Volume 62, Issue 2 Page 341

Stanford Law Review

COMMERCIALIZING PATENTS

Ted Sichelman

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About half, probably more, of all patented inventions in the United States are never commercially exploited. Even many of the most commercially significant inventions take decades to come to market. In this Article, I contend that the patent system is substantially retarding the commercialization of valuable inventions. This result should not come as a surprise—the dominant framework undergirding patent law, the "reward" theory, is premised on providing incentives for nascent inventions, not commercialized end-products. Although more recent "prospect" theories properly recognize the importance of patent protection for commercializing inventions, they incorrectly conclude that strong, real property-like rights for inventors are necessary to spur robust commercialization—sometimes, weaker rights are preferable. In analyzing these dominant theories of patent law, I conclude that it is effectively impossible to adjust the timing, duration, and scope of traditional patent rights in order to encourage substantial commercialization. In place of reforming the traditional patent, whose quid pro quo is the disclosure of new and non-obvious information, I propose a new "commercialization" patent, granted in exchange for the commitment to make and sell a substantially novel product. Decoupling the invention and commercialization functions of patent law into dual rights would yield more commercialization than the existing system, without unduly decreasing competition, encouraging rent-seeking, or increasing administrative costs.

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INTRODUCTION

About half, probably more, of all patented inventions in the United States are never commercially exploited.[1] Many of these undeveloped inventions are commercially worthless ab initio, such as the anti-eating face mask,[2] beer bottle mini-umbrella,[3] and weed-cutting golf club.[4] Yet, for several reasons, the patent "underdevelopment" problem arguably applies to a large share of potentially valuable inventions.[5] First, patent law encourages inventors to file for patents early in the innovation process.[6] At this stage, especially for modern technologies, an invention is usually not in the form of a finished product ready for sale, and its commercial success is highly uncertain.[7] Instead, the inventor must undertake costly and risky development and testing to transform the invention into a commercially viable product.[8] This uncertainty encourages inventors to delay commercialization in the hopes of reducing risk—for example, by taking advantage of emerging complementary technologies that may lower production costs more than any forgone profits.[9] Indeed, many of the twentieth century's greatest inventions, including the television, radio, radar, and penicillin, were not commercialized until decades after they were invented.[10] In some instances, the uncertainty is so great that the commercialization of a worthwhile invention never occurs.[11]

Second, patent law allows broad claims that encompass more than what an inventor actually discloses in a patent.[12] Although broad claims can reduce commercialization costs by allowing the original patentee to coordinate development among multiple firms, often this coordination fails to occur because of high bargaining costs or strategic behavior, which can stymie the

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1. *See infra* notes 126-140 and accompanying text.

2. *See* U.S. Patent No. 4,344,424 (filed Mar. 27, 1980) (disclosing a medieval-looking mask that prevents the wearer from eating).

3. *See* U.S. Patent No. 6,637,447 B2 (filed Oct. 19, 2001) (disclosing a "beerbrella," a small umbrella that attaches to a beer bottle to keep the bottle shaded).

4. *See* U.S. Patent No. 6,988,954 B1 (filed Oct. 14, 2004) (disclosing a weed-whacker in the shape of a golf club).

5. Michael Abramowicz, *The Danger of Underdeveloped Patent Prospects*, 92 CORNELL L. REV. 1065, 1068 (2007).

6. *See* Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 68-70, 72-81 (2009).

7. *See id.* at 69.

8. *See* F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 707-08 (2001) ("The invention must be developed into some commercial embodiment."); *infra* Part I.

9. *See* Abramowicz, *supra* note 5, at 1076-77.

10. Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 272 (1977).

11. *See* Abramowicz, *supra* note 5, at 1076-77.

12. *See infra* Part II.A.

independent commercialization efforts of more efficient firms.[13] Because early patent grants reward the best *inventor*,[14] but not necessarily the best *commercializer*, broad claims can impose unwarranted burdens on third-party commercializers.[15] Rampant defects in patent examination, licensing, and litigation often make these undue costs quite large and diminish commercialization.[16]

Third, patent law is primarily designed to induce invention; any protection it provides to commercialization is mostly an afterthought. The dominant "reward" theory of patenting, which undergirds much of today's law, perceives little to no need to protect risky and costly post-invention development and commercialization efforts.[17] Thus, reward theorists view the patent system as an unfortunate "second-best" compared with one in which all inventions are immediately placed in the public domain.[18] The upshot is that patent law confers direct encouragement to inventors who create and disclose intangible specifications, but not necessarily tangible products.

Fourth, although there has been limited empirical study of the issue, in a 1998 survey of 133 companies worldwide conducted by the British Technology Group,[19] approximately 40% of the patents held by the respondents were uncommercialized.[20] Nonetheless, these companies reported that 32% of these patents were either commercially "very important" or "quite important."[21] For engineering companies, the figure increased to 40%, and for biosciences/pharmaceutical companies, to 34%.[22] These results are consistent with a European Commission-funded survey that focused on "important" patents, which found that 38% of the patents were never commercialized.[23]

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13. *See infra* Part III.A-B.

14. Here, I assume the inventor that wins the patent race is the "best" one. In some cases, a later inventor may actually be more efficient. For example, a later inventor may produce the same output for less input, taking into account the costs of the delay.

15. *See infra* Part III.A-B.

16. *See infra* Part II.B-C, III.A-B.

17. *See infra* Part II.B. Some scholars use the term "reward theory" to refer to natural labor theories, wherein the inventor is "rewarded" for the fruits of her labor. *See, e.g.*, Christopher A. Cotropia, *"After-Arising" Technologies and Tailoring Patent Scope*, 61 N.Y.U. ANN. SURV. AM. L. 151, 168 n.89 (2005). This Article uses the term to refer to the utilitarian variant. *See generally* Kitch, *supra* note 10, at 266.

18. *See* Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 172 (2003); Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129, 129-30 & n.2 (2004).

19. British Technology Group, IPR Market Benchmark: Summary Report of Findings (1999) [hereinafter BTG Benchmark Study] (prepared by Business Planning & Research International) (on file with author).

20. *See infra* notes 131-138 and accompanying text.

21. *See* BTG Benchmark Study, *supra* note 19, at 18 (presentation notes).

22. *See id.*

23. *See* ALFONSO GAMBARDELLA ET AL., THE VALUE OF EUROPEAN PATENTS: EVIDENCE

Several scholars have suggested various reforms to improve patent law's commercialization incentives. One approach, which follows Ed Kitch's influential "prospect" theory of patents,[24] proposes strengthening patent rights—by, for example, broadening patent scope or lengthening patent terms—so that patentees can internalize more of the positive benefits generated by their inventions.[25] Although reward theorists have heavily criticized these proposals for increasing deadweight losses and impeding follow-on technological development,[26] scholars have said very little about whether the proposals improve commercialization incentives *per se*, as intended.[27] This Article argues that such a property-rights approach can often retard commercialization.[28] Another proposed route to improving commercialization incentives is to modify the reward theory to encourage patenting later in the innovation process, such as by requiring patentees to build a prototype before filing.[29] Although such a modified reward theory would improve upon many wanting aspects of today's patent system—specifically, by forcing inventors to engage in at least some commercialization in exchange for a patent—it could significantly diminish *ex ante* incentives to invent and could lead to duplicated development costs.[30]

Neither prospect theory nor a modified reward theory can practically achieve an ideal balance because both attempt to "commercialize" traditional patents designed to spur the *creation* of new and non-obvious *knowledge*, rather than to encourage the *manufacture and sale* of new *products*.[31] Therefore, this Article recommends adopting a novel policy lever—a "commercialization" patent—granted in exchange for a commitment to commercialize a product not available in the marketplace. Clearly, the burden of proof for adopting a new type of intellectual property (IP) right is high—patent scholars have generally been opposed to new rights, viewing them as unnecessarily increasing deadweight losses, being too costly and difficult to

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FROM A SURVEY OF EUROPEAN INVENTORS 39, 41 fig. 6.3 (2005), *available at* http://www.alfonsogambardella.it/PATVALFinalReport.pdf.

24. *See generally* Kitch, *supra* note 10.

25. *See* Abramowicz, *supra* note 5, at 1073-74; Kieff, *supra* note 8, at 705-17; F. Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 64-66 (2003); Kitch, *supra* note 10, at 276-77.

26. Deadweight losses occur: (1) when a seller with market power prices a product higher than the competitive price, which prevents some consumers from purchasing the product who otherwise would have in a competitive market; and (2) when competitors duplicate research efforts in the race to acquire a patent. *See, e.g.*, WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 17-20 (2003).

27. *See infra* Part III.A-B.

28. *See infra* Part III.A-B.

29. *See* Cotropia, *supra* note 6, at 119-28.

30. *See infra* Part III.C.

31. *See infra* Part III.D.

implement, creating needless complexity, and encouraging legislative rent-seeking. With these hurdles in mind, the remainder of this Introduction sketches the proposal and briefly explains why it overcomes these concerns.

Commercialization patents could be filed for the same types of product inventions as those within the scope of traditionally patentable subject matter.[32] Only a product that is "substantially novel"—that is, different from a product currently available in the marketplace and its "substantial equivalents"—would qualify for a patent.[33] The commercialization patent would need to be practiced no later than three years after filing. Unlike a traditional patent, which can broadly claim many embodiments, a commercialization patent's claims would be limited to the product specifically disclosed in the specification and its substantial equivalents.

In contrast to previous proposals for new forms of IP rights, a commercialization patent not only would provide a *negative* right to exclude others from making and selling the same or equivalent products, but also would include an *affirmative* equitable and legal right to its holder to make and sell the product. First, the affirmative equitable right would give the commercializer absolute immunity from any injunctive remedies otherwise available in infringement suits by traditional patent holders. Second, any traditional patent holder would be limited to a low, but fairly reasonable, fixed royalty rate it could win at suit, e.g., 1-2%, and would be subject to damages apportionment for multi-component products. In order to mitigate the potentially harsh consequences of affirmative rights, a commercialization patent could only be filed after a traditional patent goes uncommercialized for three years after issuance, extended for any regulatory or other unavoidable delays. This window would provide sufficient lead-time and a strong incentive to a traditional patent holder to commercialize its invention. Finally, because commercialization cycles tend to be quick, commercialization patents would be of short duration, e.g., five to eight years from filing, though longer terms may be appropriate for a handful of industries.

Such a patent would substantially increase the commercialization of inventions without imposing undue deadweight losses or dynamic inefficiencies. Because commercialization patents would provide partial immunity from suits by traditional patentees, they would significantly weaken the rights of non-commercializing patentees, reducing transaction costs and deadweight losses from generally welfare-decreasing patent licensing and litigation.[34] The administration of a commercialization patent system would not

32. *See* 35 U.S.C. § 101 (2000). "Processes" would be excluded from commercialization patentable subject matter. *See infra* Part IV.B.

33. "Substantial equivalents" would be defined by the "doctrine of equivalents" used for traditional patents. *See* Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 608 (1950); *infra* Part IV.B.

34. *See infra* Part II.C.

be costly and complex, could reduce the number of traditional patent filings, and could provide significant additional revenue to the Patent Office, which could be used to improve traditional patent examination. In particular, a commercialization patent would be drafted in the same way as a traditional product patent and include the same kinds of claims. Review for subject matter, utility, enablement, written description, substantial novelty, best mode, and the like would be the same or similar to that for a traditional patent. For similar reasons, judicial oversight of commercialization patents would not be terribly costly. Although the assessment of whether a commercialization patentee sufficiently "worked" the patent may initially be difficult, a "sham sale" doctrine would quickly develop and root out this problem. Finally, because commercialization patents would apply in the same manner to all patentable subject matter, the incentives for industry-specific rent-seeking would be minimal.

Part I of this Article briefly describes the stages of the innovation process, from identifying a problem to be solved, to conceiving of a solution, to making, building, and selling a commercial embodiment. In so doing, this Part addresses how patent law accounts for—and fails to account for—different phases of innovation. Part II examines various explanations in the literature for the patent underdevelopment problem, including premature patenting, high inventor-commercializer transaction costs, and the lack of protection for risky and costly commercialization efforts. It concludes that these problems are largely a result of the reward theory's preference for early patenting and its fallacious view that commercialization will proceed efficiently regardless of post-invention patent protection. Part III assesses various attempts to supplant traditional reward theory, including prospect and modified reward theories that take account of patent law's commercialization incentives. Although these approaches would on the whole improve upon the current system, they are far from ideal. In particular, they suffer from the illusory belief that traditional patents can be appropriately "commercialized" in order to induce the manufacture and sale of more new products in a relatively efficient manner. Instead, the commercialization function of patent law should be decoupled from the invention function. Thus, Part IV proposes separating patent rights into invention patents, granted in exchange for the disclosure of new and non-obvious knowledge, and commercialization patents, granted in exchange for the commitment to make and sell a new commercial product. Part IV argues that this system would improve commercialization incentives without unduly increasing deadweight losses, dynamic inefficiencies, rent-seeking, or administrative costs.

I. FROM INVENTION TO COMMERCIALIZATION IN PATENT LAW

Innovation isn't instant.[35] It involves numerous steps, many of which are fraught with uncertainty and great expense. Indeed, as a former founder and CEO of a "dot.com"-era software company,[36] I have personally witnessed this lengthy process. Unfortunately, patent law and the widely accepted reward theory of patents essentially ignore all but the beginning of the process. This Part provides a stylized overview of the innovation path from conception to a marketable good, using as illustration my company's product, a speech recognition system for automating phone calls for taxicabs.[37] (One important caveat: The process of innovation varies across industries and firms within industries. The description here conveys a sense of the risky and costly efforts often involved in the innovative process, and is not meant to provide a precise or exhaustive account.[38])

A. *Identifying a Problem to Be Solved*

In 1999, taxicab companies in the United States handled phone calls for orders essentially the same way they did in 1929—a call center agent or dispatcher would answer the phone, collect address information, ask when the caller would like to be picked up, and sometimes collect other details, such as payment information.[39] This process was labor intensive and costly, and during peak demand, led to long hold times and callers hanging up altogether.[40] The first step in my company's innovation path was identifying this nontrivial problem.[41] Although taxicab company managers knew of the problem for many

35. *See* Emmett W. Eldred & Michael E. McGrath, *Commercializing New Technology-I*, RES. TECH. MGMT., Jan.-Feb. 1997, at 41, 41 ("Promising new technologies are not magically transformed into products; they need to be developed to the point where they are ready for commercialization.").

36. The company is Unified Dispatch, Inc., which was a spin-off of 1-800-TAXICAB, Inc. *See* 1-800-TAXICAB, http://www.1800taxicab.com/ (last visited Oct. 17, 2009); Unified Dispatch, http://www.unified-dispatch.com/ (last visited Oct. 17, 2009).

37. *See generally* Unified Dispatch, Products, http://www.unified-dispatch.com/products.asp (last visited Oct. 17, 2009).

38. For a description of more sophisticated accounts of the innovation process, including "non-linear" models, see OFFICE OF TECH. ASSESSMENT, U.S. CONG., INNOVATION AND COMMERCIALIZATION OF EMERGING TECHNOLOGIES 31-60 (1995) [hereinafter INNOVATION AND COMMERCIALIZATION], *available at* http://www.fas.org/ota/reports/9539.pdf.

39. *Compare* United States v. Carrillo, 123 F. Supp. 2d 1223, 1242 (D. Colo. 2000) ("Also in April of 1999, when Atayde called for a taxi, a female dispatcher for the Metro Cab Company alerted him that the police were following him."), *with* United States v. One W. W. Shaw Auto. Taxi, 272 F. 491, 493 (N.D. Ohio 1921) ("[A] dispatcher of the taxicab company . . . answer[s] calls and send[s] out taxicabs . . . .").

40. *See* Unified Dispatch, Products, *supra* note 37.

41. *See* Stephen J. Kline & Nathan Rosenberg, *An Overview of Innovation*, *in* THE

years, because they lacked expertise in speech recognition systems—and generally failed to communicate the problem to anyone who possessed such expertise—their knowledge was of little use in devising a solution. Rather, it was necessary for a person having "skill in the art" of speech recognition systems to recognize the problem.[42]

Although an invention must be "useful,"[43] an inventor's[44] identification of a salient problem plays a relatively minor role in the patentability of the invention.[45] Similarly, the dominant theories of patent law gloss over this crucial step. The reward theory of patent law generally focuses on providing direct incentives for invention, but not for the preceding step of identifying problems that need inventive solutions.[46] Even the prospect theory of patents, which analogizes the innovation process to mining a rich vein of ore, never quite explains how the vein is initially discovered.[47] This oversight can be critical, because identifying the specific problem to be solved can create information that free riders can exploit, potentially diminishing *ex ante* incentives to discern areas in need of innovation.

B. *The "Proverbial Moment of Conception" and "Developing a Working Prototype"*

Patent law has rejected the romantic notion of the "flash of creative genius"—whereby an inventor at a moment's notice comes upon a solution to the problem at hand—as an essential ingredient of invention.[48] Yet a remnant

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POSITIVE SUM STRATEGY 275, 289-94 & figs.2-3 (Ralph Landau & Nathan Rosenberg eds., 1986) (positing that the first stage of a "chain-linked" model of innovation is identifying a need in a potential market).

42. *Cf.* 35 U.S.C. § 103 (2000) (requiring for patentability that "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would [not] have been obvious at the time the invention was made to *a person having ordinary skill in the art* to which said subject matter pertains" (emphasis added)).

43. 35 U.S.C. § 101 (2000).

44. Although the singular term "inventor" is used in the text, it refers to sole or joint inventors. *See* 35 U.S.C. § 116 (2000).

45. In determining obviousness, courts will sometimes examine whether there were "long felt but unsolved needs." Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966). If anything, such an inquiry works against an inventor who identifies and solves a *new* problem. *See, e.g.*, Eli Lilly & Co. v. Zenith Goldline Pharm., Inc., 471 F.3d 1369, 1380, 1382 (Fed. Cir. 2006) (upholding the district court's finding of non-obviousness where the patentee solved a problem that had been identified, but unsolved, for fifteen years).

46. *See infra* Part II.B.

47. *See* Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 873 (1990) ("But with the technological 'prospects' . . . no one knows for sure what possible inventions are in the technological pool.").

48. Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941) ("[H]owever useful it may be, [the invention] must reveal the flash of creative genius, not

of the notion survives in patent law's stylized notion of "conception," which is the instant of "formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice."[49] Following conception, as long as the inventor diligently files a patent sufficiently disclosing a solution that is novel, non-obvious, and useful, the invention qualifies for patenting.[50] Specifically, if a patent disclosure contains sufficient "written description" so as to "enable" a "person having ordinary skill in the art" (often termed a "PHOSITA") to make and build the invention without "undue experimentation," the patent is a "constructive" reduction to practice, obviating any need to actually build a prototype.[51] Although this abbreviated requirement may sound fine in principle, in practice the Patent Office tends to grant patent claims that greatly exceed the scope of a patent's disclosure, allowing the patentee to gain rights to exclude commercial products that are far removed from the disclosed invention.[52]

In reality, there is usually no single moment of conception, but rather a series of steps that refine a potential solution.[53] Indeed, as soon as the problem is identified, usually there is a vague recognition of a solution. In my company's case, the solution was to automate the process of handling a taxicab call as an alternative to using a live dispatcher. After my company identified the problem and general solution, product engineers wrote technical white papers and specifications, programmers developed prototype software applications based on the solutions, engineers tested the prototypes, and the process continued until a specific working prototype was built and tested.[54] Because patent law does not require a working prototype to acquire a patent,

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merely the skill of the calling."), *superseded by statute*, 35 U.S.C. § 103(a) (2000) ("Patentability shall not be negatived by the manner in which the invention was made.").

49. Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223, 1227-28 (Fed. Cir. 1994) ("Conception is the touchstone of inventorship . . . .") (quoting Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986)); *see* Cotropia, *supra* note 6, at 72 ("Conception, the first step of inventing, involves the mental formation of the complete invention.").

50. *See* 35 U.S.C. §§ 101-03 (2000); *cf.* Kline & Rosenberg, *supra* note 41, at 289-94 (defining the second stage of innovation as invention, and/or the design of a new product or process that fills an identified market need).

