Patents and Incentives to Innovate: Some Theoretical and Empirical Economic Evidence*

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ABSTRACT. In this note, we try to evaluate how effective the patent system is in fostering innovation. We first develop the microeconomic reasoning underlying the legal protection of intellectual property. We then try to assess whether this legal protection does indeed fulfil its mission. We show that due to the difficulty of measuring innovative output, it is hard to reach any conclusive answer. We can at best provide a bundle of partial answers, which cast serious doubts on the necessity to strengthen patent rights, but which provide no argument either for discarding the patent system altogether.

KEYWORDS. Intellectual property (IP), patents, incentives, costs and benefits, innovation, patent paradox, microeconomics

1. INTRODUCTION

The objective of this note is to evaluate the effectiveness of the patent system for fostering innovative behavior. We proceed in two steps. First, in Section 2, we briefly develop the microeconomic reasoning underlying the legal protection of intellectual property in general, and of the patent system in particular. We start by explaining that because of three sources of market failure, knowledge-generating activities face a generic problem of appropriability; we then describe how various public responses, among them the legal protection of intellectual property, have been designed to address this appropriability problem.

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Next, in Section 3, we try to assess whether the legal protection of intellectual property does indeed fulfil the mission for which it has been created. We tackle this complicated issue by offering a bundle of partial answers. First, we report the results drawn from interviews of innovators, which all seem to indicate that patents are seen as a secondary or complementary instrument for protecting intellectual property. We then turn to macroeconomic indicators. The last three decades have witnessed the simultaneous increases (i) in the scope of patent protection, (ii) in the number of patents filed, and (iii) in innovation. It is then of theoretical and empirical interest to investigate how these three trends relate to one another and how they can be reconciled with the contrasting results drawn from microeconomic surveys. In this respect, we first note that this analysis is hard to perform mainly because of the difficulty to measure innovative output. We then address the so-called “patent paradox” (i.e., the observation that firms are filing more and more patent applications each year, although those patents are deemed as of little value), as well as the conjecture that stronger patent protection induces more innovation. We conclude in Section 4.

2. ECONOMICS OF INTELLECTUAL PROPERTY

An intellectual property can be defined as any product of the human intellect that is unique, novel, and nonobvious (and has some value in the marketplace). Inventions, business methods, industrial processes, chemical formulae, and unique names all correspond to this definition. Similarly, all information products deriving their intrinsic value from creative expression, literary creation, ideas, or presentations are also considered as intellectual property. In this section, we briefly explain why the markets for intellectual property often fail to work in an efficient way, and we give thereby the economic rationale behind public interventions in those markets.¹
2.1. Information and appropriability

Intellectual property (or IP for short) concerns the production of information or knowledge. The problem with activities generating IP is that they suffer from the three generic sources of market failure: externalities, indivisibilities, and uncertainty. Let us detail them in turn, as this will prove useful for understanding the discussion that follows.

The first source of market failure in the production of IP stems from the public-good nature of information and knowledge. Producers of public goods generate many externalities and it is well known that in the presence of externalities, markets may not provide the right incentives to produce. Public goods are characterized by nonrivalness in consumption: the consumption of the good by one person does not prevent (rival) its consumption by another person; there is thus a potential for collective consumption. Another way to define nonrivalness is to say that a good is nonrival if for any given level of production, the marginal cost of providing it to an additional consumer is zero. This is clearly the case for knowledge and information. Think of a new idea or of a song performed in public. Public goods are said to be “pure” when they are also nonexcludable, in the sense that one person cannot exclude another person from consuming the good in question. Whereas nonrivalness is an attribute of the good itself, excludability depends, at least in part, on the available technology for exclusion, and the institutional (legal) framework that permits or facilitates such technically feasible exclusion. We return to this distinction below.

