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Optimal fragmentation of intellectual property rights ☆

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Abstract

We develop an equilibrium model of product innovation to study the implications of independent invention for the design of intellectual property rights. In the model agents choose whether to be innovators seeking new ideas or imitators absorbing spillovers, and multiple innovators can find the same idea. It turns out that the optimal intellectual property right is typically strong but non-exclusive, involving fragmentation of the right among different innovators. The optimal number of property right holders is inversely related to the cost of innovation and obsolescence rate. Exclusive patent protection can be approximately optimal only if innovation is costly and the obsolescence rate is high.
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1. Introduction

The possibility of multiple independent discoveries of the same idea is ubiquitous in research in different industries (see, e.g. Granstrand, 1999, pp. 25 and 52; Armond, 2003; Lemley and Chien, 2003). This especially seems to characterise network industries such as software, the internet, telecommunications and payment systems, where standardisation limits the possible

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paths for future technologies and so firms concentrate their R&D activities on the same fields. Similar views are expressed by Rahnasto (2003) and Varian, Farrell and Shapiro (2004). Rahnasto (2003), in particular, argues that simultaneous innovation has resulted in fragmentation of intellectual property rights (IPRs) in these industries. As a result, products and services in network industries are based on combinations of IPRs that are held by multiple owners. Because of the hold-up power conferred to a single patent holder, it has been suggested that fragmentation retards the use of innovations. The discussion has, however, mainly been concerned with vertical fragmentation in the chain of innovations.

We develop an equilibrium model of product innovation to study the *horizontal* fragmentation of IPRs, which means that more than one inventor of the same technology obtains the right to use it. Because such fragmentation renders the market for new products more competitive, it should stimulate the use of innovations rather than retard it. We find that optimal IPRs are strong and perpetual but typically non-exclusive. The cheaper the innovation, the larger the number of property right holders that should be granted for an innovation. Exclusive patent protection is approximately optimal only if innovation is very costly.

Related to optimal fragmentation of IPRs is the question of whether independent invention should be a defence to infringement. A key distinction between patents and other forms of IP protection is that only one patent can be awarded even in the case of several independent developments of the same idea, whereas other forms recognise the rights of independent inventors. In the seminal analysis of independent invention with IPRs Wright (1983) advocates "marginal patents" that are awarded only in the case of unduplicated innovation, but regards such awards as practically impossible to implement. Closest to our work is La Manna et al. (1989), which presents a patent race model with free entry. They advocate a permissive patent system allowing independent infringements of patents over a given period of time and show that it is welfare-superior to the traditional strict patent system under a wide range of circumstances. A reason is that in the permissive system wasteful duplication of innovation costs is less of an issue, since more innovators lead to more production. This effect is present in our model, but there is also an additional benefit, since more innovators produce a greater number of new products.

Another difference compared with La Manna et al. (1989) is that in our model the set of agents is well-specified, and the agents become either innovators who seek ideas or imitators who enjoy spillovers. Our analysis can be seen to provide a robustness check for their partial equilibrium results, because in our model innovators and imitators must fare equally well in equilibrium. This corresponds to the free entry condition of La Manna et al. (1989). Moreover, we distinguish innovations from ideas, consider multiple innovations, clarify how innovators happen to discover the same innovation independently, and determine the expected number of innovators to discover the same innovation. We characterise optimal IP protection, including the optimal number of property right holders, and perform comparative statics analysis.

More recent studies of the effects of independent invention on the design of IP policy include Bessen and Maskin (2002) and Maurer and Scotchmer (2002).[1] In Maurer and Scotchmer (2002) a patent holder can be threatened by rivals' independent duplication, and such duplication is a defence to infringement. The patent holder, facing an unlimited number of potential licensees but no competing licensors, has an incentive to grant a license to deter duplication. In our model independence of invention is different, as there is no possibility of consciously duplicating

[1] These and our study also exemplify 'independent invention'; we became aware of each others' studies after having completed them independently.

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