51. 35 U.S.C. § 112 (2006); Cotropia, *supra* note 6, at 74 (citing authorities). In the fields of biology and chemistry, the "utility" requirement is heightened, necessitating "proof that the invention can achieve this ultimate use." *Id.* at 76. This heightened standard often requires the inventor to "further develop her invention" before filing, and may require the inventor to actually reduce the invention to practice. *Id*.

52. *See infra* Part II.A.

53. *See* NATHAN ROSENBERG, PERSPECTIVES ON TECHNOLOGY 191-95 (1976) (describing "the continuum of inventive activity").

54. *See generally* Robert G. Cooper, *A Process Model for Industrial New Product Development*, EM-30 IEEE TRANSACTIONS ON ENG'G MGMT. 2, 2-11 (1983) (describing the seven stages of the innovation process, including development, testing, and trial stages).

there is a continuum from the identification of the problem to the building of a working prototype upon which the single marker of conception can be placed.[55] Thus, conception is more of a process than an event, and exactly how much detail is required to be "form[ed] in the mind of the inventor" is vague under current law.[56] Despite this extended nature of conception, because of the reward theory's preference for early patenting and the weak disclosure standards applied by the Patent Office, patents are granted at the initial stages of conception,[57] which as Part II explains, can lead to the significant underdevelopment of inventions.

C. *Market Testing and Marketing*

Following conception and the prototyping phase is the stage of transforming a prototype into a commercially viable product.[58] When the original patent laws were enacted in the 1790s, the bulk of inventions were farm implements, and the commercialization of an original prototype was far less onerous than for most of today's technologies.[59] For example, in the modern automotive industry, modifying a concept car to suit the tastes of the general public may take many years, even decades.[60] My software company spent considerable sums of money over several years to identify the mix of product features that would attract numerous customers. In general, a company will frequently undertake significant market testing to determine how to build a

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55. *See* ROSENBERG, *supra* note 53, at 191-94; Kline & Rosenberg, *supra* note 41, at 275, 277-78 (describing the feedback effects among the various phases of innovation).

56. *Cf.* Cedars-Sinai Med. Ctr. v. Watkins, 11 F.3d 1573, 1579 (Fed. Cir. 1993) ("[W]hen an invention was conceived may be more a question of common sense than of patent law . . . ." (quoting Am. Tel. & Tel. Co. v. Integrated Network Corp., 972 F.2d 1321, 1324 (Fed. Cir. 1992))).

57. *See* Cotropia, *supra* note 6, at 5, 72-75. The courts sometimes find conception only upon the building of a working prototype. *See, e.g.*, Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991).

58. *See* VIJAY K. JOLLY, COMMERCIALIZING NEW TECHNOLOGIES 6 (1997); TOM KELLEY, THE ART OF INNOVATION 103-11 (2001) (describing the importance of prototyping to product development); INNOVATION AND COMMERCIALIZATION, *supra* note 38, at 31-32; Kline & Rosenberg, *supra* note 41, at 289-94 (describing the third stage of innovation as the development of an innovation and testing).

59. *See* Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 584 (1999) ("[T]he canonical patented technology in the eighteenth century was a simple agricultural tool (an axe or a plow) . . . ."). The transition from individual to "corporate," large-scale invention is another important shift for which the patent system has not fully accounted. *See* William Kingston, *Innovation Needs Patents Reform*, 30 RES. POL'Y 403, 404-07 (2001).

60. *See* JONATHAN BELL, CONCEPT CAR DESIGN 9-10 (2003); JAMES M. MORGAN & JEFFREY K. LIKER, THE TOYOTA PRODUCT DEVELOPMENT SYSTEM 128-29 (2006) (documenting the development of the Toyota Prius).

commercially successful product.[61] Often, the capital required for the market testing and product commercialization phase is tremendous.[62]

Yet, unlike the costs and risks associated with invention, a patent does not directly protect the information generated during market testing and subsequent marketing, even if it is novel and non-obvious. Although a commercializer can rely upon trade secret law for protection, sometimes the information cannot be kept secret.[63] In an insightful article, Michael Abramowicz and John Duffy recognize that a potential deficiency of patent law is its failure to protect "market experimentation" directly.[64] If a commercializer truly performs innovative and non-obvious market testing and marketing that cannot be protected by trade secret or patent law, then third parties can free ride on those efforts, providing an *ex ante* disincentive for the testing and marketing, which can in turn result in an *ex ante* disincentive to invent.[65]

D. *Distribution*

Once a sale is made, the product is distributed to the customer.[66] Unlike market testing and marketing, innovative methods of distribution generally qualify for patent protection.[67] Yet, for the ordinary innovator that distributes

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61. *See* R.G. Cooper & E.J. Kleinschmidt, *An Investigation into the New Product Process: Steps, Deficiencies, and Impact*, 3 J. PROD. INNOVATION MGMT. 71, 75-76, & exh. 2 (1986) (finding that in a study of over 250 new product launches, 77% of the launches included a preliminary market assessment and 25% included a detailed marketing study); Barry Jaruzelski, Kevin Dehoff & Rakesh Bordia, *Smart Spenders: The Global Innovation 1000*, STRATEGY & BUS., Dec. 14, 2006, at 8 ("Value is created by effectively combining new or existing patents with the ability to recognize and fulfill customer needs.").

62. *See* Kitch, *supra* note 10, at 277 ("[M]arketing is a major cost in innovation.").

63. *See* Dan L. Burk, *The Role of Patent Law in Knowledge Codification*, 23 BERKELEY TECH. L.J. 1009, 1010 (2008) (explaining that "some inventions cannot be kept confidential enough to be maintained as trade secrets").

64. *See* Michael Abramowicz & John Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337 (2008).

65. *See* Kitch, *supra* note 10, at 276-77 (noting that investments in development of the invention "can be large and produce information . . . that would be appropriable by competitors absent the original patent"); *cf.* Mohanbir Sawhney et al., *The 12 Different Ways for Companies to Innovate*, 47 M.I.T. SLOAN MGMT. REV. 75-76, 81 (noting that "[i]n actuality, 'business innovation' is far broader in scope than product or technological innovation" and "takes considerable effort and time").

66. *See* Kline & Rosenberg, *supra* note 41, at 289 (describing the fifth stage in the innovation process as bringing new products and processes to market).

67. Distribution encompasses both physical shipping methods (e.g., logistics) and digital routing methods (e.g., delivery of content over the Internet). *See, e.g.*, Polycom, Inc. v. Codian Ltd., No. 2:05-CV-520-DF, 2007 WL 5688763 (E.D. Tex. Oct. 19, 2007) (concerning patents on distributing digital media over networks); Ford Motor Co. v. Lemelson, Nos. CV-N-92-613-LDG(PHA), CV-N-92-545-LDG(PHA), 1995 WL 628330 (D. Nev. June 16, 1995) (concerning patents on bar coding technology allegedly infringed by defendant's manufacturing and distribution methods).

its products through standard routes, these kinds of patents are more likely to present an unwarranted roadblock to the commercialization process, as opposed to a legal entitlement that can prevent free riding by others.[68] Specifically, if holders of patents on methods of distributing products are entitled to injunctions that hinder the free flow of products from sellers to buyers, the holders will very likely be able to extract excessive licensing fees and litigation awards from would-be infringers, which act as a veritable "tax" on commercialization.[69] Like others have shown for the invention stage, and as Part II explains in more detail, patents can be a double-edged sword for commercialization. Specifically, they can work for a commercializing patentee to prevent free riding by third parties of post-invention commercialization efforts, thereby increasing *ex ante* incentives to commercialize inventions; yet, they can stifle commercialization by increasing a commercializer's costs through often unwarranted fees paid to third-party patent holders.[70]

E. *Product Improvements*

Usually soon after a product is launched, the company selling the product (or an entirely different company) will invent an improvement.[71] For instance, within months of my company's launch of its automated taxicab ordering system, customers requested new features, such as specialized handling of cell phones and the ability to provide callers with the estimated time of arrival of their taxicabs. By developing new technology in response to these demands, my company created improved versions of the original product. Under patent law, often these improved products both fall under the scope of the patent covering the original product and also qualify for separate patent protection.[72] If, instead of the original patentee, a third party creates the patentable improvement, the oft-described phenomenon of "blocking patents" arises.[73] Specifically, the second patent holder is blocked from making or selling the improved product by the first patent, and the first patent holder is blocked from

68. *See, e.g.*, John Markoff & Miguel Helft, *Patent Lawsuit Names Leading Technology Firms*, N.Y. TIMES, Jan. 3, 2007, at C3, *available at* www.nytimes.com/2007/01/03/technology/03patent.html (describing a lawsuit filed by Intertainer, Inc., a technology licensing company, against Apple, Google, and Napster on its patent claiming methods of distributing audio and video over the Internet).

69. Carl Shapiro, *Patent System Reform: Economic Analysis and Critique*, 19 BERKELEY TECH. L.J. 1017, 1034 (2004).

70. *See infra* Part III.A-B.

71. *See* JOLLY, *supra* note 58, at 12.

72. *See* Merges & Nelson, *supra* note 47, at 860-62.

73. *See* Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75 (1994); Merges & Nelson, *supra* note 47, at 860-62 (explaining blocking patents).

doing the same by the second patent.[74] If the bargaining costs are lower than the benefit of the improvement, presumably the two patent holders would come to an agreement and share the profits.[75] Yet, if transaction costs are high, the improvement may never be developed.[76]

F. *"Commercialization" Writ Large*

Almost all innovation improves upon earlier products.[77] Although much of the underlying technology for these earlier products is in the public domain—either because it is not patentable or any applicable patents have expired—many patented products contain components that infringe earlier patents.[78] Thus, improvements—and the phenomenon of blocking patents—are central to the role patents play in the development, marketing, and sale of innovative products. In this sense, improvement should be viewed as a species of "commercialization" of the original invention designed to solve a recognized problem. If the stone wheel is an original invention that solves the problem of slow human—and animal—powered motion, *any* new type of wheel that is made and sold is not merely an improvement, but also a *commercial* embodiment of the original invention of the wheel. Thus, any activity following the initial invention that leads to a commercially available product or service—including developing, testing, manufacturing, sales, and service of the initial invention, *as well as* the invention and subsequent development of improvements—should be viewed as part of ongoing "commercialization" of the original invention.[79] So while invention is a cumulative process, so is commercialization. Similarly, while invention produces information subject to free riding, so does commercialization. And, like invention itself, the risks of *commercializing* inventions regularly demand supernormal returns to justify taking them.[80]

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74. *See* Merges, *supra* note 73, at 80.

75. *See* Ian Ayres & Gideon Parchomovsky, *Tradable Patent Rights*, 60 STAN. L. REV. 863, 871-73 (2007).

76. *See id.* at 872 ("On the margin, the . . . fees may not leave enough profits to justify the investment in the innovation.").

77. *See* Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 29 (1991).

78. *See* Robert P. Merges, *Intellectual Property Rights and the New Institutional Economics*, 53 VAND. L. REV. 1857, 1859 (2000) ("Complex, multi-component products are the norm in many industries (e.g., autos and consumer electronics), and individual patents often cover . . . a single component or sub-component.").

79. *See* JOLLY, *supra* note 58, at 3 ("Technology commercialization . . . is about . . . adding value to the technology as it progresses.").

80. *See infra* Part II.B.

II. INDIRECT INCENTIVES FOR COMMERCIALIZATION IN PATENT LAW

As Part I explained, an inventor crosses the threshold of patentability at the putative point of conception, which is very early in the innovation process. This Part begins by arguing that this approach to patentability only provides indirect incentives for commercialization. It then explores the dominant framework of patent law, the reward theory, which provides ostensible justification for such an "invention-centric" patentability threshold. This Part concludes, however, that the reward theory is flawed, because it fails to take proper account of the supernormal risks and costs of unpatentable post-invention commercialization efforts. As such, reward theory has led to the underdevelopment of inventions into commercial products. Although an important aim of patent law is to spur the disclosure of new and non-obvious technical information—absent consumable, commercial products incorporating this information, patent law would provide little benefit to the public.

A. *Inventor-Focused Protection*

Three key aspects of the patent system cause it to provide direct incentives for the creation—but not the commercialization—of inventions. First, the patent laws do not require inventions to be in a commercialized form to garner protection. Rather, a mere written disclosure of the invention suffices to meet the requirement of "reducing the invention to practice"[81]—the obligation to submit a working model of the invention, originally enacted in the Patent Act of 1790,[82] was effectively abolished in 1880.[83] Furthermore, there is often a wide gulf between a patent disclosure that can satisfy the written description, enablement, and best mode disclosure requirements[84] and the documents that are actually used to build commercial products.[85] Indeed, inventors are often

81. Cotropia, *supra* note 6, at 128.

82. Patent Act of 1790, ch. 7, 1 Stat. 109, 110. *See generally* Kendall J. Dood, *Patent Models and the Patent Law: 1790-1880 (Part I)*, 65 J. PAT. OFF. SOC'Y 187, 189-200 (1983).

83. *See* Dood, *supra* note 82, at 271. The Patent Office still retains the right to request a working model, though it rarely does so. *See id.* at 187.

84. *See* 35 U.S.C. § 112 (2006) ("The specification shall contain a *written description* of the invention . . . in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same, and shall set forth the *best mode* contemplated by the inventor of carrying out his invention." (emphasis added)).

85. *See* CFMT, Inc. v. YieldUP Int'l Corp., 349 F.3d 1333, 1338 (Fed. Cir. 2003) ("Enablement does not require an inventor to meet lofty standards for success in the commercial marketplace. Title 35 does not require that a patent disclosure enable one of ordinary skill in the art to make and use a perfected, commercially viable embodiment . . . ."); Fonar Corp. v. Gen. Elec. Co., 107 F.3d 1543, 1549 (Fed. Cir. 1997); *see also* 3 DONALD S. CHISUM, CHISUM ON PATENTS § 7.03[4] (2009). The Federal Circuit implemented a relatively heightened disclosure requirement for biotechnology products in *Regents of the University of California v. Eli Lilly & Co.*, 119 F.3d 1559, 1566-67 (Fed. Cir.

able to retain important commercial know-how, such as software source code, as trade secrets and still obtain a patent.[86] Additionally, an inventor need not—in fact, cannot—update the disclosure during the prosecution of the patent application in front of the Patent Office.[87] Thus, if an inventor files a patent early in the research and development process, the disclosed best mode of making and using the invention may greatly differ from the ultimate commercial embodiment.[88]

Second, despite the black-letter rule that an inventor "can lawfully claim only what he has invented and described,"[89] courts and the Patent Office typically allow patent claims that are of much broader scope than what is actually disclosed in a patent application.[90] Specifically, a patent will usually disclose just one or a few "embodiments" of the invention in the patent's specification, but will often claim thousands of different embodiments in a claim.[91] This result is partly due to patent law's aim of sufficiently rewarding

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1997), but arguably has not applied it consistently. *See* Ajeet P. Pai, Note, *The Low Written Description Bar for Software Inventions*, 94 VA. L. REV. 457, 471-78 (2008); *see also In re* Alonso, 545 F.3d 1015 (Fed. Cir. 2008). The Federal Circuit is considering whether to eliminate this heightened disclosure requirement. *See* ARIAD Pharms., Inc. v. Eli Lilly & Co., No. 2008-1248, 2009 WL 2573004 (Fed. Cir. Aug. 21, 2009) (granting en banc review on whether there is "a written description requirement separate from an enablement requirement").

86. *See Fonar*, 107 F.3d at 1548; Gregory J. Maier, *Software Protection—Integrating Patent, Copyright and Trade Secret Law*, 69 J. PAT. & TRADEMARK OFF. SOC'Y 151, 163-65 (1987) (noting that patent law does not require the disclosure of software code and that "there is sometimes motivation . . . to obtain broad patent protection and yet retain significant trade secret protection").

87. *See* 35 U.S.C. § 132 (2000) ("No amendment shall introduce new matter into the disclosure of the invention.").

88. Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 805, 807 (1988) ("[T]he innovation will in all likelihood be different in significant respects from the invention due to the changes necessary to turn the invention into a commercial product."); Dennis Crouch, *The Trade Secret Value of Early Patent Filing*, PATENTLY-O, Oct. 23, 2008, http://www.patentlyo.com/patent/2008/10/the-trade-secre.html ("[M]any if not most patent applications are filed well before the associated product or method is ready for public consumption—before the inventor knows the best *commercially viable* mode.").

89. O'Reilly v. Morse, 56 U.S. (15 How.) 62, 121 (1853); 1 CHISUM, *supra* note 85, § 1.03[2][b]; *see also* Kitch, *supra* note 10, at 268 (remarking that ostensibly "the inventor may not claim more than he has invented").

90. *See* JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 66-68 (2008) (describing biotechnology and software patent claims that greatly exceeded the scope of the disclosed inventions); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1499-1500 (2001) (explaining how the Patent and Trademark Office (PTO) is unable to adequately examine each patent and grants many broad patents as a result).

91. Indeed, one commentator views modern claims as potentially covering "an infinite number of variations" of the disclosed embodiments. Jeffrey A. Lefstin, *The Formal Structure of Patent Law and the Limits of Enablement*, 23 BERKELEY TECH. L.J. 1141, 1169,

early inventors and partly due to the courts' and Patent Office's relatively lax implementation of the written description and enablement requirements.[92]

Third, U.S. patent laws provide few to no off-setting rights to third parties desiring to commercialize embodiments of patented inventions that patent holders fail to commercialize.[93] Moreover, by allowing for "continuation" applications—that is, later-filed patent claims based on the original patent disclosure—patent holders can learn about a commercializer's products and draft claims that specifically cover them.[94] These continuation claims are usually difficult to defeat in litigation, because (by design) infringement is usually a given, and overcoming the "presumption of validity" for issued patents is very costly or highly uncertain given the typically narrow scope of the claims.[95] In effect, in order to garner any rights under patent law, a commercializer must create an independently patentable invention.[96] Additionally, such a patent will not provide any affirmative rights to sell a commercial embodiment of the invention, but only the right to block the original patentee from doing so.[97]

Taken together, these three aspects of the patent laws—namely, the often broad differences between the disclosed invention and the commercialized product, the ability to garner rights over significantly more than what is disclosed, and the lack of meaningful rights for commercializers—tilt the

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1173 (2008). However one characterizes it, today's claims can cover multitudes of potential embodiments.

92. *See* Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1168 (2002) (noting that "disclosure is a minimal hurdle for software patents"); Cotropia, *supra* note 6, at 117 ("The more general and vague the original disclosure is, the more likely support is found."); Merges & Nelson, *supra* note 47, at 845 (1990) ("This [enablement] requirement can at times be applied rather loosely: a specification that describes only one working example of an invention but that supplies less guidance on the subject matter at the fringes of a patent's claims is often sufficient.").

93. *See infra* Part III.A.

94. Even though the continuation claims are usually drafted and filed well after the original patent application was filed (even issued), if the patent disclosure is not amended, the claims receive the benefit of the original patent's filing date. *See* 35 U.S.C. § 120 (2000); 37 C.F.R. § 1.78 (2008); Mark A. Lemley & Kimberley A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 66-81 (2004).

95. Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 47 (2007) ("The culprit is a legal doctrine known as *the presumption of validity*. Under that doctrine, courts are obligated to defer to the PTO's initial determination that an invention qualifies for patent protection unless the defendant can show by 'clear and convincing' evidence that the PTO erred.").

96. *See* Abramowicz, *supra* note 5, at 1101-02.

97. *See* 35 U.S.C. § 154(a)(1) (2000); Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 485 (2006) ("[A] patent confers only the right to exclude others from practicing the invention rather than the affirmative right to practice the invention."); *supra* Part I.E.

system heavily in favor of inventors.[98] In essence, patent laws provide direct incentives to *create*, but not to *commercialize*, inventions.