Indivisibilities are a second source of failure in IP markets. The creation of new knowledge and new information involves large fixed set-up costs. As such activities often require the division of highly specialized labour, they are also prone to economies of scale. Finally, both knowledge and information are inherently discrete. As a result, marginal costs are generally driven below average costs, which makes marginal cost pricing economically unviable. Furthermore, there is a tendency towards monopolization of such markets.
The third source of market failure in IP markets is *uncertainty*. Investments in R&D involve two types of uncertainty: on top of technological uncertainty (how to make new things and how to make them work), there is also commercial uncertainty (how to make new things adopted by the consumers). The same uncertainties apply for the creation of artistic and literary work. The decisions to produce or to invest in IP are therefore necessarily mixed with decisions to bear risk. Separating the two types of decisions is often difficult because of moral hazard, which arises when the transfer of risk undermines the efficiency of the investment. Moral hazard may be acute for the production of IP as it is generally impossible to attribute the failure of a project to a lack of effort or simply to bad luck.

Because of these three sources of market failure, IP-generating activities face a generic *problem of appropriability*, which sets them apart from other investments made by firms or individuals. That is, innovators and creators face a serious risk of incompletely appropriating the returns from their activities. As a result, there is a general presumption that markets provide too few incentives to introduce new innovations and that the production of IP may well be insufficient from a social point of view. There is also a wide agreement among economists that, in such circumstances, there is room for public intervention.

2.2. *Public responses to the appropriability problem*

There are several ways to close the wedge that the appropriability problem drives between social and private rates of return from innovation. The main public responses consist either in restricting the exploitation of knowledge (by protecting IP and by allowing putative competitors to form cooperative R&D ventures), or in raising the expected returns of new knowledge by lowering its cost of production (through subsidization of research and patronage of artists). We examine these various responses in turn and we discuss their respective merits.
A. Intellectual property protection

The main objective of intellectual property law is to promote innovation and aesthetic creativity. To solve the appropriability problem, IP law intends to make knowledge excludable by legal means. That is, it grants exclusive use of the protected knowledge or creative work to the creator. Thereby, IP law provides creators with the necessary incentives to produce new knowledge and solves the underproduction problem that would have resulted from the non-excludability of knowledge. However, by granting exclusive - i.e., monopoly - rights to the creator, IP law creates an underutilization problem. Indeed, as the marginal cost of production is zero, any positive price creates a welfare-reducing rationing.

In order to strike a balance between these two conflicting problems, IP law grants exclusive rights only for a limited period of time. That is, IP law addresses the two problems sequentially. First, legal protection makes the good excludable: to enjoy the services, users have to pay royalties to the producer. Second, once the protection is over, the good falls in the public domain, which means that all users may access the good for free (i.e., at marginal cost). In other words, IP law attempts to find the best possible compromise between dynamic efficiency considerations (how to provide the right incentives to create and innovate), and static efficiency considerations (how to promote the diffusion and use of the results of creation and innovation).

Note that dynamic efficiency calls for the broadest and longest possible protection (to maximize the flow of new knowledge creation), whereas static efficiency calls for the absence of protection (to avoid the deadweight loss of monopoly). Therefore, the balance struck by IP law is necessarily imperfect as it is impossible to reach both objectives at the same time. It follows that when it comes to design the appropriate way to protect IP, the complexity is of a quantitative rather than qualitative nature: what are the level and the structure of the rent that should be left to the innovator?
B. Subsidization

When governments fund technical and artistic works, static efficiency is enhanced with respect to IP protection: as there is no need to grant exclusive rights to the innovator, the innovation is in free access and no deadweight loss ensues. However, to fund research and creation, governments have to raise taxes, which introduces distortions elsewhere in the economy and reduces static efficiency (in contrast, the patent system assigns costs to users rather than to tax payers). Moreover, there is no guarantee that subsidies achieve dynamic efficiency. Indeed, the uncertainty surrounding the social value of an innovation might yield the government to over- or underestimate the amount of subsidy and, thereby, to give too much or too little incentive (in contrast, the patent system can be implemented without requiring sensible economic information that is only privately known).

