Alternative damage rules and probabilistic intellectual property rights: Unjust enrichment, lost profits, and reasonable royalty remedies ☆

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A R T I C L E   I N F O

A B S T R A C T

This paper investigates how alternative damage rules in patent infringement cases shape competition when intellectual property rights are *probabilistic*. More specifically, I develop a simple model of oligopolistic competition to compare two main liability doctrines that have been used in the U.S. to assess infringement damages – the unjust enrichment rule and the lost profit rule. I show that the lost profit rule provides more protection to the patent holder than the unjust enrichment rule if the patent holder and infringer are equally efficient. When the lost profits from the infringement cannot be proved, the court accepts a "reasonable royalty rate" that would have been negotiated in a hypothetical bargaining situation as an alternative measure of damage. However, I point out that the concept of "reasonable" royalty rates lacks logical consistency when intellectual property rights are probabilistic.

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1. Introduction

This paper investigates how different damage rules in patent infringement cases shape competition when intellectual property rights (IPR) are *probabilistic*. Most of the literature on patent protection assumes ironclad patents and no uncertainty regarding patent claims.[1] The

analysis of damage rules in the literature also seems to implicitly assume no uncertainty. However, patents can be challenged in the court, and there is a substantial amount of uncertainty when patents are litigated. According to Allison and Lemley (1998), for instance, approximately 46% of all litigated patents are found to be invalid. To reflect this reality, I develop a simple model of oligopolistic competition that incorporates the probabilistic nature of patents.

Patent infringement damages are intended to protect intellectual property rights and compensate for the pecuniary loss that the patent holder has suffered from the infringement. In the US, there are two main liability doctrines that have been used to assess infringement damages. The "unjust enrichment" (UE) rule aims at deterring theft of intellectual property right by punishing the infringer who is required to disgorge all the profits from the infringement. As an example, suppose that the infringer had a profit of 10 as a result of patent infringement. The infringer is then required to pay back

[1] Recently, however, more attention has been paid to the probabilistic nature of patent protection and its implications for competition. See Aoki and Hu (1999) and Anton and Yao (2003) for recent papers that consider probabilistic patent rights and the binary enforcement outcome with exogenous probability. In addition, Lemley and Shapiro (2005) provide a survey of important issues associated with probabilistic patent protection.

its ill-gotten profit of 10 when it is found to have infringed the patent. This doctrine was mainly used in the assessment of damages up until the 1946 Amendment of Patent Act. Since then US courts have shifted towards the "lost profit" (LP) doctrine that is compensatory in nature. It intends to make the patentee "whole" by enforcing the defendant to make up for the difference between the patentee's pecuniary condition that would have been without infringement and the one after the infringement.[2] As an example, suppose that the patent holder's monopoly profit is 25. If the patent holder has earned a profit of 10 as a result of infringement, the infringing firm has to pay 15 (=25 − 10) to the patent holder if it is found to have infringed the patent.

Considering the recent explosion in patent litigation and increasingly important role of intellectual property rights as a competitive strategy, it is important to understand the impact of different damage rules on market competition.[3] Even thought there are a long standing interest and extensive discussions on patent damage rules in the law literature, formal and rigorous economics analyzes on this issue are virtually non-existent with the exceptions of Schankerman and Scotchmer (2001) and Anton and Yao (2007).

I develop a simple model of oligopolistic competition to compare two main liability doctrines that have been used in the U.S. to assess infringement damages – the unjust enrichment rule and the lost profit rule. More specifically, I consider a duopolistic competition with a patent holder of product innovation/drastic process innovation and a potential infringer. Until recently, the existing literature on innovation typically assumed ironclad patents that are assumed to be valid with certainty and a well-defined scope of protection. In reality, however, most patents issued face a significant amount of uncertainty in terms of their commercial value, validity, and scope of protection. I thus develop a model that explicitly accounts for the uncertain nature of patents.[4] In fact, in my basic model, which assumes product innovation and equal production cost, either there is no infringement or the market outcome stays essentially the same as if there were no infringement with ironclad patents under the damage rules analyzed below.[5] Both the patent holder and potential infringer are aware of the probabilistic nature of patents and compete in the shadow of litigation in that the amount of damages to be paid in the case of infringement depend on the strategies taken in the market place. The set-up of the model re-

flects the fact that a significant number of infringements can go undetected for more than a nominal period of time and the resolution of disputes entails significant delays in the court system.[6]

Often the courts seem to conclude that all these approaches yield more or less the same estimate or similar effects, if implemented correctly. The aim of this paper is to analyze how these different damage rules affect competition in different ways and to understand what factors drive the differences. In particular, I show that the lost profit rule provides more protection to the patent holder than the unjust enrichment rule if the patent holder and infringer are equally efficient. The intuition for this result is as follows. In the UE regime, the patent holder partially internalizes the effect of its output decision on the potential infringer's profit, since the patent holder receives the infringer's profits with probability α when it prevails in patent litigation. This internalization incentive induces the patent holder to contract its output, shifting its reaction curve inward. In response, the imitator increases its output in my model with strategic substitutes. As a result, before any damage payments, the patent holder has a lower profit while the imitator has a higher profit compared to the Cournot equilibrium in the absence of IPR. In the LP regime, the role is reversed. Since the imitator has to compensate the patent holder for any profit reduction from the monopoly level when it is found to have infringed the patent, the imitator is the one that internalizes the effect of its output decision on the patent holder's profit. As a result, the imitator contracts its output and the patent holder responds by expanding its output in the LP regime. Thus, in the event that the imitator is not found to have infringed the patent and there is no damage payment, the patent holder has a higher profit under the LP regime. In the other event where the imitator is found to have infringed the patent, the patent holder's profit is restored to the monopoly level under the LP regime. In contrast, the patent holder's profit after damage payment is the joint duopoly profits under the UE. Since the sum of infringement duopoly profits cannot be higher than the monopoly profit under our setting, the LP regime yields a higher payoff for the patent holder when the infringer is found to be liable. Thus, the LP regime provides more protection because the patent holder receives a higher payoff regardless of the litigation outcomes under the LP regime.

When the lost profits from the infringement cannot be proved, the court accepts a "reasonable royalty rate" that would have been negotiated in a hypothetical bargaining situation as an alternative measure of damage. However, I point out the logical inconsistency in the concept of "reasonable royalty rates" when intellectual property rights are not ironclad. The main intuition for this result is that the

[2] Currently in the US, economic damages in patent infringement litigation are based on Title 35, Section 284 of U.S. Code, which mandates that damages be adequate to compensate for the infringement, but no less than a reasonable royalty rate for the use of the subject patented invention.

[3] See Bessen and Meurer (2005), Blair and Cotter (1998), and Pincus (1991).

[4] See Lemley and Shapiro (2005) for an excellent discussion of probabilistic patents. They discuss implications of patent litigation uncertainty and potential reforms of the current patent system in the US. However, they do not analyze and compare the effects of different damage rules on market competition.

[5] As explained below, there are multiple equilibria with ironclad patents. However, all equilibria generate the same payoffs for the patent holder and the potential imitator, and the total market output is the same across all equilibria.

[6] See Crampes and Langinier (2002) for a model in which the patent holder invests in monitoring to supervise the market and detect infringement. For product innovation, the delay in detection is less reasonable. However, patent litigation is a lengthy process. According to Cook (2007), the average duration of a patent case was over 700 days in the early 1970s. It has decreased over time, but still is about 400 days as of 2000. If detection is immediate, competition before damage judgment in my model thus can be considered as taking place during the litigation process.