilateral trade negociations in order to bring IPRs to the table and reach an agreement during the Uruguay Round. These efforts were successful and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) constitutes a founding component of the WTO.

The TRIPs agreement represents a major turning point in the protection of intellectual property at the international level. It sets strong minimum standards in the different areas of IPRs, including patents, copyrights trademarks, trade secrets and even methods of protecting new technologies such as chip designs. Recent events, related in particular to

[20] They have in particular produced numerous reports estimating revenue losses from piracy. Piracy is a significant economic phenomenon, but industry association figures, which were an important source of information for the US government, have tended to overestimate the losses to piracy (Sell 2000, Cockburn and Chwelos 2001)

[21] In the mid-to-late 1980s, there were also a number of 'patent wars' between the US and Japan.

access to vital medecines in poor countries, suggest that this strengthening of IPRs at the international level needs to be implemented flexibly.[22]

2. Assessing the Strengthening of IPRs

Roughly coincident in time with the changes in the legal and institutional environment, there has been a remarkable surge in patenting in the United-States; The total number of patents increased from 66,000 in 1980 to 99,000 in 1990. During the 1990s, the rapid increase went on and the total reached 176,000 in 2000.[23] Does this mean that the policy changes have been the cause for this surge in patenting ? More importantly, did the policy changes lead to more innovation ? This issue is examined below, first from a general point of view and then for the case of software.

2.1 Static and Dynamic Perspectives

The primary rationale for the existence of patents is to stimulate investment in R&D and innovation. The cost to society of granting a patent stems from the monopoly on the technology that the patent awards. The underlying assumption then is that patents are needed to provide firms with the requisite incentive to invent, and that this does justify the awarding a temporary monopoly. In other words, the question of whether a patent should be granted depends on the trade-off between invention and monopoly dead-weight loss. The outcome of this trade-off then depends on the length, scope and strength of the monopoly being granted. This issue has been studied by economists through a various theoretical models. These models show that the optimal design of a patent depends on a number of parameters since the trade-off is influenced by both the firm's profit and the consumer surplus.

Until the 1980s, most economics literature on patenting had looked at innovations in isolation, whithout examining the externalities or potential spillovers that early innovators confer on later innovators. More recent studies have underscored on the contrary the cumulativeness of the innovation process. Innovation is often sequential and improvements on an original innovation may be extremely valuable. Moreover, innovations from different firms are also often complementary. The sequential and complementary nature of innovation is widely recognized, especially in high tech industries. The cumulative nature of research

[22] More broadly, developing countries have been questioning the TRIPs and its implementation, as biased in favor of advanced countries (see for example Cattaneo 2000 and Maskus 2000)

poses problems for the optimal design of patents that had not been previously considered and which have been hotly debated. Whenever an invention is understood as contributing to further invention potential, and not only as creating a new product for final use, strong patents might well hinder rather than enhance technical advances. The question of whether a patent should be granted and of how strong it should be then no longer turns on the traditional static trade-off. The argument is rather about whether the long run effect on inventing is positive or negative.

Imitation inhibits innovation in a static world and patents preserve innovation incentives. In a dynamic world, firms may have sufficient incentives to innovate while patents may constrict complementary innovations. In such a perspective, broad patents may be particularly harmful. Mazzolini and Nelson (1998) argue that there might be high social costs to granting a broad patent which gives monopoly rights on the exploration of the prospect opened by an initial invention. This is because the broad patent would cut down on the number of inventors who would be induced to explore the possibilities to come up with a profitable invention. At the beginning of the XXth century, the airplane and radio technologies have experienced such a situation. In both cases, several companies had obtained patents covering important aspects of these valuable inventions, but were unable to reach satisfactory cross-licensing agreements. Mutual blockage precluded the manufacture of the most advanced aircraft and radios in the United States until the government stepped in during the First World War (Merges and Nelson 1990). These example suggest that the seriousness of the problem raised by cumulative systems technologies also depends on the ability of firms to reach cross-licensing agreements.