C. Trade secrets

In the absence of any external mechanism, inventors might sometimes find sufficient incentives to innovate when they manage to keep their discoveries secret. Famous examples are the Michelin radial tires and the Coca-Cola formula. As long as the innovation is kept secret, information is excludable and the appropriability problem disappears. Firms may prefer to protect their discoveries through secrecy because they find that seeking a patent is, comparatively, a long and costly process. They might also wish to exploit their discoveries on a longer period than the duration of the patent. However, secrecy might be hard to keep, as the risk is high that an employee (or some industrial spy) will disclose the invention, which would then become public knowledge. Trade secrets partly reduce such risk. But, even if the costs of keeping secrets are reduced, the innovator looses all protection once the idea is released. Also, trade secrets offer no protection against independent innovations (which, by contrast, patents do).
Although secrecy makes information excludable, which solves the underproduction problem, secrecy does not solve the underutilization problem, as information remains nonrival. Hence, the absence of diffusion creates a cost for society. This cost is reduced in the patent system for two reasons. First, as already explained, patent protection is limited in time: at the end of the protection, the innovation falls in the public domain. Second, patents entail a disclosure requirement: applicants must describe their invention in sufficient detail for a skilled person or team to be able to reproduce it. Knowledge is thus diffused, which fosters technical progress.

D. R&D cooperation

As indicated above, IP-generating activities suffer from three sources of market failures: externalities, indivisibilities, and uncertainty. When it comes to R&D, one way to alleviate these three problems is to allow firms to form a cooperative R&D venture. In many situations, rival firms exert positive externalities on one another through their research activities. Indeed, new knowledge easily spreads across firms (one talks about “knowledge spillovers”), meaning that firms freely benefit from the R&D efforts of their rivals. Because of this prospect of free-riding, firms might be inclined to cut back their R&D spending. In response to this problem, the formation of a cooperative R&D venture allows firms to internalize the externalities and, thereby, to preserve their incentives to do R&D.

Cooperative R&D ventures might also reduce the problems stemming from indivisibilities by allowing firms to share costs, to eliminate useless duplication of R&D projects, to pool complementary skills, and to exploit economies of scale. Finally, cooperative R&D ventures are also a way to pool risk and, hence, to better manage technological and market uncertainty. However, cooperation in research might, like IP law, introduce one market failure to correct others. In particular, in the presence of weak spillovers, cooperation might decrease global R&D
spending. Worse, if cooperation extends to price fixing, collusive behavior will translate into a deadweight loss.

After this brief presentation of the appropriability problem of innovation and of the economic rationale behind several public responses, we focus on the legal protection of IP (mainly patents) and try to assess the effectiveness of this policy instrument.

3. Does IP law fulfil its mission?

Although there is a wide agreement about the theoretical arguments underlying the existence of the patent regime (and about the legal protection of IP in general), there is much less consensus about how effective this institution is in practice. As we have seen above, IP protection is just one among several public responses designed to alleviate the appropriability problem of innovation. Moreover, as we will see below, there also exist private responses to this problem. Hence, one basic question follows naturally: Are patents necessary to stimulate innovation?

As we will discuss in this section, the previous question turns out to be extremely tricky to answer. A first natural direction is to survey innovators and ask them directly whether they see patents as important. In Subsection 3.1, we report the results of several surveys of this kind; they all seem to indicate the relative unimportance of patents, which are seen as a secondary or complementary instrument for protecting IP.

Such surveys offer important elements of the answer to our question, but their scope remains limited. It is therefore necessary to adopt a broader point of view and examine macroeconomic facts. In Subsection 3.2, we describe the main trends observed over the last 30 years. Three stylized facts emerge: (i) IP protection has been generally strengthened and broadened; (ii) patents have soared; (iii) innovation has increased. The coexistence of these facts, coupled with what innovators declare, raises a number of additional questions: (Q1) How can we reconcile the relative unimportance of
patents with the huge increase in patents counts? (Q2) Is there a logical sequence from fact (i) to fact (ii), and from fact (ii) to fact (iii)? (Q3) Even if the answer to Q2 is yes, is IP the least-cost means to increase innovation?

In Subsection 3.3, we explain why all these questions are hard to answer mainly because of measurement problems. Actually, because there is no easy way to measure innovation, the best available indicators of innovation are, in fact, patent indicators, which makes it extremely hard to assess what effect patents have on innovation. Finally, we present some elements of answer to the questions we have just raised: in Subsection 3.4, we address Q1 and refer to the “patent portfolio theory” to solve what has been called the “patent paradox”; in Subsection 3.5, we briefly address questions Q2 and Q3, which are, for now, mainly unresolved.