B. *Rationalizing Rewards for Invention*

Both dominant justificatory theories of patent law—the reward and prospect theories—argue in favor of patenting early in the innovation process, though for different reasons. The reward theory, described briefly in Part I, justifies patents as necessary to induce the invention and disclosure of new and non-obvious knowledge, which inventors would otherwise be reluctant to do in the fear that others may free ride off their efforts.[99] For example, if someone invents a new mousetrap, by disclosing the design to the potentially free-riding public—absent a "prize" payment (e.g., from the government) or some legal right to exclude others from using the design without paying for it (i.e., a patent)—the incentives to invent the mousetrap in the first instance would be diminished.[100] Although a prize system would be ideal for the reward theorist—since all inventions would immediately enter the public domain for anyone's use—most observers believe such a system would be too costly and inaccurate, and subject to excessive rent-seeking by its benefactors.[101]

Thus, the patent system serves as a "second-best," allowing an inventor to earn a return on his efforts either by selling a commercial embodiment of the invention at higher-than-normal prices or by licensing the invention to others

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98. Current patent law does provide some targeted, yet still indirect, incentives to commercialize inventions. Most importantly, following the Supreme Court's decision in *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006), courts often withhold injunctive relief from non-practicing patentees. Nonetheless, the bulk of patent law is agnostic when it comes to whether the patentee practices its invention.

99. *See* John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 439 (2004); Lemley, *supra* note 18, at 129 ("The traditional economic justification for intellectual property is well known. Ideas are public goods: they can be copied freely and used by anyone who is aware of them without depriving others of their use."); A. Samuel Oddi, *Un-Unified Economic Theories of Patents—The Not-Quite-Holy Grail*, 71 NOTRE DAME L. REV. 267, 275-77 (1996).

100. This example is a form of Arrow's "disclosure paradox," namely that, absent a legal right protecting information, in order to sell novel information, it usually must be disclosed, but once disclosed it is of no monetary value. *See* 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, 614-16 (Richard R. Nelson ed., 1962).

101. *See, e.g.*, Abramowicz, *supra* note 18, at 209-10 ("Given the possibility of receiving a government benefit, whether a patent or a prize, private companies might invest resources to influence the government's decision."); Henry E. Smith, *Intellectual Property as Property: Delineating Entitlements in Information*, 116 YALE L.J. 1742, 1747-58 (2007) (remarking that although monetary rewards would directly address inventors "not being able to appropriate the returns from their activities . . . they also by their very directness are more costly than exclusive rights").

for a fee.[102] The downside of such a system is mainly twofold. First, it can create deadweight losses by allowing supracompetitive prices and thereby excluding potential purchasers who would otherwise buy the good in a competitive market (a "static inefficiency"). Second, it can stifle follow-on invention, especially via the phenomenon of blocking patents (a "dynamic inefficiency"). If an original patentee can block subsequent product improvements by others, there will be diminished *ex ante* incentives for others to improve upon the original invention.[103]

Importantly, the reward theory only views invention—in particular, *the knowledge created during invention*—as in need of direct protection. In this sense, the fact that patent protection applies to the stages of the innovation process following invention is an artifact of adopting a second-best patent system instead of a prize system. If a prize system were costless and accurate, adopting it would accord perfectly with the aims of the reward theory, because the information generated during invention would be available to all commercializers, seeding a competitive market and eliminating deadweight losses. The ideal world for the reward theorist is one in which the knowledge of invention magically appears in the public domain.[104] Once that occurs, reward theory assumes commercialization will proceed efficiently.[105]

In a well-known article, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, Mark Lemley makes this reward-based argument explicit.[106] In Lemley's view, patent law should promote *ex ante* activity because "the goal of intellectual property is to influence behavior that occurs

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102. *See, e.g.*, Michael W. Carroll, *One for All: The Problem of Uniformity Cost in Intellectual Property Law*, 55 AM. U. L. REV. 845, 850 (2006) ("Intellectual property rights are a second-best solution to an 'appropriability problem.'"); Scotchmer, *supra* note 77, at 30 ("Patent protection would be an unnecessary policy tool if the government had the same information about the costs and benefits of individual research projects as firms have."). *See generally* R.G. Lipsey & R.K. Lancaster, *The General Theory of Second Best*, 24 REV. ECON. STUD. 11 (1956).

103. *See* Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 990-91 (1997) [hereinafter Lemley, *Economics of Improvement*] (discussing follow-on invention in the context of patent and copyright law); Merges & Nelson, *supra* note 47, at 884-93 (explaining the effects of blocking patents on cumulative invention). Other inefficiencies of a patent system include rent-seeking behavior, especially "strategic" litigation and licensing; high administrative costs; and potential overinvestment in research and development. *See* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1058-60 (2005) [hereinafter Lemley, *Free Riding*].

104. *See generally* Smith, *supra* note 101, at 1761 n.56 ("If the benefits stemming from nonrivalness are assumed to dominate, then 'full' decentralization through the public domain . . . might well be superior [to intellectual property rights].").

105. *See, e.g.*, Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 529 (2001) (assuming that the result of "research" is an "innovation," such that if the "innovation" were made freely "available to competitors" that it would "sell at marginal cost").

106. *See* Lemley, *supra* note 18, at 129-31.

before the [patent] right comes into being."[107] Lemley sees no need for patent rights to encourage *ex post* activity, particularly "further investment in the improvement, maintenance, or commercialization of the product."[108] According to Lemley, if commercialization were the aim of intellectual property, rights should be made perpetual.[109] But doing so would lead to inefficient and utterly unnecessary results:

> It is hard to imagine senators, lobbyists, and scholars arguing with a straight face that the government should grant one company the perpetual right to control the sale of all paper clips in the country, on the theory that otherwise no one will have an incentive to make and distribute paper clips. We know from long experience that companies will make and distribute paper clips if they can sell them for more than it costs to supply them. The market for paper clips functions just fine without this type of government intervention. We can also predict with some confidence that if we did grant one company the exclusive right to make paper clips, the likely result would be an increase in the price and a decrease in the supply of paper clips.[110]

Yet, Lemley's argument depends on several critical assumptions that are not fully borne out in commercial reality. First, as explained in the prior Part, patent law only requires *conception*—not a working product—for rights to inhere. Thus, Lemley's characterization of "ex post" activity as "further investment in . . . *the product*" unfairly splits the *ex ante*/*ex post* dividing line at the "product" phase of the innovation process. Second, even if patent law required a product, as described in Part I, the first product embodying an invention—effectively, a prototype—is usually not the most commercially viable embodiment.[111] Rather, a commercializer will often need to undertake costly and risky scientific testing, market testing, market research, and marketing to determine how to commercialize an invention in the most profitable manner, generating information that—in the absence of robust patent protection—would typically be subject to free riding by others.[112] Lemley's

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107. *Id.* at 130.

108. *Id.* at 130-31.

109. *Id.* at 131.

110. *Id.* at 135-36.

111. *See supra* Part I.C.

112. *See* INNOVATION AND COMMERCIALIZATION, *supra* note 38, at 35 ("Many innovations derive not from advances in science, but from . . . recognizing potential new markets . . . . [L]essons learned from manufacturing and marketing operations can feed back into the product development process."); DAVID J. TEECE, *Competition, Cooperation, and Innovation Organizational Arrangements for Regimes of Rapid Technological Progress*, *in* ESSAYS IN TECHNOLOGY MANAGEMENT AND POLICY: SELECTED PAPERS OF DAVID J. TEECE 447, 461 (2003) ("Because of fundamental weaknesses in the system of intellectual property law, leakage and free riding are commonplace."); Peter N. Golder & Gerard J. Tellis, *Pioneer Advantage: Marketing Logic or Marketing Legend?*, 30 J. MKTG. RES. 158, 161 (1993); Henry Grabowski, John Vernon & Joseph A. DiMasi, *Returns on Research and Development for 1990s New Drug Introductions*, 20 PHARMACOECONOMICS 11, 18 (2002) ("Many of the uncertainties that exist for a new [pharmaceutical] product (i.e. its clinical

paper clip example obscures this aspect of the innovation process, because he implicitly assumes that *ex post* activity operates on a finished, commercially viable product.[113] Third, although the manufacture and sale of *non-innovative*, ordinary commercial products, such as paper clips, will involve risks—including risk from third-party free riding—generally, only *ordinary* returns are needed to induce a commercializer to take those risks.[114] For untested *innovative* products, however, these risks will tend to be supernormal.[115] As Richard Cooper and Elko Kleinschmidt—luminaries in the field of product development and commercialization—have aptly remarked, "product innovation is plagued by high risks: both the large amounts at stake and the high probability of failure."[116] Rational market actors will only absorb

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profile in terms of risks and benefits, the introduction of substitute products, the size of market demand, etc.) are usually not resolved until late in the R & D process."); Benjamin N. Roin, *Unpatentable Drugs and the Standards of Patentability*, 87 TEX. L. REV. 503, 535 n.172 (2009) ("[T]he spillover benefits from commercializing inventions can sometimes be substantial."); *cf.* Smith, *supra* note 101, at 1758 ("But the resources used to develop and commercialize . . . information *are* rival. They cannot be used by more than one person and are often nonrenewable.").

113. Lemley recognizes that significant scientific testing occurs for patented pharmaceuticals, which he believes could justify an *ex post* approach to these types of inventions, but he fails to acknowledge that risky and costly *ex post* efforts occur in most, if not all, innovative industries. Lemley, *supra* note 18, at 141; *see infra* Part II.C.

114. *See, e.g.*, ALEXANDER ELDER, COME INTO MY TRADING ROOM 59 (2002) ("Imagine you're . . . running a fruit and vegetable stand. You take a risk each time you buy a crate of tomatoes. If your customers do not buy them, that crate will rot on you. That's a normal business risk . . . ."). *See generally* JOHN CRAVEN, INTRODUCTION TO ECONOMICS: AN INTEGRATED APPROACH TO FUNDAMENTAL PRINCIPLES 248 (1984) (stating that rewards must be commensurate with risks to induce firms to act).

115. *See* Eldred & McGrath, *supra* note 35, at 41 ("Realizing the promise of new technologies through their commercialization into new products is far from easy."); Joshua S. Gans & Scott Stern, *The Product Market and the Market for "Ideas": Commercialization Strategies for Technology Entrepreneurs*, 32 RES. POL'Y 333, 333 (2003) ("For [startups], a key management challenge is how to translate promising technologies into a stream of economic returns . . . . In other words, the main problem is not so much invention but *commercialization*."); Thomas M. Jorde & David J. Teece, *Rule of Reason Analysis of Horizontal Arrangements: Agreements Designed to Advance Innovation and Commercialize Technology*, 61 ANTITRUST L.J. 579, 583 (1993) ("[C]ommercialization is both costly and risky, perhaps even more so than R & D activity."); Josh Lerner, *The Returns to Investments in Innovative Activities: An Overview and an Analysis of the Software Industry*, *in* MICROSOFT, ANTITRUST AND THE NEW ECONOMY: SELECTED ESSAYS 463, 466-67 (David S. Evans ed., 2002) ("By their very nature, efforts to accomplish significant innovations are associated with high levels of uncertainty."); Atul Nerkar & Scott Shane, *Determinants of Invention Commercialization: An Empirical Examination of Academically Sourced Inventions*, 28 STRAT. MGMT. J. 1155, 1157 (2007) ("The commercialization of technological inventions is highly uncertain." (citation omitted)).

116. Cooper & Kleinschmidt, *supra* note 61, at 71; *see also* Eldred & McGrath, *supra* note 35, at 44 (describing how the development of new technology entails more uncertainty than usual product development); Jimme A. Keizer & Johannes I. M. Halman, *Diagnosing Risk in Radical Innovation Projects*, 50 RES. TECH. MGMT. 30, 33 (2007); Mariana

extraordinary risk in commercializing innovative products if they can achieve extraordinary returns.[117] Thus, while "[t]he market for paper clips" may "function[] just fine without . . . government intervention," the market for innovations often will not.[118] Fourth, although encouraging *ex post* commercialization may depend upon patent protection, this does not imply that a perpetual term is justified.[119] Indeed, in addition to limiting the term to prevent deadweight losses, Part III shows that limited terms can sometimes enhance overall commercialization. In general, there are many reasons to expect that, absent limited patent protection during the commercialization phase, many inventions would go undeveloped, destined to become, as two commentators put it, veritable "Rembrandts in the Attic."[120]

C. *The Under-Commercialization of Invention*

As an empirical matter, it appears that less, probably much less, than half of all patented product inventions are commercialized. In addition to several surveys reporting roughly 50% commercialization rates,[121] patentees fail to pay

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Mazzucato & Massimiliano Tancioni, *Innovation and Idiosyncratic Risk: An Industry- and Firm-Level Analysis*, 17 INDUS. & CORP. CHANGE 779 (2008) (finding a statistically significant relationship between firm-level R & D intensity and firm-level volatility of returns); Gerard J. Wedig, *How Risky is R and D? A Financial Approach*, 72 REV. ECON. & STAT. 296, 303 (1990) (concluding as an empirical matter that investment in R & D is riskier than in other assets).

117. *See* CRAVEN, *supra* note 114, at 248; *cf.* Lemley, *Free Riding*, *supra* note 103, at 1050 (explaining that "economic theory properly requires . . . the capture of returns sufficient to recoup the investment").

118. *See* Emmanuel Dechenaux et al., *Appropriability and Commercialization: Evidence from MIT Inventions*, 54 MGMT. SCI. 893, 904-05 (2008) (finding that for university inventions, which "typically require . . . risky" post-invention development, patent protection can have a "positive effect on the hazard of commercialization").

119. *See* Abramowicz, *supra* note 5, at 1102; Andrew W. Horowitz & Edwin L.C. Lai, *Patent Length and the Rate of Innovation*, 37 INT'L ECON. REV. 785 (1996) (finding that patents with very long terms would reduce overall innovation, because although they would induce the development of more significant innovations, they would tend to reduce the frequency of innovation more so).

120. KEVIN G. RIVETTE & DAVID KLINE, REMBRANDTS IN THE ATTIC: UNLOCKING THE HIDDEN VALUE OF PATENTS 119-44 (2000) (describing how companies can extract value from otherwise dormant patent portfolios).

121. *See* Roger L. Beck, *Competition for Patent Monopolies*, 3 RES. L. & ECON. 91, 98 (1981) (noting that about 40-50% of patents are never commercialized); Eugene Mattes et al., *Surveying Inventors Listed on Patents to Investigate Determinants of Innovation*, 69 SCIENTOMETRICS 475, 483 (2006) (examining most of the studies on patent commercialization and reporting that the "range for granted patents becoming innovations [i.e., commercial products or processes] is somewhere between 43% and 54%"); Robert P. Morgan et al., *Patenting and Invention Activity of U.S. Scientists and Engineers in the Academic Sector: Comparisons with Industry*, 26 J. TECH. TRANSFER 173, 178 & tbl.2 (2001) (reporting a 48.9% private-sector commercialization rate based on data from a 1995 National Science Foundation survey); Kazuyuki Motohashi, *Licensing or Not Licensing? An*

maintenance fees on more than 60% of patents within twelve years after issuance.[122] Unless a product was a complete flop,[123] in many industries, it would have likely survived for at least twelve years in one form or another.[124] Thus, notwithstanding the absent-mindedness of some patentees (or their lawyers) who fail to renew their valuable patents,[125] these low renewal rates are strong evidence that most patented inventions are never commercialized.[126]

Empirical Analysis of the Strategic Use of Patents by Japanese Firms, 37 RES. POL'Y 1548, 1550 (2008) (reporting an average patent utilization rate of 51% for over 5000 Japanese respondent firms, research organizations, and inventors); Roger Svensson, *Commercialization of Patents and External Financing During the R & D Phase*, 36 RES. POL'Y 1052, 1057-58 (2007) (reporting a 61% commercialization rate for a sample of Swedish patents held by individuals, micro-companies, and small and medium-sized firms); BTG Benchmark Study, *supra* note 19, at 13, 19 (presentation notes) (showing roughly 60% commercialization rates). In a survey from the 1950s, for the over 1000 companies responding, "[t]he overall utilization rate of patents in current use, used in the past, and reported about to be used [was] 57 to 58%." A. Samuel Oddi, *An Uneasier Case for Copyright Than for Patent Protection of Computer Programs*, 72 NEB. L. REV. 351, 426 n.310 (1993) (citations omitted) (quoting Barkev S. Sanders et al., *Patent Acquisition by Corporations*, 3 PAT. TRADEMARK & COPYRIGHT J. RES. & EDUC. 217, 239 (1959)); *see also* Joseph Rossman & Barkev S. Sanders, *The Patent Utilization Study*, 1 PAT. TRADEMARK & COPYRIGHT J. RES. & EDUC. 74, 90 (1957) (finding about 54% of patents used).

At least one commentator has indicated that the patent utilization rate is only 10%. *See* Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1042 n.108 (1989) ("Barkev Sanders, in a study of assigned patents issued in 1938, 1948, and 1952, found that . . . 10 percent of patented inventions [are] ever put to commercial use . . . ."). However, the Sanders study found that "ten per cent of the patented inventions*, reported as to be used in the future*, will be used commercially." Barkev S. Sanders, *Speedy Entry of Patented Inventions into Commercial Use*, 6 PAT. TRADEMARK & COPYRIGHT J. RES. & EDUC. 87, 87 (1962) [hereinafter Sanders, *Speedy Entry*] (emphasis added). As Sanders explained in an earlier article addressing the same study, respondent assignees reported having used approximately *58% of their patents either currently or in the past*, and stated that they *expected to use* 2.4% of their patents in the "near future." Rossman & Sanders, *supra*, at 90. Thus, the "ten per cent" remark refers not to the total utilization rate, but specifically to the estimated utilization rate of patents that a class of respondents (here, assignees) had reported would be used in the future. *See id.*; Sanders, *Speedy Entry*, *supra*, at 87.

122. Nearly 20% of all patents are not renewed four years after issuance; more than 40%, eight years after issuance; and more than 60%, twelve years after issuance. Lemley, *supra* note 90, at 1504; *see also* Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521, 1530-36 (2005).

123. Based on data from the late 1970s and early 1980s, about one-third of all new product launches fail. R.G. Cooper & E.J. Kleinschmidt, *New Products: What Separates Winners from Losers?*, 4 J. PRODUCT INNOVATION MGMT. 169, 170 (1987).

124. *See* Peter N. Golder & Gerard J. Tellis, *Growing, Growing, Gone: Cascades, Diffusion, and Turning Points in the Product Life Cycle*, 23 MARKETING SCI. 207, 208, 216 (2004) (finding that the median product duration until decline was twenty years).

125. *See, e.g.*, AccuWeb, Inc. v. Foley & Lardner, 746 N.W.2d 447 (Wis. 2008) (holding that there were genuine issues of material fact regarding the failure of the defendant law firm to renew plaintiff's patent that precluded summary judgment for the defendant).

126. *See* SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS OF S. COMM. ON THE JUDICIARY, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM 12 n.60 (Comm.

This is especially so given that many patents today are not used as devices for earning supernormal profits on commercial embodiments of the patents, but instead are used (1) to create broad "fences" around commercialized products in order to prevent others from designing and selling substitute products; (2) as chits in large cross-licensing deals; and (3) to defend against patent infringement suits.[127] Moreover, about only 5% of issued patents are licensed for a royalty.[128] Less than 2% of issued patents are ever litigated and about half those cases settle within fifteen months of being filed.[129] These low rates of licensing and enforcement are further evidence of under-commercialization.

One possible inference from these figures is that "most [patented] technologies will not be economically viable or commercially successful."[130] Yet, the few studies to address the issue show that many undeveloped inventions would be successful if commercialized. In 1997, the British Technology Group, a company that specializes in licensing and commercializing medical innovations,[131] surveyed 133 companies and 20 universities worldwide about their use of patents.[132] Overall, roughly 40% of the patents the respondents held were uncommercialized.[133] Nonetheless, private companies stated that 32% of their uncommercialized patents were either commercially "very important" or "quite important."[134] For engineering companies, the figure increased to 40%, and for biosciences/pharmaceutical

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Print 1958) (Fritz Machlup) (surmising that renewal failure rates probably underestimate the number of inventions never commercialized). Of course, failure to renew might simply reflect that a commercialized patent was valuable early in its life, becoming unimportant later on. Although this explanation might explain some lapses, arguably many of the patents that are abandoned are not valuable to their holders from the start.