The effect of strength of patents on inventing also depends on the dynamics of innovation. In mature industries, innovation is slow and firms can enjoy the benefits of patents over a long period of time. In such a context, if patentability criteria are relaxed,[24] more inventions will qualify and firms will be less exposed to imitation, while competition between related patented technologies might not increase too much. Overall, the value of patents should increase and invention be stimulated. Hunt (2001) argues that the contrary might be true in high tech sectors because innovation is much more dynamic and that the competition effect might dominate the incentive effect. As a consequence weaker patentability criteria in high tech sectors could reduce research activity.

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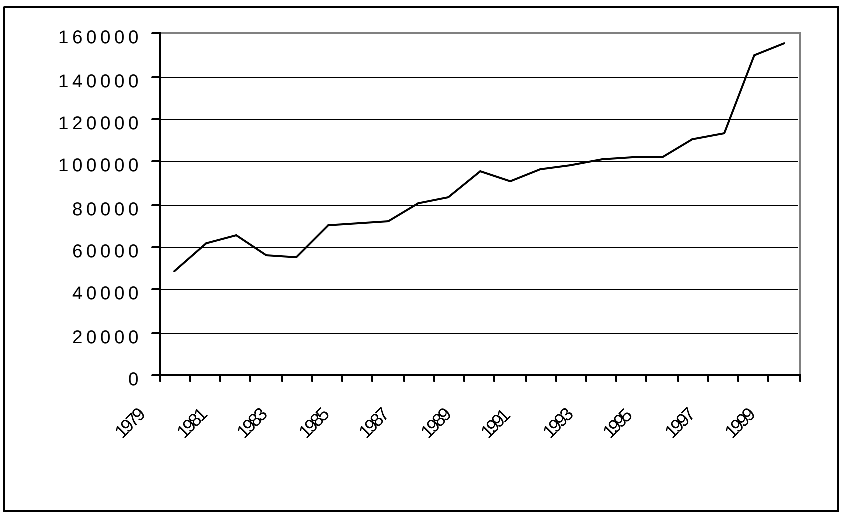
[23] Data on patent counts from the US Patent and Trademark Office (March 2001).
[24] In particular if nonobviousness is less strictly enforced.

The above discussion suggests that the effects of policy changes are quite difficult to anticipate since they depend on numerous parameters which vary across sectors and technologies. As a result, it may be impossible to connect specific changes in patent rules to precise theoretical models. It is thus helpful to look at empirical evidence.

2.2 Empirical evidence

The decline in the intensity of patenting activity in the US has been reversed in the mid-1980s (Jaffe 2000) and the number of patents has increased steadily (figure 2). This upward trend has been partly driven by the surge in patenting in information and communication technologies.

Figure 2. Increase in patenting in the United States



Source: Hunt 2000

A number of studies have examined the possible relationships between this jump in patenting and the changes in the legal environment. The evolution of specific high tech sectors have also been examined closely.

2.2.1 Does more patenting mean more innovation ?

Kortum and Lerner (1998) have examined what they call the “friendly court hypothesis”, according to which the increase in the number of patents would have resulted from legal changes which have increased the value of patents. According to this hypothesis, firms would have responded to the new context by increasing their propensity to patent from an unchanged pool of potentially patentable set of inventions. In this case, patenting in the U.S.

should have increased, both from domestic and foreign firms. Besides, patenting by U.S. firms abroad had no reaso n to increase. Patenting data does not support this friendly court hypothesis since patenting by U.S. inventors has been steadily increasing from the mid-1980s to the mid-1900s, both in the United-States and abroad. U.S. patenting by foreign inventors has also been increasing, but along various patterns. In particular, Japanese and German firms had started to increase their patenting in the US in the 1970s. Overall the U.S. has become a significantly greater source of invention while it has become a more important destination of invention to a lesser extent.

