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## Independent Invention as a Defense to Patent Infringement

Samson Vermont

*George Mason University School of Law*

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# INDEPENDENT INVENTION AS A DEFENSE TO PATENT INFRINGEMENT

*Samson Vermont\**

*Under current law, independent invention is no defense to patent infringement. This Article argues that independent invention should be a defense, provided the independent inventor creates the invention before receiving actual or constructive notice that someone else already created it. The defense reduces wasteful duplication of effort and enhances dissemination of inventions without lowering the incentive to invent below the necessary minimum. To be sure, the defense lowers the incentive for inventions that face significant odds of being invented by more than one inventor. By enabling a second inventor to compete with a first inventor, the defense essentially breaks up the first inventor's patent monopoly into a duopoly. Monopoly profits exceed the collective profits of duopoly. Thus, from the perspective of inventors ex ante the defense reduces the expected profit for inventions that could be invented by more than one inventor. This Article argues, however, that the reduction in expected profit is moderate and that the reduced expected profit is generally sufficient. Per Bayes' theorem, the fact that an invention could be invented by more than one inventor is itself evidence that a moderately reduced expected profit will still motivate at least one inventor to create the invention without inefficient delay.*

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\* Assistant Professor of Law, George Mason University School of Law. For helpful comments, the author thanks Omri Ben-Shahar, Rebecca Eisenberg, Mark Lemley, John Duffy, Michael Abramowicz, Steven Shavell, and participants in workshops at George Mason University, George Washington University, Harvard University, and the University of Michigan. The author also thanks the John M. Olin Foundation, which generously supported the author's Fellowship in Law & Economics at the University of Michigan Law School.

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## INTRODUCTION

Many scholars who study intellectual property (IP) argue that we should tailor rights in IP so that they provide protection only when output of IP would clearly be too low without protection.<sup>1</sup> This argument rests on a variant of one of the following three claims.

First, the last bit of supra-competitive pricing by a monopolist provides disproportionately small profit to the monopolist in comparison to its social cost.<sup>2</sup> For example, lowering by 10% the price of an invention charged under a patent monopoly<sup>3</sup> might reduce the patentee's profit by only 1% while

1. See, e.g., WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY* LAW 9–10, 21–24 (2003).

2. Ian Ayres & Paul Klemperer, *Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies*, 97 MICH. L. REV. 985 (1999); see also Daniel J. Gifford, *How Do the Social Benefits and Costs of the Patent System Stack Up in Pharmaceuticals?*, 12 J. INTELL. PROP. L. 75 (2004). This logic applies equally to tangible property.

3. "Patent monopoly" is convenient shorthand for a *certain degree* of market monopoly. A patent seldom confers a complete market monopoly over a good or service. See Kenneth W. Dam,

reducing the social costs of the patent monopoly by 19%.<sup>4</sup> This suggests that the optimal patent monopoly falls short of providing complete exclusivity over the invention.<sup>5</sup>

Second, property rights serve two related functions: they provide (i) a way of determining who gets what when; and (ii) an incentive to create or improve the what.<sup>6</sup> For rights in IP, however, function (i) is perverse—because IP is largely non-rivalrous. We cannot both drive the same car to different places, but we can both use the same invention to build different machines and we can both simultaneously read different copies of the same book. This suggests that the case for rights in IP is weaker than the case for rights in tangible property.<sup>7</sup>

Third, IP engenders higher rent dissipation and transaction costs than tangible property does.<sup>8</sup> This too suggests that the case for rights in IP is weaker than the case for rights in tangible property.

These three claims are more or less sound. By themselves, they counsel in favor of erring on the side of under-rewarding invention. But they do not tell the whole story. The other part of the story is that once in a while an invention provides net benefits to society that astronomically exceed the net benefits to the inventor. Consider the polio vaccine. The benefits to the inventor, Jonas Salk, consisted of fame, gratification, and relatively modest financial gain. The social benefits consisted of millions of saved lives. No particular piece of tangible property can compete with the polio vaccine when it comes to the size of the gap between the net social benefits and the net private benefits to the owner or creator. Indeed, it is tempting to conclude that the social benefits of the polio vaccine exceed the combined social costs of every invention and IP right that has ever existed. This may

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*The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247 (1994); see also LANDES & POSNER, *supra* note 1, at 22–23; John F. Duffy, *The Marginal Cost Controversy in Intellectual Property*, 71 U. CHI. L. REV. 37, 54–55 (2004).

4. These figures are based on a simple linear model. Ayres & Klemperer, *supra* note 2, at 990 tbl.1. Gifford presents a model that suggests the last bit of supra-competitive pricing is even more disproportionately costly in the normal case in which demand is concave. See Gifford, *supra* note 2, at 106.

5. See Ayres & Klemperer, *supra* note 2, at 989.

6. DAVID D. FRIEDMAN, *LAW'S ORDER* 138–39 (2000).

7. See Michele Boldrin & David Levine, IER Lawrence Klein Lecture: The Case Against Intellectual Monopoly (Mar. 28, 2003) (unpublished manuscript), available at <http://levine.sscnet.ucla.edu/papers/klein-paper.pdf> [hereinafter Boldrin & Levine, *Monopoly*]; Michele Boldrin & David Levine, *The Case Against Intellectual Property*, 92 AM. ECON. REV. 209 (2002); Danny Quah, *24/7 Competitive Innovation* (Ctr. for Econ. Performance, Working Paper No. 1218, 2002), available at <http://econ.lse.ac.uk/staff/dquah/p/0204-247.pdf>.

8. See LANDES & POSNER, *supra* note 1, at 12–18. The material costs tend to be much higher in the former case. The difference “argues for less extensive propertization of intellectual than of physical property.” *Id.* at 8; see also Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473 (2005); Edmund W. Kitch, *Patents, Prospects, and Economic Surplus: A Reply*, 23 J.L. & ECON. 205 (1980); Robert P. Merges, *Rent Control in the Patent District: Observations on the Grady-Alexander Thesis*, 78 VA. L. REV. 359, 374 (1992) (“A substantial literature documents the steep transaction costs of technology licensing . . .”); cf. Yoram Barzel, *Some Fallacies in the Interpretation of Information Costs*, 20 J.L. & ECON. 291, 292 (1977) (arguing that high transaction costs are the cause of high rent dissipation).

also be true for inventions such as the smallpox vaccine, penicillin, and the pesticide DDT. (By preventing malaria, DDT reputedly saved hundreds of millions of lives.<sup>9</sup>) Nor are such great gaps between social and private benefit exclusive to inventions in health and medicine. Other super socially valuable inventions include the light bulb, telephone, combustion engine, airplane, television, transistor, and integrated circuit.

Would these super socially valuable inventions have ever been created and put to use had they been entitled to weaker patent protection? The answer is almost certainly yes. Super socially valuable inventions are precisely the inventions that are likely to be produced even in the total absence of patent protection. Weaker patent protection, however, might have delayed some of them. Weaker patent protection implies lower expected revenue for the inventor. An inventor will not pursue an invention unless her expected revenue exceeds her expected costs of invention. The costs of invention fall with time. (Inventing the polio vaccine today, for example, would not require the Herculean effort it required in the 1940s.) Thus, to weaken patent protection is to increase the risk that inventors will postpone invention.

Many IP scholars seem to believe that we can often get something for next to nothing—that by scaling back patent protection we can often markedly decrease its social costs without markedly increasing the risk of missing out on or postponing invention. Actually, we *can* get something for next to nothing, but the opportunities to do so are scarce. To find these opportunities, we must identify the inventions for which scaling back patent protection would avoid disproportionately high social cost or would pose disproportionately low risk of under-rewarding inventors. This paper identifies a class of inventions that can satisfy this requirement: inventions that face significant odds of being invented by more than one inventor at roughly the same time.

Under current U.S. law, the second to invent generally comes up empty handed. Suppose inventor Smith and inventor Jones toil away for years in separate efforts to build a better mousetrap. They conceive of essentially the same design but Smith does so a few months after Jones. Smith and Jones separately perfect the design, file for patents, and then start commercializing the mousetrap. Under U.S. law, only inventor Jones will receive a valid patent. As soon as Jones's patent issues (usually two to three years after its filing date), Smith can no longer make, use, or sell the mousetrap unless Smith acquires a license from Jones.

This type of neck-and-neck finish is common. Researchers frequently converge on the same idea at roughly the same time.<sup>10</sup> Famous examples

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9. See COMM. ON RESEARCH IN THE LIFE SCI., NAT'L ACAD. OF SCI., *THE LIFE SCIENCES: RECENT PROGRESS AND APPLICATION TO HUMAN AFFAIRS* 432 (1970) (asserting that DDT saved 500 million lives); see also J. Gordon Edwards & Steven J. Milloy, 100 Things You Should Know About DDT, <http://www.junkscience.com/ddtfaq.htm> (last visited Aug. 11, 2006).

