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How many patents does it take to signal innovation quality?☆

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ABSTRACT

In this paper, we offer a novel explanation to the surge in patenting observed during the last few years. When PTOs (Patent and Trademark Offices) award bad patents, not only do "false innovators" have the incentive to file applications but also, and more interestingly, "true innovators" are forced to patent more intensively in an attempt to signal their type. However, if they are liquidity constrained, true innovators may fail to separate and this fact reduces the incentives to exert effort in R&D. In addition, drawing on the signaling role of patents highlighted by the model, we investigate some of the proposals that have been put forward in order to mitigate the bad patent problem. We provide an intuitive condition under which a tightening of the patentability standards ("raising the bar") reduces the distortions caused by bad patents. Moreover, we show that introducing a two-tiered patent system is unlikely to improve market outcomes.

1. Introduction

During the last few years, a dramatic increase in patenting has been accompanied by a rise in the number of so-called "bad patents". As a matter of fact, PTOs (Patent and Trademark Offices) are increasingly granting patent protection to innovations that do not meet the novelty and/or the non-obviousness requirement, and that would not get through a careful examination of the patentability standards.[2]

Since the seminal paper by Farrell and Shapiro (2008), the literature has investigated the economic consequences of bad patents.[3] According to several commentators, the vast majority of bad patents cover useless technologies or products that no one will ever use and, as such, is economically irrelevant.[4] As a consequence, PTO examiners should not pay more attention to every application being filed but they should rather concentrate on the few patents that may represent a too heavy burden to future innovators. This argument is clearly summarized by the following quote taken from Lemley et al. (2005, page 12): "The problem, then, is not that the Patent Office issues a large number of bad patents. Rather, it is that the Patent Office issues a small but worrisome number of economically significant bad patents…". However, this view overlooks an important role that patents play. When some significant characteristic of the inventor is not observable, then patents might serve as a quality signal for third parties, such as potential investors or competitors (see Long, 2002 and Schankerman, 2013).

Several empirical studies demonstrate the growing importance of patents as signaling devices, especially for start-ups and, more generally, for SMEs. These companies have little or no track record, and therefore face more serious informational problems. For instance, Hsu and Ziedonis (2008) look at US semiconductor firms that received venture financing and show that having a large stock of patent applications increases both the likelihood of the company being financed by venture capitalists as well as the amount of financial aid received. By using their estimates, Gambardella (2013) calculates that the value of patents

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[2] The issue is particularly serious for the U.S. Patent and Trademark Office. Lemley and Sampat (2008) report that between 75% and 97% of patent applications filed in the U.S. is finally approved and, rather provocatively, they ask themselves whether the USPTO has become a rubber-stamp that grants patents to every application being filed.

[3] The role of licensing negotiations in mitigating the consequences of bad patents is investigated in Farrell and Shapiro (2008) and in Choi (2005). Caillaud and Duchene (2011), on the other hand, focus on the overload problem at the PTO and demonstrate the possible emergence of a "low R&D equilibrium". In such an equilibrium, firms invest little in R&D, they file many applications some of which based on bogus ideas, and the (overloaded) PTO grants bad patents with large probability.

[4] Lemley et al. (2005) report a series of curious patents awarded by the USPTO, such as patents "covering obvious inventions like a crustless peanut butter and jelly sandwich, ridiculous ideas like a method of exercising a cat with a laser pointer, and impossible concepts like traveling faster than the speed of light."

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as quality signals could be as high as US $ 1.2 million, though he suggests that 93 thousand is a more reasonable estimate. Similarly, the recent Berkeley Patent Survey shows that the top-ranked motivations to patent for technological start-ups are the increased chances of securing outside investment and the enhancement of the company's reputation, both suggesting that patenting occurs for signaling purposes (see Graham et al., 2010). Additional empirical evidence in favor of the signaling role of patents is provided by Mann (2005), Cockburn and MacGarview (2009), Häussler et al. (2009), Conti et al. (2013a), and by Greenberg (2013).[5]

Clearly, when the PTO issues a significant number of bad patents, the credibility of the information conveyed through the patenting process can be seriously undermined. When "true innovators" as well as "false innovators" get through the examination process at the PTO, patents become a noisy signal about the quality of the inventor/innovation.[6]

A couple of recent theoretical papers investigate the signaling role of patents when the screening of the PTO is of poor quality. Koenen and Peitz (2013) model an infinite horizon game in which, at each period of time, the firm generates a patentable idea. The two authors determine the conditions under which reputational concerns induce the firm to only apply for a patent when it has generated a true innovation (and therefore refrain from filing bad applications based on bogus ideas). Atal and Bar (2014) focus on one of the proposals for mitigating the bad patent problem suggested in the literature, namely the introduction of a two-tiered patent system where inventors are free to apply for a "gold-plated" patent (with higher fees and tighter PTO scrutiny but also offering stronger protection for the invention) or for a "regular" patent. Although, the authors show that introducing a second patent-tier reduces the incidence of bad patents, they also prove that economically more significant innovations do not necessarily end up in applications for gold-plated patents.

