



Who is afraid of pirates? An experiment on the deterrence of innovation by imitation[☆]



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ABSTRACT

In the policy debate, intellectual property is often justified by what seems to be a straightforward argument: if innovators are not protected against others appropriating their ideas, incentives for innovation are suboptimally low. Now, in most industries and for most potential users, appropriating a foreign innovation is itself an investment decision fraught with cost and risk. Nonetheless, standard theory predicts too little innovation. Arguably the problem is exacerbated by the sensitivity of innovators to fairness; imitators do get a free lunch, after all.

We model the situation as a game and test it in the lab. We find more appropriation, but also more innovation than predicted by standard theory. In the lab, the prospect of giving imitators a free lunch does not have a chilling effect on innovation. This even holds if innovation automatically spills over to an outsider and if successful imitation reduces the innovator's profit. Beliefs and the analysis of experiences in the repeated game demonstrate that participants are sensitive to the fairness problem. But this concern is not strong enough to outweigh the robust propensity to invest even more in innovation than predicted by standard theory. The data suggest that this behavior results from the intention not to be outperformed by one's peers.

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1. Introduction

A standard argument in favor of patent protection relies on the fact that knowledge tends to be non-excludable. Unless the law steps in and the patent creates a temporary monopoly, other users could just copy the invention. Anticipating this, nobody is willing to engage in costly innovation (for a typical voice, see [Menell and Scotchmer, 2007](#); [United States Government Accountability Office, 2010](#)). In its weaker and more realistic form, the argument expects investment in innovation to be suboptimally low if innovators are not protected against others tapping into their efforts.

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This line of argument has long been criticized on theoretical and empirical grounds. It has been claimed that innovation is often a process rather than an isolated event. Then an imitator does not just copy, but uses the earlier innovation to make the next innovative step, which is made difficult by patent protection ([Heller and Eisenberg, 1998](#); [Aghion et al., 2001](#); [Mukoyama, 2003](#); [Bessen and Maskin, 2009](#)). If a firm's success depends on its R&D intensity, the subsidy inherent in patent protection reduces overall innovative activity and hence growth ([Segerstrom, 1991](#); [Grossman, 1993](#); [Davidson and Segerstrom, 1998](#)). Depending on payoffs from innovation and imitation, the resulting static game may not be a prisoner's dilemma ([Engel, 2011](#)), and the deadweight loss resulting from the monopoly over knowledge may outweigh the social benefit from the stronger innovation incentive ([Kaplow, 1984](#)). Empirically, protection is never perfect, which is why a patent might be better modeled as a probabilistic right ([Lemley and Shapiro, 2005](#)). Whole industries like fashion, food, stand-up comedy, or sports are not protected by property rights for creativity at all, and yet all of them are rife with innovation ([Raustiala and Sprigman, 2012](#)).

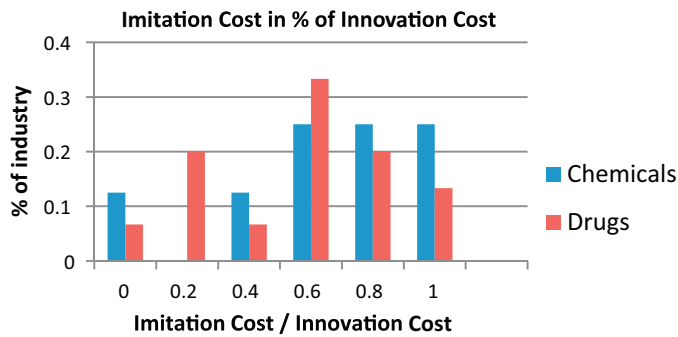


Fig. 1. Imitation cost. x-Axis: 0.8 means that the cost of imitation is 80% of the cost of innovation. y-Axis: fraction of an industry that states imitation cost to be that high, relative to innovation cost.

Data from Mansfield et al. (1981).

One major counterargument stresses that, in the field, new technological knowledge is often not a pure public good. Not only for creating, but also for using new knowledge, additional tacit knowledge is necessary that is (at least initially) only possessed by the innovator. Imitators must engage in reverse engineering, they have to change their production process or product, or else they have to invest in marketing the new product (Cimoli et al., 2011). Realistically, appropriating a foreign innovation is an investment decision itself, with its associated degree of uncertainty. Empirical studies have found imitation cost to be pronounced in many industries, but industry characteristics are critical (Mansfield et al., 1981). Fig. 1 illustrates this claim with survey data. It also shows that there is pronounced heterogeneity, both within and between industries.