127. *See* FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY ch. 2, at 26-27, 33 (2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf; Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995*, 32 RAND J. ECON. 101 (2001) (finding that in the semiconductor industry during the period studied the major driver of patenting was strategic cross-licensing); Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 26-27 (2005); Rosemarie Ham Ziedonis, *Don't Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms*, 50 MGMT. SCI. 804 (2004) (describing the strategy of patent fencing).

128. Lemley, *supra* note 90, at 1507; *see also* Abramowicz, *supra* note 5, at 1074 ("[M]any patents go unlicensed and thus appear to be worthless.").

129. Lemley, *supra* note 90, at 1501; Paul Janicke, Univ. of Houston Law Ctr., Patent Litigation Remedies: Some Statistical Observations 25 (Feb. 10, 2007), *available at* http://www.patentsmatter.com/issue/Patent_Litigation_Remedies-Janicke.ppt.

130. Merges, *supra* note 59, at 603.

131. *See* British Technology Group Home Page, http://www.btgplc.com/view.aspx (last visited Oct. 21, 2008).

132. *See* BTG Benchmark Study, *supra* note 19, at 3.

133. *See id.* at 13, 18 (presentation notes).

134. *See id.*

companies, 34%.[135] Universities reported that 40% of their uncommercialized patents were "very" or "quite" important.[136] Similarly, about 40% of the private companies stated they would like to license out their uncommercialized patents to third parties.[137] Of respondents who did not view licensing out as "attractive," only 33% said their uncommercialized inventions were of "no" or "minimal value."[138] Similarly, in a survey funded by the European Commission, which generated responses from over 9000 European inventors and oversampled on "important" patents, nearly 38% of the inventors' patents were unused by them or others.[139] Based on these reports and the theoretical arguments presented earlier, it appears that many *valuable* inventions go uncommercialized.[140] Moreover, empirical studies show that when a highly valuable invention is commercialized, it often takes decades to transform the invention into a commercial product.[141]

There are at least three reasons to believe that the reward theory of patents, which informs much of today's patent law,[142] deserves significant blame for

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135. *See id.*

136. *See id.*

137. *See id.* at 21 (presentation notes).

138. *Id.* at 22. Similarly, a U.S. study from the 1950s found that about 31% of patents went uncommercialized because of competitive disadvantages, shortages of venture capital, the lack of complementary technologies, and general neglect. *See* Rossman & Sanders, *supra* note 121, at 97.

139. GAMBARDELLA, *supra* note 23, at 39-40.

140. Of course, it may not be socially optimal for every invention a patentee deems "commercially important" to be commercialized. Yet, presumably, a large number of these inventions are socially valuable.

141. *See infra* notes 185-186 and accompanying text.

142. Today's law is also informed by prospect-style theories, which take into account incentives to develop and commercialize inventions. *See* F. Scott Kieff & Troy A. Paredes, *An Approach to Intellectual Property, Bankruptcy, and Corporate Control*, 82 WASH. U. L.Q. 1313, 1319 (2004) ("[T]he reward theory fails to explain much of the positive IP law framework."); Kieff, *supra* note 8, at 740-46. Most importantly, the drafters of the 1952 Patent Act aimed to strengthen patent rights in order to improve commercialization incentives. *See* Kieff, *supra* note 8, at 741; Kingston, *supra* note 59, at 406 (arguing that the 1952 Act played an important role in promoting large-scale, corporate investment in innovation by eliminating the "flash of genius" test of obviousness). Nonetheless, the 1952 Act primarily implements the then-dominant reward theory. *See* Graham v. John Deere Co., 383 U.S. 1, 3-4 (1966) ("[T]he 1952 [Patent] Act was intended to codify judicial precedents embracing the principle long ago announced by this Court in *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248 (1851) . . . ."); Aro Mfg. Co. v. Convertible Top Replacement Co., 365 U.S. 336, 342 (1961) (finding that new sections in the 1952 Act setting forth infringement "left intact the entire body of case law on direct infringement"); Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305, 310-14 (1992) (describing the "long intellectual history of reward theory"); Harold C. Wegner, *The Disclosure Requirements of the 1952 Patent Act: Looking Back and a New Statute for the Next Fifty Years*, 37 AKRON L. REV. 243, 243 (2004) ("The great bulk [of the 1952 Act] was a mere codification of principles, going back in some cases to the earliest patent laws of the eighteenth century . . . ."). That is not to say that prospect theory does not deserve blame,

the under-commercialization problem.[143] First, by setting the threshold of patentability early in the innovation process, at conception and constructive reduction to practice—as opposed to actual reduction to practice (i.e., the making of a prototype) or the sale of a commercial product—patent law "rewards" the best *inventors*, but not the best *commercializers*.[144] Second, because the reward theory counsels in favor of early patenting and a limited patent term, a patent may expire well before an invention is commercially viable.[145] Third, reward theory finds that protection is unnecessary for *ex post* commercialization efforts.[146] Even though patents provide some hedge against free riding on otherwise unpatentable, non-technological innovation, they are not foolproof. This lacuna diminishes optimal incentives for patentees to take the types of extraordinary risks involved in unprotectable development and other post-invention commercialization efforts. Because of the severity of the underdevelopment problem, this Part addresses each reason in further detail.

1. *Inventors vs. innovators*

There is an important distinction between the notions of "invention" and "innovation" that is often overlooked in the scholarly literature and popular media. Properly understood, in the context of patent law, "invention" refers to the act of conceiving the design for a new and non-obvious technological product or process.[147] Although "innovation" includes the act of invention, it is not so limited; rather, innovation encompasses the entire process of identifying a problem to solved; conceiving a solution to the problem; identifying a market; building a prototype; testing the prototype; making a commercial product embodying the invention;[148] marketing, selling, and distributing the

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too—this Article argues in Part III.A that strengthening patent rights often leads to diminished commercialization.

143. Of course, market inefficiencies and the failure of other innovation-related laws—e.g., copyright, trademark, regulatory, and antitrust—might also play important roles in the under-commercialization problem. *See* Cooper & Kleinschmidt, *supra* note 123, at 171 (discussing various reasons new product launches may fail).

144. *See* Edmund W. Kitch, *Elementary and Persistent Errors in the Economic Analysis of Intellectual Property*, 53 VAND. L. REV. 1727, 1740 (2000) ("[Patent] rights can easily arise in the hands of persons or firms who are not in the best position to exploit them."); Lemley, *supra* note 18, at 137 ("Creators are often terrible managers. They frequently misunderstand the significance of their own invention and the uses to which it can be put.").

145. *See infra* Part II.C.2.

146. *See supra* Part II.B.

147. *See* Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 60 (1998) ("The primary meaning of the word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea."); *supra* notes 48-51 and accompanying text.

148. Often, the term "commercialization" refers only to the stage of making a

product; and improving upon that product.[149] Strictly speaking, patent laws provide direct incentives to *invent*, but not generally to *innovate*.[150]

For patent law to promote innovation, it must rely on a variety of activities that occur only after an inventor has completed the work necessary for patenting. As explained earlier, these *ex post* endeavors are not usually as simple as manufacturing, selling, and distributing a paper clip.[151] Rather, significant knowledge and expertise are usually required to overcome the often risky and costly hurdles on the path to producing and marketing a commercially viable product.[152] Although invention is related to the later stages of the innovation process, there is no reason to expect that inventors who win the race to patent will be the best commercializers.

The reward theory, then, must make use of low-cost market mechanisms to

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commercial product that embodies an invention. *See, e.g.*, INNOVATION AND COMMERCIALIZATION, *supra* note 38, at 2 ("*Commercialization* refers to the attempt to profit from innovation through the sale or use of new products, processes, and services."). This Article uses the term more broadly, covering any *post-invention* stage of the innovation process. *See supra* Part I. However, the "commercialization patent" proposed herein turns centrally on the manufacture and sale of a commercial product. *See infra* Part IV.B.

149. *See supra* Part I. Some economists use the term "innovation" to refer solely to post-invention development and commercialization endeavors, or a finalized product that results from such efforts. *See, e.g.*, Jan Fagerberg, *Innovation: A Guide to the Literature*, *in* THE OXFORD HANDBOOK OF INNOVATION 3, 4 (Jan Fagerberg et al. eds., 2005) ("Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice."); *cf.* JOSEPH A. SCHUMPETER, THE THEORY OF ECONOMIC DEVELOPMENT: AN INQUIRY INTO PROFITS, CAPITAL, CREDIT, INTEREST, AND THE BUSINESS CYCLE 66 (Redvers Opie trans., Transaction Books 1983) (1934) (contending that innovation consists of novel goods, production methods, markets, production inputs, and forms of organization). But today's usage generally encompasses the entire process of invention, development, and commercialization of innovative products. *See*, *e.g.*, Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 259 n.4 (2007) ("We use the term 'innovation' . . . to refer to the process of research, invention, and development and refinement of new ideas."); Kline & Rosenberg, *supra* note 41; Bruce A. McDaniel, *A Survey on Entrepreneurship and Innovation*, 37 SOC. SCI. J. 277, 279 (2000) ("[M]ore recent literature on technology has recognized four stages of development [that form the innovation process] from the scientific laboratory to the market through which a technology must progress." (citation omitted)); Federico Munari & Maurizio Sobrero, *Corporate Governance and Innovation*, *in* CORPORATE GOVERNANCE, MARKET STRUCTURE AND INNOVATION 3, 3 (Mario Calderini et al. eds., 2003) (remarking that innovation starts "with the generation of new knowledge targeted to the discovery of new products and processes, and ending with their commercial exploitation"). Hence, this Article refers to "innovation" in the broader sense.

150. *See* Merges, *supra* note 88, at 809 ("[T]he patent system rewards *innovation* only indirectly, through the granting of patents on *inventions*.") (citing DIRECT PROTECTION OF INNOVATION 2-3 (William Kingston ed., 1987)); *supra* Part II.A.

151. *See supra* Part II.B.

152. *See supra* Parts I, II.B. Although risks and costs of commercialization will be greatest for radical and pioneering inventions, they will tend to be greater than ordinary business risks and costs even for incremental inventions. *See supra* notes 114-118 and accompanying text.

promote robust innovation.[153] Importantly, although patent laws do not provide direct motivation to commercialize, there are at least four indirect mechanisms that frequently result in robust commercialization. First, commercializers typically hire inventors as employees or consultants under contracts that automatically assign the rights in all patents to the commercializer.[154] The added transaction costs of this effective vertical integration of commercializers and inventors are relatively low in many cases.[155] Second, inventors who lack significant resources or know-how can often engage in low-cost "do-it-yourself" commercialization, which given today's distribution technologies, may often be just as effective as traditional, capital-intensive approaches.[156] Third, for projects requiring substantial capital or other assets, inventors may seek financing from venture capital firms, angel inventors, private companies, government grants, friends, and family.[157] Fourth, there are sophisticated markets that enable licensing or the outright sale of intellectual property rights from inventors to commercializers.[158] For example, "patent pools" aggregate large numbers of patents in various technological fields, which are then licensed out to commercializing companies.[159] Thus, reward theorists can make

153. *See* Jorde & Teece, *supra* note 115, at 583 ("The limitations of intellectual property protection require that commercialization activities be conducted effectively and efficiently in order to extract wealth from intellectual property.").

154. *See* Steven Cherensky, *A Penny for Their Thoughts: Employee-Inventors, Preinvention Assignment Agreements, Property, and Personhood*, 81 CAL. L. REV. 595, 598 (1993) ("And it is also likely that the employee who invented that [invention] agreed, before it was even invented, to assign her entire interest in the invention to her employer.").

155. *See* Arti K. Rai, *Fostering Cumulative Innovation in the Biopharmaceutical Industry: The Role of Patents and Antitrust*, 16 BERKELEY TECH. L.J. 813, 835 (2001) ("[M]ovements toward vertical integration can reduce transaction costs."); *see also* Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights, and Firm Boundaries*, 13 INDUS. & CORP. CHANGE 451, 471 (2004).

156. *See, e.g.*, Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1514 (2005) ("Gone is the large, vertically integrated firm that gathered all the resources—physical, intellectual, and human—needed to produce a given item."); Michael L. Rustad & Thomas H. Koenig, *The Tort of Negligent Enablement of Cybercrime*, 20 BERKELEY TECH. L.J. 1553, 1555 (2005) ("America is rapidly shifting its economic base from the production of durable goods to software engineering and other types of information production."). *See generally* HENRY W. CHESBROUGH, OPEN INNOVATION: THE NEW IMPERATIVE FOR CREATING AND PROFITING FROM TECHNOLOGY (2003).

157. *See* John E. Dubiansky, *An Analysis for the Valuation of Venture-Capital-Funded Startup Firm Patents*, 12 B.U. J. SCI. & TECH. L. 170, 171 (2006) ("The rise of the venture capital industry has [led] to the emergence of startup firms founded to commercialize new technologies.").

158. *See* ASHISH ARORA ET AL., MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY 38-39 (2001) (pointing to more than 15,000 licensing transactions worldwide with a total value of over $320 billion in the period from 1985 to 1987); RIVETTE & KLINE, *supra* note 120, at 5 (estimating that the licensing market grew 700% from $15 billion in 1990 to well over $100 billion in 1998).

159. Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1319 (1996) ("Patent pools

a very credible argument that transaction costs are low enough in many situations that inventors will be able to license or transfer their inventions to commercializers in an efficient manner.

Yet, there are numerous instances involving significant inventor-commercializer transaction costs, which can stifle commercialization. First, nonpracticing entities (NPEs)—namely, firms that do not commercialize their patented inventions and perform little to no R & D—are often termed "patent trolls," because they tend to exploit litigation and licensing market defects to extract unwarranted rents from commercializers, usually on patents that the commercializer was completely unaware of before the NPE's demand for payment.[160] Indeed, many of the so-called "patent pools" are not mechanisms to provide new technology to commercializers, but are merely "patent thickets" that already-commercializing entities need to navigate, often with large payments, to continue making and selling their products.[161] Second, if an invention is socially beneficial, but not significantly so, then transaction costs in licensing and technology transfer—especially the costs of determining if the invention works as stated—may be high enough to prevent commercialization.[162] Third, even if an invention is a major breakthrough, its inventor might lack the knowledge or wherewithal to sell or license it to a commercializer.[163] Furthermore, because today's complex technological

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facilitate licensing and royalty splitting, and also extensive cross-licensing *among members*.").

160. Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 2009 (2007) (arguing that awarding "patent trolls" injunctive remedies distorts the economic purpose of the patent system); Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law* 28-29 (Stanford Pub. Law Working Paper No. 1270160, 2009), *available at* http://ssrn.com/abstract=1270160 (finding that for software and communications patent suits—the most likely types for nonpracticing entities—copying by alleged infringers is almost nonexistent). Much less discussed in the literature, *practicing* entities are often able to exploit the same defects and impose similar undue costs on commercializers. *See* Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1068 (2008).

161. Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, *in* 1 INNOVATION POLICY AND THE ECONOMY 119, 120 (Adam B. Jaffe et al. eds., 2001) (describing a "patent thicket" as "a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize new technology"). Although Shapiro notes that patent pools can reduce the transaction costs of a patent thicket composed of independent patentees, the substantial likelihood that commercializers will need to negotiate with separate pools and the increased threat value of the pool owners in litigation diminishes the potential reduction in transaction costs. *See id.* at 134-35; Parchomovsky & Wagner, *supra* note 127, at 35-36.

162. *See* BESSEN & MEURER, *supra* note 90, at 182-83; *cf.* Merges & Nelson, *supra* note 47, at 874-75 (describing the effects of high technology transfer costs).

163. A significant case in point is the failure of Chester Carlson, the inventor of the photocopier, to license his technology—and then, only for further development—until seven years after he filed his first patent application. *See* RICHARD C. DORF & THOMAS H. BYERS, TECHNOLOGY VENTURES 107 (2005); JOLLY, *supra* note 58, at 5 ("Carlson [unsuccessfully]

inventions often require ongoing participation by the inventor to transfer important know-how or other tacit knowledge about the invention, licensing may be practically infeasible.[164] Fourth, even if parties are willing to bargain, they may drastically differ in their assessment of the commercial value of an embryonic invention, creating large information asymmetries that prevent them from closing a deal.[165] Fifth, if multiple competitors are "racing" to patent an invention, early patenting makes it more likely they will all reach the finish line nearly simultaneously, potentially resulting in a host of different patents and claims that the competitors may fight over in years of costly litigation.[166]

Some reward theorists recognize the problems of transaction costs and, for this reason, have recommended a variety of solutions, such as prize systems, ratcheting up the threshold of patentability, and narrowing the scope of patent rights.[167] As Part III explains, if one believes that unprotected *ex post* commercialization activity does not lead to pernicious free riding by others—specifically, positive spillovers, the value of which cannot be sufficiently captured by commercializers to motivate them to take the extraordinary risks of commercialization—then these reactions largely seem sensible.[168] However, as explained earlier in this Part and in more detail below,[169] there are strong reasons to believe that commercialization is in need of legal protection. On this basis, the combination of high transaction costs and patent law's choice of

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approached as many as twenty-one companies, including the likes of IBM, RCA, and Eastman Kodak."); DAVID OWEN, COPIES IN SECONDS 102-05 (2004).

164. *See* BESSEN & MEURER, *supra* note 90, at 183; Richard Jensen & Marie Thursby, *Proofs and Prototypes for Sale: The Licensing of University Inventions*, 91 AM. ECON. REV. 240, 241 (2001) (noting that university inventions are usually "so embryonic that additional effort in development by the inventor is required for a reasonable chance of commercial success").

165. *See* Roger D. Blair & Thomas F. Cotter, *Strict Liability and Its Alternatives in Patent Law*, 17 BERKELEY TECH. L.J. 799, 818 (2002) ("The transaction costs of and other obstacles to licensing can be burdensome for a number of reasons, including asymmetric information; the potential for competition from substitutes for the patented invention; the interdependence of potential licensees' demand curves; and the fact that licensees are free to challenge the patent's validity."); Nancy T. Gallini, *The Economics of Patents: Lessons from Recent U.S. Patent Reform*, 16 J. ECON. PERSP. 131, 137 (2002) (describing a variety of transaction costs, including information asymmetries, that can stymie deals between an inventor and prospective licensees); Lemley, *Economics of Improvement*, *supra* note 103, at 1055-56; *cf.* Kingston, *supra* note 59, at 408 ("[I]f competing firms hold patents on different components of a complex technology, and they fail to cross-license them (which can happen from many causes, not all of them rational) development in an entire industry can be slowed down or even rendered impossible." (citation omitted)).

166. *Cf.* Daralyn J. Durie & Mark A. Lemley, *A Realistic Approach to the Obviousness of Inventions*, 50 WM. & MARY L. REV. 989, 1007 n.96 (2008) ("[I]t may be that simultaneous invention resulted from a patent race that would not have occurred in the absence of the prospect of a patent reward.").

167. *See infra* Part III.C.

168. *See id.*

169. *See infra* Part II.C.3.

inventor over innovator as rights-holder is a significant problem that cannot simply be solved by modifying reward theory.[170]

2. *The timing of invention and commercialization*

Michael Abramowicz has convincingly argued that even if a patent is awarded to the ideal commercializer, because it is granted early in the innovation process and expires in a finite time period, the uncertainty surrounding the potential success of a commercial embodiment may cause the patentee to forgo commercialization if the patent term expires too early.[171] Specifically, he views patent rights as including a "real option" to develop the invention before the patent expires.[172] As with a stock option, a patent holder has an incentive to wait to "exercise" its option to commercialize until better information is known about the underlying asset—here, the value of the commercial embodiment of the invention.[173] Although waiting to commercialize a patented invention will reduce the amount of potential supernormal profits redounding to the patentee's benefit, it will also reduce the supernormal risk that a patentee will make the wrong choice—namely, commercializing a valueless invention.[174] Using computer modeling, Abramowicz shows under very conservative assumptions that early grants of patents may lead to significant commercialization delays and underdevelopment.[175] Indeed, given the variety of uncertain events that can affect the risk and profitability of commercialization—such as whether competing products will enter the market or production inputs will increase or decrease in price—one would expect this effect to be large in practice.[176]

Abramowicz also notes another important reason why inventions that are patented early may be commercialized late, or not at all—namely, complementary technologies required to successfully commercialize the

170. *See infra* Part III.C.