10. See Eugene Garfield, *Multiple Independent Discovery & Creativity in Science*, CURRENT COMMENTS (Inst. for Scientific Info., Phila., Pa.), reprinted in 4 *ESSAYS OF AN INFORMATION SCIENTIST* 660 (Eugene Garfield ed., 1981); D. LAMB & S.M. EASTON, *MULTIPLE DISCOVERY: THE PATTERN OF SCIENTIFIC PROGRESS* (1984); WILLIAM FIELDING OGBURN, *SOCIAL CHANGE* 90–122

include the light bulb (Edison and Swann), the telephone (Bell and Gray), the integrated circuit (Kilby and Noyce), calculus (Newton and Leibniz), the periodic table (Mendeleev and Meyer), the telegraph (Morse, Henry, and Cooke and Wheatstone), the telescope (Hans Lippershey, Drebbel, Fontana, Jansen, Metius, and Galileo—each claiming they invented it in 1608 or 1609),<sup>11</sup> and certain facets of the theory of relativity (Einstein and Poincaré).<sup>12</sup> Some historians and philosophers of science believe convergence is the rule rather than the exception.<sup>13</sup>

A crucial claim of this paper is that convergence is evidence that a smaller reward would have been sufficient to incentivize the invention. This claim rests on Bayes' theorem, which tells us how to revise an estimated probability in light of new information.<sup>14</sup> For our purposes, the estimated probability in question is the probability that complete patent protection, meaning the standard protection conferred under current law, provides an excessive reward for a given invention. A reward is excessive when it exceeds the minimum necessary to incentivize timely creation of the invention. The new information in question—the information we use to revise the estimated probability—is the number of inventors who create the invention, that is, the number of inventors who invent the same invention. If no inventor ever creates the invention, the probability is very low that complete protection provides an excessive reward for the invention. If exactly one inventor creates the invention, the probability is higher but still not high overall. If two or more inventors independently create the invention at about the same time (convergence), the probability of an excessive reward is high overall.

Therefore, I argue, in a case in which two or more independent inventors converge on an invention, the patent protection available for that invention should be ratcheted down moderately. A good way to ratchet down protection moderately is to automatically bestow a defense to patent infringement on the independent inventor(s) not entitled to the patent.

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(1922); Jerry Gaston, *Secretiveness and Competition for Priority of Discovery in Physics*, 9 *MiNERVA* 472 (1971); Robert K. Merton, *Singletons and Multiples in Scientific Discovery: A Chapter in the Sociology of Science*, 105 *PROC. AM. PHIL. SOC'Y* 470 (1961); William F. Ogburn & Dorothy Thomas, *Are Inventions Inevitable?* 37 *POL. SCI. Q.* 83 (1922). One study showed that 46% of researchers believed they had been anticipated once or twice in their career, and an additional 16% believed they had been anticipated at least three times. See Warren O. Hagstrom, *Competition in Science*, 39 *AM. SOC. R.* 1, 3 (1974). These figures agree with theoretical models of multiple discovery. Garfield, *supra*.

11. See LAMB & EASTON, *supra* note 10, at 145.

12. Poincaré formulated (but did not interpret) the exact equivalent of  $E = mc^2$  slightly before Einstein did. See Tony Rothman, *Lost in Einstein's Shadow*, 94 *AM. SCIENTIST* 112 (2006).

13. See, e.g., LAMB & EASTON, *supra* note 10; Merton, *supra* note 10.

14. The probability of event A "conditional on"—meaning given the occurrence of—event B generally differs from the probability of event B conditional on event A. Yet, there is a definite relationship between these two probabilities, and Bayes' theorem is an expression of that relationship, which is:  $\Pr(A|B) = \Pr(A) \Pr(B|A) / \Pr(B)$ , or, the probability of event A conditional on event B equals the product of the unconditional probability of event A and the probability of event B conditional on event A, divided by the unconditional probability of event B. In place of "event A" and "event B," one can substitute "hypothesis A" and "data B," thereby bringing into relief the central insight of Bayes' theorem, which is that a hypothesis is supported by data that is more likely to appear when the hypothesis is true than when the hypothesis is false.

Hereinafter, this proposed defense is referred to as the “reinvention defense” or simply the “defense.” Inventions for which the probability of reinvention is significant—or for which the probability of reinvention would be significant were it not for the law’s adoption of the reinvention defense—are referred to as “reinventables.” The independent inventor not entitled to the patent is referred to as the “reinventor.” Although the second inventor is occasionally entitled to the patent under U.S. law,<sup>15</sup> and although more than two independent inventors may be entitled to assert the reinvention defense, “reinventor” is used interchangeably with “second inventor,” and “patentee” is used interchangeably with “first inventor,” unless stated otherwise. To avoid vague pronoun references, the reinventor/second inventor is referred to as a “he” and the patentee/first inventor is referred to as a “she.” Also referred to as a “she” is an inventor at the *ex ante* stage who is yet neither a reinventor/second inventor nor a patentee/first inventor.

Part I discusses the literature most relevant to the reinvention defense. Part II characterizes a version of the defense that would work best in the real world. Part III establishes a test to evaluate the overall desirability of the defense. Part IV, the heart of the paper, aims to show that the defense passes this test, arguing that the defense reduces system costs markedly while reducing the incentive to invent only moderately. Finally, Part V discusses four objections to the defense and concludes that none of them are especially troubling.

## I. PREVIOUS COMMENTARY

### A. Long’s Theory of Information Costs

Unlike a patent, a copyright provides no protection against independent creation of a copyrighted work, and a trade secret provides no protection against independent discovery. Clarisa Long attempts to explain the patent law difference in terms of the “information cost profile” of patents.<sup>16</sup> IP rights protect information. It is costly to produce information worthy of such protection, but the costs of producing protected information are not the costs Long has in mind. She has in mind the costs of information *about* protected information.<sup>17</sup> Costs of information about protected information include the

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15. The second inventor may be entitled to the patent if the first inventor “abandoned, suppressed, or concealed” the invention. 35 U.S.C. § 102(g) (2000). In other words, the second inventor may be entitled to the patent if the first inventor does not publish, commercialize, or file for a patent on the invention at some point before the second inventor files for a patent on it. However, the courts will seldom presume abandonment, suppression, or concealment, unless it appears the first inventor abandoned, suppressed, or concealed for several uninterrupted years. Also, the first inventor can overcome the presumption by showing that she was working to perfect the invention. *See generally* Lutzker v. Plet, 843 F.2d 1364 (Fed. Cir. 1988); *cf.* Kyla Harriel, *Prior User Rights in A First-To-Invent Patent System: Why Not?*, 36 IDEA 543, 550 (1996); *see also* Karl F. Jorda, *The Rights of the First Inventor-Trade Secret User as Against Those of the Second Inventor-Patentee (Part II)*, 61 J. PAT. OFF. SOC’Y 593, 600 (1979).

16. Clarisa Long, *Information Costs in Patent and Copyright*, 90 VA. L. REV. 465 (2004).

17. *Id.* at 467 n.5, 480.

costs of identifying the boundaries of protected information and the nature of its protection. These costs are borne by potential owners, infringers, and licensees,<sup>18</sup> and by the courts and administrative agencies.

In copyright, Long argues, the defense of independent creation economizes on these information costs by rendering it unnecessary for an author to determine whether the expressive work she plans to create is covered by another author's copyright. This cost savings outweighs the social costs arising from the defense's negligible reduction in the incentive to create expressive works.<sup>19</sup>

In patent law, a reinvention defense would confer only modest savings in information costs, savings that would, Long argues, likely be outweighed by the costs of the defense's reduction in the incentive to invent.<sup>20</sup> Under current law, when a firm invents something on its own, the firm cannot assume it is free to embark on commercial development. Before embarking, the firm will typically ask patent counsel to prepare a "freedom to operate" or "clearance" opinion, which consists of a comprehensive search for and detailed analysis of patents that may cover the invention. A reinvention defense would mitigate the need for and the complexity of these costly opinions, but the savings would be modest for three reasons.

First, compared to copyrights, the number of patents through which a potential infringer must search is small, and the class of parties who must search patents is relatively small.<sup>21</sup> That class is limited to the types of firms likely to be sued for patent infringement, i.e., sophisticated firms that specialize in the technology in question. The average Joe could not infringe the typical patent if his life depended on it, whereas anybody can copy a copyrighted work.

Second, patents are easier to search than copyrighted works because patents must be applied for, the applications and resulting patents have a uniform format, they are organized into predetermined classes, and they are published in keyword-searchable databases. The fact that it is even possible to search patents by keyword goes to the heart of the difference in the information cost profiles of patent versus copyright. Inventions can be described in words because they are functional in nature, whereas the ineffable nature of expressive works often makes them harder to describe than to create in the first place.<sup>22</sup>

Third, patent rights are easier to cognize than copyrights because patent rights cannot be parsed.<sup>23</sup> Unlike a copyright, a patent does not cover subparts of the whole. If a patent claims an invention with elements A, B, C,

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18. *See id.* at 468, 490–95.

19. *Id.* at 528–29; *see also id.* at 469–70, 511–12, 517–27.

20. *Id.* at 528–29, 532; *see also id.* at 517–27.

21. *Id.* at 469, 487–89, 502–05, 509.

22. *Id.* at 469, 487–88, 508–09.

23. *Id.* at 510–11.



and D, a firm that practices only one, two, or three of the elements does not infringe the patent. A firm must practice all four to infringe.

Long's argument—that the reinvention defense would at best confer only modest savings in information costs—is essentially sound. Yet, her argument neither explains nor justifies the absence of the defense from patent law. For one thing, her argument ignores savings in costs other than information costs. Her argument also presumes, contrary to the argument of this paper, that the defense would unduly lower the incentive to invent.

### B. *Reinvention Defense for Concealable Inventions*

Economists Stephen Maurer, Suzanne Scotchmer, Elisabetta Ottoz, and Franco Cugno conclude that a reinvention defense would discourage wasteful patent races while lowering inventors' profits to levels commensurate with their costs of invention.<sup>24</sup> I agree with this conclusion, but the models on which these economists base it do not for the most part speak to patentable inventions. The models purport to ask and answer the following question: when will a potential reinventor choose to incur the costs of reinventing a patented invention rather than to license it from the patentee?<sup>25</sup> The answers generated by the models suggest that giving the potential reinventor the ability to make this choice—by shielding him from liability if he does so—would enhance social welfare.

