WHAT KIND OF INTELLECTUAL PROPFRTY REGIME IS MORE FAVORABLE TO INNOVATION: WITH OR WITHOUT A PATENT?

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Abstract: *Theoretically, the introduction of a patent system serves two purposes: to encourage firms to produce new knowledge and to disseminate information. However, economic practice has highlighted the dilemma between protection and diffusion. In addition, there has been criticism that patents constitute a handicap to research that would result from them and therefore hinder technological progress. Thus, some economists emphasize the preference of secrecy over the patent. Others go even further in criticizing the protection of intellectual property rights and propose the removal of such rights by promoting a world without patents. In this article we will analyze some ideas that do not see the patent as the most effective way to ensure protection, in exchange for a dissemination of knowledge. The authors who defend this position raise the questions: Patents an incentive or brake to innovation? The patent: is it not an unjustifiable property right?*

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INTRODUCTION

Theoretically, the introduction of a patent system serves two purposes: to encourage firms to produce new knowledge and to disseminate information. However, economic practice has highlighted the dilemma between protection and diffusion. Despite a broad consensus that the patent is essential to spur innovation, there is no consensus on the optimal level of protection across the three dimensions of patents. In addition, there has been criticism that patents constitute a handicap to research that would result from them and therefore hinder technological progress.

Encaoua et al. (2006) drew three major implications for current policy debates on the patent. First, patents may not be the most appropriate way to protect inventors in order to recover R&D investment costs when imitation is expensive. Second, patentability requirements, such as novelty or non-obviousness, should be sufficiently stringent to avoid patents for inventions of low social value that increase the social cost of the patent system. Third, arbitration between patent characteristics (length, breadth and height) could be used to provide sufficient incentives for inventions with high social value. Beyond these three implications, economic theory also argues for an approach to the design of the patent mechanism, where an optimal patent system could be based on a range of degrees of patent protection, with enhanced protection corresponding to stricter rights.

Contrary to the traditional view of economic analysis which considers the patent as the most appropriate tool to guarantee protection, in exchange for information dissemination, Anton and Yao (2004), Kultti, Takalo and Toikka (2005), Boldrin and Levine (2008), Henry and Ponce (2011) and Henry and Ruiz-Aliseda (2016) emphasize the companies' preference for secrecy over patents. Stiglitz (2008) argues that what motivates people to engage in research projects is not really reflected in the intellectual property regime. Some other economists, including Boldrin and Levine (2002, 2005, 2008, 2011), Henry and Ponce (2011) and Picron (2017), go even further in criticizing the protection of intellectual property rights and propose the removal of such rights by promoting a world without patents.

Thus, we question the place of the patent in the economic analysis. The questions we ask ourselves: ***What kind of intellectual property regime is more favorable to innovation: with or without a patent? Is the patent an unjustifiable property right?***

1. THE PATENT PROMOTE INNOVATION FOR THE BENEFIT OF GROWTH

Patent policy aims not only to protect industrial property, but also to create incentives for innovation and thus encourage companies to invest more in research and development. This policy should not consider excessive protection and constitute a barrier to the dissemination of knowledge. Indeed, by privatizing the knowledge of innovations, excessive protection is an obstacle to the dissemination of new ideas and a barrier to entry. This could therefore slow

down innovation in the long term.

The choice of a patent policy is faced with a great dilemma between the need for protection of inventions by a patent system on the one hand, and the need for dissemination of knowledge which requires an optimal patent policy that does not the monopoly. How to create sufficient incentives for innovations without hindering their diffusion?

The introduction of a patent policy has a dual purpose: to protect innovators in order to encourage them to produce new knowledge and disseminate information. These two objectives are contradictory. Balance is tricky to find. This raises the question of the optimal level of patent protection.

Several patent policies are conceivable according to the three characteristics of legal protection (length, breadth, height). The study of the role of patent policy on growth involves the analysis of the different methods, two types of work having apprehended these three dimensions of the patent.

1.1. New theories of growth

New theories of growth or endogenous growth have generally represented the patent in a rather abstract way. The literature on endogenous growth based on innovation shows two main families of models: the first brings together models of horizontal differentiation where innovation increases the range of intermediate products used in the production of the final good. The second groups vertical differentiation models where new innovations replace old ones. It relates to the quality of the products; that is, higher quality products replace substandard products. Some models of endogenous growth represented innovation in these two demerits: vertical differentiation and horizontal differentiation.

The expansion model of the number of Romer varieties (1990) is based on the assumption of knowledge dissemination by the patent office. Technical progress is determined by the effect of research and development activity generated by companies and protected by a patent of infinite duration.