171. Abramowicz, *supra* note 5, at 1075-78.

172. *See id.* at 1075-76 (citing video recording: Shaun Martin & Frank Partnoy, Presentation at the Washington University School of Law Conference on Commercializing Innovation (Nov. 4, 2005), *available at* http://law.wustl.edu/CRIE/videos/CI11.4-5.06/03martinpartnoy.ram). Technically, the option is a negative right to be free from an infringement suit on the specific patent held. Because patents only convey rights to exclude others, there is no assurance that the patentee would not infringe *another's* patent if it builds a commercial embodiment of its patented invention. *See* Merges & Nelson, *supra* note 47, at 860-62.

173. *See* Abramowicz, *supra* note 5, at 1075-76.

174. *See id.*

175. *See id.* at 1084-1091; *see also* Dechenaux et al., *supra* note 118, at 905 (finding that there may be a greater risk that a commercializer will terminate development if the remaining patent term is relatively short).

176. *See* Golder & Tellis, *supra* note 112, at 161-62 (describing beneficial changes that may arise by delaying the innovation process).

invention may not be available, at least in a cost-effective form, until the patent term expires.[177] For example, although a mechanical version of the programmable digital computer was invented by Charles Babbage in the 1820s, it was not until the invention of the modern transistor in the late 1940s that the computer could be commercialized in any significant fashion.[178] Furthermore, even if inexpensive complementary technologies are available, to the extent the cost of these production inputs is continually declining, a commercializer may decide that the benefit of waiting for even cheaper complementary technologies outweighs the added profit of immediate commercialization, especially if choosing an early complementary technology creates large costs in switching to a more efficient one later.[179]

Abramowicz tempers these findings, however. First, he notes that the development of a patent will sometimes produce improvement patents, which expire later than the original patent.[180] Yet, he also recognizes that the same problems of delayed commercialization might apply to improvement patents; moreover, he acknowledges that much commercialization is unpatentable.[181] Second, he argues that the current patent system often requires a significant amount of development prior to patenting.[182] Although the law as written may do so, in practice, it appears that post-invention development and commercialization expenses dwarf pre-invention expenses in nearly all industries.[183] The pharmaceutical industry is usually singled out as the prime example of one in which *ex post* commercialization expenses are substantial. Yet, because the threshold of patentability is so low for most technologies and *ex post* expenses include *non-technological* commercialization efforts—as a

177. *See* Abramowicz, *supra* note 5, at 1081 n.63 ("[I]t might not make sense to commercialize a particular invention until another, complementary invention is developed."); *see also* Oddi, *supra* note 99, at 275 ("Because of the finite term of a patent, those inventions that may be ahead of their time may not be rewarded commensuratively to their contribution to society, while those inventions that may be easily commercialized may be excessively rewarded considering the relatively trivial contribution made.").

178. *See* JAMES E. MCCLELLAN III & HAROLD DORN, SCIENCE AND TECHNOLOGY IN WORLD HISTORY 406 (2006).

179. *See* Joseph P. Kaboski, *Factor Price Uncertainty, Technology Choice and Investment Delay*, 29 J. ECON. DYNAMICS & CONTROL 509, 521-24 (2005) (modeling the incentives of firms to delay adopting new technologies in the presence of switching costs and uncertain input prices). Intentional suppression of invention for commercial gain has been bandied about as another reason for noncommercialization. *See, e.g.*, Kurt M. Saunders, *Patent Nonuse and the Role of Public Interest as a Deterrent to Technology Suppression*, 15 HARVARD J.L. & TECH. 389, 434 (2002). Although patent suppression surely occurs, it seems unlikely that it accounts for a significant share of undeveloped inventions.

180. *See* Abramowicz, *supra* note 5, at 1091.

181. *See id.* at 1099.

182. *See id.* at 1092-98.

183. *See* CMFT, Inc. v. Yieldup Int'l Corp., 349 F.3d 1333, 1340 (Fed. Cir. 2003) ("[M]ost inventions require further development to achieve commercial success."); Kitch, *supra* note 10, at 270-71; *infra* note 184.

percentage of *overall* innovation expenses, the same appears to hold true in software, communications, medical devices, computer hardware, and other innovative industries.[184]

Thus, Abramowicz's qualifications probably do not mitigate his stark theoretical findings much. Indeed, Abramowicz cites a detailed table showing that many of the twentieth century's most important inventions were not commercialized until many years after patenting.[185] For example, the television was invented in 1905, but only commercialized in 1940; the automatic transmission, 1904 versus 1937; penicillin, 1928 versus 1944; and the helicopter, 1912 versus 1941.[186] If the most well-known—and presumably, profitable—innovations face significant commercialization delays, arguably the patenting threshold comes very early in the innovation process.

3. *The protection of non-technological innovation*

If the reward theory were correct, then patent protection during the post-invention commercialization phase of the innovation process would be unnecessary.[187] This might be so if all of the risks associated with post-patenting commercialization involved activities that were (1) ultimately patentable, such as technological commercialization;[188] (2) protectable through some other form of IP or similar exclusive right, such as copyrights, trademarks, trade secrets, or direct market regulation;[189] or (3) leveraged

184. *See, e.g.*, INNOVATION AND COMMERCIALIZATION, *supra* note 38, at 50 & tbl.2-7 (finding that 74% of U.S. company product launch expenditures occur after "applied research" and the preparation of "product specifications"); Jensen & Thursby, *supra* note 164, at 243 (finding that only 12% of licensed university inventions were "ready for commercial use"); Edwin Mansfield, *Industrial Innovation in Japan and the United States*, 241 SCIENCE 1769, 1770 & tbl.2 (1988) (finding that, in the United States, applied research accounts for only 18% of the costs of developing and introducing new products, with the remainder attributable to post-research activities, including the preparation of product specifications, prototyping, tooling and equipment, manufacturing startup, and marketing); André Piatier, *Innovation Patent, Invention Patent, or Both?*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 136 ("In numerous industries the cost of development outweighs the cost of research."); Sanders, *Speedy Entry*, *supra* note 121, at 87 (finding that for patented commercialized inventions, about 60% are commercialized after the patent application is filed).

185. *See* Abramowicz, *supra* note 5, at 1069 (citing Kitch, *supra* note 10, at 272 (citing JOHN JEWKES ET AL., THE SOURCES OF INVENTION (1958))).

186. *See* Kitch, *supra* note 10, at 272; *see also* Thomas W. Eagar, *Bringing New Materials to Market*, 98 TECH. REV. 42, 45 (1995) (documenting long lead times between invention and commercialization for vulcanized rubber, teflon, titanium, velcro, bullet-proof glass, semiconductors, and other important inventions).

187. *See supra* Part II.B.

188. *See* Abramowicz & Duffy, *supra* note 64, at 398.

189. *See* Gideon Parchomovsky & Peter Siegelman, *Towards an Integrated Theory of Intellectual Propert*y, 88 VA. L. REV. 1455, 1473 (2002) (arguing that "brand loyalty enables

"complementary assets" (such as marketing strength) or network effects that resulted in a first-mover or other market advantage sufficient to provide supracompetitive profits.[190] But, as explained earlier, much commercialization is not protectable by patents, copyrights, trademarks, trade secrets, or other forms of market regulation.[191] While a first-mover advantage can be significant, there is an ample literature on "second-mover" advantages, whereby a follower is able to reap the benefits of a first-mover's efforts at a much lower cost—exactly the type of free riding patent protection is designed to prevent.[192] And although complementary assets may assist large, entrenched incumbents, they are typically of little value to start-up companies and independent inventors.[193] More importantly, even if first-mover advantages and complementary assets were sufficient to protect *unpatentable* commercialization activities, then by the same token, they arguably would be sufficient to protect currently *patentable* inventive efforts.[194] In sum, the

patentees to preserve some of their market share after the patent protection expires").

190. *See* David J. Teece, *Profiting from Technological Innovation*: *Implications for Integration, Collaboration, Licensing and Public Policy*, 15 RES. POL'Y 285 (1986) (discussing the advantages that accrue to first movers and holders of complementary assets); *see also* Paul J. Heald, *Optimal Remedies for Patent Infringement: A Transactional Model*, 45 HOUS. L. REV. 1165, 1167 ("Society does not need patent law in order to stimulate the General Motors R & D department to invent an improvement for GM cars (at least in the case where the improvement only works in GM cars).").

191. *See supra* Part II.C.2. Of course, "much" does not mean "all." For example, for inventions that solely reduce the costs of manufacturing an existing product, arguably, often all of the risk and expense of implementation is merely technological in nature and protectable by patents or trade secrets.

192. *See, e.g.*, STEVEN P. SCHNAARS, MANAGING IMITATION STRATEGIES: HOW LATER ENTRANTS SEIZE MARKETS FROM PIONEERS 29-30 (1994); Joseph Farrell & Garth Saloner, *Standardization, Compatibility, and Innovation*, 16 RAND J. ECON. 70, 75-79 (1985); Frischmann & Lemley, *supra* note 149, at 257-58, 268-70; *see also* JOHN BATES CLARK, ESSENTIALS OF ECONOMIC THEORY 360 (1907) ("Why should one *entrepreneur* incur the cost and the risk of experimenting [in making and selling] a new machine if another can look on, ascertain whether the device works well or not, and duplicate it if it is successful?").

193. *See* INNOVATION AND COMMERCIALIZATION, *supra* note 38, at 23; Jorde & Teece, *supra* note 115, at 590 ("Particularly for small firms, innovation may require accessing complementary assets that lie outside the organization."); Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 25 BERKELEY TECH. L.J. (forthcoming 2010) (finding that complementary assets are between "slightly" and "moderately" important as an appropriability mechanism for startups); Scott Shane, *Technological Opportunities and New Firm Creation*, 47 MGMT. SCI. 205, 209 (2001) ("Although established firms might also be more likely to commercialize broad patents, they are disproportionately important to independent entrepreneurs who lack complementary assets.").

194. Of course, one might argue that there is an insufficient basis to protect not only innovation, but also invention, with intellectual property rights. *See, e.g.*, MICHELE BOLDRIN & DAVID K. LEVINE, AGAINST INTELLECTUAL MONOPOLY (2008) (arguing that society would be better off without patents). Although the patent system imposes many unnecessary costs, for the reasons presented in this section, it seems advisable to remedy institutional and market defects rather than eliminate the patent system. *See, e.g.*, BESSEN & MEURER, *supra*

economic rationale for patent protection for *ex ante* inventive efforts arguably applies with similar force for *ex post* commercialization efforts.[195]

Indeed, since at least the late nineteenth century, a number of scholars and jurists have made these sorts of arguments. In 1896, the economist A.T. Hadley argued that the patent system "has established itself, not primarily as a stimulus for invention or for disclosure, but for [the] utilization and development of new methods requiring the investment of capital and the guarantees which shall make such investment possible."[196] In 1942, the prominent judge, Giles Rich—who co-drafted the Patent Act of 1952 and served on the Federal Circuit and its forerunner for over 40 years—remarked that the "aspect of inducement [of the patent laws that] is by far the greatest in practical importance . . . might be called the inducement to risk an attempt to commercialize the invention."[197] In 1958, in an exhaustive review of the patent system commissioned by Congress, Fritz Machlup surmised that the risks involved in "experimentation in production and experimentation in marketing . . . may be too great to be undertaken except under the shelter of a monopoly grant" of a patent.[198]

The modern incarnation of these *ex post* theories of patent law began with Ed Kitch's landmark 1977 article, *The Nature and Function of the Patent System*, which introduced the "prospect" theory. Here, Kitch likened patents, which protect "a particular opportunity to develop a known technological possibility . . . shortly after its discovery" (i.e., a "prospect"), to the historical mineral claim laws, which allowed prospectors to exclude others as they mined their discovered vein of minerals.[199] What distinguished Kitch from earlier *ex post* theorists was his recognition that, like a mining prospect, the legal claim to

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note 90, at 215-53 (suggesting reforms to the patent system to diminish socially harmful costs).

195. *See* Abramowicz & Duffy, *supra* note 64, at 340 ("Just as patents encourage risky but ultimately beneficial technological experimentation, some form of intellectual property protection could result in a socially beneficial increase in market experimentation and entrepreneurial activity."); Daniel F. Spulber, *Competition Policy and the Incentive to Innovate: The Dynamic Effects of* Microsoft v. Commission, 25 YALE J. ON REG. 247, 268 (2008) ("Innovative activity involves the commercialization of inventions and decisions about new products, manufacturing processes, and transaction methods. . . . Innovative efficiency contains elements of allocative efficiency and dynamic efficiency. . . . Effective protections for intellectual property are essential for innovation efficiency.").

196. ARTHUR TWINNING HADLEY, ECONOMICS 134 (New York, G.P. Putnam's Sons 1896); *see also* CLARK, *supra* note 192; IRVING FISHER, ELEMENTARY PRINCIPLES OF ECONOMICS 331 (1912) (arguing that patents encourage investment of capital into industries otherwise characterized by "cutthroat competition"); ALBERT F. RAVENSHEAR, THE INDUSTRIAL AND COMMERCIAL INFLUENCE OF THE ENGLISH PATENT SYSTEM 55 (1908) ("[T]he final conclusion is that patents exercise a net influence in stimulating the growth of industry . . . .").

197. Giles S. Rich, *The Relation Between Patent Practices and the Anti-Monopoly Laws*, 24 J. PAT. OFF. SOC'Y 159, 177 (1942).

198. Machlup, *supra* note 126, at 36-37.

199. Kitch, *supra* note 10, at 266, 271-75.

a patent exceeds the scope of the discovery.[200] Kitch argued that "the scope accorded to patent claims . . . reaches well beyond what the reward function would require."[201] Although the reward theory might extend the scope of an inventor's claims beyond the invention itself to allow the inventor to capture sufficient monopoly rents from her "investment in the invention," that view could not support patent law's tendency to grant claims of such expansive scope.[202] Kitch's prospect theory, however, explained such claims on a purely *ex post* basis: by granting broad claims early in the innovation process, the patentee could coordinate post-patenting development and commercialization efforts among several players, reducing duplicated costs and preventing competitors' use of unpatentable information generated in the process.[203] Although Kitch recognized that the reward function of patent law plays an important role, he argued that the prospect function is a "significant, if not the predominate, function of the American patent system as it has operated in fact."[204] Thus, on Kitch's view, the patent system would produce greater levels of commercialization if patents were granted even earlier in the innovation process—and with much broader claims—than warranted under the reward theory.[205] Doing so would insure against commercialization risk and eliminate duplicated costs, promoting the investment needed to make and sell products in the marketplace.[206]

Scott Kieff has recently developed these points in his "commercialization" theory of patents.[207] Drawing upon Kitch's espousal of broad patent rights, Kieff argues that strong, real property-like protection "is necessary to facilitate investment in the complex, costly, and risky commercialization activities required to turn nascent inventions into new goods and services."[208] In this

200. *Id.* at 265-67.

201. *Id.* at 267.

202. *Id.* at 266.

203. *See id.* at 278 ("Once a patent has been issued, other firms can learn of the innovative work of the patent holder and redirect their work so as not to duplicate work already done."); *id.* at 276 ("[T]he patent owner has an incentive to make investments to maximize the value of the patent without fear that the fruits of the investment will produce unpatentable information appropriable by competitors.").

204. *Id.* at 267.

205. *See id.* at 269-70. Recent empirical research lends support to Kitch's thesis. For example, a cross-industry empirical study found that firms lacking specialized complementary assets were, in the presence of strong patent protection, more likely to license their innovations than compete in the market, arguably a relatively efficient outcome. *See* Ashish Arora & Marco Ceccagnoli, *Patent Protection, Complementary Assets, and Firms' Incentives for Technology Licensing*, 52 MGMT. SCI. 293 (2006).

206. Kitch, *supra* note 10, at 269; *see also* Gans & Stern, *supra* note 115, at 348 ("[IP protection] allows for cooperation between start-ups and incumbents who might otherwise view innovation purely as a competitive threat.").

207. Kieff, *supra* note 8.

208. *Id.* at 703; *see also* Nerkar & Shane, *supra* note 115, at 1157 ("Broader scope

regard, using sophisticated computer modeling, Michael Abramowicz and John Duffy have recently shown that the incentives to engage in unpatentable marketing experimentation in the absence of exclusive rights can be highly suboptimal.[209] Although Kitch and Kieff overlook the tendency of very early patenting to lead to under-commercialization, to the extent that broad claims reduce duplicated costs and prevent against free riding enough to induce commercialization during the patent term, then the under-commercialization problem might not be so severe.[210] If this is so, then it is only reward theory's coupling of early grants with relatively *narrow* claims that leads to under-commercialization.[211]

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protection increases the likelihood that any trial-and-error efforts that are necessary to develop new products will result in something for which returns can be appropriated because broader patent scope allows the firm exploiting the invention to explore product and service applications over a wider range of technical areas."); *id.* at 1162 (finding that inventions covered by patents with broader scope were more likely to be commercialized); Shane, *supra* note 193, at 215 (finding in an empirical study of MIT patents that ones with broader "scope," defined as the number of international classes assigned to the patent, were "more likely to be commercialized through the creation of new firms").

The Bayh-Dole Act, which allows universities to patent technology that would arguably have been invented absent the patent system, is premised upon such an *ex post* view. *See* DAVID C. MOWERY ET AL., IVORY TOWER AND INDUSTRIAL INNOVATION 59, 85-87 (2004); Jerry Thursby & Marie Thursby, *Knowledge Creation and Diffusion of Public Science with Intellectual Property Rights*, *in* 2 FRONTIERS OF ECONOMICS AND GLOBALIZATION 199, 203 (2008).

209. Abramowicz & Duffy, *supra* note 64, at 342-43, 353-63.

210. A recent study of Australian patent holders concluded that "while the receipt of a patent grant had a positive and significant effect on most commercialization stages, the magnitude of the effect is quite modest. . . . Although patents matter, they are hardly the powerful force that economic theory suggests." Elizabeth Webster & Paul H. Jensen, *Do Patents Matter for Commercialization?* 4 (Melbourne Inst., Working Paper No. 8/09, 2009), *available at* http://melbourneinstitute.com/wp/wp2009n08.pdf. Yet, this conclusion is probably flawed for at least two reasons. First, it appears most commercialization efforts are undertaken before an applicable patent is granted. *See infra* note 372. Thus, it is more likely that the *filing*, not the receipt, of a patent is operative in spurring commercialization. For this reason, that the Australian study found the *grant* of a patent to be at all significant in commercialization decisions indicates that patents are quite a "powerful force." Second, the study's conclusions are based on the *average* effect of a patent on commercialization—because the value of patents is highly skewed, if merely the most valuable patents substantially promote commercialization, then patents will play an important economic role. Indeed, the same study notes significant effects on commercialization of pharmaceutical patents, which represent the bulk of the most valuable patents. *See* Webster & Jensen, *supra* at 9.

211. *See* Merges & Nelson, *supra* note 47, at 875 ("Property rights that are too narrow will not provide enough incentive to develop the asset . . . ."). Part III.A addresses the particular question of whether the benefits of *broad* and early granted claims generally outweigh their costs.

4. *Why under-commercialization thwarts the aims of the patent laws*

The discussion above presents three sound reasons why the reward theory, which largely motivates current patent doctrine,[212] arguably leads to the under-commercialization of invention. Implicit in these arguments is that a fundamental goal of the patent system is to yield novel and non-obvious commercial products (and methods of making and using those products). Thus, a possible counter-argument to the analysis so far is that the patent system does—or at least should—serve other, more important goals, such as the disclosure of new and non-obvious information, the signaling of technological capability within and outside firms, and the reduction of transaction costs in business dealings. This position, however, has little force: while fostering innovation is not the sole function of the patent system, none of the other functions plays, nor should play, a significant, independent role.