The problem with the models is that they assume a potential reinventor can evaluate a patented invention and still invent *independently*. Seldom can a potential reinventor evaluate a patented invention and still invent it independently.<sup>26</sup> In practice, learning that a patented invention exists usually coincides with learning how to replicate it. For one thing, the patent explains how to make and use the invention. Also, in most cases the key elements of the patented invention can be readily ascertained by examining the commercial product that embodies it.

As such, the models are really models of trade secrecy rather than models of patent protection. The models speak only to inventions for which trade secrecy is suitable, that is, inventions that can be commercially exploited and kept secret at the same time, such as a manufacturing process that cannot be reverse-engineered through examination of the manufactured product.<sup>27</sup> With respect to such inventions, the models demonstrate that rein-

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24. Stephen M. Maurer & Suzanne Scotchmer, *The Independent Invention Defence in Intellectual Property*, 69 *ECONOMICA* 535 (2002); Elisabetta Ottoz & Franco Cugno, *The Independent Invention Defence in a Cournot Duopoly Model*, *ECON. BULL.*, June 20, 2004, at 1, <http://economicsbulletin.vanderbilt.edu/2004/volume12/EB-04L10005A.pdf>; see also James J. Anton & Dennis A. Yao, *Expropriation and Inventions: Appropriable Rents in the Absence of Property Rights*, 84 *AM. ECON. REV.* 190 (1994).

25. Maurer & Scotchmer, *supra* note 24, at 537; Ottoz & Cugno, *supra* note 24.

26. See also Roger D. Blair & Thomas F. Cotter, *Strict Liability and Its Alternatives in Patent Law*, 17 *BERKELEY TECH. L.J.* 799, 813–20 (2002) (listing additional problems with the Maurer-Scotchmer model).

27. See generally LANDES & POSNER, *supra* note 1, at 6–7; Heald, *supra* note 8.

ventors should be exempt from liability. Thus the models confirm the wisdom of the long-standing rule that trade secrets do not protect against reinvention. With respect to inventions that must rely on patent (i.e., inventions that cannot be commercially exploited and kept secret at the same time), the models are largely irrelevant.

### C. User Rights

In countries that recognize prior user rights, the patent goes to the first to file the application as opposed to the first to invent. Typically, a prior user is defined as an inventor who commercialized the invention, or made substantial preparations to do so, before the patentee filed the application.<sup>28</sup> Prior user rights enable the prior user to continue commercializing the invention in the same manner and to the same extent that she had commercialized it, or had prepared to, before the patentee filed the application.

Economist Carl Shapiro explores the welfare effects of a stylized version of prior user rights.<sup>29</sup> Under his model, two inventors pursue an invention and create it simultaneously. Thus, his model ignores the issue of which inventor filed the application first and which created the invention slightly before or after the other. This effectively removes the “prior” from “prior user rights,” leaving “user rights.”

Under his model, the law either recognizes or does not recognize user rights. If the law does not recognize user rights, one of the inventors always obtains a monopoly on the invention. If the law recognizes user rights, a duopoly always results. The ex post benefits of user rights are straightforward, assuming social welfare under duopoly exceeds social welfare under monopoly. The model also shows that user rights confer ex ante benefits, assuming the competition under duopoly is not too sharp. Shapiro concludes as follows:

[U]ser rights will *automatically* reduce the rewards precisely for those inventions with a high profit-to-cost ratio, since these are the inventions most likely to be discovered simultaneously. These are also the inventions that the patent system is most likely to overreward. From a Bayesian perspective, the fact that an invention was discovered independently by two or more parties is evidence that the profit-to-cost ratio for that invention was

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28. See, e.g., Tokkyoh [Patent Law], Law No. 121 of 1959, art. 79 (Japan) (non-exclusive license by virtue of prior use).

29. Carl Shapiro, *Prior User Rights*, 96 AM. ECON. REV. 92 (2006). The United States recognized prior user rights for part of the nineteenth century. See Patent Act of 1839, ch.88, § 7, 5 Stat. 353 (establishing prior user rights later revoked in the Patent Act of 1952); see also Harriel, *supra* note 15, at 550. Currently, the United States recognizes only a very limited form of prior user rights for inventions covered by business methods. See 35 U.S.C. § 273 (2000). Not only must the prior user have used the business method commercially in the United States before the application was filed, she must have done so at least one year before the application was filed. In most cases where these criteria are satisfied, prior user rights are unnecessary because the patent in question is invalid for lack of novelty. *Id.* § 102.

relatively high, so reducing the reward based on market power is attractive.<sup>30</sup>

In addition, Shapiro points out that user rights mitigate the bias in R&D toward overly similar research projects. That is, by reducing the expected return for achieving the same invention as someone else, user rights encourage firms to pursue more diverse research projects, which is good, provided R&D is, as theory suggests, too similar in market equilibrium.<sup>31</sup>

Note that Shapiro's user rights lack certain features of the reinvention defense advocated herein. The reinvention defense does not, for instance, confer the same rights on the first inventor and the second inventor. Nevertheless, Shapiro's main argument for user rights supports the reinvention defense. At bottom, his main argument is also my main argument.

Shapiro's only reservation about user rights is that they may encourage first inventors to keep their inventions secret. Though Shapiro's main argument applies to the reinvention defense, his reservation does not. As discussed in Section IV.A.2, the reinvention defense would, overall, discourage first inventors from keeping their inventions secret. Indeed, the defense would create a strong incentive for first inventors to disclose their inventions to the public as soon as possible.

Of the few papers relevant to the reinvention defense, only Shapiro's is on track. And his fleshes out none of the key contours of a reinvention defense that would work in the real world. Part II (below) fleshes out those contours.

## II. FEATURES OF THE REINVENTION DEFENSE

### A. *The Thoughts and Acts That Constitute Reinvention*

There appears to be no reason why the thoughts and acts that constitute a reinvention should differ from the thoughts and acts long recognized as constituting a first invention: independent conception of the invention and independent reduction of it to practice.<sup>32</sup> In other words, a reinventor must come up with the idea for the invention on his own and get the invention into workable form on his own.

30. Shapiro, *supra* note 29, at 4.

31. Theory suggests firms pursue projects that are "overly correlated." See generally Luís Cabral, *Bias in Market R&D Portfolios*, 12 INT'L J. INDUS. ORG. 533 (1994); Partha Dasgupta, *The Welfare Economics of Knowledge Production*, 4 OXFORD REV. ECON. POL'Y 8 (1988); Partha Dasgupta & Eric Maskin, *The Simple Economics of Research Portfolios*, 97 ECON. J. 581 (1987); Joseph Zeira, *Innovation, Patent Races, and Endogenous Growth* (Kennedy Sch. of Gov't Faculty Research Working Paper Series, Working Paper No. RWP02-047, 2002), available at [http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP02-047/\\$File/rwp02\\_047\\_zeira.pdf](http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP02-047/$File/rwp02_047_zeira.pdf). The reason is the same reason there is excessive entry of firms into patent races—society cares only about getting the most useful inventions at the least cost, whereas firms care only about maximizing their individual gains. Thus, individual firms do not care if the number of firms pursuing an invention that is a relatively "sure thing" from a technological standpoint is non-optimally high.

32. See, e.g., *Loom Co. v. Higgins*, 105 U.S. 580, 592–94 (1881); *Agawam Co. v. Jordan*, 74 U.S. 583, 602–03 (1868); *Pitts v. Hall*, 19 F. Cas. 754 (C.C.N.D.N.Y. 1851) (No. 11,192).

### B. *One Patent per Invention*

In copyright, independent creators can get their own copyrights for works previously copyrighted by others. Should reinventors be able to get their own patents for inventions previously patented by others? No. Allowing reinventors to get separate patents would require changes in the law that would upset numerous settled patent doctrines. For example, it would require changes at odds with the novelty requirement, which is as fundamental to patent law as consideration is to contract law. It would also require changes that would undermine the widely accepted notion that a patent confers only the right to exclude others from practicing the invention rather than the affirmative right to practice the invention.

In addition, allowing reinventors to get separate patents could unduly reduce incentives to pursue reinventables. If the reduction in incentives is to be moderate, inventors must believe *ex ante* that there is a fair chance that convergence on the same invention will give rise to a Cournot duopoly that maintains prices above the competitive level.<sup>33</sup> As discussed later, a Cournot duopoly cannot persist without some inequality between the reinventor and the patentee. Thus, awarding them equal patent rights would undermine their *ex ante* prospect of Cournot duopoly.

Also, allowing reinventors to get separate patents would increase uncertainty in the market for inventions. No one could be sure whether or when a reinventor's patent might suddenly issue from the Patent Office and thereby markedly alter the value and exclusivity conferred by the first inventor's patent and licenses thereto. The Patent Office keeps applications secret for at least eighteen months after they are filed. It publishes most of them at eighteen months, but an applicant who is willing to forego patent protection in foreign countries can instruct the Patent Office to delay publication until the application issues as a patent. The delay between filing and issuance ranges from approximately thirty-four to forty-three months.<sup>34</sup> However, an applicant who wants to can delay issuance indefinitely by, for instance, filing one continuation application after another.

### C. *When Reinvention Must Occur*

As mentioned earlier, it is impossible for a potential reinventor to learn about the details of an invention and *then* reinvent it independently. Therefore, the defense cannot be available to a purported reinventor who received actual notice of the details before purportedly reinventing.

What about constructive notice? The law tends to regard constructive notice as sufficient when proving that the intended recipient received actual

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33. A Cournot duopoly forms when two firms that produce homogeneous goods compete against each other but at least one of the firms cannot increase output freely and other firms are barred from entry.

34. John R. Allison & Mark A. Lemley, *Who's Patenting What? An Empirical Exploration of Patent Prosecution*, 53 VAND. L. REV. 2099, 2101, 2118 (2000); John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 237 (1998).

notice is difficult. Suppose a first inventor's application is published and another party sees it (actual notice). How could the first inventor prove that this other party, who purports to be a reinventor, saw the application and used it as an instruction manual to copy the invention?