Such modeling of an infinite length of protection does not allow the patent (and its characteristics) to be considered as an instrument of economic policy.

For example, Grossman and Helpman (1991) considered that the hypothesis of an infinite patent life is equivalent to the independence between knowledge and the life of patents.

Michel and Nyssen (1998) introduced a limited patent life as part of a variety model at Grossman and Helpman (1991).

The work of Grossman and Helpman (1991) and Aghion and Howitt (1992) gave rise to a category of models that incorporate a qualitative representation of innovation. This category of so-called "creative destruction" models has its origins in work on the patent race.

In the context of both horizontal and vertical differentiation of products, Caballero and Jaffe (1993) have developed a model that constitutes a significant both theoretical and empirical contribution to establishing the patent length as a tool for innovation. policy for innovation and growth. These authors have shown that the patent system can play an important role in disseminating new ideas; where the information contained in patents ensures the rapid access of researchers to new knowledge.

All these models have focused the analysis on the length of the patent as the only instrument of public policy. But lifespan is not the only way proposed by the endogenous growth literature. An important part of this literature is devoted to determining the optimal arbitration between the length and scope of the patent: the arbitration between length and breadth, the arbitration between length and height and the arbitration between length, breadth and height. According to these types of models, a decrease in the length of the patent can be offset by an increase in the legal scope. Hence the introduction of the possibility of substitutability (arbitrage) between the three dimensions of the patent.

In order to determine an optimal combination of patent length and breadth, Segerstrom (1991) considered that economic growth is fueled by both innovation and imitation. He introduced imitation as an alternative to innovation and integrates it into the research sector. In this model, the patent system makes it possible to remunerate innovation and then imitation through a

license agreement between the innovator and the imitator.

In the framework of an endogenous growth model at Grossman and Helpman (1991), Li (2000) and (2001) addressed, successively, the question of arbitration between the length and the height of the patent then the arbitration between length, breadth and height. He developed his model (variety / quality) by introducing the concept of the license agreement.

1.2. Microeconomic or industrial economy models

Microeconomic models or industrial economics, represented the patent in a rather rich and detailed way. These models provided important models of innovation at the microeconomic level; such as horizontal differentiation since Hotelling (1929) and vertical differentiation since Chamberlin (1933).

The main formalizations of the lifetime or length of the patent have been proposed by Nordhaus (1969) and Scherer (1972). Nordhaus (1969) has studied the question of choosing an optimal level of protection conferred by the patent over time in terms of economic policy. The life of the patent is considered an exogenous factor. Nordhaus's (1969) model is static and does not assess the dynamic efficiency of a patent system.

Other works consider that the length of the patent can be flexible (is not exogenous). The modular aspect of the life of the patent is introduced thanks to the notion of renewal. In fact, innovators must pay a renewal fee to maintain their patents. Thus, the renewal determines the effective life of the patent.

The question of arbitration between the length and the breadth of the patent was the subject of the models of Gilbert and Shapiro (1990), Klemperer (1990) and Gallini (1992).

Gilbert and Shapiro (1990) discussed arguments to prove that the patent can be a policy instrument to reward innovations. They have provided the conditions under which the optimal policy of an infinite lifetime patent with a breadth adjustment allows the reward required for innovation. However, these rewards require the creation of market power, which causes some loss of well-being. Hence, the origin of the debate on patent policy which consists of studying

the arbitration between the dynamic efficiency and the static inefficiency attached to the patent.

Klemperer (1990) discussed the possibility of minimizing all losses resulting from the introduction of patent protection by playing on the duration- breadth combination of the patent.

By focusing on the optimal patent policy in the presence of costly imitation possibilities, Gallini (1992) has modeled the incentive to imitate according to the life of the patent.

The issue of arbitration between the length and the height of the patent has been the subject of several works:

Matutes, Regibeau and Rockett (1996) defined the scope of patents by the number of different applications protected by the same patent. They focus on protecting fundamental innovations.

Manna (1992) presented a model in which height is implicitly represented by a minimum level of patentability that refers to a minimum investment in research and development necessary for an invention to be patentable by the patent office. Patent design is considered in this model as a two-player game (a leader and a follower) in which the patent office sets, in an endogenous way, the rules of the game.

The Hunt model (1999) aims to show that the novelty requirement can be used as an instrument of economic policy.

O'Donoghue, Scotchmer and Thisse (1998) discussed the possibility of arbitration between the length, breadth and height of the patent. They considered that a priori determination of the optimal life of a patent without taking into account its breadth and height characteristics leads to false results. In this model the characteristic breadth is modeled in such a way that the statutory life coincides with the effective life.