First, courts often remark that disclosure is "the *quid pro quo* of the right to exclude,"[213] possibly implying that the greatest benefit to society from patenting is the addition of new and non-obvious knowledge to the existing pool.[214] Although the disclosed knowledge—at least that which is encompassed by the patent claims—cannot be used during the patent term, this cost is viewed by disclosure theorists as a worthwhile bargain, since all of the knowledge can be used after expiration.[215] Once a patent expires, as long as its knowledge is new and non-obvious, the public arguably has available what it otherwise would not. Although disclosure is an important function of the patent system, this view suffers from the same sorts of weaknesses as its relative, the reward theory. As an initial matter, it appears that many, perhaps most, scientists and engineers never read patents.[216] More importantly, even when they do read them—or, alternatively, acquire the information disclosed in patents from other sources, such as product manuals or products embodying the patents—there is no significant benefit to the public *but for the manufacture*

212. *See supra* note 142 and accompanying text.

213. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 484 (1974); *see also* J.E.M. AG Supply v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124 (2001) (reiterating the quid pro quo rationale); Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 63 (1998) ("[T]he patent system represents a carefully crafted bargain that encourages both the creation and the public disclosure of new and useful advances in technology, in return for an exclusive monopoly for a limited period of time."). *But cf.* Brenner v. Manson, 383 U.S. 519, 533-35 (1966) (questioning the viability of a disclosure theory of patents).

214. *Cf.* Merges, *supra* note 88, at 807-10 (rejecting commercialization-based theories in favor of the "dual functions of disclosure and reward [which] are the essence of our patent system").

215. Grant v. Raymond, 31 U.S. (6 Pet.) 218, 218-19 (1832); Merges, *supra* note 88, at 808.

216. Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19, 21-22; Note, *The Disclosure Function of the Patent System (Or Lack Thereof)*, 118 HARV. L. REV. 2007, 2017 (2005) [hereinafter Note, *Disclosure Function*].

and sale of products or the use of processes relying upon the disclosed inventions.[217] Disclosure is sensible as part of the patenting process—specifically, to aid in providing notice of the legal rights of the patentee, to encourage others to use unprotected information or to improve upon the original invention, and to serve as prior art in analyzing other patent applications.[218] But there is relatively little social value to disclosure as an end in itself: technical knowledge put to no use is not worth much.[219]

Second, a few scholars have argued that there are other commercial benefits to patents, but none appears to be important aside from encouraging the production of innovative commercial goods. For example, patents may play important roles in providing "signals" to potential investors that a company has the wherewithal to conceive of new and non-obvious inventions and the discipline to document that knowledge.[220] On this view, patents serve as a "proxy for hard-to-measure capabilities and assets" in patenting firms.[221] Although there is evidence that patents play important signaling roles for start-up companies and potential acquisition targets,[222] there is neither an empirical nor a theoretical basis to believe that signaling, particularly outside of the role it plays in coordinating commercialization, is a dominant effect of patenting.

Paul Heald recently proposed a more general "transaction cost"-lowering model of patenting in which patents strengthen legal boundaries around technological assets.[223] By so doing, patents can prevent these assets from

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217. *See* Note, *Disclosure Function*, *supra* note 216, at 2009; *cf.* Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1575 (Fed. Cir. 1995) (Nies, J., dissenting) ("For our patent system to fully serve its goal of promoting economic growth, innovations must make it to market during the patent term.").

218. *See* Note, *Disclosure Function*, *supra* note 216, at 2009-10.

219. *Cf.* Jorde & Teece, *supra* note 115, at 579 ("The development, commercialization, and diffusion of product and process technologies have long been the most fundamental competitive forces in advanced industrial economies, generating economic growth, enhancing consumer welfare, and in the process, constantly challenging and frequently overturning the established order within and among industries.").

220. *See generally* Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625 (2002).

221. *See* Graham & Sichelman, *supra* note 160, at 1067; *see also* Paul J. Heald, *Transaction Costs and Patent Reform*, 23 SANTA CLARA COMPUTER & HIGH TECH. L.J. 447, 455 (2007) ("The information provided by the publication of all patents also indirectly helps in the difficult task of valuation and pricing by providing a central clearinghouse of information on innovation.").

222. *See, e.g.*, Graham et al., *supra* note 193, at 39-42 (finding that a major driver of patenting by startups is to improve the chances and quality of financing events); David H. Hsu & Rosemarie H. Ziedonis, Patents as Quality Signals for Entrepreneurial Ventures 4 (Nov. 2007) (unpublished manuscript, on file with Mack Center for Technological Innovation working paper series), *available at* http://webuser.bus.umich.edu/rzied/research/Hsu%20Ziedonis%20Signals,%2011-5-07%20copy.pdf (finding that a doubling in the number of patents held by venture-backed semiconductor companies resulted in a 28% premium in market valuation).

223. Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473

being levied by creditors of managers and stockholders, dissipated by exiting employees, and usurped by competitors, which lowers the costs of negotiation with third parties and allows for firms to forgo costly and, often, ineffective non-disclosure agreements.[224] Although there is little doubt that patents play these roles, the reason that patents ultimately lower transaction costs is because the ultimate "asset" that patents protect is profit derived from the commercialization of the patented invention. Thus, while Heald's theory might elucidate how patents operate to deliver value to their owners, it is wholly consistent with the goal of encouraging the manufacture and sale of innovative products to the consuming public. As such, Heald's theory boils down to a further refinement on *ex post* approaches to patent law.[225]

Last, some scholars have recognized the defensive importance of patents: having one's own patents to assert back against a potential plaintiff or licensor can significantly reduce the costs of a potential suit or license.[226] But "defensive patenting" is merely a secondary effect of patents' primary role in promoting innovation—the only reason defensive patents have commercial value is because one party or another is actually making and selling an *infringing* product. Thus, they cannot serve as an aim of the patent system independent of innovation.

The foregoing theories have all been economic in nature. Another line of theorizing contends that patent rights are a "natural" reward for the labor expended by an inventor in coming to her invention.[227] The major hurdle for these natural rights approaches to patents, at least in the United States, is that the constitutional grant allowing Congress to issue patents is decidedly utilitarian in nature: "To *promote the Progress* of Science and useful Arts . . . ."[228] In any event, even if natural rights formed the basis of the U.S. patent

(2005); *see also* Kitch, *supra* note 10, at 277-78 ("[A] patent system lowers the cost for the owner of technological information of contracting with other firms possessing complementary information and resources."); Robert P. Merges, *Intellectual Property and the Costs of Commercial Exchange: A Review Essay*, 93 MICH. L. REV. 1570, 1590-91 (1995) (recognizing that patents can lower transaction costs); Smith, *supra* note 101, at 1799-1819 (positing a theory of intellectual property premised on "information costs").

224. *See* Heald, *supra* note 221, at 456-57.

225. *See* Heald, *supra* note 223, at 506-09 (discussing the ramifications of his theory in the context of Kitch's theory).

226. *See* Lemley, *supra* note 90, at 1504.

227. *See, e.g.*, Justin Hughes, *The Philosophy of Intellectual Property*, 77 GEO. L.J. 287 (1988); Tom G. Palmer, *Are Patents and Copyrights Morally Justified? The Philosophy of Property Rights and Ideal Objects*, 13 HARV. J.L. & PUB. POL'Y 817 (1990); *supra* note 17.

228. U.S. CONST. art. I, § 8, cl. 8 (emphasis added); *see also* Peter S. Menell, *Intellectual Property: General Theories*, *in* 2 ENCYCLOPEDIA OF LAW AND ECONOMICS 129, 130-48, 155-56 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000) ("The United States Constitution expressly conditions the grant of power to Congress to create patent and copyright laws upon a utilitarian foundation.").

system, arguably if inventors are deserving of rights, so are commercializers. As such, a natural rights approach to patents cannot justify granting patents merely for invention, but not for innovation more generally.

In sum, the alternative utilitarian and deontological explanations of patents do not justify disregarding commercialization. In fact, when these approaches are examined carefully, it is clear they are merely consistent with the patent system's fundamental role in spurring innovation.

III. THE DIFFICULTY OF COMMERCIALIZING "INVENTION" PATENTS

Part II presented theoretical arguments and empirical evidence showing that the patent system, in significant part, very likely causes low rates and elongated timelines of commercialization for many valuable patented inventions. A natural question arises: how might we change the current patent laws to better promote commercialization? So far, there have been two main lines of thought. First, prospect theorists, like Kitch and Kieff—who believe that *ex post* commercialization efforts need substantial patent protection—have argued that we should grant strong patents with broad claims and real property-like rights early in the innovation process.[229] Abramowicz has extended this line of thinking to recommend lengthening the patent term through carefully calibrated auctions designed to spur commercialization for patents issued too early.[230] Second, the reward theorists—at least the ones who perceive a commercialization problem in patent law—have suggested strengthening patent law's disclosure requirements, narrowing the scope of patent rights, allowing compulsory licensing of undeveloped patents, and adopting prize systems.[231]

The prospect and reward theorists' recommendations are mostly in direct opposition to one another. This gulf stems from the prospect theorists' emphasis on diminishing duplicated development costs and preventing free riding and the reward theorists' focus on minimizing deadweight losses and high transaction costs, especially those costs that hinder the development efforts of third-party improvers. For example, the early patenting problem cuts both ways—one can attempt to solve it either by causing patenting to occur later in the innovation process or by lengthening the patent term. Because toughening the patenting requirements would decrease deadweight losses but increase duplicated costs and free riding, the reward theorists prefer it; because strengthening patent rights would tend to have the opposite effect, the prospect theorists prefer it.[232]

This Part first explores and analyzes the recommendations of the prospect

229. *See supra* notes 199-211 and accompanying text.
230. *See infra* Part III.B.
231. *See infra* Part III.C.
232. *See infra* Part III.B-C.

theorists. Although reward theorists have criticized prospect theory for impeding follow-on *invention*, and a few scholars have persuasively argued that *early granted* rights can diminish commercialization, there has been little analysis of prospect theorists' claim that *broad* rights encourage commercialization.[233] Contrary to Kitch, Kieff, and others, this Part finds that strengthening patent rights for inventors can lead to significant under-commercialization in many technological fields and types of innovation, particularly when bargaining costs between inventors and commercializers are high. Moreover, the effects of high transaction costs are especially problematic when significant technological, marketing, or other experimentation is needed to produce a commercially viable embodiment of the patented invention. Finally, even if broad rights promote optimal commercialization, there may be distributive concerns—such as commercializing inventions to cure rare diseases—that counsel in favor of weaker inventor rights.

Nonetheless, merely weakening patent rights or raising the bar for patentability may lead to unintended negative consequences. Despite rejecting the prescriptions of the prospect theorists, this Part contends that modifying the reward theory by strengthening the enablement standard, shortening patent duration, allowing compulsory licensing, and adopting prize systems could significantly diminish incentives to engage in costly and risky *ex post* commercialization efforts. Although a middle ground might seem the best solution, this Part concludes by arguing that in view of the industry-specific and dynamic nature of innovation, it is practically impossible to adjust the timing, scope, and duration of traditional patent rights to spur optimal levels of commercialization. In other words, it is a quixotic goal to commercialize "invention" patents—namely, those patents issued in exchange for the disclosure of inventive knowledge.

A. *The Problems of Prospect Patents*

Not long after Kitch published his prospect theory came critiques from reward theorists and others.[234] Robert Merges and Richard Nelson criticized prospect theory for failing to take proper account of improvements to the original invention.[235] Specifically, if the original inventor cannot coordinate development of the original invention, for example, because of high transaction costs, then broad claims can dampen incentives for improvement inventions.[236]

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233. *See infra* Part III.A.

234. *See, e.g.*, Roger L. Beck, *The Prospect Theory of the Patent System and Unproductive Competition*, *in* 5 RESEARCH IN LAW AND ECONOMICS 193 (Richard O. Zerbe, Jr. ed., 1983); Donald G. McFetridge & Douglas A. Smith, *Patents, Prospects, and Economic Surplus: A Comment*, 23 J.L. & ECON. 197 (1980).

235. Merges & Nelson, *supra* note 47, at 871-74.

236. *See* Jerry R. Green & Suzanne Scotchmer, *On the Division of Profit in Sequential*

Using a series of case studies as examples, Merges and Nelson voiced their preference for "rivalrous competition" over prospect patents to spur the development of invention.[237] Duffy and Lemley have echoed these concerns.[238] Yet these critiques mainly focus on the *technological* development aspect of commercialization, and do not address prospect theory's effects on commercialization more generally.[239]

More recently, Michael Abramowicz and Chris Cotropia have cast significant doubt on prospect theory's prediction that early patenting encourages the development of commercially viable embodiments. As described in Part II, Abramowicz identifies the problem of uncertainty early in the innovation process as causing delay in commercialization. Cotropia builds upon Abramowicz's analysis to provide an even more dismal picture of the retarding effects of early filing on commercialization. First, Cotropia explains that early filing is not only allowed by the Patent Office, but essentially required, because failing to do so raises the risks of losing the patent to another inventor or having it invalidated by prior art.[240] Second, incentives to file early, coupled with the ability to file follow-on continuation applications on the same invention, result in a "file early, file often" mentality, clogging the patent system with applications.[241] By increasing the workload on the patent office, more "bad" patents issue.[242] Because these bad patents are costly to commercialize, it is usually cheaper to extract value from them by litigating and licensing, instead of commercializing.[243] This unfortunate fact has led to a proliferation of suits from NPEs, i.e., non-practicing entities, which inefficiently diminishes product commercialization. Indeed, one can continue Cotropia's negative feedback cycle by noting that as the value of litigation increases from bad patents, it leads to a "litigation explosion," clogging the courts, which results in more bad judgments and, hence, even more bad patents.[244]

Innovation, 26 RAND J. ECON. 20, 20-21, 26-27 (1995).

237. *See* Merges & Nelson, *supra* note 47, at 872.

238. Duffy, *supra* note 99, at 442-43; Lemley, *Economics of Improvement*, *supra* note 103, at 1044-46.

239. *See* Duffy, *supra* note 99, at 442-43; Lemley, *Economics of Improvement*, *supra* note 103, at 1046-47; Merges & Nelson, *supra* note 47, at 870-72.

240. Cotropia, *supra* note 6, at 72; *see also* Griffith v. Kanamaru, 816 F.2d 624, 627 (Fed. Cir. 1987) ("Delays in reduction to practice caused by an inventor's efforts to refine an invention to the most marketable and profitable form have not been accepted as sufficient excuses for inactivity.").

241. Cotropia, *supra* note 6, at 101.

242. *Id.* at 104-05.

243. *Id.* at 113-14.

244. 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.

While these critiques tend to be quite powerful indictments of *ex post* theories, it appears just a handful of scholars have examined—and, those, incompletely—whether Kitch's and, later, Kieff's proposal for *broad*, property-like patent protection (as opposed to their call for early filing) can also diminish commercialization.[245] This Part addresses Kitch's and Kieff's *ex post*

245. *See* Richard Gilbert & Carl Shapiro, *Optimal Patent Length and Breadth*, 21 RAND J. ECON. 106, 107-08 (1990) (implicitly assuming that patenting results in a commercially viable innovation such that the role patent breadth plays in commercialization becomes unimportant); Green & Scotchmer, *supra* note 236 (proposing a model of the role patent breadth plays in cumulative innovation and remarking that "innovation" includes "development," but not explaining how the model addresses commercialization); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113, 117-19 (1990) (analyzing the effect of patent scope on consumer deadweight losses but avoiding key commercialization concerns by assuming that non-infringing competitors can enter the market without incurring fixed costs); Josh Lerner, *The Importance of Patent Scope: An Empirical Analysis*, 25 RAND J. ECON. 319 (1994) (finding a positive correlation between patent "scope," defined as the number of international classes assigned to the patent, and the valuation of biotechnology startups, but failing to investigate the role that the breadth of relevant *third-party* patents might play in diminishing valuations); Roberto Mazzoleni & Richard R. Nelson, *The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate*, 27 RES. POL'Y 273, 280 (1998) (recognizing only briefly that broad patents can impede the creation of "a new or improved product or process of immediately final use"); Mariko Sakakibara & Lee Branstetter, *Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Law Reforms*, 32 RAND J. ECON. 77 (2001) (analyzing the effects of increased patent scope following reforms in Japanese law on innovation by investigating R & D spending and overall patenting, but not commercial output); Shane, *supra* note 193, at 213-15 (showing a significant positive correlation between patent scope, using the Lerner metric, and the formation of university spin-offs, but failing to investigate the role that the breadth of relevant *third-party* patents might play in dampening firm formation); Smith, *supra* note 101, at 1797, 1815 (positing that the "functional breadth of patent rights . . . reflects the high costs of delineating rights" in post-invention commercialization, but noting that "how strong the property rights for commercialization should be . . . is beyond the scope of th[e] Article"); Erika Farnstrand Damsgaard, *Patent Scope and Technology Choic*e 1, 6 (Research Inst. of Indus. Econ., IFN Working Paper No. 792, 2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1352690 (modeling the effects of broad patents on innovation and development costs, but considering "innovation" merely as "a one-shot game" focused on R & D, not commercialization).

Notably, Scotchmer's model of "cumulative innovation" implicitly assumes that the *invention* process always produces a commercial "good" that may be immediately distributed, thereby abstracting away from the critical step of post-invention development and commercialization. *See* SUZANNE SCOTCHMER, INNOVATION AND INCENTIVES 37-39, 243-44 (2004); *see also* Merges & Nelson, *supra* note 47, at 878-79 (making similar assumptions). Nonetheless, one can reconceptualize Scotchmer's model so that follow-on innovators are viewed solely as commercializers, instead of technological innovators. *See* Michael J. Meurer, Patent Notice and Cumulative Innovation (May 15, 2008) (unpublished manuscript), *available at* http://innovationforum.gmu.edu/2008/papers/patent_notice.pdf (adapting Scotchmer's approach so that the follow-on innovator is a commercializer that is subject to the original innovator's patent). However, Meurer uses this adapted model to analyze the incentives of commercializers to search for potentially relevant patents—not to determine the effects of patent scope on commercialization.

theories wholly on *ex post* terms, concluding that broad rights can severely hamper commercialization. Because the Patent Office tends to issue very broad claims in exchange for relatively narrow disclosures—and courts are wont to uphold these claims—in addition to early patenting, it appears broad patent rights are also to blame for low commercialization rates.

1. *Substantial inventor-commercializer transaction costs*

As the reward theorists have recognized,[246] prospect theory's prediction of reduced development and commercialization costs depends heavily on the low-cost coordination of inventors and commercializers.[247] Part II explained why these means of technology transfer are often of limited effectiveness for reward theory—this Part briefly describes how broad, prospect-style patent claims can reduce their functionality even further.

First, the narrower the patent claims, the more likely an efficient commercializer will be able to build a substitute embodiment of the invention that does not infringe the patent (a "design-around"). This lowers licensing transaction costs, because the commercializer will discount the value of the patent by the probability that its design-around will not infringe.[248] Second, because broad claims hold out a larger prize at the end of a patent race, firms will race harder and faster to invent than for narrow claims.[249] This will push filing even earlier in the innovation process, heightening the effects noted by Abramowicz and Cotropia, and skewing the award of a patent even more towards the best inventor, as opposed to the best commercializer. Third, a patent licensor can engage in inefficient strategic negotiation behavior, because bargaining occurs in the proverbial "shadow" of patent litigation, which is riddled with uncertainty and defects.[250] Like the *ex ante* licensing context, broad patent claims and strong, property-like rights will exacerbate the effects of strategic, *ex post* litigation by increasing the risk of infringement, making the damage award or injunction value to the patentee inefficiently high relative to the social value of commercialization.[251] The preferred defense of non-infringement will be a less likely option the broader the asserted patent claims.[252] Although broad claims are more prone to invalidity attacks than

246. *See supra* notes 153-158 and accompanying text.

247. *See* Peter S. Menell & Suzanne Scotchmer, *Intellectual Property*, *in* 2 HANDBOOK OF LAW AND ECONOMICS 1473, 1503 (A. Mitchell Polinsky & Steven Shavell eds., 2008) ("Kitch . . . was the earliest, and perhaps most extreme, licensing optimist.").