In the well-known Yale Survey, 650 respondents from various industries rated patent protection to be the least important measure for securing a competitive advantage, while on average they place most emphasis on lead time, followed by going down the learning curve quickly, being good at sales and service, and secrecy (Levin et al., 1987). In the subsequent Carnegie Mellon Survey, the estimated disadvantage of patent was less pronounced. But patent was still outperformed by secrecy and lead time (Cohen et al., 2000). Similar findings have been made for Germany, Portugal (de Faria and Sofka, 2010), Switzerland (Harabi, 1994), and the US, but not for Japan (Cohen et al., 2002). On average, patent protection only prolongs the imitation lag by a few months (Cohen et al., 2002).

In the policy debate, it sometimes sounds as if the mere possibility of appropriation by others could deter any innovation.¹ At the opposite end of the spectrum, idealists equate appropriation of “intellectual property” with theft.² Since stealing is clearly morally condemned in almost all cultures, if this perspective gets it right, moral compunctions might suffice to prevent almost all potential users from appropriating foreign innovation. For either extreme position, the cost and risk of appropriation are immaterial.

If all actors are fully rational money maximizers, and if all of them anticipate all others to hold the same preferences, none of these extreme positions is supported when both innovation and imitation are risky. The theoretical prediction hinges on the expected individual profitability of innovation, on the one hand,

and of appropriation, on the other. In equilibrium, actors split their resources between innovation and imitation. Standard theory therefore predicts the policy problem to be much more contained. Yet if all actors hold standard preferences, there is still not enough investment in innovation, compared with the social optimum, as long as innovation yields a positive externality for potential appropriators.

Studying in the field whether this prediction holds true would be difficult, if not impossible. Neither the ease nor the cost at which outsiders may appropriate innovations are randomly assigned, which would be necessary for identification. In this paper, we therefore investigate the investment behavior experimentally. We introduce a two-person game of two stages. In the first stage, each player may invest in her own innovation project. She learns whether her own project and her counterpart’s project have been successful. In the second stage, she may invest in appropriating her counterpart’s project, provided it has been successful. We make innovation risky and manipulate the conditions for appropriation. In the *LowRisk* treatment, appropriation is risky (and costly), but the risk of not succeeding in appropriating a foreign innovation is small. In the *HighRisk* treatment, this risk is pronounced.

In our data, the concern of suboptimally low innovation investments is not supported. Both in a one-shot game and in the subsequent repeated game, participants invest significantly more than predicted by standard theory, and even more than the efficient benchmark.

The situation of our main experiment is not uncommon in the field. My innovation may be of use in markets where I do not sell my products. Yet, from a policy perspective, the situation is obviously even more important where innovative success also gives me a competitive advantage. Then successful appropriation has one direct drawback. I lose some of the gains from innovation for myself. To study whether this additional drawback is critical for investment choices, we run another two treatments. In a 2×2 factorial design, we keep the appropriation functions from the *LowRisk* and *HighRisk* treatments, but change gains from innovation. In the *LowAppr* and *HighAppr* treatments, if appropriation is not attempted or fails, my gains from successful innovation are as in the main experiment. Yet they are lower if the second player successfully appropriates the innovation. We have another striking finding: the fact that the innovator’s profit is affected does not reduce innovation investment either.

We offer an explanation for the very robust finding that participants overinvest in innovation. Our data suggest that this results from a competitive motive. Participants do not want to fall behind the innovation efforts of their peers.

From a behavioral perspective, one might think that the policy problem looms even larger. If innovation is not protected, successful innovators expose themselves to exploitation. Others tap into their efforts without having contributed to the cost. Investors might consider such an impingement as unfair and invest even less in innovation than predicted by standard theory. To understand whether this fairness concern is actually relevant, we elicit beliefs. The more participants believe that their counterpart will try to appropriate innovation success, the less they invest. In the repeated game, they reduce investment in innovation the more they learn that their counterpart has invested in appropriating their innovation in the previous period. All of this suggests that participants are actually sensitive to the fairness concern, and that this sensitivity is merely not strong enough to create a policy problem.

To understand the behavioral effects better, we run two supplementary treatments. In these treatments, we radicalize the fairness concern. In the *FullRisk* treatment, imitation is technically excluded (the risk of not succeeding in appropriating the foreign

¹ Take what Menell and Scotchmer (2007) define as “the economic problem”: “Most firms would not invest in developing new technologies, and potential creators might not spend their time on creative works, if rivals could enter the market and dissipate the profit.”

² See, e.g., <http://www.ideaights.com/ideat theft.htm>.

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