To date, we have developed work that considers the patent as the most appropriate tool for technology transfer and investment incentive in R&D. In the following sections we will analyze some ideas that do not see the patent as the most effective way to ensure protection, in exchange for a dissemination of knowledge.

2. THE INDUSTRIAL SECRET AN ALTERNATIVE TO THEPATENT TO PROTECT AN INNAVATION

The standard economic literature on intellectual property has long neglected the issue of the decision to patent or keep the secret. Indeed, we find that in patent racing models, innovation necessarily leads to obtaining a patent. Some studies examine the trade-off between secrecy and intellectual property protection when there are several competitors in a market (Anton and Yao (2004), Kultti, Takalo and Toikka (2005), Boldrin and Levine (2008), Henry and Ponce (2011) and Henry and Ruiz-Aliseda (2016)).

2.1. The model of Anton and Yao (2004)

Anton and Yao (2004) model patent protection, while considering several sources of uncertainty and costs (monitoring costs and uncertainty about the outcome of the legal action). Their model provides the opportunity to distinguish between the decision to patent on the one hand and the voluntary distribution of non-patented information on the other. The secret takes here the status of a protected decision that can be less risky than the patent. However, in Anton and Yao (1994), the model avoids the possibility of patent protection and assumes that companies cannot observe the quality of the invention ex ante. In a context characterized by incomplete information, this model shows how an inventor can make gains without resorting to patent protection.

The counterpart of granting patent protection is the disclosure of all the information needed to fully replicate the innovation. However, the dissemination of information facilitates the imitation of this innovation; and only the protection granted, enforced by legal action, and prevents imitation. Anton and Yao (2004) take into account the uncertainty of this protection and the certainty of patenting costs. The model therefore incorporates three essential characteristics in this context: innovation creates asymmetrical information, innovation often has only limited legal protection, and disclosure facilitates imitation. The question then is: how should an innovator manage its intellectual property when confronted with limited intellectual property rights and possible imitation? The result is an arbitration. Arbitration between what must remain secret and what must be disclosed (with and without legal protection).

Whereas Scotchmer and Green (1990) and Gallini (1992) treat the decision to patent or not as a binary choice in which the information is fully disclosed and there are no incomplete information problems; Anton and Yao (2004) review imitation patenting, disclosure and infringement decisions based on incomplete information. Assuming that the disclosure provides competitors with usable information and focuses on the innovator's decision regarding the amount of innovation to disclose, their model is particularly relevant to a particular type of secrecy effectiveness. Indeed, by choosing the part of the information to be disseminated, the innovator directly and effectively controls the behaviors of the potential imitator.

Anton and Yao (2004) find that the amount of information disclosed on an innovation is a decreasing function in relation to the importance of this innovation. They show the existence of a balance: with total patent protection in the case of a small innovation; with partial protection for a medium-sized and unprotected innovation but with partial disclosure of information in the case of major innovation.

In a more recent article, Anton and Yao (2005) introduced in their analyzes the "lost" profits of the patentee, defined as the profits that would have been made in the absence of counterfeiting. They show that in equilibrium, counterfeiting can take two forms: a "passive" form in which the lost profits of the patentee are null and an "aggressive" form where they are positive. Anton, Greene and Yao (2006) show that weak patents have strong implications for competitive behavior. Thus, while further encouraging secrecy to protect innovation; weak patents create key economic decisions about the conditions of private information.

Anton and Yao (2008) examine the sale of intellectual property between a seller (S) and two potential buyers (A and B). All parties are risk-neutral and seek to maximize expected payoffs. The model has five steps. In the first stage, the seller makes a private draw of the innovation and then publicly indicates whether the right to bring an expropriation action is maintained or removed. In the second step, after observing this choice of protection, each buyer decides whether or not to participate in the auction. In the third step, the seller makes a first disclosure to any buyer participating in the auction. Then, the buyers choose the possible contractual offers to be made to the seller; the seller decides whether or not to accept an offer and disclose any

previously undisclosed knowledge. Finally, uncertainty is resolved, market results are achieved and contracts are enforced.

2.2. The model of Encaoua and Lefouili (2010)

In a study on the strategic choice of an innovative company, Encaoua and Lefouili (2010) develop a model close to Anton and Yao (2004). They modeled the possibility of patenting innovation or keeping the secret, in order to answer the question: under what conditions a patent is preferable to the trade secret for a process innovation. This model assumes that:

- the size of process innovation, measured by cost reduction, is directly observable;
- a patent reveals technological information that lowers the cost of imitation compared to the situation in which the innovation is kept secret.