3.1. Protection of IP in practice

Several empirical studies have attempted to assess the relative attractiveness of the different means innovators have at their disposal to protect their inventions. In his survey of recent studies, Caillaud (2003) stresses that innovating firms consider trade secrets (for process innovations) and business strategies based of early-mover advantage (for product innovations) as the main means of getting returns on R&D investments and to appropriate the rents stemming from innovation. Similarly, Anand and Galetovic (2004) report survey results showing that managers claim that “lead time, learning curves, and sales or service efforts are substantially more effective in protecting IP than patents are.”

It appears thus that the appropriability problem is often better addressed through private responses than through public responses. In particular, except for the chemical and pharmaceutical sectors, patent protection is generally deemed as of little efficiency, especially for process innovations. Caillaud (2003) advances several explanations: firms consider (i) that a patent can easily be ‘invented around’ by imitators, (ii) that a patent is costly to obtain and to enforce, and (iii) that they suffer from disclosing the information, as required by the patent.
In the light of the previous observations, one is tempted to ask why firms in most sectors still bother to seek patent protection for their inventions. Several reasons can be advanced: \(^5\) (i) patents are relatively inexpensive to register (although they are generally costly to defend); (ii) patents can serve to measure the output of a firm’s R&D division and, thereby, to structure compensation and incentive schemes; (iii) venture capitalists often demand that firms patent technology, both to block rivals and to have assets to sell in case the firm flounders; (iv) patents can be used as a ‘trading device.’ The latter reason is confirmed by a number of surveys, which show that it is essentially large firms that resort to patent protection, especially in complex industries (like, e.g., electronics and software) where innovations overlap and where patents are then used as a ‘currency’ in the bargaining process among firms (to negotiate cross-licensing agreements, for instance). We come back to this argument in Subsection 3.4 when trying to explain the “patent paradox” raised in question Q1.

3.2. Recent trends

The observation of the evolutions of IP protection, R&D, and innovation over the last three decades reveals the emergence of three basic trends.

First, under the initiative of the United States and of Europe, IP protection has been strengthened, broadened, and harmonized internationally. In terms of strengthening, in the early 1980s, legal and procedural reforms in the United States provided stronger protection to holders of existing patents; \(^6\) in Europe, the European Patent Office (EPO) granted the first European patents in 1978, but a genuine European patent (superseding national patents) was only implemented by the European Council in March, 2003. Regarding broadening IP, new categories of inventions have been protected, either through an extension of patent protection (software, business methods, genetic inventions) or through the creation of “sui generis” rights (semiconductors, databases). \(^7\) Finally, the TRIPS Agreement of 1994, \(^8\) negotiated within the framework of the World Trade Organization, represents a major advance toward the harmonization of IP laws; it includes
a general definition of patents, which adopts U.S. criteria and, thereby, broadens the scope of patentable inventions internationally; furthermore, the United States and the E.U. repeatedly concluded bilateral agreements with their trading partners in order to coerce them to significantly strengthen their own IP rights regimes.

Second, the number of patent applications and grants has risen exponentially. In the United States, it has more than tripled between 1980 and 2001 (whereas it was practically stable over the previous two decades). A comparable trend is observed for European countries (although it began later). Although nearly all technology fields experienced growth in patenting, two technology fields contributed substantially to the overall surge in patenting: biotechnology and information and communication technologies.\(^9\)

Third, innovation has also expanded rapidly. An important indicator of this fact is the increase in R&D spending: for instance, in the United States, R&D spending (in real terms) has been multiplied by 2.5 from 1971 to 2001;\(^10\) also, as reported by National Science Foundation, the investment in R&D by U.S. firms employing fewer than 5,000 people more than doubled between 1987 and 1997. It must be noted, however, that R&D spending is a measure of inventive inputs (while patents are measures of inventive outputs) and that some of these inputs might be wasted or never lead to any new marketable product or process. Nevertheless, the increase in R&D investment has most likely lead to the discovery and commercial exploitation of an increased number of new technological leads.