In this paper, we focus on a different mechanism true innovators might use in order to signal their type, namely the number of applications they file.[7] As a matter of fact, firms are often involved in various R&D projects and, therefore, they may file several patent applications. Moreover, there is no one-to-one correspondence between innovations and patents and a single new product or process may be covered by a series of patents, some of them applied possibly for some ancillary/secondary aspects of the innovation.[8]

In the following sections, we consider a start-up company with limited financial resources involved in a multi-stage innovation game in which patents just have a signaling role (they are used to signal whether the firm is a "true" or a "false" innovator). In the first stage, the firm observes the financial resources needed to complete the research project and chooses whether to make the investment. Should it choose to invest, the innovation is developed and the firm becomes a "true innovator"; if it does not, the innovation does not materialize and we say that the firm becomes a "false innovator". In the second stage, the firm decides how many patent applications to file. However, since the PTO does not screen applications perfectly, the false innovator also has an incentive to file applications. The maximum number of patents the firm can apply for is determined by the financial resources remaining after the investment decision. Hence, the assumption of limited financial resources implies that, even though a true innovator benefits most from signaling, the false innovator is endowed with a greater budget for patenting, as it did not invest during the previous stage. We show that as a result of the imperfections in the PTO examination process, true innovators increase the number of applications filed in an attempt to signal their type. However, if they are liquidity constrained at the patenting stage they are unable to separate from the false innovator; hence, they collect lower revenues. In turn, as we show in the Extensions section, the inability of the true innovators to signal their type reduces R&D incentives.

Our paper contributes to the recent literature addressing the growing concerns for the increasing numbers of patents that allegedly fail to meet the novelty or non-obviousness requirement and offers a new explanation to the recent surge in patenting. While the literature suggests that, especially in high-tech sectors, companies amass large patent portfolios in order to use them strategically during negotiations or even to preempt competitors,[9] we argue that the observed rise in patenting can also be explained by poor PTO screening coupled with the signaling role of patents.[10] In our model, the rise in patenting is not simply due to the rather obvious fact that the false innovator takes advantage of low PTO standards to file numerous applications. More interestingly, the increase may result from the fact that true innovators are induced to raise the number of applications in an attempt to signal their type.

As argued above, the signaling motive for patenting seems to be particularly important for start-ups and SMEs. Similarly, the assumption of a limited budget available for patenting and research, is more suited to characterize the behavior of start-up companies and small enterprises. For instance, the existence of a trade-off between resources spent on patenting and investment in R&D activities was shown by Mann (2005) in a study on the software industry. The author reported an interview with a software developer who explicitly acknowledged that "Every dollar we spend on [patenting] is a dollar we can't spend on a software engineer (pp. 982-3)". A trade-off between patenting and R&D is also suggested by the size of spending on the patent application process. According to Graham et al. (2010) the estimated cost of obtaining a patent in the U.S., including attorney fees, is $35,000. As regards the E.U., in a study prepared for the European Patent Office, Roland Berger (2005) estimates that the overall cost of filing an application is between 30,000 and 46,000 euros. These figures clearly show that the cost of patenting may be substantial, especially for start-ups or SMEs. Indeed, the technological start-ups included in the Berkeley Patent Survey reported that the main reason they choose not to apply for patent protection was the cost of the application process. The second most important reason was the cost of enforcing patents (see Graham et al., 2010). Similarly, in a study on patenting behavior in the UK, Hall et al. (2013) observed that the low propensity to patent of SMEs is most likely explained by the high costs related to both the application process as well as the monitoring, enforcement and, possibly, litigation of the IP rights.

A series of recent theoretical papers focuses on the informational content revealed by the decision of whether to patent or keep the innovation secret and/or by the decision of how much innovation-related information to disclose (Anton and Yao, 2003, 2004; Jansen, 2011 and

[5] Conti et al. (2013b) on the other hand look at two signals firms may use (patents and capital invested by the entrepreneur in the venture) and show that venture capitalists care more about patents, while business angels are more concerned with the money the founder has invested.

[6] The examination process at PTOs can be very long and one may wonder whether their decisions actually convey valuable information to third parties. As a matter of fact, PTOs reveal important information on applications before taking the final approval/rejection decision. For instance, within 18 months of the application being filed, the European Patent Office (EPO) publishes the search report where the references that call the novelty or the inventive step of a claim into question (the so-called X and Y references) are listed; applications with many X and Y references are likely to be ultimately rejected. Greater details on the examination process at the EPO can be found in Harhoff and Wagner (2009).

[7] The number of applications as a signal of quality is also considered by Conti et al. (2013a). However, they do not consider the issue of bad patents, and they assume that deciding how many patents to apply for the innovator is never liquidity constrained, which is one of the key drivers of our analysis.

[8] In a study on the pharmaceutical industry, Ouellette (2010) reports that, on average, 3.5 patents cover one single drug increasing to about 5 in the case of blockbuster drugs. For the use of patents covering ancillary aspects of the innovation, see Hemphill and Sampat (2012).

[9] See Hall and Ziedonis (2001) among others.

[10] This fact is also suggested implicitly in Long (2002). When patent stocks convey information, then there are incentives "to patent the smallest publishable unit, and divide what would normally be a single patent on an invention into multiple smaller patents on different facets of the same invention."