They consider that the choice of patenting can expose the innovator to a higher level of imitation or a lower level, because the level of imitation does not only depend on the cost of imitation, but also two other crucial parameters: the size of the innovation and the strength of the patent.

The results show that for a given innovation size, the strength of the patent and the relative cost of imitation generally act as strategic substitutes. An increase in one of these parameters must be offset by a decrease in the other in order to maintain the same value of the innovator's profit. Larger innovations are the most likely to be kept secret while smaller ones are still subject to patent protection. For intermediate-sized innovations, they are only patented if the probability of invalidation is sufficiently low.

3. A WORLD WITHOUT INTELLECTUAL PROPERTY

In recent years, some economists have advanced the idea of a pure and simple abolition of intellectual property rights with a transitional period. The work of Henry and Ponce (2011) suggests that the traditional justification of patent protection is nullified when considering the trade in knowledge. They have shown that the introduction of a knowledge market fundamentally affects the traditional view of the need for patent protection. Boldrin and Levine

(2002, 2005, 2008, 2011) have also shown that there are sources of income for inventors even in the absence of patent protection.

3.1. The model of Henry and Ponce (2011)

Henry and Ponce (2011) analyze the problem of an inventor who brings to the market an innovation that can be legally copied. The model gives imitators the opportunity to "enter" the market by copying the innovation at a cost or by purchasing from the inventor the knowledge required to reproduce and use the invention.

This work aims to answer the question of Gallini and Scotchmer (2001): are there natural market forces that protect inventors without having to resort to formal protections? They provide the theoretical underpinnings of a natural, intuitive and market-based mechanism that generates substantial rents for inventors in the absence of patent protection. They identify a natural market force based on the dynamic trading of knowledge.

The main results that emerge from Henry and Ponce (2011) show that in equilibrium, potential imitators will obtain innovation by buying knowledge rather than spending duplicate resources on imitation. Also, the inventor chooses optimally to sell knowledge through contracts that allow for subsequent resale by buyers. Thus, the first buyer will compete with the inventor to sell his acquired knowledge to the remaining imitators. Therefore imitators prefer to delay their entry hoping that some of their competitors will trade with the inventor before them, which may lead to a future decline in the price of knowledge. Temporarily, the inventor becomes a monopoly and could receive a reward arbitrarily close to monopolistic profits, even for relatively low imitation costs.

3.2. The model of Boldrin and Levine (2008)

According to Boldrin and Levine, «intellectual property is a propaganda term» used by proponents of copyrights and patents to promote the idea that government-imposed monopolies on ideas and parts of ideas share the same effects beneficial to the property.

In analyzing 24 studies that examined whether the introduction or strengthening of patent protection led to greater innovation, Boldrin and Levine (2008) found that these studies almost

do not find evidence that stronger patent regimes support innovation. They find evidence that strengthening the patent system increases patents! They also noted that in countries where IP regimes are initially weak, the strengthening of IP increases foreign investment flows in areas where patients are frequently used. They also found that in new industries such as biotechnology and software, where innovation thrived in the absence of patents, patents were introduced. This raises the question: has this led to an explosion of innovation? They stated that no economist was able to find a corresponding increase in overall productivity.

In a more recent work, Boldrin and Levine (2011) addressed the question: What kind of intellectual property regime is more favorable to innovation: with or without a patent? Economic theory is incapable of answering this question, because the arguments put forward do not seem instrumental; they can be made for and against patents. For this purpose, these authors reviewed the empirical evidence collected by other researchers and added new evidence. They concluded that the empirical evidence suggests that patents do not promote innovation, but rather delay it. Indeed, there is no objective reason to strengthen patents more than we have already done. They even stressed that it seems urgent to start slowly but surely reforming the entire intellectual property system.

CONCLUSIONS AND DISCUSSION

We discussed how to determine the optimal level of protection across the three dimensions of the patent. While the representation of patent characteristics by microeconomic models is very rich and detailed, innovation-based growth models that have examined with precision how growth can vary with the system of industrial protection are few. The representation of three dimensions of the patent, by these latter models is rather abstract. It should be noted that in most of these models, patents are only indirectly considered.

We have focused our analysis on whether economic theory allows us to draw useful conclusions for what might be an optimal patent policy. Our goal is to extract lessons from modern economic theory on how patent policy can foster the innovation process and affect growth.