The data also does not support the "regulatory capture hypothesis" according to which large firms with established patent departments would have been the main beneficiaries of the legal evolution. The share of patents by new and small patentees has actually been increasing relatively more rapidly in the recent period (Kortum and Lerner 1998). This could mean that small firms and new entrants have benefitted from the new legal environment, which would then not have been "captured" by large incumbents. Results from a survey of European firms suggest however that small innovative firms tend to rely relatively more on secrecy to protect their innovations than large firms (Arundel 2001). These results are not necessarily contradictory and might be due to the differences in the type of data used in the studies or to the different role of small innovative firms on both sides of the Atlantic during the 1990s. The rate of entry of high tech start ups has been much higher in the United States (Sachwald 2001), which would explain the rapid increase in patenting from small firms.

Kortum and Lerner (1998) also consider that the increase in patenting does not result from a widening of the set of technological opportunities in high tech sectors. Biotechnology and information technology patent classes have grown particularly rapidly, but the vast majority of patent classes have exhibited an increased rate of patenting between the mid-1980s and the mid 1990s. Patenting in information technology has nevertheless accelerated further at the end of the 1990s. Could it be that the "fertile technology hypothesis" has become more relevant in this area ? Or possibly that the friendly court hypothesis could apply in this case ? These issues are taken up again in the next section which focuses on software.

Kortum and Lerner (1998) conclude their extensive empirical analysis by suggesting that the increase in patenting has been driven by changes in the management of innovation, involving in particular a shift to more applied research activities. This conclusion would then suggest that the patent surge has not been caused by the evolution of the patent system.

Jaffe (2000) considers that such a conclusion may be reinforced by the fact that the usefulness of patents as a means for protecting the returns to innovation did not increase over the 1980s.

Box 1. Assessing the Effects of the Bayh -Dole Act

Much university research in the United States has an applied character. As a consequence, a number of US universities have traditionally been active in patenting and licensing faculty inventions. University patenting has nevertheless sharply increased after the passage of the Bayh-Dole Act in 1980. The number of patents issued by universities and colleges increased about ten fold between 1979 and 1997 (From 264 to 2436 (Mowery *et al*. 2001). Moreover, the ratio of patents to R&D spending in universities increased – which was not the case in industry (Jaffe 2000). As for the general surge in patenting, a major policy issue is the role of the Bayh-Dole Act, as opposed to other evolutions. University patenting had been increasing since the 1970s and there is no significant break in the series in the early 1980s.

Detailed analyses of American universities behavior show that the Bayh-Dole Act stimulated enterpreneurial activity, with more patenting and licensing (Mowery *et al.* 2001). University patents nevertheless remain concentrated on a limited number of fields, and in particular biomedical area. High quality patents are concentrated in a limited number of areas and in a small number of universities. As a consequence, a very small share of the patent portfolio of universities accounts for the majority of licensing revenues. Besides, licensing generated revenues, but also involved specific costs related to the management and marketing of university patents.

Some observers feared that the pro -patent new context would shift university research toward applied work to the detriment of basic research. Mowery *et al*. (2001) have not observed such a tendency in the three universities which they studied thoroughly (Stanford, University of California and Columbia). University research has shifted toward biomedical research, which has largely remained quite fundamental in nature, even if it has been rich in results with commercial promise. Another set of concerns is related to the more general discussion of research tools and broad patents. Mazzoleni and Nelson (1998) in particular have expressed concerns with respect to exclusive licensing from university research. They argue in favor of widespread licensing in order to avoid the problems related to monopoly control for ‘prospect opening’ inventions.

Overall, studies also underscore the difficulty in separating the effects of the Bayh-Dole Act from those of other factors in the technological context and in the US national innovation system (Jaffe 2000, Mowery *et al*. 2001)

Empirical studies have found that in most industries firms reported that patents were neither very effective, nor necessary for enabling them to appropriate returns from R&D activities.[25] In a number of sectors, firms are not willing to disclose information and prefer to rely on secrecy to protect their invention. Pharmaceuticals and fine chemicals are exceptions in their strong reliance on patents. Actually firms do not consider that patents are unimportant, but point to limitations of patents from their point of view (Arundel 2001). They consider that patents are too high (they are not able to demonstrate the novelty of invention), or too narrow (they are afraid of "inventing around" by competitors). The strengthening of the patent system does not seem to have changed firms' opinion on the the effectiveness of patents (Cohen *et al.* 1997). One important limitation of these empirical studies though is that they have relied on perceptions from R&D managers from large incumbent firms. Managers from small firms and start-ups might be of a different opinion, as suggested by the above discussion of the division of innovative labor. Another way to reconcile the jump in patenting and the lack of increase in perceived effectiveness of patents may lie in the so called strategic use firms now make of their IPR portfolio.