3.3. Patent indicators

Among the few available indicators of technology output, patent indicators are the most frequently used. The main advantages of patent indicators are the following: (i) patents have a close link to invention; (ii) patents cover a broad range of technologies; (iii) patent documents contain a rich source of information; (iv) patent data are readily available from patent offices.
However, patent indicators are also subject to some major disadvantages. First, because there is no standard method of calculating indicators from patent data, there is also a wide divergence in the political lessons that can be drawn from patent indicators. To solve this problem, the OECD is currently trying to standardize these indicators. Such standardization requires a good understanding of how and why patents are taken out, of how they are administered and enforced, and of how all this changes over time. Indeed, a second disadvantage of patent indicators comes from four sources of differences in the interpretation of patents counts: (i) differences across countries in economic costs and benefits of patents, (ii) differences among technologies and sectors in the importance of patents as protection against imitation, (iii) differences among firms in propensity to patent (especially unimportant innovations), and (iv) differences in patent law over the years. A third disadvantage is that patents are an imperfect indicator of inventive output; indeed, many inventions are simply not patented (either because they are not patentable or, as we mentioned above, because inventors prefer to protect them using other methods, such as secrecy, lead time, etc.).

Nevertheless, despite these problems, patent indicators are the best available indicators of innovation. What kind of information can we then extract from patent data? Ultimately, what we would like to measure is the consumer value created by R&D spending. As long as R&D spending and patents are linked, the issue is thus to measure the private value of patents. This issue, however, is far from simple as the private value of receiving a patent depends on the counterfactual. That is, what would happen if no patent was granted? There are four possible scenarios: either (i) the invention is not made at all, or the invention is made, but (ii) the patent is granted to a rival firm, or (iii) the invention is put in the public domain, or (iv) the invention is kept secret and not patented. Scotchmer summarizes the main results drawn from various estimations of patent values: “(1) the values of patent rights are very dispersed, (2) the distribution of values is very skewed, with most of the value provided by
Several attempts have been made to refine the measure of innovation given by patents. One direction consists in weighing each patent for the number of citations it generates in subsequent patents (so as to measure knowledge externalities). Another approach is to use renewal efforts or the filing of a legal opposition to the patents. It is indeed expensive for holders of European patents to renew patent protection for one year. Similarly, legal battles are costly. So, only privately valuable patents are worth renewing or opposing. Finally, useful additional information can be drawn from direct interviews of inventors.

3.4. A patent paradox?

The huge increase in patent counts (reported in Subsection 3.2) seems to contradict what innovators declare about the relative unimportance of patents to protect their IP (see Subsection 3.1). How can we solve this so-called “patent paradox,” which has been systematically documented in the semiconductor industry? The *patent portfolio theory* provides us with a convincing explanation. The main idea is that, in many industries, the true value of patents lies not in their individual worth, but in their aggregation into a collection of related patents. In other words, the more patents the merrier, because patents are increasingly used as a ‘trading device’ or a ‘bargaining chip.’ This trend is confirmed by a number of surveys, which reveal that it is essentially large firms that resort to patent protection, and especially in complex industries (e.g., biotech, IT, telecoms, electronics and software).

It is because these complex industries heavily rely on *cumulative innovations* that firms have an incentive to constitute patent portfolios. There are two types of cumulativeness. On the one hand, in the case of *sequential innovations*, a particular innovation leads to many second-generation innovations. The main problem with sequential innovations is that a patent on the first-generation innovation confers the patentee a holdup
right over subsequent innovations. On the other hand, in the case of complementary innovations, a second-generation product requires the input of a number of different first-generation innovations. Here, the main problem, referred to as the “tragedy of the anti-commons,” is that the prices are higher if they are set by independent patentees rather than jointly. Shapiro (2001) uses a nice metaphor to explain why these problems are worst in industries where hundreds if not thousands of patents can potentially read on a given product:

In these industries, the danger that a manufacturer will step on a land mine is all too real. The result will be that some companies avoid the mine field altogether, that is, refrain from introducing certain products for fear of holdup. Other companies will lose their corporate legs, that is, will be forced to pay royalties on patents that they could easily have invented around at an earlier stage, had they merely been aware that such a patent either existed or was pending. Of course, ultimately the expected value of these royalties must be reflected in the price of final goods.