The law also tends to regard constructive notice as sufficient when requiring actual notice would encourage would-be recipients to cultivate ignorance. Requiring actual notice would discourage potential legitimate reinventors from reading patents, scientific journals, and other sources of information that might notify them of a prior invention and thereby shut their reinvention window. As well as retarding the flow of information, requiring actual notice would generate high costs in cases in which the first inventor is unsure who the potential reinventors are. To cover her bases, the first inventor would have to send registered letters to numerous irrelevant parties who would waste time and money ascertaining the significance of the letters.

Therefore, first inventors should have the option to provide constructive notice through publication instead of or in addition to providing actual notice. When a first inventor provides both, a reinventor should not qualify for the defense unless he reinvents before receiving the earlier of the two. Notice must, however, be sufficient. Actual notice should be considered sufficient if it "enables" the invention, which means it includes a disclosure that teaches a person of ordinary skill in the art how to make and use the invention. This is the criterion under current law for what prior art must teach in order to invalidate a patent.<sup>35</sup>

Constructive notice could be considered sufficient for purposes of the defense if, in addition to enabling the invention, the disclosure was published in good faith rather than in a manner designed to avoid giving actual notice to potential reinventors.<sup>36</sup> This is not the very liberal standard that defines publication for prior art purposes. To qualify as published for prior art purposes, a disclosure need not appear in a mainstream source or even in English. Instead, a disclosure is deemed published for prior art purposes when it is made publicly accessible *in principle*. For example, one copy of a doctoral thesis in a library somewhere in the world qualifies as published prior art as long as a member of the public could have obtained access to it without much trouble.<sup>37</sup>

If that standard were the standard for what counts as constructive notice sufficient to shut the reinvention window, first inventors could shut the reinvention window for potential legitimate reinventors without really disclosing

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35. 35 U.S.C. § 103 (2000).

36. Admittedly, it might be difficult for courts to distinguish between bad faith publication that does not shut the reinvention window and good faith publication that does. If this proves to be the case, a better rule might be that only a published patent application dispositively shuts the reinvention window; any other form of publication merely creates a rebuttable presumption that it has shut the window. The presumption is rebutted if the reinventor shows that the first inventor could have published the invention at lower or equivalent cost in a manner that would have notified a substantially larger portion of the relevant public.

37. See *In re Hall*, 781 F.2d 897, 900 (Fed. Cir. 1986).

the invention to the relevant public. For example, immediately after achieving the invention, a first inventor could “publish” it where no one would see it by posting a disclosure for one week on an obscure page of an obscure website. Such strategic behavior could nullify the reinvention defense.

Thus, the standard for what qualifies as publication for purposes of constructive notice should probably be stricter than the standard for what qualifies as publication for purposes of prior art. Publication that would likely satisfy the standard for purposes of constructive notice includes English-language publication in an issued patent, a published patent application, publication in a mainstream scientific journal, or publication via presentation at a conference open to the relevant public. Note that, even with the stricter standard, an unavoidable evil of letting constructive notice shut the reinvention window is that legitimate reinventors who look for but never see the first inventor’s good faith publication will nonetheless lose the defense if they fail to complete reinvention before the date of that publication.<sup>38</sup>

#### D. *First Inventor as Reinventor*

Under 35 U.S.C. § 102(g), the second inventor may be entitled to the patent on the invention if the first inventor forgoes patent protection in favor of trade secrecy.<sup>39</sup> Under current law, the second inventor’s patent bars such a first inventor from continuing to practice the invention. The question arises: if the reinvention defense is adopted, should first inventors who maintain inventions as trade secrets be entitled to assert the defense against second inventors’ patents? Probably not. If these first inventors were entitled to assert the defense, it would encourage them (relative to the status quo) to elect trade secrecy over patent—it would assure them they could continue practicing their inventions even if second inventors later obtained patents. This would partially undermine the defense’s overall tendency (discussed in Section IV.A.2) to discourage secrecy among inventors.

To obviate this problem, the rule could be that only second inventors can assert the defense. Or, the rule could be that a first inventor can assert the

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38. What if the reinventor comes up with the basic idea for the invention (“conception”) before the first inventor’s publication, but does not get the invention into workable form (“reduction to practice”) until after that publication? The normal rule in patent law is that one’s date of invention is one’s date of conception, provided one was continually diligent in one’s efforts to reduce the invention to practice throughout the time between conception and reduction. For example, inventor A, who conceives an invention in, say, 2005, and reduces it to a working prototype in 2008, has an earlier date of invention than inventor B, who conceives the same invention in 2006 and reduces it to a working prototype in 2007—provided inventor A was consistently diligent in her efforts to reduce the invention to a working prototype between 2005 and 2008. Adoption of the reinvention defense will not change this rule, a rule that governs who qualifies as the first inventor. A different rule, however, may have to govern who qualifies as a reinventor. Conceiving of an invention is often easier and cheaper than reducing it to practice. Thus, it may be wise to insist that a reinventor qualify for the defense only if he both conceives of the invention and reduces it to practice before receiving notice of the prior invention.

39. § 102(g) bars a later inventor from patenting an invention only if the first inventor “had not abandoned, suppressed, or concealed” the invention. 35 U.S.C. § 102(g) (2000) (emphasis added). If the first inventor had abandoned, suppressed, or concealed the invention, a later inventor can patent it, provided the later inventor satisfies all the other requirements of patentability.

defense only if she did not maintain the invention as a trade secret. Either rule would work. However, the latter rule, which could be modeled on 35 U.S.C. § 102(g), is probably superior. The former rule would cause some upheaval in the law if the United States later changed over to a first-to-file system.

### E. Transferability

As a rule, transferability of rights is a prerequisite of efficiency. Rights in inventions are generally subject to this rule. Inventors commonly license or assign rights in their inventions to other parties who can better commercialize and enforce those rights. Indeed, small inventors and companies that specialize in inventing (so-called “invention factories”) would be ruined if they were unable to transfer their rights in inventions.

It is not clear, however, that *unlimited* transferability of the reinvention defense is efficient. Specifically, it is not clear whether the reinventor should be able to license out the defense (“unlimited transferability”) or whether the reinventor should only be able to assign it in its entirety to a single party (“limited transferability”). The question of which transferability regime is best implicates numerous tradeoffs among interrelated variables.<sup>40</sup> No definitive answer to this question is forthcoming. There are reasons to believe, however, that a limited-transferability regime is best overall. With limited transferability, only one party can possess the defense at any given time.<sup>41</sup> Keeping the defense in the hands of a single party prevents the defense from increasing—or at least from markedly increasing—uncertainty, transaction costs, and fragmentation of rights in the market for inventions.<sup>42</sup> As dis-

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40. Three examples of the variables include (1) the extent to which the reinventor’s ability to license out the defense would reduce the expected reward for invention relative to the expected reward if reinventors could not license out; (2) the extent to which the reinventor’s ability to license out would increase the information costs to all parties of determining who holds what rights to inventions and what those rights entail; and (3) the extent to which the reinventor’s inability to license out would bias R&D toward industries—such as software—that rely heavily on licensing to end users.

41. An exception would be if there were more than one timely reinventor. For example, if each of two inventors reinvented the invention before the first inventor or the other reinventor issued notice, then both reinventors would possess the defense.

42. It is easy to overuse the argument that a doctrine will increase uncertainty, transaction costs, or fragmentation of rights. The argument can be (but seldom is) made against many long-standing patent doctrines. Undoubtedly, if one of these doctrines did not already exist and some commentator proposed that it be adopted into law, other commentators would raise the argument. Consider, for instance, the shop rights doctrine, which is similar to the reinvention defense in some ways. Under the shop rights doctrine, an employer is entitled to free use of an invention made by an employee on company time or with company resources. Shop rights do not prevent the employee from patenting the invention and licensing it to other firms. Shop rights merely allow the employer to avoid paying a royalty. See *United States v. Dubilier Condenser Corp.*, 289 U.S. 178 (1933); Robert P. Merges, *The Law and Economics of Employee Inventions*, 13 HARV. J.L. & TECH. 1, 4–7 (1999). The shop rights doctrine is well accepted and uncontroversial. Yet, if the shop rights doctrine did not exist and some commentator proposed that it be adopted into law, other commentators could easily argue that it would increase uncertainty, transaction costs, or fragmentation of rights. The argument is virtually unfalsifiable unless and until the doctrine is adopted and its actual effects are assessed.

cussed later, prohibiting the reinventor from licensing out the defense to multiple parties also helps secure the inequality between reinventor and patentee that is necessary to maintain Cournot duopoly.

Now that we have tentatively established the main contours of the defense, we must establish a framework in which to evaluate its overall desirability. Part III establishes this framework.

### III. FRAMEWORK FOR EVALUATING THE REINVENTION DEFENSE

The patent system should stimulate creation of inventions for which the social benefits exceed the social costs. The social costs of an invention consist of (1) the unavoidable R&D costs inherent in overcoming the technical challenge of achieving the invention; (2) any negative externalities resulting from use of the invention (e.g., those of nuclear technology); and (3) the costs of providing patent protection for the invention. This paper focuses on the costs of providing patent protection, which are referred to as "system costs."

Lowering system costs is tricky because system costs are the flipside of the incentive to invent. Lowering system costs tends to lower the incentive to invent, and raising the incentive to invent tends to raise system costs. In other words, system costs are the price we pay to provide the incentive to invent, and the more incentive to invent we provide, the higher the price tends to be.

