

## Patent litigation when innovation is cumulative

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### Abstract

This paper studies the effect of litigation as a way to enforce patents when firms hold private information. Patent protection granted by courts affect the entry, settlement and litigation decisions of future innovations. The model is broadly consistent with recent empirical evidence. We show that higher protection might be detrimental to the patentholder since it reduces entry of infringers that would otherwise license the patent. We argue that this is more likely to be the case for large improvements or large litigation costs. Finally, we compare the effects of Preemptive Injunctive Relief on innovation and litigation.

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### 1. Introduction

Patents are imperfect assignments of property rights on innovation. The uncertainty surrounding the innovation process usually does not allow a precise specification of the range of innovations protected, provoking extensive infringement of these rights. These unavoidable disputes have made of litigation an integral part of the patent system, with important consequences for the incentives to innovate and patent.

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The costs of patent enforcement are substantial. In the US, from October 1996 to September 1997, 1530 lawsuits involving patents were reported, although the number of disputes is much higher.<sup>1</sup> The associated legal costs can represent as much as 25% of firms' basic R&D expenses. For this reason recent debates have emphasized the observation that the supervision of patent applications is not very rigorous, and as a result, litigation is mainly used to obtain a judicial definition of the boundaries of the protection that firms obtain.

An important dimension of a patent is its *breadth* or *scope*, understood as the range of competing products and processes that are covered by the patent. Although breadth is considered an essential component, the ambiguity of the concept has not allowed a general formulation. Most of the literature assumes that the infringement of a patent's breadth is evident.<sup>2</sup> Such a setup makes the existence of litigation irrelevant. In reality, the boundaries of the protection associated with a patent are rather blurry, and the process through which courts assess whether an invention infringes an existing patent or not is subject to uncertainty. The existence of courts and their rulings can be interpreted as a way to aggregate the relevant features of a patent. In other words, the breadth of a patent is endogenously determined by the 'litigation technology.'

When innovation is cumulative, Green and Scotchmer (1995), Chang (1995) and O'Donoghue et al. (1998) show that the optimal patent must provide claims over future research. Innovations represent permanent improvements over the stock of knowledge, but firms can only partially appropriate the value of the improvement through the sale of their products, since future producers will compete away the profits. By protecting the patentees against future innovation, the life of their monopoly power is extended. One of main concerns of those papers is that in general more protection benefits the patentholder, but it reduces the incentives for future research to be undertaken. Therefore, the design of the optimal patent must counterbalance these effects.

These papers usually interpret patent breadth as the minimum size of the following invention that will be allowed and consider it a policy variable. One of the contributions of this paper is to show that the way courts enforce patents defines endogenously not only the decisions to enter of future inventors but also the licensing and litigation choices. In particular, the real protection that a patent grants to an innovator depends on the quality of the invention, and it is for bigger inventions that more patent breadth can reduce profits.

Previous models of patent litigation, such as Meurer (1989) and Aoki and Hu (1999) deal with the case of a pure imitator. However, when the protection is

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<sup>1</sup>This data was published by the US Patent and Trademark Office (1997). It does not take into account patent disputes that are settled before filing the suit. Lerner (1995) estimates using a sample of 530 patents awarded to firms in the biotechnology sector in Massachusetts that 6% of them were involved in a litigation process.

<sup>2</sup>Two remarkable exceptions are Waterson (1990) and Aoki and Hu (1999).

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