Whatever the type of cumulativeness, the trade of patent rights among firms might alleviate the problems: ex ante licensing addresses the hold-up problem, while cross-licensing and patent pools can solve the tragedy of the anti-commons. These private arrangements are also useful for addressing the increasing demand for interoperability and common standards that is expressed in these sectors. However, this private response might be excessive. One observes indeed that many firms are acquiring large numbers of patents for purely defensive reasons (i.e., the only objective is to keep the threats stemming from other firms’ patents at bay). The global situation looks thus like a prisoners’ dilemma, where the equilibrium is such that all firms file a large number of patents (following a “balance of power” argument), but would be better off if they could commit to file fewer patents.

3.5. Do stronger patents induce more innovation?

In the introduction to this section, we also raised two other questions. The question labeled Q2 concerns the relationships between the trends
described in Subsection 3.2; in particular, does the strengthening of IP protection explain the huge increase in patent counts, and does this higher patenting activity explain in turn the increase in innovation? The question labeled Q3 extends Q2 and asks whether IP is the least-cost means to increase innovation and, thereby, economic growth. The U.S. position on IP rights (and, to a large extent, the European position as well) assumes that the answer to both questions is “yes!”: it is believed that the additional innovation induced by stronger patent systems is substantial and that strengthening of IP rights at home and abroad is beneficial. However, the empirical evidence supporting these beliefs ranges from sketchy to nonexistent. Let us examine the two questions in turn.

Regarding the first part of Q2, one of the rare attempts to tests firms’ responses to the strengthening of a preexisting patent regime is Sakakibara and Branstetter (2001). To examine whether stronger patents induce more innovative effort, they analyze the response to the 1988 Japanese patent reforms, which expanded patent scope. They find no evidence of a statistically or economically significant increase in either R&D spending or innovative output that could plausibly be attributed to these reforms. The empirical evidence suggests that the responsiveness to changes in patent scope is limited. Two more recent papers confirm this conclusion. Lerner (2002) analyzes the impact of major patent policy shifts in sixty nations over the past 150 years that enhanced the amount of patent protection provided. An examination of 177 policy changes reveals that strengthening patent protection appears to have few positive effects on patent applications by entities in the country undertaking the policy change (whether filings in Great Britain or the nation making the policy change are considered). Gallini (2002) surveys recent theoretical and empirical research and concludes that the case for stronger patents as a spur to innovation is a weak one; however, she mitigates this conclusion by noting that evidence that stronger patents encourage disclosure and technology transfer is persuasive.

As far as the second part of Q2 is concerned, empirical studies reveal that the increase in patents (innovative output) goes along with an increase
in spending on R&D (innovative input). As a rule of thumb, one can say
that technological firms file on average almost two patents for every $1m
they spend on R&D. Yet, in IT industry, it is worrying that the growth
in the number of patents exceeds the increase in R&D expenditure.\textsuperscript{22}

To address this issue further, we can refer to our previous discussion
concerning the patent paradox and ask whether the proliferation of
patents impedes or speeds up innovation. Again, the evidence is mixed.
On the one hand, the proliferation of patents may be seen as an encum-
brance to businesses. When innovations are complementary, the patent
system creates what Shapiro (2001) calls a \textit{patent thicket}: “an overlapping
set of patent rights requiring that those seeking to commercialize new
technology obtain licenses from multiple patentees.” The fear is that,
because it is costly for firms to ‘hack their way’ through this dense thicket,
stronger patent rights can have the perverse effect of stifling, not encour-
aging, innovation. Even if cross-licensing and patent pools alleviate this
problem, they create important transaction costs. On the other hand,
stronger and more numerous patents might also solve the appropriability
problem of innovation by creating a real “market for technology.” The
way these two opposite forces balance each other largely remains an unre-
solved issue. However, this lack of empirical evidence does not prevent
some managers from forming their own clear opinion; for instance, a sen-
ior official at Sun Microsystems declared the following to \textit{The Economist}
(October 20, 2005):

There is certainly a level of mutually assured destruction among the
big companies. If you build up your patent portfolio, I build up mine—
nukes pointing at each other. [...] That has exactly the right outcome.
We sit here and exchange patents with each other. Ultimately, that’s
great: you have a set of companies doing more innovation than they
would have otherwise.