Nevertheless, there are bargains to be had: First, different ways of providing the same amount of incentive can impose different amounts of system costs.<sup>43</sup> Second, small reductions in the amount of incentive sometimes result in large reductions in the amounts of system costs. Third, even when a reduction in incentive exceeds the concomitant reduction in system costs, the reduced incentive may suffice to stimulate invention. Note that the incentive need not be proportional to the social value of the invention.<sup>44</sup> All that is required to incentivize invention is that an inventor's expected revenue exceed his costs of invention (including his opportunity costs). Ideally, we would never provide more than this minimum incentive. The more the incentive exceeds this minimum, the more we incur system costs without commensurate gain.

Our test for assessing the desirability of the reinvention defense boils down to asking: does the defense decrease system costs more than it increases the expected loss of invention?<sup>45</sup> The defense passes the test if it

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43. Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1829-37 (1984).

44. The common intuition that a patent should reward an inventor in proportion to the social value of his invention incorrectly focuses on total social benefits rather than net social benefits. *Id.* at 1821, 1827-28. This common intuition arises in part from mistaking correlation for causation. The social value of an invention often correlates positively with R&D costs simply because highly valuable inventions often cost more to produce than less valuable inventions.

45. "Expected" means the loss is discounted by its probability of occurring. Loss in this context refers to foregone benefit. Suppose an invention would confer \$10 million in net social



(1) markedly decreases system costs and (2) only marginally increases the risk that no timely inventor will expect to profit from the invention.

### A. System Costs

System costs can be divided into three categories: monopoly loss, rent dissipation, and miscellaneous costs.

#### 1. Monopoly Loss

Monopoly loss refers to deadweight losses proximately caused by supra-competitive pricing of the invention. Patents both supply and deny consumers access to (or use of) inventions. Patents supply access by giving inventors the incentive to invent in the first place.<sup>46</sup> Without such incentive, many inventions would never be created or would be long delayed. Once inventions have been invented, however, patents deny access by maintaining prices above the competitive level. If the price of the invention is \$100 when protected by patent and \$75 when not protected by patent, the patent denies access to all consumers who value the invention at more than \$75 but at less than \$100.<sup>47</sup> This does not represent a pure transfer from consumers to producers. It is well known that each dollar of monopoly profit reduces the consumer surplus more than it increases the producer surplus.

Monopoly also leads to inefficient production. To maintain supra-competitive prices, monopolists must produce at quantities short of those necessary to fully exploit the advantages of mass production. That is, by deliberately restricting output, monopolists fail to wring the most out of the resources used to produce the invention commercially. Also, monopolists are less pressured to adopt new ways of producing the invention more efficiently.

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benefits, and the probability of failing to incentivize its creation is 10%. In this case, the expected loss of invention is \$1 million. Though not apparent in this simple example, "expected loss" encompasses delay of invention as well as permanent loss.

46. Most purported alternatives to the incentive theory of patent law are merely alternatives to a narrowly conceived formulation of the incentive theory. In the final analysis, these purported alternatives seldom stray from the basic point that patents enable inventors to profit from invention. One exception is the portion of Kitch's prospect theory that posits avoidance of redundant effort as a contributory rationale for the patent system. See Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 276 (1977); see also Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305, 313-16 (1992) (revising Kitch's prospect theory of the patent system).

47. Patents also deny consumers access to inventions in the future by denying potential inventors access to preexisting inventions. The vast majority of inventions are improvements on preexisting inventions. Potential inventors must access preexisting inventions in order to improve them. When access to preexisting inventions is very costly, potential inventors make fewer improvement inventions. See generally Grady & Alexander, *supra* note 46; Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. 698 (1998); Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989 (1997); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990).

## 2. Rent Dissipation

Rent dissipation includes the increase in R&D costs attributable to patent races that is not offset by the benefits of getting inventions earlier. Under current law, patent races are winner-take-all contests. Winner-take-all contests can attract too much investment and too many contestants, for reasons similar to those underlying the tragedy of the commons. Landes and Posner analogize patent races to salvaging sunken treasure:

Suppose a sunken ship has a salvage value of \$1 million that could be realized at a cost of only \$100,000. The potential gain to the salvager—the economic rent or pure profit from salvaging the sunken ship—is thus \$900,000 if a property right in the sunken ship can be acquired. The competition to realize that gain by acquiring the property right may gobble up all or most of the potential rent, transforming it into a deadweight social loss unless the pell-mell competition speeds up the salvage process enough to produce an increase in present value of the treasure that offsets the added cost.<sup>48</sup>

Similarly, patent races increase R&D costs by encouraging speed and duplication among rival inventors.<sup>49</sup> Speed and duplication result in earlier invention, but the marginal social costs of earlier invention often exceed the marginal social benefits. Speed responsible for costs in excess of benefits will be referred to herein as “haste.” Duplication responsible for costs in excess of benefits will be referred to herein as “redundancy.”

Rent dissipation also includes wasteful efforts by competitors to invent around the patent. The further the patented invention is priced above the competitive level, the more profitable are non-infringing substitutes for the patented invention and the more incentive competitors have to design products

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48. LANDES & POSNER, *supra* note 1, at 16–17; *see also id.* at 25–29 (analogizing patent race to a race to claim an uninhabited continent); GEORGE J. STIGLER, *THE ORGANIZATION OF INDUSTRY* 124 (1968) (“The prospects of monopoly pricing will lead to such a scale of investment in producing knowledge that it will return only the competitive rate of return on average.”); Yoram Barzel, *Optimal Timing of Innovations*, 50 *REV. ECON. & STAT.* 348, 349 (1968) (“[C]ompetition among potential innovators may deprive innovations of all their special economic value.”); Giuseppe Dari-Mattiacci & Francesco Parisi, *Rents, Dissipation, and Lost Treasures: Rethinking Tullock’s Paradox*, 124 *PUB. CHOICE* 411 (2005), available at <http://ssrn.com/abstract=467343>.

49. *See generally* SUZANNE SCOTCHMER, *INNOVATIONS AND INCENTIVES* 100–03, 112–14, 120–23 (2004); Barzel, *supra* note 48; Partha Dasgupta & Joseph Stiglitz, *Uncertainty, Industrial Structure and the Speed of R&D*, 11 *BELL J. ECON.* 1, 11–12 (1980); Pankaj Tandon, *Rivalry and the Excessive Allocation of Resources to Research*, 14 *BELL J. ECON.* 152 (1983); Urs Fischbacher & Christian Thöni, *Excess Entry in an Experimental Winner-Take-All Market* (Zurich Inst. for Empirical Research in Econ., Working Paper No. 86, 2002) available at <http://ssrn.com/abstract=282729>; Roger A. McCain, *Optimal Entry in Information Product Sectors* (E. Econ. Assoc. Conf., Boston, Mar. 1996). *But cf.* Christopher Harris & John Vickers, *Patent Races and the Persistence of Monopoly*, 33 *J. INDUS. ECON.* 461 (1985) (stating that in race in which incumbent firm would affirmatively lose something if challenger won, challenger may anticipate that incumbent will outrace challenger, in which case challenger will not bother to enter race); Mark R. Patterson, *Patent Races with No Entrants* (Fordham Law & Econ., Research Paper No. 22, 2002), available at <http://www.fordham.edu/law/faculty/patterson/workingpapers/patent Races.pdf> (stating that *underinvestment* in R&D can occur when an inventor who would have won the race drops out after suffering early setbacks in his research, not knowing his competitors have suffered similar setbacks).

that fall just outside the patent's scope. This is inefficient to the extent these products are inferior substitutes for the patented invention.<sup>50</sup>

### 3. *Miscellaneous Costs*

Miscellaneous costs is a catchall category for the various social costs that do not clearly or traditionally fall into the category of monopoly loss or rent dissipation. Examples of miscellaneous costs include

- the costs of ascertaining the boundaries of patent rights;<sup>51</sup>
- the costs of transacting over patent rights;
- the costs attributable to the biasing of R&D toward patentable technology and away from unpatentable technology that is nevertheless socially valuable;
- the costs for patent applicants to prosecute applications through the Patent Office;
- the costs of running the Patent Office;
- the costs for litigants of pressing and defending patent suits; and
- the costs of running the courts that are attributable to patent litigation.

Miscellaneous costs do not play a key role in the analysis to follow. They are included largely for purposes of completeness.

### B. *Kaplow's Test*

Our test differs from a test established by Louis Kaplow in his landmark article on the intersection of patent and antitrust.<sup>52</sup> His test, in which "monopoly loss" apparently stands for all types of system costs, is framed in terms of a ratio:

Patentee Reward

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Monopoly Loss

His test treats the desired magnitude of the incentive as a given. A patent doctrine passes his test if the doctrine increases the ratio by reducing the denominator. In other words, Kaplow brackets the question of whether the magnitude of incentive is right and instead asks whether we can get the same magnitude of incentive at a lower cost than we are paying. This bracketing makes sense in the context of his article, which adopts a bird's eye view of the patent system that encompasses all classes of invention as opposed to, say, one exceptional class of inventions.

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50. Races to invent superior substitutes can also be inefficient if rent dissipation is severe. See generally Grady & Alexander, *supra* note 46, at 308.

51. See Long, *supra* note 16, at 468.

52. See Kaplow, *supra* note 43.

Our test does not treat the magnitude of the incentive as a given.<sup>53</sup> The reinvention defense could pass our test not only by altering the form of the incentive but also by reducing the magnitude of the incentive. Thus, our test cannot be framed in terms of Kaplow's ratio because we cannot say the defense should always increase his ratio.

The defense might pass our test even if it would reduce his ratio. For example, the defense passes our test but flunks Kaplow's test when standard, complete patent exclusivity would provide an *above-average* expected return on invention and when the defense would scale back the patent exclusivity until the expected return on invention dropped from above-average to average. Expected return and system costs both fall with reductions in patent exclusivity. With respect to inventions for which complete patent exclusivity would provide an above-average expected return, the opportunity presents itself to scale back the patent exclusivity and, in turn, to reduce system costs without reducing the expected return below the average. The average expected return is sufficient provided that, as it is popular and reasonable to believe, the average return on invention generally exceeds the necessary minimum to incentivize invention.