2.2.2 Patenting strategies

Since the late 1980s, it seems that firms have been increasingly using patents for purposes that go well beyond the mere protection of their own technology. They have been using the patent system in a pro-active way as part of their overall innovation strategy and not only as an ex post protection of their R&D results.

Some firms have developed patent strategies in order to maximize their own R&D yield in terms of competitveness and, symetrically, to hinder competitors' innovative efforts. Firms can for example artificially increase their patenting in order to control access to such or such technological prospect and thus prevent competitors from following it (Grandstrand 1999). The payoff from IP strateigies may depend on the patent system, including the definition and sanction of fraud. Donald Spero (1990) illustrates one such strategy, patent flooding, with the case of his small company, Fusion, which specializes in high-intensity ultraviolet lamps. The CEO explains that when it entered the Japanese market at the end of the 70s, Mitsubishi purchased one of Fusion's lamp system and filed about 300 patent applications related to its micro-wave lamp technology in the course of the following year. The purpose of this patent flooding was to extract a cross-licensing agreement from Fusion. The small company refused to grant a license on its basic technology, but then had to wage a long battle; « the Mitsubishi dispute has become a longer term, perhaps permanent feature of Fusion's Japanese landscape » (Spero 1990, p.67).

[25] See for example Levin *et al.* (1987), Arundel and Paal (1995).

In cases where products are complex systems, some patents can block innovation by competitors, and firms may use such patents in a strategic way. When industrial standards depend on numerous patents, some firms may prevent competitors from entering the market by making a strategic use of their IPRs. Motorola has used its rich portfolio of essential patents[26] related to GSM technologies in this way (Bekkers *et al.* 2000).

The strategic use of patents has been particularly examined in the semiconductor industry. The propensity of semiconductor firms to patent has risen dramatically at the end of the 1980s.[27] Yet these same firms declare that they do not rely much on patents to protect their R&D results. The survey by Cohen *et al.* (1997) clearly shows that they rely firstly on secrecy and secondly on lead time to appropriate the returns from their innovations. Patents play a minor role in comparison with these first two means of appropriability. Hall and Ham (1999) have explored this apparent paradox by analyzing the patenting behavior of about 100 U.S. semiconductor firms during the contemporary pro-patent era (1980-1994).

The semiconductor industry extensively relies on cumulative systems technologies. Multiple firms develop patented innovations in the same technological fields and the "state of the art" is covered by a large number of patents held by different firms. Besides, a particular product can utilize technology from several other technology fields, such as computers, software, materials or communications. As a result, a given semiconductor product such as a memory device can be covered by hundreds of individual patents relating to cirucuitry design, materials or manufacturing methods. Firms thus need to have extensive access to each other's patent portfolios in order to be able to design and manufacture new products without risking costly infringements. They typically cross-licence all patents in a field-of-use to ensure adequate access to technology.[28] Overlapping R&D and the need to buy "freedom-to-operate" do not date back to the 1980s and the semiconductor industry has historically been characterized by broad cross-licensing of patent rights among manufacturers. The use of IPRs has nevertheless become more strategic as the technology has evolved and as new firms have entered the sector.

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[26] A patent is essential to a standard if the invention involved is the only way of « doing things » while adhering to the standard. Such patents may thus be used to block a standard when it is being negotiated, or to reap high royalties after the standard has been agreed upon.
[27] The increase far exceeds that of manufacturing firms as a whole.
[28] A cross-licensing will often include all patents that licensees may own in a given field-of-use, giving each firm the freedom to infringe the other's existing and future patents for a given period (Grindley and Teece 1997).

