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Endogenous licensing in cumulative innovation

Abstract This paper analyzes the endogeneity of licensing arrangements in cost-reducing cumulative innovation. There exists the following results. First, for the first-generation patentee, \textit{ex post} licensing matters for rent extraction while \textit{ex ante} licensing matters for efficiency. Second, if the second-generation innovator does not exit, then the firms’ profits as well as social welfare are all irrelevant to whether \textit{ex ante} licensing is allowed. Third, costly litigation can occur on the equilibrium path and its occurrence is also irrelevant to \textit{ex ante} licensing. Interestingly, the conditional probability of the first-generation patentee winning litigation first decreases and then increases in patent breadth. Fourth, optimal patent breadth depends on the tradeoff between litigation costs and antitrust effect.

Keywords cumulative innovation, patent breadth, \textit{ex post} licensing, \textit{ex ante} licensing, perfect bayesian equilibrium

JEL Classifications D23, K41, O34

Abstract 这篇论文分析了成本减少的累积创新环境下许可证形式的内生决定机制如下：第一，对先期创新者而言，事前许可证的重要性在于维护效率。第二，诉讼可以出现在博弈的均衡路径上，诉讼行为和是否存在事前许可证无关。第三，如果存在退出问题，则事前许可证对社会福利至关重要；专利保护宽度同时影响市场总利润和利润分配。此时，若仅有事后许可证，先期创新者的利润可能随专利保护宽度的增加而下降。第四，给定存在事前许可证，则依赖于诉讼的成本和反垄断效应。


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1 Introduction

Scotchmer’s (1991) pioneering work showed that the central issue in cumulative innovation is the efficient profit division between sequential innovators. Cumulativeness means that the second-generation innovations are impossible without the first-generation ones and hence the social value of the first-generation innovation should include the latter’s net social value. Therefore, it is important to find some kind of compensating mechanism for the first-generation innovator, especially when innovation is characterized by creative destruction. As suggested by Scotchmer (1991), the combination of patent system and licensing arrangement makes it possible. If the derivative innovations fall in the patent breadth of the first-generation patentee, their holders have to pay licensing fees for permission of commercialization. Furthermore, the subsequent innovators will also be willing to pay such licensing fee to avoid costly litigation. Suppose that (research and development) R&D investment, once made, will become sunk cost. Then, there are two kinds of licensing arrangements depending on the timing. Ex ante or ex post licensing means that licensing contract is concluded before or after the subsequent innovator has made her R&D investment. The aim of this paper is to analyze how the licensing arrangements between cumulative innovators are endogenously determined when the second-generation innovators have private information.

Consider a process of cost-reducing cumulative innovation in which each innovation results in a reduction of marginal cost of producing one given product. Our model reflects the following facts. (i) By the very nature of incomplete contract, not every contingency has been specified in patent claim. As a result, when a patent litigation arises between cumulative innovators, court will be needed to verdict whether a derivative innovation infringes on its predecessor, which in turn depends on how the court will use the so-called doctrine of the equivalents. As argued by Aoki and Hu (1999) and Llobet (2003) among others, ceteris paribus, the bigger the patent breadth, the bigger the probability that first-generation patentee wins the litigation. (ii) While ex ante licensing can avoid potential patent disputes, ex post licensing can solve the existing ones. (iii) When the parties in question can come to neither ex ante nor ex post licensing arrangement, the first-generation patentee will resort to either costly lawsuit or simple give up. (iv) The second-generation innovator has informational advantages in litigation.

Suppose that the first-generation patentee has the right of offering licensing contract. Then, while offering contract he faces a fundamental tradeoff between