Our test further differs from Kaplow's in that his focuses attention on the patentee's reward rather than the inventors' incentives. Our test focuses on the inventors' incentives because not all relevant inventors are patentees and because expected profit is not solely a function of patent exclusivity.<sup>54</sup>

#### IV. THE REINVENTION DEFENSE LOWERS SYSTEM COSTS WITHOUT DESTROYING NECESSARY INCENTIVE

This Part argues that the reinvention defense characterized in Part II passes the test established in Part III. Section A below argues that the defense markedly lowers system costs. Section B below argues that the defense seldom lowers expected revenue below every timely inventor's costs. To be sure, the defense does lower the expected revenue for reinventables. Ex ante, an inventor does not know whether she will end up as the patentee or as the reinventor. If the defense is adopted into law, a reinventor could compete with whoever ends up as the patentee, thereby breaking up the patent monopoly into a duopoly. Monopoly profits exceed the collective profits of duopoly. Thus, from the ex ante perspective of inventors who are considering reinventables, the defense tends to shrink the pot at the end of

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53. Note that, though our test does not take the desired magnitude of the reward as a given, it does assume that the social benefits exceed the social costs for the invention in question. Thus, this test is inappropriate for inventions that society would be better off without. It is in this sense that this paper focuses on system costs rather than the other two costs of invention: the unavoidable R&D costs inherent in overcoming the technical challenge of the invention, and any negative externalities resulting from use of the invention.

54. See Vincenzo Denicolò, *Patent Races and Optimal Patent Breadth and Length*, 44 J. INDUS. ECON. 249, 253 (1996) (stating that a more general framework considers firms' overall incentives to invent rather than patentee firms' patent rents). Inventors also have non-monetary incentives.

the rainbow. Section B.1 argues, however, that the shrinkage is moderate. Section B.2 argues that, without the shrinkage, the pot is too big.

### A. *The Reinvention Defense Lowers System Costs*

#### 1. *The Reinvention Defense Reduces Monopoly Loss*

The defense reduces monopoly loss in a straightforward manner. In cases in which reinvention occurs, the reinventor (or his assignee) will typically sell the patented invention in competition with the patentee, thereby increasing commercial output of the invention and decreasing its price. Increased output and decreased price mean increased consumer access.

#### 2. *The Reinvention Defense Reduces Rent Dissipation*

The defense reduces rent dissipation, though not always in a straightforward manner. Haste and redundancy can occur at three stages: (1) before anyone has created the invention (“pre-invention stage”); (2) after the first inventor has created the invention but before she has notified a potential reinventor of it (“submarine stage”); and (3) after a reinventor has reinvented in a timely manner (“commercialization stage”).

By reducing the expected reward for reinventables, the defense reduces haste and redundancy at the pre-invention and submarine stages in a straightforward manner. Specifically, by reducing the expected reward for reinventables, the defense causes fewer and less zealous inventors to pursue reinventables, thereby reducing the number and intensity of patent races.

The defense further reduces haste and redundancy at the submarine stage in a less straightforward manner—by shortening the stage. Recall that reinvention qualifies as a defense only if the reinventor completes the invention before receiving notice that someone else already completed it. If the defense is adopted into law, first inventors will try to safeguard their patent monopolies by issuing notice of their inventions before would-be reinventors can complete the invention. The notice will apprise would-be reinventors that they have already lost the patent race and are too late to qualify for the defense.<sup>55</sup> These would-be reinventors will terminate their hasty and redundant work on the inventions and will turn their attention to other projects. Under current law, first inventors have little incentive to issue notice of their inventions promptly.

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55. See also Patterson, *supra* note 49, at 12–19. In Patterson’s model, an inventor who otherwise would have won the race may drop out after suffering early setbacks, not knowing that her competitors have suffered similar setbacks. This is another way of saying that patent races occasionally generate too little duplication rather than too much. Nevertheless, the reinvention defense comports with Patterson’s remedies for this exceptional problem. He identifies three types of changes in the law one might consider: those that provide race participants with information about the progress of their competitors; those that encourage competitors to provide information to each other about whether they are still in the race; and those that mitigate the winner-take-all nature of patent races by providing some reward to those who do not finish first. The reinvention defense would bring about all three of these changes.

Harder to assess are the effects of the defense at the commercialization stage. Under current law, patents deter reinventors from commercializing the patented inventions. If the defense is adopted into law, reinvention will occur less often overall, but in cases in which it does occur, reinventors and patentees will both be able to exploit the patented inventions. Their competitive efforts to do so may qualify as hasty and redundant. To reiterate, the defense makes reinvention less common in the first place, which reduces the absolute number—compared to the status quo—of cases in which reinventors stand ready to commercialize the patented inventions. But the defense could increase the relative *proportion* of those cases in which reinventors move forward with commercializing the patented inventions.

This leads to the question: is haste or redundancy at the commercialization stage as significant as haste or redundancy at the pre-invention and submarine stages? Probably not. Haste can arise at the commercialization stage because the patentee and reinventor both have an incentive to capture the reputational and branding advantages of being first to market.<sup>56</sup> In many cases, however, the patentee enjoys too big a head start for the reinventor to have any hope of being first to market. Not only will the patentee often enjoy a big head start, the patentee can also scale up faster because, unlike the reinventor, she can coordinate multiparty production by licensing out the invention.<sup>57</sup>

Redundancy can arise at the commercialization stage when the patentee and reinventor duplicate their efforts to commercialize. Note, however, the indivisibility of duplication (which typically has a bad connotation) and competition (which typically has a good connotation). Competition simultaneously entails inherent costs in the form of duplication and generates social benefits in the form of increased productive and allocative efficiency. Duplication is properly regarded as redundant only when (and only to the extent that) the costs of duplication inherent in competition exceed the benefits of competition.<sup>58</sup>

For IP, the inherent costs of duplication at the pre-invention and submarine stages tend to exceed the inherent costs of duplication at the commercialization stage. A defining characteristic of IP is that, compared to

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56. The first-mover advantage is more important than the patent right in some industries. See generally Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 3 BROOKINGS PAPERS ON ECON. ACTIVITY 783 (1987); Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MGMT. SCI. 173 (1986); Boldrin & Levine, *Monopoly*, *supra* note 7, at 24–27; Andrew Farlow, Dep't of Econ. & Oriel Coll., Univ. of Oxford, Presentation at the Access to Medicines and the Financing of Innovations in Health Care Conference, The Program on Science, Technology, and Global Development at The Earth Institute at Columbia University, Costs of Monopoly Pricing Under Patent Protection (Dec. 4, 2003), available at <http://www.earthinstitute.columbia.edu/cgsd/documents/farlow2.ppt>.

57. See discussion *supra* Section II.E.

58. *But cf.* Barzel, *supra* note 8, at 352. Under the assumptions of Barzel's model, including continuously rising demand for the invention over time, "the basic wasteful effect of competition lies not in duplicating the use of resources but in using these resources prematurely, when they would have earned a higher return elsewhere in the economy." *Id.*

tangible property, it has a high ratio of fixed costs to variable costs.<sup>59</sup> The fixed costs of invention consist more or less of the costs of R&D, which are incurred during the pre-invention and submarine stages. The variable costs of invention consist of the costs of commercializing the invention, i.e., the costs of producing, marketing, and selling the product or service embodying the invention. The variable costs of invention are incurred during the commercialization stage. Because the fixed costs of invention tend to be high and the variable costs low, the inherent costs of duplicating the fixed costs of invention tend to exceed the inherent costs of duplicating the variable costs of invention. This is especially true for information goods with very low variable costs, such as software.

In sum, the defense clearly decreases haste and redundancy in the first and second of the three stages in which haste and redundancy can occur. Unclear is whether the defense decreases or increases haste and redundancy at the third stage. However, even if the defense increases haste and redundancy at the third stage, that increase appears to be outweighed by the decrease at the first and second stages.<sup>60</sup>

### 3. *The Reinvention Defense Reduces Miscellaneous Costs*

The defense probably reduces miscellaneous costs overall. For example, the defense reduces legal costs by lowering the number of patent suits. Recent scholarship suggests that many if not most patent suits are against independent inventors as opposed to pirates or firms that attempted to invent around the patent.<sup>61</sup> The defense further reduces legal costs by allowing at least some reinventors to commercialize their inventions without first obtaining elaborate clearance opinions from patent counsel, opinions that under cur-

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59. See LANDES & POSNER, *supra* note 1, at 23.

60. *But cf.* Kitch, *supra* note 46. Kitch believes that redundant efforts to exploit an invention commercially are very costly. According to his well-known "prospect theory," patent rights are doled out to the first "prospector" to identify the inventive prospect, much the way mineral rights are doled out to the first prospector to identify a mineral deposit. Patents do not, Kitch argues, merely encourage the initial creation of the invention.

Another major function of patents is to encourage efficient investment in the perfection and commercialization of the invention. The exclusivity conferred by the patent enables the first prospector to coordinate perfection and commercialization efficiently, thereby encouraging the first prospector to invest in bringing the invention to market while simultaneously discouraging rivals from doing so.

Few scholars, however, accept prospect theory. It does not explain the case law. See, e.g., Grady & Alexander, *supra* note 46, at 317. Moreover, prospect theory is belied by the fact that patents confer only the right to exclude and not an affirmative right to exploit a patch of technology. In other words, patent law allows subsequent inventors to obtain patents on improvements within the prospect. For example, if inventor A patents the light bulb, inventor B is free to patent an improved light bulb filament. A cannot adopt B's filament without first obtaining a license from B.