In the semiconductor industry, sunk cost in manufacturing capabilities have increased over time and are now very large. A wafer production facility in particular costs over $ 1 billion. As a result, it has become ever more crucial to avoid any delay or blocking of the production process which might result from unvoluntary patent infringement. At the same time, technology has become more complex and technological inputs come from more actors. In this context, firms have increased their propensity to patent in response to an increasing fear of "hold-up" when they are sued for infringement. This is partly due to the fact that firms use patents as "bargaining chips" to negociate cross-licencing agreements. If a firm's portfolio is not strong enough, it will need to pay royalties to various patent owners, which will weigh on its profitability.

The increasing role of design firms[29] has also contributed to promoting the role of patents in the semiconductor industry. Design firms find themselves in the typical new entrant or start up position described in section 1 above. As a consequence, they rely on their IPRs to secure capital from investors and to improve their competitive position in niche product markets. Hall and Ham (1999) have found that these new entrants have a higher propensity to patent than larger firms which own manufacturing facilities. Their overall results thus support two complementary explanations for the surge in patenting in the semicondutor industry. Capital intensive firms have increased their patenting in order to protect their investments in manufacturing facilities from the "hold up danger". Design firms have been patenting even more aggressively in order to secure financing and broad proprietary rights in niche markets. Patenting has thus become a significant dimension of competition for both large incumbents and new entrants. In both cases, the surge in patenting is not mainly explained by the traditional funciton of safeguarding against theft of innovative ideas. Broader strategic motives and increasing patenting do not seem however to have hindered the pace of innovation in the semiconductor industry.

Overall, legal changes have only contributed to the surge of patenting in semiconductors, in combination with technological factors, including high R&D spending in the late 1970s and early 1980s. Legal changes have strengthened patents and have promoted their strategic use. In particular, the separation of design from manufacture and the resulting lowering in the barriers to entry into chip design would not have been possible if the designing firm could not protect its creation form appropriation by the contracting manufacturer. The strengthening of patents has also played a role in the decision by a number of large

[29] Or « fabless » firms, without fabrication capability.

patenters to assert their rights in court and to earn higher royalty payments. This strategy, which was first initiated by Texas Instrument in 1985-86, increased the cost of technology and thus contributed to the patent-race.[30]

2.3 Software and Business Methods

Controversies between the US and Europe on the issue of the broadening and strengthening of patents will be discussed (differences with Japan exist but seem less contentious). Software and business models on the one hand, data bases on the other hand. David "digital boomerang" sur l'aspect cqs du brevetage

Hence patenting software, both rationales : 1. technical aspects, new; 2. stimulation of innovation, as in other sectors

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2.3.1 From copyright to patents

Software is also a technological area with interconnected incremetnal advances. Especially software that controls or defnes systems interfaces. Moreover, it has experienced high levels of innovation despite weak patent protection for most of its history. As a result, strengthening of IPRs in software has raised strong opposition. On both sides of the Atlantic, a number of researchers and policy makers have suggested that this trend might stifle rather than stimulate innovation.

Bessen and Maskin (2000) have examined whether the static model which underlies the traditional justification for patents holds in the case of software, or whether a dynamic models would not be more relevant.[31] If the static model holds, patenting in the United States should have induce an increase in R&D spending in software in the recent period, leading to an increase in productivity. In constrast, if software follows the dynamic model, stronger IPRs should have hindered innovation and we should expect a reduction in R&D spending and productivity growth.

The authors examine the data for the largest software patentees. The latter belong to the computer hardware and teclecommunication industries, which sell both software

[30] Other firms such as AT&T, IBM or Motorola have followed a similar strategy and increased their royalty earnings (Grindley and Teece 1997, Bekkers *et al.* 2000).

products and incorporate software in hardware products. Pure software companies do not rank among the large software patenters in the data used by Bessen and Maskin (2000). The first software company in 1995 was Microsoft, which ranked 24th and had only 39 patents, while IBM had 503 and AT&T 185.[32] The study suggests that both relative R&D and productivity by software patenters have been slightly declining at the end of the 1980s. The only exception being smaller firms,[33] which have increased their R&D intensity at the beginning of the 1980s, and maintained it at a higher level than the top patenters at the end of the 1980s. This result suggests that stronger IPRs might have helped new firms to enter the industry. Besides, the influence of the strengthening of IPRs might have had a stronger effect on pure software firms, which are not well represented in the sample. Finally, the study only covers the 1980s and the effects of the legal changes might have fully developed only later. It nevertheless suggests a cautionary approach to strengthening IPRs in software.

