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Licensing to a durable-good duopoly in patent litigation

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ABSTRACT

Incorporating patent litigation into a durable-good duopoly model, we revisit the optimal licensing contract on a cost-reducing innovation. We find that both the optimal licensing contract and the innovator's licensing revenue are closely related to the patent's strength, i.e., the probability it would be found valid if tested in court. It is shown that, for a relatively weak patent (patent's strength is low), it's optimal for the innovator to charge the royalty rate as high as possible coupled with a negative fixed fee. But for a relatively strong patent (patent's strength is high), contract involving the combination of a medium level royalty rate and a positive fixed fee is optimal. We also discuss how the patent's strength affects the social welfare of a patent. Finally we present two policy suggestions that may alleviate the social welfare loss raised by the licensing of weak patents.

1. Introduction

Total patent application number in China has grown almost exponentially. For example, from the statistical data of State Intellectual Property Office of the People's Republic of China, the patent application number is 9411 in 1985, which increases to 170,682 in 2000. According to the latest figures, it climbs up to 976,686 in 2009. At the same time, the patent litigation number is also on the rise from 347 in 1985 to 5148 in 2000 and it has added up to 30,509 in 2009.[1] In the United States, for example, since the 1990s the growth rate of patent prosecution cases has surpassed 100%. The US Patent and Trademark Office (PTO) has issued roughly 15,000 patents a month, but the patent examiner time of an average application is only about 15–20 h.[2] Since there are so many patent applications in every year, it's impossible for the State Intellectual Property Office of the People's Republic of China or PTO to get through with a thorough assessment procedure for every patent application due to the information and cost constraints. Therefore, licensing of patented technology often inevitably occurs in the shadow of patent litigation, that is, the patent is uncertain and it may be held invalid by a court if litigated. However, the existing formal licensing literature has focused on the certain patent (the so-called ironclad patents).

Patent licensing is a commonly used practice. Licensing of patented technology is becoming more and more important in technology transfer for many developing countries and industrialized countries. Appropriating licensing revenue is an effective way for the innovator to compensate for his R&D expenditures in technology innovation activities. Furthermore, licensing can serve as a way of financing for financially constrained firms (Gompers and Lerner, 1999; Hall, 2002; Kulatilaka and Lin, 2006). Although we believe that a lot of scholars offer valuable insights into patent licensing, it is surprising that there is little theoretical guidance on durable-good licensing. In reality, however, licensing involves many durable-goods, such as computers, cars and mobile phones, for example, 3G licensing case in Hong Kong (more detail see Xu, 2004).

So far few literatures feature both durable-good and patent litigation. This paper specifically builds a parsimonious model of patent licensing that integrates both of these important features largely unexplored in the literatures. We argue that many real-life license contracts are similar to the situation described here. We set up a licensing model involving an outside innovator and two competing firms which play a simultaneous two-period game. Our paper is related to Paul and Poddar (2000) and Poddar (2004) in treatment of durable-good duopoly, which emphasizes the strategic choice between renting and selling, showing that selling turns out to be the unique dominant contract of the firms. In contrast, we lay stress on the arrangements of licensing contracts in the presence of patent litigation. The innovator can choose from fixed fee, royalty rate or their combination to maximize his licensing revenue, while the two firms compete against each other in outputs in both periods to maximize total individual profit. The patent strength turns out to have a crucial impact on the licensing strategy.

This paper departs from the traditional licensing literatures in three ways. First, we consider the licensing of durable-good. Second,

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[1] Statistics are compiled by SIPO (www.sipo.gov.cn/sipo2008/).
[2] Federal Trade Commission.

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we conduct a study of patent litigation risk, and its role in licensing. Third, we allow negative fixed fee and royalties, so the innovator has access to a broad set of licensing arrangements.

The main results in this paper are as follows. We argue that the innovator will strike a balance between a firm's expected profits of triggering patent litigation and the firm's net profits of joining up to a licensing agreement. From the innovator's perspective, the optimal combination of fixed fee and royalty rate depends on the patent strength. More specifically, for a relatively weak patent, it is optimal for the innovator to charge the royalty rate as high as possible connected with a negative fixed fee (the innovator pays the licensee a lump sum subsidy). But for a relatively strong patent, contract involving the combination of a medium level royalty rate and a positive fixed fee is optimal. We also discuss the society welfare and licensing policy of weak patents. For relatively strong patents, the license contract involving unrestricted two-part tariffs leads to an overall improvement in the society's welfare, whereas for relatively weak patents, this leads to an overall inducement in the society's welfare. In order to improve the society's welfare of relatively weak patents, we present two policy suggestions: taking the case of the innovator and the unsuccessful challenger attempting to agree on a renegotiated per-unit royalty rate and allowing a collusive scheme.

1.1. Literature review

A large economics literature has studied the patent licensing. The theoretical studies find that, hinging on the environment, upfront fee, royalties or combinations of both can be provided. Rostoker (1984) finds that 39% of the licensing contracts use royalties alone, 13% fixed fee alone, and 46% use down payment plus a running royalty. Because of this disparity in contractual arrangements, theoretical investigations of the conditions under which each type of licensing arrangement is optimal for the innovator are extensive.