61. See James Bessen & Michael J. Meurer, *Patent Litigation with Endogenous Disputes*, 96 AMER. ECON. REV. 77 (2006); James Bessen & Michael J. Meurer, *The Patent Litigation Explosion* (Boston Univ. Sch. of Law Working Paper No. 05-18, 2005), available at <http://ssrn.com/abstract=831685>.

rent law range in price from perhaps \$10,000 to \$150,000 each.<sup>62</sup> In addition, by reducing the expected return on reinventables, the defense mitigates the bias in R&D toward patentable technology.

*B. The Reinvention Defense Seldom Lowers the  
Reward below Break-Even Point*

Let “reward C” be the reward for an invention afforded by complete patent exclusivity, that is, the reward inventors expect under current law. Let “reward R” be the lower reward for an invention that inventors would expect were the reinvention defense adopted into law. If reward C causes an invention to be reinvented—if reward C incentivizes multiple inventors to cross the same finish line neck and neck—it is more than tempting to conclude that reward R would have been sufficient (provided it were only moderately lower than reward C) to incentivize at least one of the inventors to cross the finish line without undue delay.<sup>63</sup> This is indeed my conclusion, but I cannot jump to it. Reward C might be the break-even point below which no inventor would be incentivized to cross the finish line without undue delay. Or, reward C might exceed the inventors’ break-even point by only a tiny margin, in which case reward R could lie beneath the break-even point. This Section argues that, with respect to reinventables, reward C exceeds the break-even point by a large margin and that reward R exceeds the break-even point by a small but still clear margin.

Subsection (1) below argues that reward R is only moderately lower than reward C. Subsection (2) argues that, with respect to reinventables, reward C provides a considerably higher-than-average return on invention. Note that, consistent with “moderately” being an inexact term, it does not strictly follow from the arguments of Subsections (1) and (2) that reward R exceeds an inventor’s break-even point. I cannot *prove* reward R exceeds an inventor’s break-even point. I can only show that the probability is high that reward R exceeds an inventor’s break-even point in the vast majority of cases. Such indeterminacy is the norm in all areas of IP law. All IP doctrines are based on informed intuitions about the magnitudes of competing effects, not on close reasoning from hard data.<sup>64</sup>

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62. This range of prices is based on my experience from practicing between 2001 to 2004 at a large firm in Washington DC.

63. Can we analogize to foot races? Consider marathons. In 2005, rewards were \$100,000 for the men’s winner of the New York Marathon, \$25,000 for the men’s winner of the Honolulu Marathon, \$15,000 for the men’s winner of the Baltimore Marathon, and \$0 for the men’s winner of the Marine Corps Marathon. The New York reward is immoderately higher than these other rewards. Yet, the New York winner was only 2.5 minutes faster than the Honolulu winner, 4 minutes faster than the Baltimore winner, and 10.5 minutes faster than the Marine Corps winner. A similar pattern holds for other marathons such as the Boston, Las Vegas, and Houston marathons. Of course, people typically run, but do not typically invent, for reasons that are largely non-pecuniary.

64. Cf. George L. Priest, *What Economists Can Tell Lawyers About Intellectual Property*, 8 RES. L. & ECON. 19, 24 (1986) (concluding not much); William Fisher, *Theories of Intellectual Property*, in NEW ESSAYS IN THE LEGAL AND POLITICAL THEORY OF PROPERTY 17 (Stephen R. Munzer ed., 2001).



### 1. Reward R Is Only Moderately Lower Than Reward C

The defense drops the expected reward for reinventables from reward C to reward R. The drop from reward C to reward R is moderate, for the following three reasons.

First, even when a reinventor breaks up the patentee's monopoly, some degree of market exclusivity will usually remain. The duopoly shared by the patentee and the reinventor will usually be a Cournot duopoly that maintains prices above the competitive level. Given his limited rights, a reinventor cannot increase output freely. If he increases output until he competes away all of the patentee's profits, the patentee will have no incentive to enforce the patent against third parties or to pay the periodic maintenance fees necessary to keep the patent in force. If the patentee stops enforcing the patent or stops paying maintenance fees, the invention will effectively fall into the public domain, rendering the reinventor's defense worthless. In any event, even if a reinventor wanted to compete away all profits, he may be unable to do so: a reinventor cannot increase output as easily as a patentee because he cannot coordinate multiparty production by licensing out the invention.

Second, the drop from reward C to reward R is also moderate because the defense reduces the risk of inventive activity by reducing the variance in its payoffs.<sup>65</sup> Under current law, a reinventor gets no rights to the invention and may be sued by the patentee. Thus, inventors ex ante face the prospect of spending enormous sums on R&D only to end up scuttling the whole project. If the defense is adopted, inventors will take some comfort in the prospect of receiving the defense as a consolation prize. This effect partially<sup>66</sup> offsets the defense's overall tendency to decrease the incentive to pursue reinventables.

Third, the drop from reward C to reward R is moderate because it is somewhat self-moderating. As explained earlier, reducing the expected reward lowers the number of inventors who will pursue a reinventable in the first place. With fewer inventors, an inventor who stays in the race has better odds of winning the reward and not having to share it with a reinventor.

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65. In his classic article on invention, Kenneth Arrow suggested risk aversion leads to underinvestment in invention. Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS* 609, 610-14 (1962). Invention is indeed a risky activity. Not only is technological success far from assured, financial success is the exception. It is not clear, however, that risk aversion has actually led to underinvestment in invention in general. A stronger argument can be made that risk aversion has biased investment away from especially risky inventions toward less risky inventions. See, e.g., Cabral, *supra* note 31 (arguing R&D is biased toward non-optimally low risk projects); see also Joseph A. DiMasi, Ronald W. Hansen & Henry G. Grabowski, *The Price of Innovation: New Estimates of Drug Development Costs*, 22 *J. HEALTH ECON.* 151, 151 (2003) (half of the cost of developing a new drug is the increased cost of capital attributable to the high risk of failure in drug development).

66. Occasionally, the defense's attenuation of risk may wholly offset or even outweigh its attenuation of the promise of exclusivity. That is, in exceptional cases, the increase in incentives due to the reduction in risk could equal or exceed the decrease in incentives due to the reduction in patent protection.

Indeed, reducing the expected reward “on paper” can occasionally increase the expected reward for the inventor who stays in. Suppose, for example, the following: Inventor A can develop a patentable invention at an R&D cost of \$500,000, and the invention will yield \$4 million in revenue after discounting to present value. However, the initial expected profit of \$3.5 million will attract rival inventor B, thereby starting a race. The race will result in invention one year earlier than otherwise but will drive up R&D to \$1.5 million for each of the rival inventors. If A and B face an equal chance of winning the patent, the revised expected profit for each will be \$500,000 [(\$4 million / 2)–\$1.5 million], plus the reduction in the present-value discount attributable to realizing profits one year earlier. The rent dissipation is \$2.5 million<sup>67</sup> minus the social benefits of public access to the invention one year earlier.

Now suppose that a newly adopted patent doctrine will decrease the patent exclusivity available for the invention so that it yields \$2 million in revenue instead of \$4 million. The initial expected profit is therefore only \$1.5 million, which is less attractive to inventor B than the initial expected profit of \$3.5 million in the previous scenario. If the initial expected profit of \$1.5 million is insufficient to attract B, A’s expected profit will remain \$1.5 million, which well exceeds the revised expected profit of \$500,000 (or more) in the previous scenario. Also, rent dissipation will be far lower than in the previous scenario unless achieving the invention one year earlier provides freakishly high social benefits.<sup>68</sup>

## *2. Reward C Is Too High for Reinventables*

The occurrence of reinvention implies a high probability that reward C is excessive. Recall the Bayesian point in the Introduction: if no inventor ever creates a given invention, the probability is very low that reward C is excessive for that invention. If only one inventor creates the invention, the probability is higher (but still not high overall) that reward C is excessive. If two or more inventors independently create the invention at about the same time, the probability is high that reward C is excessive.

Reward C is excessive when it exceeds the minimum reward necessary to stimulate creation of the particular invention. Reward C tends to be excessive when it exceeds the average reward for invention. (This assumes that the average reward is not systematically too low to begin with, i.e., that the average reward is not already so low that it under-incentivizes many valuable inventions.) Reward C also tends to be excessive when the minimum reward necessary for the particular invention is lower than the minimum reward necessary for the average invention.

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67. \$2.5 million is the difference between what the total R&D costs ended up being (\$3 million) and what they started out as (\$500,000).

68. Revenue (as opposed to profit) is a proxy for the social benefits of an invention. Thus, if the total revenue the inventor could ever get from the invention were only \$2–4 million, the social benefits of getting the invention one year earlier would almost never exceed \$2.5 million.

In other words, reward C is excessive for inventions that promise inventors either unusually low costs or unusually high revenue. This situation can arise when, for example, an abrupt social or technological change suddenly lowers the cost of an input into an invention, thereby transforming it overnight from a high-cost invention into a low-cost invention. Or, an abrupt social or technological change can create demand for an invention that was low cost to begin with. Innumerable non-existent inventions have low costs but are never brought into existence because they are of no value to anyone. If demand for the invention suddenly appears, multiple inventors may invent it more or less simultaneously.<sup>69</sup> Consider Amazon.com's infamous one-click patent, which covers website transactions in which, after creating an account, the consumer buys the goods with one click rather than having to click through several pages to check out.<sup>70</sup> The one-click method posed only a trivial technical challenge (low cost of invention) but did not come into being until e-commerce abruptly emerged.