The change in the legal environment described in section 1 above has meant a radical strengthening of IPRs in software during the 1990s in the Untied States. In such a context, it is important to know how the market for patent licenses works. Granting patents on broad prospects may not be a problem if transaction costs are low and cross-licensing easily negociated. This model has worked relatively well in the semiconductor industry, as shown above. Fears have been expressed, that it might be much more hazardous in the case of software and business methods.

2.3.2 Patenting business methods

The evolution in the US at the end of the 1990s has been particularly preoccupying with respect to business methods patents. The latter are related to software patents since business methods are often applied using computer programs. The very rapid increase in the number of business method patents (figure 1) has met with violent opposition from some observers, who feel that the system has gone out of control (Gleick 2000). A number of examples of business methods patents indeed suggest that the condition of non-obviousness or sufficient inventivity is not well implemented (Hunt 1999). As in the case of software, one major problem is that prior art is very difficult to assess and that adequate data bases and knowledge on this issue are lacking (Hart *et al*. 2000, Smets-Solanes 2000).

[31] The static and dynamic models have been presented above in section 2.1.
[32] Since then, Microsoft has been rapidly increasing its patenting (with a total of 340 patents in 2000), but large manufacturers remain prominent patenters of software.
[33] « Small firms » are a panel of 49 firms in software-related industries.

More adequate knowledge of prior art may be accumulated, provided sufficient investment and personnel is allocated to patent offices. This could be an important step to introduce more discipline in the field of software and business method patents. From this perspective, it might be argued that the surge in software patents and the growing number of “bad” patents may be due to the emergence of a new sector in relation with new technologies. The patent surge in software and business methods would be, in a way, related to the internet bubble at the end of the 1990s. From this perspective the patent bubble and the stock market bubble would have interacted, in particular through the connection between patents and start up funding. Time and a better assessment of innovation in the new fields would then put the hype to rest.

A number of researchers, economists and lawyers nevertheless question the very possibility to grant software and business method patents. Their arguments are grounded in their scepticism about the positive influence of patents on innovation. The above discussion of this issue suggests that the jury is still out. People working with open software nevertheless fear that software patents might stiffle both innovation and competition. Others rather advocate a reform of the patenting process, so that the rate of bad patents be reduced. R. Merges (1999) has argued that the increased volume of patent applications in the US, related in particular to software and Internet matters, has pushed the American patent system into crisis and that it should thus be reformed. He has outlined a number of measures aimed at reinforcing the examination process, including higher salaries to stem the turnover at the patent office, an alternative bonus system to reduce the incentives in favor of granting patents and a better use of the reexamination system after a patent has been granted.

In Europe, this type of considerations has also been raised in the debate over the patentability of software. Patentability of software should be clarified, and possibly plainly accepted, provided the patent system is organized so as to grant good patents and reduce the risk of hindering innovation (Dupuis *et al*. 2001). In a recent opinion to the government, the French Academy of Technologies has proposed that software patentability be accepted, provided it can be implemented “with reason” (Académie des Technologies 2001). Its recommendations in this respect are similar to those expressed in the US. It further suggests specific measures to better inform small firms and protect them against predatory practices related to patents. The French Academy of Technologies further adds that software patents should probably be limited to 10 years since obsolescence is particularly rapid in this field. Another recent French report suggests to go further in the direction of a *sui generis* property right for “immaterial inventions”, including in particular software (Smets-Solanes 2000).