248. *See* John M. Golden, *"Patent Trolls" and Patent Remedies*, 85 TEX. L. REV. 2111, 2130-31 (2007).

249. *See* Gilbert & Shapiro, *supra* note 245, at 107-09.

250. *See* Cotropia, *supra* note 6, at 117; Michael J. Meurer, *Controlling Opportunistic and Anti-Competitive Intellectual Property Litigation*, 44 B.C. L. REV. 509, 516-17 (2003).

251. *See* Lemley & Shapiro, *supra* note 160, at 2010.

252. For example, in one case, even though the court characterized the disclosed

narrow ones, the presumption of validity usually makes invalidating a patent difficult and costly.[253] Fourth, broad claims will exacerbate the holdup problems caused by blocking patents. As described earlier, blocking patents result when a third party patents an improvement to an initially patented invention, preventing both the original patent holder and the improver from practicing the improvement.[254] The need for a third party to license the blocking patent can suboptimally diminish commercialization when the blocking patent contributes little or nothing to the third party's innovation.[255] Broad patents make this situation more likely, because they allow inventors to claim *more* than what they actually invented.[256] Indeed, a third-party inventor that develops an *entirely new* product or process may still find itself blocked by another patent with broad claims.[257]

Thus, broad claims will tend to cause defendants to license or settle—or pay in damages—amounts that are far more divorced from optimal levels than narrow claims. These distortions, especially when coupled with the Patent Office's apparent issuance of many questionable patents, may dampen overall commercialization.[258] In sum, although broad claims have the potential to

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embodiment of an asserted patent as "commercially useless," because its broad claims were enabled by that embodiment, a later-developed, commercially viable product was held to infringe. Phillips Petroleum Co. v. U.S. Steel Corp., 673 F. Supp. 1278, 1286, 1317, 1353-54 (D. Del. 1987), *aff'd*, 865 F.2d 1247 (Fed. Cir. 1989).

253. *See* Cotropia, *supra* note 6, at 106; Lichtman & Lemley, *supra* note 95, at 51-53. Moreover, broadening patent scope might very well increase overall costs by increasing the uncertainty surrounding validity. *Cf.* Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions*, 60 STAN. L. REV. 803, 828 (2007).

254. *See supra* notes 73-74 and accompanying text.

255. *See* Charles W. Adams, *Allocating Patent Rights Between Earlier and Later Inventions*, 54 ST. LOUIS U. L.J. (forthcoming 2010); Merges & Nelson, *supra* note 47, at 892-93; *cf.* Duffy, *supra* note 99, at 442-43 (noting that a broad prospect patent cannot foreclose third parties from patenting improvements to the patent, which "undermine[s] the ability of a prospect patent holder to . . . coordinat[e] and control[] further investment in the innovation."). *But cf.* Grady & Alexander, *supra* note 142, at 316-17 (arguing that prospect patents still reduce costs in the post-filing development of the invention).

256. *See* Kitch, *supra* note 10, at 265-67; *see also* Qin Shi, *Patent System Meets New Sciences: Is the Law Responsive to Changing Technologies and Industries?*, 61 N.Y.U. ANN. SURV. AM. L. 317, 334 (2005) ("Unrestrained increases in the number of patents covering small and incremental inventions, however, may over-encumber a field and exert mixed, or negative, effects on commercialization.").

257. *See* Adams, *supra* note 255 (documenting how the assignee of the Nobel Prize winning inventors of polypropylene was found to infringe a Phillips Petroleum patent with extremely broad claims upheld by the Federal Circuit).

258. *See* Shapiro, *supra* note 69, at 1018-19, 1028-34 (discussing how defects at the Patent Office and in patent litigation can impede competition and innovation); *see also* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 34 (7th ed. 2007) ("[T]he costs of effecting a transfer of rights—transaction costs—are often prohibitive, and when this is so, giving someone the exclusive right to a resource may reduce rather than increase efficiency."); Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, *in* 2 INNOVATION POLICY AND THE ECONOMY, *supra* note 161, at 68

reduce duplicated costs and protect against third-party free riding, they can engender very high transaction costs, which can reduce—and even eliminate—these benefits.

2. *Distributive values in commercializing intellectual property*

Even when the patent laws provide incentives for efficient commercialization, some consumers may nonetheless be denied deserving opportunities to benefit from inventions. As discussed in Part II, if a patent confers market power, it enables the patentee to charge supracompetitive prices for the commercialized invention, typically preventing consumers who value the good at more than its marginal cost from purchasing it. Even though it may be optimal for society to exchange these deadweight losses in return for the creation and commercialization of the invention, society sometimes widens the distribution and use of commercialized products otherwise protected by intellectual property rights. One important example is the U.S. government's more than $50 billion in annual subsidies to consumers to purchase patented pharmaceuticals.[259]

Yet, there is arguably another distributive value in intellectual property—one that relates more directly to commercialization. Traditional distributive concerns in intellectual property generally assume that a commercial embodiment of a patented invention *already exists*, e.g., a patented pharmaceutical, which absent monopoly pricing would be widely distributed.[260] In some circumstances, however, an invention may exist, yet remains uncommercialized, because there is no financial incentive for its owner to transform the invention into a commercial product. For instance, the R & D costs of *discovering* a patentable cure to a disease are usually significantly less than the costs of *commercializing* that cure into a drug that meets FDA standards and will turn a profit.[261] The upshot is that very few pharmaceuticals

(stating that the "benefits [of broad patents] disappear if licensing fails").

259. *See* Rick Mayes, *Medicare and America's Healthcare System in Transition: From the Death of Managed Care to the Medicare Modernization Act of 2003 and Beyond*, 38 J. HEALTH L. 391, 422 (2005) (noting that Medicare prescription drug subsidies for the elderly provided for in the Medicare Modernization Act of 2003 will cost "upwards of $724 billion over the next ten years"). Although 60% of prescription drugs sold are generics, more than 80% of expenditures relate to patented drugs. *See* Michael Enzo Furrow, *Pharmaceutical Patent Life-Cycle Management After* KSR v. Teleflex, 63 FOOD & DRUG L.J. 275, 288 (2008); Tony Pugh, *Generics Will Benefit as 75 Drugs Lose Their Patent Protections*, KNIGHT RIDDER NEWSPAPERS, Apr. 27, 2006, http://www.mcclatchydc.com/staff/tony_pugh/story/13896.html.

260. *See, e.g.*, Amy Kapczynski, *The Access to Knowledge Mobilization and the New Politics of Intellectual Property*, 117 YALE L.J. 804, 828-29 (2008) (describing the "access-to-medicines campaign," which acts to secure patented medicines for "millions of people in developing countries").

261. The Boston Consulting Group (BCG) estimates the cost to discover, develop, and

synthesized in the laboratory are commercialized.[262] Although there are strong reasons to believe that this under-commercialization may partly be the result of defects in the patent system,[263] even if the choice not to commercialize a given pharmaceutical were socially efficient, significant numbers of people with rare diseases might go untreated in the absence of redistribution.[264]

For these reasons, in 1983, Congress passed the Orphan Drug Act,[265] which provides seven-year "market exclusivity" rights similar to patent rights, subsidies for clinical trials, tax incentives, and an exemption from certain FDA registration fees for companies developing drugs for rare diseases,[266] even if those drugs are unpatentable—because, for example, the underlying patents have expired.[267] In this regard, orphan drug benefits do not merely induce the discovery of a drug in the first instance, but also encourage risky and costly post-invention testing.[268] For already-discovered drugs, the Orphan Drug Act is

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commercialize each patented drug is about $880 million. *See* PETER TOLLMAN ET AL., BOSTON CONSULTING GROUP, A REVOLUTION IN R & D: HOW GENOMICS AND GENETICS ARE TRANSFORMING THE BIOPHARMACEUTICAL INDUSTRY 12 (2001), *available at* http://www.bcg.com/publications/files/eng_genomicsgenetics_rep_11_01.pdf. Overall, BCG suggests that $165 million is spent in target identification, $205 million on target validation, $40 million on screening, $120 million on optimization, $90 million on preclinical development, and $260 million on clinical development. Target identification—and perhaps some validation—is all that is typically needed to secure a patent. *See id.*

262. *See* Barbara M. Bolten & Tracy DeGregorio, *Trends in Development Cycles*, 1 NATURE REV. DRUG DISCOVERY 335, 336 (2002) ("The attrition rate of compunds [sic] during the long and risky drug development process is enormous, with roughly 1 in 5,000 compounds that are screened in early-stage discovery making it through to approval . . . .").

263. *See* Roin, *supra* note 112 (arguing that the patent system retards the commercialization of valuable pharmaceuticals, because it does not adequately take into account the significant costs and risks involved in post-invention testing).

264. *See* Shubha Ghosh, *The Merits of Ownership; Or, How I Learned to Stop Worrying and Love Intellectual Property*, 15 HARV. J.L. & TECH. 453, 477-78 (2002) (describing the dilemma between overall costs and the number of saved lives for drugs targeted at obscure diseases); *cf.* Molly Shaffer Van Houweling, *Distributive Values in Copyright*, 83 TEX. L. REV. 1535, 1547 (2005).

265. Orphan Drug Act, Pub. L. No. 97-414, § 2(a) (codified at 21 U.S.C. §§ 360aa-360cc (2000)).

266. The Act covers "drugs for diseases affecting less than 200,000 patients or drugs for diseases affecting more than 200,000, when there is no reasonable expectation to recover research and development costs . . . ." Mark Shtilerman, *Pharmaceutical Inventions: A Proposal for Risk-Sensitive Rewards*, 46 IDEA 337, 342 (2006).

267. *See* Colleen Chien, *Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?*, 18 BERKELEY TECH. L.J. 853, 866 (2003). As of 2006, "over 200 orphan drugs have been introduced into the market and an additional 900 are in various stages of development," compared with ten orphan drugs in the decade preceding the Act. Shtilerman, *supra* note 266, at 343.

268. *See* Chien, *supra* note 267, at 866; Richard A. Merrill, *The Architecture of Government Regulation of Medical Products*, 82 VA. L. REV. 1753, 1791 n.119 (1996) ("[T]here is general agreement that the Orphan Drug Act produced the economic incentives needed to promote development of drugs for rare diseases . . . .").

an example of a pure *ex post* IP regime that directly incentivizes commercialization. Just as the Orphan Drug Act supplements the patent laws to stimulate commercialization of drugs for rare diseases, there are arguably a number of other areas for which this sort of stimulus is justified, including environmental technologies, mobility technologies for the disabled, medical devices to diagnose rare diseases, reading aids for the blind, and so forth.[269]

Contrary to prospect theory's mandate for broad claims, the Orphan Drug Act encourages commercialization by providing narrow protection over the specific drug marketed. Additionally, unlike prospect theory, exclusive IP-like rights issue only after market approval, which is very late in the innovation process. In one sense, it is because of prospect theory's failure to engender commercialization that the narrow, commercialization-focused protection of the Orphan Drug Act is necessary. Yet, from a different angle, one could view the Orphan Drug Act as validating prospect theory. In particular, if an orphan drug is patentable, then the Act allows a patentee that does not gain early market approval for a drug embodying its patent to extend the effective term of the patent.[270] In particular, patent protection provides for a twenty-year term from the filing date, adjusted to take into account regulatory and Patent Office delay, while Orphan Drug Act protection provides for seven years of market exclusivity from the date the FDA grants market approval for a drug for a rare disease.[271] Because Orphan Drug Act protection is available for currently patented drugs, if the patentee does not gain market approval during the first thirteen years of the patent term, it may extend the term with up to an additional seven years of orphan drug market exclusivity.[272] According to one commentator, the ability to extend the patent term of a costly drug for a rare disease is an "attractive option" to develop and commercialize the drug.[273] In this respect, the Orphan Drug Act's attempt to solve the early filing problem by extending the patent term is a refashioning of prospect theory to solve the under-commercialization problem.

B. *The Drawbacks to Revamping Prospect Theory*

Akin to aspects of the Orphan Drug Act, Abramowicz and Duffy have offered several ways to reconceptualize and reform prospect theory to retain its

269. *See, e.g.*, Heidi M. Berven & Peter David Blanck, *The Economics of the Americans with Disabilities Act Part II—Patents and Innovations in Assistive Technology*, 12 NOTRE DAME J.L. ETHICS & PUB. POL'Y 9, 24 (1998).

270. *See* David Loughnot, *Potential Interactions of the Orphan Drug Act and Pharmacogenomics: A Flood of Orphan Drugs and Abuses?*, 31 AM. J.L. & MED. 365, 369-70 (2005).

271. *See id.*

272. *See id.*

273. *Id.* at 370.

better features. First, in 2004, Duffy critiqued a central argument in favor of prospect theory, yet reaffirmed his enthusiasm for it by suggesting another. In particular, Duffy rejects Kitch's claim that early-granted, broad patents will reduce rent-seeking, because the race to secure the rights will merely be pushed earlier in time, continuing to dissipate the entire producer surplus available to the winner and eventual patentee.[274] Nonetheless, Duffy finds that because prospect patents shift patent filing to a very early stage in the innovation process, they *expire* earlier than otherwise.[275] Because, in Duffy's view, commercialization tends to occur a fixed number of years after conception, even if producer surplus is completely dissipated, earlier expiration reduces deadweight losses and, hence, increases social welfare.[276] Thus, Duffy argues strongly in favor of early patent grants.[277]

As Abramowicz has pointed out, Duffy makes two unrealistic assumptions regarding commercialization.[278] First, Duffy assumes that a commercializing patentee can perfectly price discriminate.[279] In practice, few patentees are able to charge differential prices so as to extract the entire available social surplus;[280] in this event, there will be diminished incentives for patentees to commercialize their inventions, resulting in delays not present in Duffy's model. As Abramowicz shows with a simple model, the social costs from these delays can outweigh the benefits to early patenting, though he finds the negative effects to be relatively slight.[281] Second, Duffy assumes that, in commercializing the invention, the patentee perfectly knows the net returns from doing so.[282] Unlike price discrimination, Abramowicz finds that relaxing this assumption—that is, adding the effects of uncertainty—can lead to potentially overwhelming costs and severely delayed commercialization.[283]

The result is that although Duffy focuses on Kitch's claim that prospect patents can reduce duplicated costs, he essentially ignores Kitch's additional contention that *ex post* patent protection is essential to spur risky development and commercialization of the patent prospect. Indeed, Duffy states that "the overarching goal of the patent system . . . is not to curb rivalry but merely to channel it into a relentless quest for earlier patenting and thus earlier dedication

274. *See* Duffy, *supra* note 99, at 442 (citing McFetridge & Smith, *supra* note 234, at 198-201).

275. *Id.* at 445-46, 464-75.

276. *See id.*

277. *Id.* at 499-500, 509-10.

278. *See* Abramowicz, *supra* note 5, at 1081-93.

279. Duffy, *supra* note 99, at 465-75.

280. *See* Abramowicz, *supra* note 5, at 1086; *see also* Lemley, *Free Riding*, *supra* note 103, at 1059 n.115 ("[P]erfect price discrimination seems essentially impossible . . . .").

281. *See* Abramowicz, *supra* note 5, at 1085-86.

282. Duffy, *supra* note 99, at 465-75.

283. *See* Abramowicz, *supra* note 5, at 1090-93.

to the public."[284] This view echoes the reward theory—specifically, the notion that the patent system should induce early invention and, ideally, lodge it in the public domain immediately thereafter.[285] For the reasons discussed in Part II, however, such a view overlooks the supernormal risks and costs involved in commercializing inventions.[286]

In criticizing Duffy's conclusion, Abramowicz proposes a fix for prospect theory's early filing approach: if patent protection is needed to spur commercialization and patent terms expire too early, then extend the patent term for those inventions that would not have been commercialized *but for* an extension.[287] Ordinarily, extending a patent term increases deadweight losses by allowing a patentee to continue to charge supracompetitive prices for its patented product. However, like extensions under the Orphan Drug Act, if the invention would not have been commercialized during the term, then extensions could increase social welfare, encouraging the manufacture and sale of products not otherwise available to consumers.[288]

Of course, the trick is sorting out the inventions deserving of patent term extensions. Abramowicz argues that "patent extension auctions" could accomplish this sorting function at a reasonable cost.[289] Specifically, at the behest of the government or on the request of the patentee, any interested party could bid on the right to gain post-expiration ownership of the patent, along with an extension of the original patent term.[290] Although Abramowicz recognizes the rent-seeking problems of such auctions, he argues that because patentees "will have a greater incentive to lobby [or call] for patent extension auctions when the costs of underdevelopment are high," there should be "a rough correlation between cases in which patentees will seek extension auctions and cases in which such extension auctions will be socially beneficial."[291] Nonetheless, he admits that a patentee may enjoy asymmetric advantages in bidding, such as those that may occur if the patent is "complementary to another patent in the patentee's portfolio" or allows the patentee to "extend its monopoly into another market."[292] To cure these sorts of defects, Abramowicz recommends that the patentee be required to bid not merely more than the highest third-party bidder, but some "markup" (i.e., multiplier) above the highest bid, in order to ensure that its acquisition is related to "continuous ownership," and not other unique benefits of holding the

284. Duffy, *supra* note 99, at 446.
285. *See supra* Part II.B.
286. *See id.*
287. *See* Abramowicz, *supra* note 5, at 1108.
288. *See id.*
289. *See id.* at 1109-20.
290. *See id.*
291. *Id.* at 1112.
292. *Id.*

patent.[293]

Yet, the benefits of continuous ownership might relate not only to general development of the underlying invention, but to know-how, trademarks, copyrights, and general goodwill *not transferable* to third parties. For instance, it is well known that even after patent protection expires, large pharmaceutical companies can charge significantly more for trademarked, brand-name drugs than generic manufacturers for identical formulations.[294] Contrary to Abramowicz's contention, a third-party winner would not be able to extract all of this unique value in a post-auction sale to the original patentee.[295] Instead, the third party would act as a conduit, splitting a portion of the added, unique benefit to the patentee in exchange for lowering the effective amount of the winning bid by allowing the patentee to forgo paying the markup. Knowing this, a patentee would engage in even greater marketing and other asymmetric value-enhancing efforts during the term than usual. Thus, asymmetries in value could simply lead to arbitrage among bidders, with little additional commercialization and significant increases in deadweight losses. One potential fix is to apply an across-the-board restriction on sales of the patent from third-party winners to the original patentee, but this could result in inefficiencies, because (1) if the markup is set too high, less efficient third-party commercializers would hold the patent post-expiration; or (2) if the markup is set too low, a patentee might purchase the patent for socially inefficient reasons. In sum, while patent extension auctions could potentially cure many under-commercialization problems, given the possible asymmetries between original patentees and third-party bidders that do not arise from the benefits of development during the term, implementation could be quite difficult and could lead to marked increases in deadweight losses.

More recently, Abramowicz and Duffy joined forces to address the problem of non-technological innovation involved in developing and commercializing an invention. Specifically, they focus on *unpatentable* "market experimentation," such as the market testing and marketing involved in launching a new type of product or service, adding new product features, and entering new geographic markets.[296] Abramowicz and Duffy model the suboptimal effects of failing to protect market experimentation via *ex post* intellectual property rights, concluding that, in many cases, it is likely that "the

293. *Id.* at 1112-14.

294. Typically, "generic pharmaceuticals cost between 25 percent and 60 percent less than brand-name pharmaceuticals . . . ." Generic Pharmaceutical Access and Choice for Consumers Act of 2003, S. 51, 108th Cong. § 2(a)(3)(B) (2003); *see also* Andrea Coscelli, *The Importance of Doctors' and Patients' Preferences in the Prescription Decision*, 48 J. INDUS. ECON. 349, 367-68 (2000).

295. Although Abramowicz's proposal outlaws sales to the original patentee during the original patent term, it allows them after the original term expires. *See* Abramowicz, *supra* note 5, at 1114.