Finally, regarding Q3, the empirical evidence is even scarcer, which is
largely due to the difficulty of constructing counterfactual cases to study.
We are thus left with the theoretical analyses that seek to compare the relative merits of the patent system, compared to a system of lump-sum transfers from consumers to inventors, or to government provision of R&D.23

4. Conclusion

In this note, we aimed at evaluating the effectiveness of the patent system for fostering innovative behavior. We first developed the microeconomic reasoning underlying the legal protection of intellectual property and then tried to assess whether this legal protection does indeed fulfill its mission. Because of the difficulty of measuring innovative output and of extracting meaningful information from patent indicators, we have not been able to propose any conclusive answer to this fundamental issue. At best, we have put forward a number of partial elements of answer.

What can we conclude from this survey? First, it appears that the case for strengthening patent protection (as advocated by the strong IP lobbies in the US and in Europe) as a spur to innovation is a very weak one. Theoretical and empirical research tends to show that the reforms undertaken since the 1980s have pushed the IP system towards overprotection, which is unfavorable to innovation. Second, we can report that in complex industries such as IT, telecoms and biotech, patents are now also used as a trading or bargaining device; whether these strategies based on patent portfolios are conducive to more or less innovation remains an open issue. Third, in the absence of sound counterfactual analyses, it is impossible to assess whether other public responses to the appropriability problem provide less costly means to increase innovation. Therefore, even if the effectiveness of the patent system can be questioned, we do not have any convincing theoretical or empirical argument for discarding the patent system altogether.24
It is striking to note the parallel between the previous conclusions and what economists declared fifty years ago:

If national patent laws did not exist, it would be difficult to make a conclusive case for introducing them; but the fact that they do exist shifts the burden of proof and it is equally difficult to make a really conclusive case for abolishing them (Penrose, 1951).

No economist, on the basis of present knowledge, could possibly state with certainty that the patent system, as it now operates, confers a net benefit or net loss upon society [...] If we did not have a patent system, it would be irresponsible [...] to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it” (Machlup 1958, quoted by Lévêque and Ménière 2005).

Even though a completely new body of empirical and theoretical knowledge has emerged since then, we are still unable to revise Penrose’s and Machlup’s views. We are, however, able to refine the evaluation, as recent economic analysis has brought to light previously unsuspected costs and benefits of the patent system. Among these costs are the ones linked to the administration of the system. So, rather than questioning the raison d’être of patents, today’s economists propose ways of correcting their shortcomings. For instance, a proposed measure is to remove the factors that encourage patent offices to lower their guard and approve applications carelessly; a corollary measure would be to enlarge the staff of patent offices in order to maintain (or improve) the quality standards of the examination process.25 These considerations belong to the “political economics of patents,” which goes beyond the scope of this note.26 We just indicate that for the effectiveness of patents to be properly assessed, more (theoretical and, mainly, empirical) research is needed along these lines.
REFERENCES


NOTES

1. The main references for this section are Geroski (1995), Lévêque and Ménière (2004), and Scotchmer (2004).

2. “Under trade secret law, an inventor need merely take reasonable steps to maintain secrecy in order to obtain strong remedies against individuals within the laboratory or commercial enterprise and those subject to contractual limitations who misappropriate proprietary information” (Menell and Scotchmer 2005).

3. On the other hand, cooperative ventures are likely to be subject to contractual hazards (opportunistic behavior, free-riding, difficulties about sharing the results, etc).

4. Six hundred managers were surveyed by economists at Carnegie Mellon and Yale.


6. For instance, the Patent and Trademark (Bayh-Dole) Act of 1980 allows universities and other nonprofit organizations to patent discoveries made in their laboratories. Also, the Court of Appeals for the Federal Circuit was established in 1982 to harmonize patent law nationwide, which had the effect of strengthening patent protection.

7. See Lévêque and Ménière (2004, 47-48) for a compared analysis of U.S. and European stands concerning the patentability of these inventions.