Conclusions and Policy Issues

This paper has discussed the role of intellectual property as part of the nexus of institutions aimed at promoting innovation and the diffusion of new technologies. Over the last twenty years IPRs have strengthened and expanded under two interacting sets of pressures. The first one has come from the corporate world. As knowledge and intangible assets have become an ever more important source of revenues and competitiveness, firms have sought stronger protection from IPRs all over the world. The second set of pressures has come from policy makers themselves, who have been seeking ways to stimulate innovation and speed up the development of information technologies in the broader context of the emerging global knowledge based economy. The public and private objectives should be compatible: stronger IPRs should ensure adequate rewards to innovation, which in turn should stimulate innovation. This paper nevertheless suggests that the fundamental trade off between incentives to innovate and the downside of monopoly granted by IPRs remains a subtle policy issue. As the emergence of new technologies have accelerated innovation, the incentive role of IPRs has been prominent and intellectual property may have become too strong in a number of cases. In this context, the evolution of IPRs remains an important policy issue, both at the national and at the global levels.

Which IPRs for New Technological Fields ?

The strengthening of IPRs over the last twenty years has been raising two sets of issues. The first concerns the patent system in general and its consequences on highly cumulative innovation processes, while the second is more specific to software and internet related technologies, which have been examined more closely in this paper.

IPRs have been strengthened in order to stimulate innovation, in particular in new technological areas, such as biotechnologies and information technologies. Innovation and new technologies have been all the rage at the end of the XXth century and institutions have logically evolved in order to accomodate or even promote these developments. Institutions are sticky and have historically lagged technological change. At the end of the XXth century the evolution of IPRs has on the contrary been very substantial and one may wonder whether it does not constitute a case of *institutional overshooting*. Since the late 1990s, a number of analyses and debates thus suggest that the American patent system should be examined and possibly reformed with the view to make patenting less easy. Such arguments have focused on the examination of some new technology areas, including in particular semiconductors and software.[34] In both areas cumulativeness is a major feature of the innovative process, which implies that some patents could be easily block innovation.

In the case of software, data bases and internet related innovations, things are even more complex as they constitute very recent areas for intellectual property. Software has been clearly protected by copyright in the United States after 1980s and at the international level in the 1990s. Data bases have become strongly protected by a *sui generis* right in the EU in the late 1990s, but not in other geographical zones. The latest episode is the extension of patent protection to software and business methods in the United States and in Japan.[35] In all these new areas of information technologies, the assessment of inventiveness constitutes a major problem. One issue is that of prior art, which is insufficiently known. A broader issue is that of patentability itself as the technological nature of some of these inventions is contested. As a result, there is no consensus on what patents are meant to protect. These debates and uncertainties may be due to the fact that computer software is a relatively new area and a working definition of "technology" applicable to this field may progressively emerge. Other technological areas have experienced such a process in the past, chemicals and pharmaceuticals being prominent examples.

In this context, some oppose software and business method patents altogether as there is no evidence that they can stimulate innovation, while the evolution in the United States since the 1990s suggests that a large number of bad patents have been issued. A less radical and possibly more productive way to go is to reform the patent system, so as to both integrate the new areas of innovation and preserve the quality of patents. The main issue here is to ensure that patent offices be able to ensure that the condition of nonobviousness is respected. In other words, patents may be granted to new categories of inventions, provided inventiveness remains a necessary condition. As suggested above, this approach includes both new resources to assess better prior art in software related areas, and a different organisation of the process of patenting itself. Interactions between IPRs and competition have recently become an area of concern for companies and policy makers. As a consequence, this perspective should also be included in future reflections on the evolution of the patent system (Hart *et al.* 1999).

The need for new IP legislation, beyond clarifications and international harmonization, has not been convincingly demonstated. Nevertheless, a number of important pieces of

[34] Patenting in biotechnology areas has also been discussed, both for similar reasons and for ethical reasons.

legislation have recently been passed, and some are under consideration in different countries. Some of this new legislation will significantly alter the balance of rights between producers and consumers of digital content. In particular, it would be wise to examine more precisely the impact of software patenting on the emerging “information society”. One recommendation before going further is that studies should be done to assess the consequences of recent changes, and in the process of reflecting and drafting further legislation, consultation should be as large as possible.[36] One of the dangers in rushing into new legislation, particularly that which creates new statutory rights, is that it becomes difficult to subsequently justify repealing or modifying these rights. Besides, rapid technological progress tends to provide better ways to implement existing rights.