Some important conclusions could be drawn from this work:

Concerning the main question raised by this study: What kind of intellectual property regime is more favorable to innovation: with or without a patent? Economic theory is incapable of answering this question because the arguments put forward do not seem instrumental; they can be made for and against patents.

Indeed, through the investigation of the economic literature that defends the protection of intellectual property, we find that there is no consensus on the optimal level of protection across the three dimensions of patents. Economic arguments are often highly dependent on the particular characteristics of each model. However, we emphasize that there is, to a large extent, a consensus on a main idea: patent, through the application of these characteristics, can constitute a political instrument in favor of innovation and growth. It is only in recent years that we have been confronted with a body of work that sees the existence of intellectual property rights as unjustifiable. Some of these models even advance the idea of outright suppression of intellectual property rights. It is not strange that this idea can be present in several news articles.

Antoine Picron (2017) in an article « Reforming patents to unlock innovation" discussed the rise of troll patents and the obstacle to competition. He suggested that "society pays a high price for an incentive that gives the inventor little incentive to invent. If they want to release innovation, the public authorities have no choice but to rethink patents in order to adapt them to the changes in the economy of the 21st century ».

For his part Thibault Schrepel (2014), PhD in international competition law, raised the question: patents: a necessary evil? He spoke of a central question: Are patents an incentive or an obstacle to innovation? Hence, the question: is the existence of patents anyway justifiable? He proposed reforming the current system of incentives for innovation by following progressive steps conditioned by the success of the previous ones. The first step is to conduct a comparative study covering different countries, their patent protection system and compare the state of innovation. The aim is to seek to establish a link between the existence of patents and technological advances. In the second stage, a reduction in the length of patents could be considered. Then, it is essential that the patent length is variable. In a fourth step, it is necessary to create a new

evaluation criterion when granting patents. Finally, according to the results obtained in the four previous steps, it would be possible to envisage a total suppression of patents.

In addition, Stiglitz (2008), winner of the Nobel Prize in Economics in 2001, our innovation system is based on the fundamentals of basic research, and most basic research is carried out in universities and government-sponsored research laboratories. . These researchers are motivated only to a small extent by monetary remuneration. For example, the author concluded that what motivates people to engage in research projects is not really reflected in the intellectual property regime. For him, the question of how we motivate research, as well as the question of how we fund it, needs to be addressed. He suggests that research funding through monopolistic profits may not be the most efficient and equitable way to do it. Stiglitz recognizes the importance of intellectual property rights, but considers that this importance has been exaggerated because they are only part of our innovation system. He noted that intellectual property rights should be considered as part of a portfolio of instruments. Thus, we must strengthen the other elements of this portfolio and redefine our intellectual property regime in order to increase its benefits and reduce its disadvantages. He thinks that this will increase the efficiency of our economy and, most likely, promote innovation.

In a more recent article, Stiglits (2013) noted that intellectual property rights advocates have overemphasized their role in promoting innovation. While most of the key innovations (basic ideas behind the computer, transistors, lasers, DNA discovery) were not profit-driven. But they were motivated by the quest for knowledge. He says resources must be available. But according to him, the patent system is only one way, and often not the best, by providing these resources. Government-funded research, foundations and the price system are alternatives, with major benefits and without the disadvantages of the growing inequality of the current system of intellectual property rights.

Comparing "intellectual property" with physical property David Madore (2002) argues that so-called "intellectual property" is not a natural right. For him the right of "intellectual property", seems to have for the sole purpose to protect the investments of the lobbies which contributed to its perpetual consolidation.

This overview of the economic theory of patents has enabled us to emphasize that the way in which a patent policy can be implemented effectively remains to be studied with particular attention. Enhancing the effectiveness of patents as a public policy instrument to promote innovation and promote economic growth is a key element of the study's further development through the input of decision-makers and specialized institutions.

In conclusion, we believe that we are not only dealing with patent protection as such, but also the effectiveness of the industrial property protection regime in terms of incentives, dissemination and development. Innovation has been a key driver of economic growth and one of the most important factors we are counting on to promote this innovation is the creation and implementation of an optimal patent system. The mission of such a system is to promote innovation and encourage economic growth. By offering monopoly rights for a limited period in space and time, an inventor can recover the costs of R&D investments. This system, through the publication of patent applications and granted patents, is likely to disseminate the new knowledge to the public. However, the effectiveness of an industrial property system depends largely on the particular circumstances in each country. The establishment of a patent system in accordance with an effective national strategy based on the requirements and priorities of each country can promote development and combat poverty. A patent office should be an agent responsible for aspects of innovation policy.

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