In the case of an outsider innovator with complete information, a fixed fee licensing is preferred (Kamien and Tauman, 1986, 2002; Katz and Shapiro, 1986; Kamien, 1992; Kamien et al., 1992). In the case of asymmetric information, however, royalties are useful to alleviate two-sided moral hazard and share risk, which suggests that a licensing contract should include royalties. If there is also a fixed fee component to the contracts, then the fee can be used to distribute the profits among the participants in the licensing. For example, Gallini and Wright (1990) show that, the optimum licensing contract will consist of royalties and fixed fee in order to separate high-cost technologies from low-cost technologies. Royalties have the advantage that they are used by the innovator to signal the value of the innovation. On the other hand, when the licensee possesses private information about market conditions (Poddar and Sinha, 2002), it is shown that either only royalty or a combination of fixed fee and royalty contract is offered for low demand type and a contract with only a fixed fee is optimal for high demand type. Faulí-Oler and Sandonís (2002) study the optimal combination of royalties and fees in an environment with differentiated products. Sharing the risk associated with any market and new product is another common reason for contracts involving both royalties and fixed fee. For example, Bousquet et al. (1998) find that the resulting optimum is characterized by a combination of a fixed fee with an ad valorem royalty which is charged by the innovator under demand uncertainty, while under cost uncertainty the contract may involve a combination of either type of royalties, coupled with a fixed fee. The focus of all these models, however, is on the licensing of non durable-good. They study the impact of different factors on the nature of licensing contracts, such as the role of incumbent innovators, informational asymmetry, product differentiation, etc. But they preclude a study of the determinant of patent litigation risk, and its role in licensing, which is what we focus on.

This paper is also related to Li and Geng (2008) in terms of licensing of durable-good. They study a durable-good monopoly model where an outsider innovator of a cost-reducing innovation interacts with a monopolist. They show that, for the outsider innovator, charging royalty is optimal for small innovation, while contracts with a fixed fee and royalties will be superior to using either alone for large innovation. Saracho (2007) considers a model where the innovator is a durable-good monopolist and shows that the licensor may be willing to use royalties to license its innovation. However we consider an oligopoly market structure with patent litigation being presented. We show that the contract involving a combination of royalties and fixed fee is optimal.

Farrell and Shapiro (2008) and Encaoua and Lefouili (2009) are closest to ours in the sense that they allow for the patent litigation risk. Farrell and Shapiro (2008) consider a situation where the outsider innovator offers a two-part tariff contract to all downstream firms. They study the optimal fixed fee and the royalty rate at which it would be licensed and show that determining patent validity prior to licensing is socially beneficial. Departing from the paper by Farrell and Shapiro (2008), Encaoua and Lefouili (2009) allow the number of licensees to be endogenous. It is shown that the optimal license contract hinges on the level of maximal per-unit royalty that deters litigation. If this level is high, the optimal licensing contract is the pure royalty, and it is accepted by all firms. But if this level is low, the innovator is willing to license its technology to a subset of firms, at the optimal two-part tariff that triggers litigation. Finally they suggest two policy levers in order to defuse the concerns about the licensing of uncertain patents. Like Farrell and Shapiro (2008), in our paper the optimal license from the innovator's perspective that deters litigation is accepted by all firms, which is in contrast to Encaoua and Lefouili (2009). Moreover, we focus on a durable-good framework, which is neglected in these papers. We will take up three contract specifications separately and find the optimal one.

The remainder of the paper is organized as follows. In Section 2 we describe the model. Section 3 discusses three different licensing contract specifications available to the innovator and the optimal one without triggering patent litigation. Section 4 obtains the welfare implications. Section 5 presents the policy suggestions. Section 6 concludes. All proofs are relegated to Appendix.

2. The model

Consider an outside innovator and a Cournot oligopoly market where two competing firms (denoted by M, $M=\{1,2\}$) produce the perfectly homogeneous durable-good. In our analysis, the durable-good lasts for two periods. If the consumer makes the purchase of a durable-good in period one, he or she need not repurchase in period two. The inverse demand function for one period of service is $P=a-Q$, where Q stands for the aggregate output and P denotes the price. With the initial old technology, both the two firms have the same marginal cost c, assuming that $0<c\leq 2a/5$.[3] In other literatures on durable-good duopoly, the competing firms can choose between selling and renting. In this point, we follow the study of Poddar (2004), who considers a durable-good duopoly market structure and has found that selling is the unique dominant strategy. So we rule out the case of renting in our paper and neglect time discounting.[4]

The innovator has a cost-reducing innovation which can reduce the cost of production by ε (the magnitude of the innovation) and attempts to license it to the two firms. His only source of income stems from license revenue, which crucially depends on the contractual specification—fixed fee, royalty rate or the combination of the two (two-part tariff contract). However, licensing often inevitably occurs in the shadow of patent litigation. Here, a firm that rejects the licensing contract has an alternative option: litigating a claim against the validity

[3] This assumption excludes the case of negative outputs, in which production is not profitable without the innovation.

[4] It can be verified that all the results obtained in this paper remain unaffected if we allow time discounting for the firms.