Global issues

International differences in IPRs have existed for a long time, but the potent combination of the increasing role of innovation in competition and globalization has lead to closer comparisons and has exacerbated confrontation in a number of cases. As in other areas, differences in policy and national characteristics lead to the issue of the level playing field. This issue has been illustrated by the brief discussion of TRIPS above.

The United States and Europe have chosen to strengthen IPRs on different categories of inventions. Europe has issued a directive which creates a new category of rights for data bases, while the American patent system now routinely grants patents on software and business methods. US projects to emulate the EU on data bases have met with vocal opposition and have so far failed. The main argument of the opponents is that stronger property rights on data bases would reduce access to public information. As in other thorny areas related to Internet and information technologies, the trade off between incentives to innovate and broad access to newly generated knowledge is difficult to strike. The emerging knowledge based economy may be the “age of access” to services through networks,[37] but strong property rights might “boomerang” (David 2001) and excessively reduce access to information. In particular, more selective access might deprive researchers from useful information and research tools, which in turn might slow innovation down.

[35] The situation may be less clear in Japan, but patents are effectively granted.
[36] On the current process in the EU, see below.
[37] As argued by Rifkin (2000), who contrasts the industrial society where property of goods was the major feature.

Conversely, stronger protection of software and business methods has been opposed in Europe. Over the last two years, extensive consultations have taken place throughout the EU on the issue of software patenting. The process is still underway, but it seems that a consensus is emerging to clarify and harmonize the scope of software patenting in Europe, rather than in favour of its broadening.[38] Clarification should underscore the patentability of software which involves technical effects and thus reject the patentability of business methods. Indeed national consultations have shown that small companies tend to ignore such possibility and underuse software patenting. National authorities consider that this may undermine the competitive position of European firms in information technologies. A European ruling on software patents would also harmonize national practices which remain different.

European harmonization is also deemed important in order to influence what is considered as a dangerous drift of the American system (Ministère des Finances 2001). The European Union appears to be moving toward unified regulations for software patents that would be less encompassing than regulations in the United States and Japan, with the view to then work at further international harmonization among the triad countries. Such harmonization could be eased if the different countries were to streamline their national patent systems in order to reduce the probability of bad patents being granted, as discussed above.

Over the past two decades, the strengthening of IPRs has been considered an important issue for innovation policy. It has been part of a new approach which emphasizes the role of incentives, for both firms and individual researchers. In the case of IPRs, and more particularly in information technology, the consequences of this approach have been compounded with uncertainties about what exactly constitutes invention and about the process of innovation itself. As a consequence, the trend towards ever stronger IPRs is now being questioned. Recent crises over access to adequate pharmaceutical treatments in developing countries have offered a more dramatic illustration of this emerging issue.

IPRs belong to the national and global soft infrastructure of contemporary economies, but in order to be legitimate and efficient, they have to strike the right balance between incentives and access. From this point of view, the specific technological areas related to Internet should be considered as part of a global approach to IPRs in the global knowledge

[38] See Patent Office (2001) for the UK, Académie des Technologies (2001) and Ministère de l'Economie (2001) for France.

based economy. If IPRs are perceived as too strong and contradictory with fundamental values such as health or privacy, their legitimacy may be seriously challenged, which in turn would be detrimental to the development of international technology exchanges and innovation. Recent episodes of conflict between the enforcement of property rights and the diffusion of innovative products remind us that IPRs constitute one important chapter of global governance. They further suggest that the latter has to take into account multiple objectives, including in particular sustainable innovation in advanced countries, diffusion of technological progress and oportunities to catch up for developing countries. This paper focuses on information technologies, but its conclusions suggest that stronger IPRs at the global level, as enacted by the TRIPs agreement in particular, should also be assessed and probably clarified.

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