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Knowledge disclosure as intellectual property rights protection

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ABSTRACT

We consider the problem of an inventor who discloses knowledge under the threat of a rival who may patent a competing idea. Disclosure diminishes the probability that the rival has of receiving a patent (legal externality) but it also decreases the rival's marginal R&D cost (knowledge externality). Our results reveal that: (i) when the knowledge externality is 'large' ('small') relative to the legal one, an increase (decrease) in the patentability standard leads to higher disclosure and promotes R&D and (ii) if subsequent research creates positive external effects, the patentability standard should be set to promote further disclosure and R&D in equilibrium. The impact on the equilibrium configuration of changes in market profits is also examined.

1. Introduction

The knowledge that first inventors disclose in patents is difficult to protect. Future inventors may use it to obtain superior non-infringing innovations which may end up undermining the market position of the original inventor. This is likely the crucial reason for an important majority of patents being obscure and difficult to read despite the formal enablement requirement of patent law (Scotchmer, 2004). Similarly, inventors, to avoid disclosure and imitation, use secrecy. In this manner, they protect their superior market position.[1] However, the 'secret' may be independently rediscovered by a second research firm. Furthermore, at least in the U.S., if the research firm that rediscovers the 'secret' obtained a valid patent, it would have the right to exclude the prior inventor from using the secret innovation.[2]

As these disclosure problems suggest, inventors anticipate that disclosure reveals knowledge that rivals may use to obtain better products which later might be protected by patents. Thus they may be reluctant to disclose. However, they also foresee that rivals invest in R&D to obtain their own inventions. Hence, the competitive *t* hreat of future inventions drives them to

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[1] Secrecy has gained prominence is several U.S. industries (Cohen et al. (2000); Lerner (2000)) especially among smaller firms. For these firms, the costs of enforcing patent rights are significant Lanjouw and Schankerman's, 2001.

[2] See Denicolo and Franzoni (2004) for the first inventor defense.

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disclose knowledge to diminish the chances that a rival has of patenting a competing innovation. The idea is simple. Since *future* patents are evaluated in the light of prior art, first inventors, by disclosing and creating new prior art, make it more difficult for second inventors to obtain patent rights on related inventions.[3,4]

We focus here on the strategic determination of disclosure when inventors are confronted with that trade-off. We examine the optimal R&D response of a rival to disclosure and the repercussion that changes in patent policy and market profits have on the equilibrium configuration of disclosure and R&D. Our ideas are organized around the premise that when the rival succeeds in R&D, the inventor strictly prefers that the rival fails to obtain a patent, while the rival has opposite preferences. Within this setup, we address questions like the following ones: (i) is decreasing the patentability standard a good policy to encourage disclosure and to boost R&D? More generally: how does the patentability standard relate to welfare? and (ii) how do disclosure and R&D depend on the market premium for technological leadership?

Three features specific to our model are shown to underpin the conclusions. First: disclosure reveals useful knowledge for R&D. This is captured by assuming that disclosure decreases the rival's marginal cost of achieving any probability of success in its R&D activity. This *knowledge externality* encourages R&D. Second: disclosure creates prior art and thus it diminishes the probability that the rival has of receiving a patent.[5] This *l* egal externality discourages R&D. The net impact of disclosure on R&D is called the *transfer effect*. We focus on the case in which this effect is positive and thus the rival's best response R&D probability increases with disclosure. Third and last: the marginal benefit of disclosing increases with the level of the R&D probability. This is called the *threat effect*. Intuitively, disclosure is used to prevent the rival from patenting a competing idea. But to receive a patent, the rival must first succeed in R&D. When the level of the R&D probability is higher, success and hence the threat of a patent becomes a more likely event. Thus the marginal value of disclosing rises.

To answer our first question, observe how a lower patentability standard impacts the equilibrium configuration. When the patentability standard decreases, the marginal cost of disclosing increases since the rival's patenting probability is higher for any given disclosure level. However, a lower patentability standard also raises the marginal benefit of disclosing because the rival's R&D probability shifts upwards and thus—the *threat* of the rival's patent becomes a more likely event.

A clear taxonomy emerges. First, when the transfer effect is 'small' a decrease in the patentability standard generates a higher disclosure level and boosts R&D. Second, when the transfer effect is 'large', a decrease in the patentability standard generates a strategic withholding of knowledge. But then whether or not R&D is encouraged is not clear. For a fixed disclosure level, R&D rises as a result of a decrease in the patentability standard. But a lower patentability standard induces fewer disclosures, increasing the marginal R&D cost and thus discouraging R&D. The final outcome might be a reduction in R&D.

Welfare aspects are more complex. However, under some conditions, some suggestive insights are obtained. When subsequent R&D creates positive external effects, both the equilibrium R&D probability and the disclosure level are below the welfare-maximizing ones. Hence, a welfare-maximizing policy requires setting a patentability standard in order to correct these distortions. In our model, whether the patentability standard should decrease or not depends on the size of the transfer effect as the previous discussion suggests. When the transfer effect is 'small', the welfare-maximizing policy consists, under an additional sufficient condition, of decreasing the patentability standard to its 'minimum' level. However, when the transfer effect is 'large', the welfare-maximizing policy requires increasing the patentability standard to its 'maximal' feasible level.

These results contribute to clarifying some of the issues involved in the debate about the optimal patentability standard and patent quality. In some knowledge-based industries, particularly in Software, Semiconductors and Biotechnology, there are good reasons to believe that disclosure, innovation and R&D overall would be well promoted by increasing the patentability standard. In these sectors disclosure seems to be crucial for decreasing the future cost of incremental innovations while its influence on patentability is really low. There is extensive evidence that documents the 'low' quality of patents which most of the time do not meet the requirements for patentability, particularly in regard to prior art.[6]

Lastly, we discuss one more interesting result. When the rival fails in R&D, the most advanced innovation is the one used by the inventor. However, when the rival succeeds in R&D but fails to obtain a patent, both firms use the most advanced invention in the market. We define the *market premium* as the difference between the profits received by the inventor in the first and the second case. Suppose that there is an exogenous increase in the market premium: how would the equilibrium change?

The aim of this exercise is to find a regularity between the amount of secrecy, the intensity of R&D and the size of the premium for leadership. Interestingly, the answer depends on how strong the *linkage* between the market profit of the inventor and her rival's profit is. We show that for those industries in which the *t* ransfer effect is 'small', a relatively

[3] Prior art is all the public knowledge either in previous patents, manuscripts, printed publications, etc. that existed prior to the filing of a patent application.

[4] An example of disclosure in the public domain is that of Plantronics, a telephone headset manufacturer in California. The company developed a technology for reducing microphone noise. Since the invention could not be used immediately, the firm posted a 'description' of it on its web site. See 'Protecting Intellectual Property' The New York Times 02/18/2002, "Suddenly, 'Idea Wars' Take On a New Global Urgency"The New York Times 11/11/2002, 'On the Defensive About Invention' The Financial Times 09/19/2001.

[5] According to patent law, an invention deserves a patent only if it is a substantial advancement over the prior state of the art. In reality, patents are granted and then invalidated in private court disputes. The most frequent ground for invalidity is prior art (Allison and Lemley, 1998). For simplicity, no distinction is made between the process of obtaining a patent and the defense from challenges to their validity.

[6] Which seems to be dispersed in the public domain rather than in prior patents.