8. TRIPS stands for Trade-Related aspects of Intellectual Property rights.

9. According to OECD (2004), “more than 109,609 patent applications were filed at the European Patent Office (EPO), and 179,658 patents granted by the US Patent and Trademark Office (USPTO) in 2000, compared with 60,104 and 107,039, respectively, in 1991. [...] Between
1991 and 2000, biotechnology and ICT patent applications to the European Patent Office (EPO) increased by 10.9% and 9.5% respectively, compared to 6.9% for all EPO patent applications.\

10. Measured in millions of 1996 dollars, R&D spending was just below $100,000 in 1971 and just above $250,000 in 2001. See Scotchmer (2005, 272), who quotes data from the National Science Board.\

11. See OECD (2004).\

12. For detailed studies of these differences, see, e.g., Pavitt (1988), Griliches (1989), Hall, Jaffe and Trajtenberg (2002), Lanjouw and Schankerman (2004).\

13. Harhoff et al. (1999) discuss different methods of valuing patent rights based on these different counterfactuals.\

14. However as for innovations, as pointed out by Jaffe and Trajtenberg (2002), not all citations have the same value.\

15. For instance, Gambardella, Harhoff and Verspagen (2005) ask the following question: “What is your best guess of the minimum price at which the owner of the patent would sell the patent right to an independent party on the day in which the patent was granted?”\

16. Hall and Ziedonis (2001) interviewed industry representatives and observed (during 1979-1995) that (i) firms did not rely heavily on patents to appropriate returns to R&D, but (ii) their propensity to patent has risen dramatically since the mid-1980s.\

17. A recent survey published in The Economist (October 20, 2005) report the following facts: IBM now earns over $1 billion annually from its IP portfolio; HP’s revenue from licensing has quadrupled in less than three years, to over $200m this year; Microsoft is on course to file 3,000 patents this year, when in 1990 it received a mere five; 54% of companies saw growth in licensing of 10-50% between 2000 and 2002; almost 75% of executives say they expect to buy as well as sell more licences over the next two to five years, and 43% expect a dramatic increase in their licensing revenue (according to a survey by McKinsey).\

18. For instance, the invention of the laser lead to surgical applications, spectroscopy, etc.\

19. Think of firms in the electronic industry (e.g., trying to produce new peripherals to be coupled with personal computers or video game consoles) or in the biotech industry (e.g., combining patented genes to bioengineer a new crop seed).\

20. A recent example of a patent pool is the MPEG-2 video compression technology. Nine companies have pooled their patents to permit one-stop shopping for makers of televisions, digital video disks and players, and telecommunications equipment as well as cable, satellite, and broadcast television services. Shapiro (2001) reports that broad cross licenses are the norm in markets for the design and manufacture of microprocessors.\

21. Some other studies focus on understanding the impact of isolated patent-policy reforms: Kortum and Lerner (1998) and Hall and Ziedonis (2001) examine the effects of the establishment of the Court of Appeals for the Federal Circuit in the United States; Lanjouw (1998) and Scherer and Weisburst (1995) analyze how the strengthening of patent protection on pharmaceuticals has affected, respectively, India and Italy. In general, these studies conclude that enhancing patent protection does not significantly spur innovative behavior.\

22. This finding could be attributed to an excessive generosity by patent offices and courts toward patent filers and owners. Such attitude can indeed encourage firms to seek IP rights for the economic power they confer, independently of their R&D efforts.
23. For more on this issue, see for instance Shavell and van Ypersele (2001).

24. It must be recalled that patents also serve other purposes apart from the incentive role that we examined in this note: patents (and licenses) facilitate technology trade; they are used as a signalling mechanism (for shareholders, banks, venture capitalists, competitors, etc.); through the disclosure requirement, they contribute to social welfare by promoting the diffusion of knowledge. These other aspects also have to be taken into account when assessing the efficiency of the patent system as a policy instrument.

25. As indicated in Subsection 3.2, the number of patent applications processed by the EPO has more than doubled since 1995 to over 160,000 in 2003. As a result, the mean number of hours spent examining each patent claim dropped from 23.8 hours in 1992 to 11.8 hours in 2001, the last year for which figures are available.

26. For an instructive economic analysis of topical policy issues in the debate surrounding patents, see Encaoua, Guellec and Martinez (2005).