Alternatively, reward C may be excessive because the supply of the invention is inelastic. Technological and other exogenous forces can channel inventors toward the same end despite their initial attempts to pursue different ends. Sometimes there is only one feasible solution to a technological problem, so that inventors are forced by the laws of nature to merge onto the same road. In short, to some degree the invention may be inevitable.<sup>71</sup>

In summary, the sheer fact that an invention is—or is likely to be—reinvented implies that reward C is too high for that invention. It does not strictly follow that reward R is high enough. The fact that reward C incentivizes multiple inventors to create the invention contemporaneously does not prove that reward R—even if it is only moderately below reward C—will suffice to incentivize at least one inventor to create the invention in a timely manner. What does follow, however, is that *the odds are good* that reward R will suffice.

## V. OBJECTIONS TO THE REINVENTION DEFENSE

### A. *Inventors Will Learn to Issue Notice Immediately*

Again, a reinventor cannot qualify for the defense if he reinvents after the first inventor issues sufficient notice of her invention. Accordingly, if the defense is adopted into law, first inventors will have an incentive to issue notice before would-be reinventors can reinvent. What if first inventors adapt to the defense by learning to issue notice immediately (as little as a

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69. See LANDES & POSNER, *supra* note 1, at 304.

70. U.S. Patent No. 5,960,411 (filed Sept. 12, 1997).

71. See OGBURN, *supra* note 10, at 80–89; Ogburn & Thomas, *supra* note 10; Zeira, *supra* note 31. Zeira's model drops the standard assumption that the set of potential inventions in each period is unlimited. His model suggests that, when the assumption is dropped, the problem of rent dissipation and monopoly loss is even worse than standard models suggest. With regard to policy, Zeira tentatively suggests we should provide more support for inventors who pursue inventions with the lowest probabilities of success. *Id.* at 25–26.

few weeks) after completing invention?<sup>72</sup> Rarely does a reinventor complete invention immediately after the first inventor completes it. Thus, if first inventors learn to issue notice immediately, reinventors will rarely qualify for the defense. As such, the defense will do little to reduce monopoly loss. The defense will also do little to reduce ex ante incentives to pursue reinventables. If inventors ex ante know they will issue notice immediately after they complete the invention, they know the odds are very low that anyone will complete reinvention in time to qualify for the defense.

This argument is correct. To the extent inventors learn to issue notice immediately, the defense will reduce neither monopoly loss nor the number and intensity of patent races. To the same extent, however, the defense will reduce the *duration* of patent races. The sooner first inventors issue notice, the sooner trailing inventors will find out they have lost and terminate their hasty and redundant R&D. Thus, even if all inventors learn to issue notice immediately, the defense should still lead to a state of affairs superior to the status quo—provided, as will generally be true, the benefits of shortening patent races exceed the costs of issuing notice immediately.<sup>73</sup>

#### *B. The Reinvention Defense Could Exacerbate Some Patent Races*

One could argue that the defense will cause inventors to race faster in order not only to win the patent but to do so with greater lead time. That is, under current law inventors are satisfied to win by an inch; the defense may give them an incentive to win by a mile.

However, the strategy of winning by a mile is inferior to the strategy of issuing notice promptly after winning by an inch. The strategies are equally effective at shutting the window of reinvention for a trailing inventor, but the strategy of winning by a mile tends to be much more expensive than the strategy of issuing notice promptly after winning by an inch. Thus, rational inventors will choose the latter strategy.

Compare, for instance, the following two cases: In case one, inventors A and B are in the middle of a patent race. In terms of progress on the invention, A is about three months ahead of B. To prevent B from qualifying for the reinvention defense, A steps up the pace of her R&D, increases her lead, and ends up crossing the invention finish line six months before B can cross it. Yet, A issues notice of her invention five months later in her traditional unrushed fashion. In case two, A does not step up the pace of R&D. Rather, A maintains her three-month lead throughout the race, but issues notice two months after she crosses the finish line rather than five months after she crosses it. In both cases, B's reinvention window is shut one month before

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72. Inventors would be hard pressed to issue notice within less than a few weeks. It takes time for them to extract the relevant disclosure from their notebooks, to organize it, and to make sure it discloses no more proprietary material than necessary.

73. This proviso will generally be satisfied because the benefits of terminating hasty and redundant R&D that would otherwise occur generally exceed the costs of sending letters to potential reinventors (actual notice) or publishing the invention via, for example, a press release (constructive notice).

he can complete reinvention. A's costs, however, are likely to be much higher in the first case than the second.

### C. *Reinvention Can Be Faked*

An early version of this paper purported to be descriptive rather than normative. It aimed to explain why the reinvention defense does not exist in patent law rather than to argue it should exist. The purported descriptive explanation is that the defense would open the door to fraudulent claims of reinvention, which would degrade incentives for all inventions, not just for inventions that face a significant chance of being legitimately reinvented.

On closer inspection, the fraud explanation is unconvincing. To perpetrate a fraudulent reinvention defense, the phony reinventor would have to commit perjury and/or forge records. Advocacy and self-serving belief are not especially rare among members of the inventive community, but outright fraud is. That community consists of scientists and engineers who if anything are probably more earnest than the general population. Accordingly, fraudulent attempts to establish first-inventor status are quite rare.<sup>74</sup> It is true that reinvention is somewhat easier to fake than first invention is.<sup>75</sup> On the other hand, a phony first inventor stands to gain more today from successfully faking first invention than a phony reinventor will gain from successfully faking reinvention. To the extent the overall risk-reward calculation for phony first invention approximates or is better than the overall risk-reward calculation for phony reinvention, the fact that fraudulent first invention is rare today suggests that fraudulent reinvention will be rare if the defense is adopted into law. In any event, if fraudulent reinvention turns out to be a problem, we can respond by increasing the evidentiary requirements that reinventors must satisfy to qualify for the defense. For example, we can place the burden on reinventors to provide corroborated evidence that they reinvented before receiving notice.

Nor will the danger of phony reinvention encourage secrecy among first inventors. The benefit to first inventors of issuing early notice—early shutting of the reinvention window for legitimate potential reinventors—outweighs the risk to first inventors that issuing early notice will help phony reinventors to fake reinvention. Issuing early notice will seldom help phony

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74. Consider some casual evidence for this proposition. Hundreds of thousands of U.S. patent applications are filed each year, and the Patent Office has issued millions of them as patents over the years. Yet, one can count on a single hand the number of decisions in which the Board of Patent Appeals and Interferences has accused a party to a contest over inventorship (an interference) of *fraudulently* attempting to establish first inventor status.

75. In most legal disputes over who was first to invent ("priority contests"), neither party initially knows the other's date of invention. Each party must disclose his date of invention to the court or Patent Office before he knows the other's date. This discourages fraud because at the time when the fraud would need to occur—at the outset of the priority contest—the phony first inventor does not know the date to beat. In contrast, a phony reinventor would know the date to beat: the date she received actual or constructive notice of the first inventor's invention. The phony reinventor would merely have to persuade the court or Patent Office she completed reinvention at least one day before that date of notice.

reinventors any more than issuing late notice will. A phony reinventor can backdate his lab records to a date before late notice just as easily—in fact more easily—than he can backdate them to a date before early notice.

#### *D. Patent Monopolies Can Be Reinstated through Bargaining*

Timely reinvention breaks up the patent monopoly into a duopoly. However, nothing in the regime of limited transferability, discussed in Section II.E, prevents the reinventor and patentee from cobbling the patent monopoly back together. Through Coasian bargaining, the reinventor and the patentee can transfer their rights to the party who can best exploit those rights. When the patentee can best exploit the patent monopoly, the reinventor can assign his defense to the patentee. When the reinventor can best exploit the patent monopoly, the patentee can assign or license her patent to the reinventor. When a third party can best exploit the patent monopoly, the patentee and the reinventor can transfer their respective rights to the third party. In short, absent bargaining breakdown and high transaction costs, the patentee's patent rights and the reinventor's defense rights should find their way to their most highly valued use, facilitating monopoly.

If reinstatement of monopolies became the norm, the defense would do little to reduce monopoly loss and *ex ante* incentives to pursue reinventables. Reinstatement of monopolies would also generate transaction costs not incurred under current law. Nevertheless, the prospect of reinstatement is not especially troublesome. If reinstatement threatens to become the norm, we can nip it in the bud by tweaking the regime of limited transferability to forbid reinventors and patentees from transferring their rights to each other or to the same third party. We could, for example, declare that reinstating a patent monopoly in this way violates the antitrust laws or renders the patent unenforceable under the doctrine of patent misuse.

#### CONCLUSION

The incentives necessary to stimulate invention vary across inventions. In an ideal world, incentives would be calibrated individually for each invention and would never exceed the minimum necessary to bring each invention into being at an opportune time. Incentives above the minimum impose deadweight losses. One deadweight loss comes in the form of diminished consumer access due to prices of inventions being higher above the competitive level than they have to be to stimulate the initial creation of the inventions. Another deadweight loss comes in the form of increased R&D costs that do not translate into equal benefits for consumers. When multiple inventors enter a race, each incurs the costs of invention. And when only one inventor can win, each is encouraged to rush and to incur the costs of invention early in time rather than waiting for the costs to fall as they normally will.

Under current law, an inventor's incentive to invent is a function of her expected return under complete patent exclusivity weighted by the

probability of obtaining that exclusivity. If the reinvention defense is adopted into law, an inventor's incentive will be a function of her expected return under varying degrees of exclusivity, weighted by the probability of obtaining each degree of exclusivity. In general, her incentive will fall with a rise in the probability of timely reinvention. When that probability is high, she might drop out of the race. Her dropping out is usually good for society provided at least one other inventor stays in. If one inventor stays in, the invention gets made and the costs of invention are incurred only once. The risk is that no inventor stays in or that the invention is significantly delayed. This risk appears to be minimal and worth accepting.