296. *See* Abramowicz & Duffy, *supra* note 64, at 366-67.

dynamic benefit of intellectual property for market experimentation (more experimentation) will outweigh the static cost (higher prices and lower output) in expected value terms."[297] Of course, their finding is a specific form of Kitch's claim that *ex post* patent protections allow patentees to "make investments to maximize the value of the patent without fear that the fruits of the investment will produce *unpatentable information* appropriable by competitors."[298]

However, Abramowicz and Duffy make several policy recommendations to promote market experimentation that differ markedly from Kitch's and Kieff's prescriptions. First, they propose reviving the "paper patent" doctrine of the early twentieth century, which narrowed the scope of patent claims and raised the validity bar for patents that went uncommercialized.[299] Second, they recommend that when courts consider commercialization as a secondary factor of non-obviousness, only the patentee's efforts should be considered, so as not to dampen incentives for third parties to commercialize.[300] They also suggest that commercial success that results from marketing expertise, rather than mere technological skill, should count towards the secondary factor.[301]

As Abramowicz and Duffy briefly recognize, a commercialization approach to patent law is "hard to reconcile with the dominant view [i.e., the reward theory] that the patent system encourages the production and disclosure of technical information."[302] Although a paper patent doctrine would help to prevent the strategic behavior of NPEs, it is unlikely to deter fully their commercialization-diminishing efforts. Moreover, lowering the threshold for obviousness to promote commercialization might increase the patent thicket problem, deterring innovation by third parties. Although these drawbacks appear relatively minor, as I argue in the next two Parts, engrafting a "commercialization" approach onto traditional patent law—which is designed to spur invention, but not innovation—is a roundabout, and generally ineffective, way to solve the underdevelopment problem.

C. *The Hurdles to Modifying Reward Theory*

In a similar vein to Abramowicz and Duffy, several reward theorists have identified the problems created by early filing, and have recommended modifying traditional patent law to encourage commercialization. Most

297. *Id.* at 363.

298. Kitch, *supra* note 10, at 276 (emphasis added).

299. Abramowicz & Duffy, *supra* note 64, at 401-02.

300. *See id.* at 402-03.

301. *See id.* at 404. They further consider direct protection for market experimentation by expanding the effective scope of patentable subject matter, which I discuss below in Part IV.B.1.

302. *Id.* at 401-02.

notably, Cotropia has proposed requiring actual reduction to practice prior to filing a patent.[303] *Actual* reduction to practice occurs only when an apparatus embodying the invention is built and works for its intended purpose,[304] as opposed to *constructive* reduction to practice, which is satisfied by the filing of a patent application meeting a generally low disclosure threshold.[305] In essence, Cotropia's proposal is a modified version of the reward theory, with "invention" defined not only as conception, but also as the building of a prototype.[306] Such a requirement would effectively return patent law to the pre-1880 practice of submitting a working model to obtain a patent (although Cotropia suggests that actual reduction to practice could be certified by the patentee in writing).[307]

Cotropia's recommendation would improve upon several features of the current system. First, it would force the inventor to acquire knowledge that would very likely prove useful in building a commercially viable product, thereby reducing the uncertainty involved in commercialization.[308] Second, because the invention would be farther along the innovation path at filing, less work would be needed to reach commercialization, making it more likely that the patentee would "exercise the commercialization option."[309] Third, the requirement would lead to better patent disclosure, providing more information to others and reducing uncertainty in claim interpretation.[310] Fourth, fewer applications would be filed, easing the burden on the Patent Office, and presumably improving the quality of issued patents.[311]

On the other hand, Cotropia's proposal could lead to a variety of additional costs. First, as Cotropia notes, "[t]he farther down the development chain patent protection attaches, the more uncertain a potential inventor is that she can eventually gain exclusive protection to recoup research and development costs."[312] If building a prototype is costly—take, for example, fabricating a new type of computer chip—the risks of not securing a patent may be too large to justify doing so.[313] Second, later filing means more potential inventors will

303. Cotropia, *supra* note 6, at 119-28.

304. *See, e.g.*, Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1576 (Fed. Cir. 1996); *In re* Asahi/America, Inc., 68 F.3d 442, 445 (Fed. Cir. 1995); *see also* CHISUM, *supra* note 85, § 10.06.

305. *See supra* Part II.A.

306. *See, e.g.*, *Mahurkar*, 79 F.3d at 1578-79; Scott v. Finney, 34 F.3d 1058 (Fed. Cir. 1994) (finding evidence of a prototype sufficient to satisfy actual reduction to practice).

307. *See* Cotropia, *supra* note 6, at 120-22; *supra* notes 81-85 and accompanying text.

308. Cotropia, *supra* note 6, at 122-25.

309. *Id.* at 87, 124-25.

310. *See id.* at 123.

311. *See id.* at 124.

312. *Id.* at 84; *see also* Abramowicz, *supra* note 5, at 1107.

313. Although Cotropia notes the doctrine's "flexibility," including the possibility of using a computer to simulate testing, Cotropia, *supra* note 6, at 124, an inventor still must

continue their R & D efforts, possibly increasing duplicated development and commercialization costs.[314] Third, the later patenting occurs, the later expiration occurs, potentially increasing deadweight losses.[315] Fourth, the requirement may unduly burden independent inventors and small companies, which tend to have much smaller R & D budgets than large companies.[316] If, as some commentators have contended, smaller companies innovate more per R & D dollar than large ones,[317] actual reduction to practice could reduce overall innovation. Ultimately, setting the filing time "just right" so as to induce optimal commercialization appears to be a difficult balancing act. Although requiring actual reduction to practice would probably have an overall positive effect on commercialization—like patent extensions—it is far from an ideal solution to the underdevelopment problem.[318]

Another widely suggested reward-style approach to encouraging commercialization is mandating a "working requirement"—namely, a condition that the patentee commercialize its invention or forfeit its rights.[319] For instance, in many countries, a patentee that does not commercialize an invention is subject to compulsory licensing, which allows third parties to make and use the invention for a low fee.[320] Although a "working requirement" would significantly lessen the power of the patent trolls, if the *ex post* theorists

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build an actual prototype, *see* UMC Elecs. Co. v. United States, 816 F.2d 647, 652 (Fed. Cir. 1987) ("[T]here cannot be . . . [an actual] reduction to practice of the invention . . . without a *physical embodiment* which includes all limitations of the claim." (emphasis added)).

314. *See* Abramowicz, *supra* note 5, at 1107 ("While requiring more achievement up front reduces the risk of patent underdevelopment, it also increases inefficient duplication and is, in the end, a crude policy response.").

315. *See* Cotropia, *supra* note 6, at 106-07.

316. *See* Frischmann & Lemley, *supra* note 149, at 276.

317. *See, e.g.*, Jon Gertner, *Capitalism to the Rescue*, N.Y. TIMES, Oct. 5, 2008, § MM (Magazine), at 56 (quoting Harvard Business School Professor, Josh Lerner, as stating "[w]hen you try to quantify it, a dollar of venture capital is somewhat equal to three or four dollars of corporate R & D"), *available at* http://www.nytimes.com/2008/10/05/magazine/05Green-t.html.

318. For similar reasons, ratcheting up the enablement and utility requirements—although probably beneficial on the whole—is likely to fall well short of optimal commercialization. *Cf.* Michael Risch, Useless Inventions 37-40 (2009) (unpublished manuscript, on file with author) (assessing the "complex" effects of a rigorous utility requirement on commercialization incentives).

319. *See* PATENTS THROUGHOUT THE WORLD §§ 1:19-20 (4th ed. 2009); *cf.* Merges & Nelson, *supra* note 47, at 875 (noting that working requirements in the mining context "prevent[ed] hoarding and speculation").

Yet another approach to modifying reward theory is for the government to provide funds to private firms to promote commercialization. However, one empirical study found that government funding can *decrease* the likelihood of commercialization, particularly when firms are not required to pay back the funds in the event of failure and the government is not adept at picking commercially viable projects. *See* Roger Svensson, *supra* note 121, at 1067-68; *cf. supra* note 101 (explaining the drawbacks of public prize systems).

320. *See* PATENTS THROUGHOUT THE WORLD, *supra* note 319, §§ 1:19-20.

are correct that patents play a crucial role in promoting post-invention commercialization,[321] then merely allowing any third party to compulsorily license the invention is not a full solution.[322] Specifically, a non-exclusive compulsory license would allow second-movers to free ride on any non-protectable commercialization efforts of the first licensee, creating an *ex ante* disincentive for any entity to take a license and develop the invention.[323] Indeed, the available data indicate that compulsory licensing of uncommercialized patents is rare.[324]

D. *The Infinite Regress in Commercializing "Invention" Patents*

The (by now) tortuous analysis of various attempts to encourage commercialization within the existing legal framework underscores that any attempt to do so can often yield the opposite effect. Although prospect patents' early-filing dates and broad claims can reduce rent-seeking and duplicated costs as well as protect against free riding, they can also diminish commercialization by setting expiration too early, by imposing high transaction cost barriers, and by miring multiple inventors in a web of blocking patents. Abramowicz's and Duffy's attempts to reconfigure prospect theory are admirable, and many of their proposals would very likely improve commercialization incentives. The same holds true for Cotropia's and others' proposed reforms to the reward theory. Yet, in the best-case scenario, these recommendations are not a complete solution, and in the worst-case scenario, could easily dampen commercialization—especially, if they are not implemented with a fine level of precision, which would be difficult to achieve given the differing and constantly shifting economics of innovation within

321. *See, e.g.*, Abramowicz, *supra* note 5, at 1107 ("Once the patent is in the public domain, no one will have an incentive to develop it, and presumably no one who could benefit from a compulsory license will want to develop a product that the initial patentee, who unlike the licensee did not have to pay a license fee, did not think would be profitable." (citation omitted)); Nerkar & Shane, *supra* note 115, at 1161 ("If the sourced invention . . . is part of the public domain, incentives to commercialize can be undermined.").

322. On similar reasoning, other proposed modifications of the reward theory, such as shortening the patent term and narrowing claim scope, could potentially dampen commercialization. *Cf. In re* Hogan, 559 F.2d 595, 606 (C.C.P.A. 1977) ("To restrict appellants to the crystalline form disclosed . . . would be a poor way to stimulate invention . . . .").

323. *See* Abramowicz, *supra* note 5, at 1107. *See generally* ERIC VON HIPPEL, DEMOCRATIZING INNOVATION 89-91 (2005) (describing collective action problems in the context of innovation).

324. *See* Jack Kaufmann, *Afterword*, 66 ANTITRUST L.J. 527, 529 (1998) (concluding that "there are very few cases anywhere in the world of compulsory licensing resulting from non-use of a patent"). *Cf.* Roin, *supra* note 112, at 545 ("Pharmaceutical companies examine the patentability of their potential drug candidates at the beginning of each research project, and they regularly drop ones that appear to be in the public domain.").

various industries.[325] As Cotropia astutely recognizes, setting the proper balance is an unavoidable zero-sum game.[326] The upshot is that it is a Sisyphean task to "commercialize *invention* patents," that is, to engraft commercialization incentives on patents whose aim is to spur invention, not innovation. As such, a more fruitful approach might be to supplement these reforms *with a new and separate form of intellectual property right* that provides direct incentives for commercialization.[327]

IV. TOWARDS A PURE "COMMERCIALIZATION" PATENT

Patent scholars have generally been opposed to proposals for new forms of IP rights for a variety of reasons: they are costly and difficult to implement; needlessly create complexity; encourage legislative rent-seeking; and provide an additional layer of rights when most in the field believe that a contraction of rights is in order. In this Part, I attempt to overcome these concerns in recommending a new form of patent specifically designed to promote commercialization. Such a "commercialization" patent would be granted in exchange for a commitment to make and sell a "substantially novel" product—that is, a product notably different from those products currently on the market. Commercialization patents thus stand in opposition to traditional "invention" patents, which are granted in exchange for disclosing novel and non-obvious knowledge. This Part argues that commercialization patents would substantially increase the commercialization of inventions without imposing undue deadweight losses, dynamic inefficiencies in the system, increased administrative costs, or excessive rent-seeking. This Part first examines some previous proposals for "innovation patents" and "commercialization patents," concluding that each lacks a few (or more) critical elements. Next, it builds upon these ideas to describe a commercialization patent that could feasibly be introduced into the current system.

A. *The Shortfalls of Previous Proposals to "Commercialize" Patent Law*

In general, patent rights focused on commercialization are not a novel concept. In fact, as several scholars have recognized, the original English

325. *See generally* DAVID B. AUDRETSCH, INNOVATION AND INDUSTRY EVOLUTION 167-68 (1995).

326. *See* Cotropia, *supra* note 6, at 128-29; *cf.* Scotchmer, *supra* note 77, at 34-35 (explaining the "double marginalization" that occurs between a first and second innovator, because it is "impossible to give the surplus to both parties" in a manner that yields socially optimal incentives to innovate).

327. *Cf.* J. TINBERGEN, ON THE THEORY OF ECONOMIC POLICY 39 (1952) (positing that the optimal number of policy instruments must at least equal the number of policy objectives).

"patent" privilege granted by the sovereign to provide a monopoly over a particular industry or market can be viewed not as largesse, but as protection to engage in domestic commercialization efforts otherwise subject to free riding.[328] More recently, a number of scholars have suggested or examined novel forms of patent rights intended to directly promote commercialization. This Part assesses these proposals, concluding that none of them offers a satisfactory solution.

1. *The difficulties of expanding the scope of patentable subject matter*

One approach to providing direct incentives to commercialize products is to expand patentable subject matter to include innovative inputs into the commercialization process, such as product testing, market testing, and marketing. Expanding patentable subject matter in this fashion would probably entail substantial costs. First, the Patent Office would, in addition to deciding technological novelty and non-obviousness, have to determine "commercial" novelty and non-obviousness. As Abramowicz and Duffy remark on their own suggestion for "commercialization patents" on "market" innovations, significant costs would arise unless the Patent Office were "good enough at identifying instances of commercial non-obviousness."[329] Such a determination would include "judgments about market viability" and other aspects of commercialization with which the Patent Office has no current expertise. Second, this approach would not ensure that new products were manufactured and sold, unless a separate working requirement were tacked onto these new classes of patentable subject matter. Although Abramowicz and Duffy's concern that patentees could engage in "sham" sales to meet a working requirement is probably overstated, it is unclear how this requirement would play out in practice, because many commercialization-related innovations are methods or simply disembodied knowledge, which often relate to products already available on the market. Third, adding new forms of patent protection that provide rights to exclude others—but neither reduce patent thickets nor weaken the ability of traditional patentees to engage in strategic litigation and licensing behavior—could significantly increase deadweight losses. In sum, while the intention seems admirable, merely expanding patentable subject matter to create a new form of "commercialization" patent subject to all of the traditional patent rules—but modified for commercial, instead of technological, review—appears problematic.

328. Abramowicz & Duffy, *supra* note 64, at 378; William Kingston, *The "Thesis" Chapters*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 2.

329. Abramowicz & Duffy, *supra* note 64, at 407-08.

2. *The limited effectiveness of petty patents*

Another oft-touted way to encourage commercialization is through "petty patents," which are a form of "second-tier" patent in use in more than sixty countries.[330] In general, the modern form of petty patents is similar to regular patents, except that they usually implement a relaxed obviousness standard, or none at all; are shorter in term, usually five to eight years; and use a "registration" system, whereby all patent applications are immediately granted, with examination initiated upon request.[331] Although eliminating or relaxing the obviousness standard is important to encouraging the manufacture and sale of substantially novel products, and a five to eight year term is more in line with the length of protection needed to protect against post-invention free riding, petty patents do not directly encourage commercialization. Rather, just like ordinary patents, they are granted in exchange for the disclosure of information, and entail no commitment to make and sell a commercial product. Additionally, because of their low obviousness standard, and given the serious defects in patent litigation and licensing in the United States, there could very well be a huge race to acquire these sorts of patents—especially on only slightly novel features—which could diminish the commercialization efforts of third parties.[332] In sum, although certain features of petty patents seem worthwhile, it is yet another incomplete solution laced with potential drawbacks.

3. *The complexities of a move to "innovation" warrants and patents*

The last set of recommendations, which shift the focus from the disclosure of information as the quid pro quo for a patent to a commitment to make and sell a novel commercial product, solve many of the problems of the foregoing proposals, but introduce a host of others. Independent of one another, in the mid-1980s, two European scholars—William Kingston and Hermann Kronz—proposed sweeping reforms of the patent system with their "innovation" warrant and patent, respectively.[333] Kronz's innovation patent would protect

330. Mark D. Janis, *Second Tier Patent Protection*, 40 HARV. INT'L L.J. 151, 151-53 (1999); *cf.* Ann Bartow, *Separating Marketing Innovation from Actual Invention: A Proposal for a New, Improved, Lighter, and Better-Tasting Form of Patent Protection*, 4 J. SMALL & EMERGING BUS. L. 1, 5 (2000) (proposing a second-tier "origination" patent to directly protect the "commercial exploitation" of inventions in the United States).

331. *See* Janis, *supra* note 330, at 151-52.

332. *See id.* at 203-05 (arguing that "given the nature of the second tier grant, it seems probable that, in any given area of technical endeavor, there may well be a plethora of stakeholders with whom to deal" to commercialize a technology).

333. *See* Kingston, *supra* note 59, at 416-18; William Kingston, *Innovation Patents and Warrants*, *in* PATENTS IN PERSPECTIVE 68, 70 (Jeremy Phillips ed., 1985); Kingston, *supra* note 328, at 1-87.

"[a]nything new . . . in the form in which it actually enters into commercial activity," i.e., commercial products.[334] In Kingston's scheme, the scope of protection is broader, such that "anything new can be protected, as long as it can be the subject of investment, which means anything that can be bought and sold."[335]

By conceiving of patents with entirely new subject matter—particularly, commercialized products—Kingston and Kronz made a huge stride towards what Kingston termed the "direct protection of innovation."[336] Yet, instead of weaving innovation patents and warrants from strands of existing law, Kingston and Kronz proposed many other reforms, the majority of which have been criticized by scholars as making their systems too complex and costly to implement.[337] Additionally, some have argued that certain elements of their proposals would unduly diminish incentives to invent and needlessly increase deadweight losses.[338] This Part briefly addresses the most important of these concerns.

First, Kronz's innovation patents would potentially replace traditional "invention" patents.[339] While promoting commercialization is clearly an important goal of the patent system, it is not the only goal—even Kitch recognized as much.[340] Although Kingston's innovation warrants would supplement the existing system, he does not clearly explain what the interaction would be between traditional patents and the innovation warrants.[341] Absent a

334. Kingston, *supra* note 333, at 68, 70.

335. Kingston, *supra* note 328, at 61.

336. *Id.* at 88.

337. André Bouju, *Chapter XI*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 247-56 (critiquing Kingston's and Kronz's extraneous reforms); Henk Wouter de Jong, *Chapter IX*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 215-26 (same); Thomas Mandeville & Stuart Macdonald, *Innovation Protection Viewed from an Information Perspective*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 157-70 (same); Piatier, *supra* note 184 (same); Z.A. Silberston, *Chapter VIII*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 201-13 (same); Gordon Tullock, *Intellectual Property*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 171-99 (same); Brian D. Wright, *On the Design of a System to Improve the Production of Innovations*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 227-46 (same).

338. *See* Mandeville, *supra* note 337, at 163; Silberston, *supra* note 337, at 212; Wright, *supra* note 337, at 244.

339. *See* Kingston, *supra* note 328, at 57 ("Kronz sees his system as capable of supplementing or replacing the classical patent system.").

340. *See* Kitch, *supra* note 10, at 276.

341. *See* Silberston, *supra* note 337, at 208-09 (describing potential conflicts of jurisdiction between patents and innovation warrants). In a rejoinder to the aforementioned critiques, Kingston suggests modifying his original proposal so as to void the rights of a noncommercializing patent holder vis-à-vis an applicable innovation warrant holder. *See* W. Kingston, *Chapter XIII*, *in* DIRECT PROTECTION OF INNOVATION, *supra* note 150, at 297. Although such an approach would clearly define the interaction between the two systems, it would very likely unduly diminish *ex ante* incentives to invent. *See infra* Part IV.B.4.

detailed account of how these two systems would interact with one another, an additional layer of patent protection could lead to unnecessary transaction costs and, hence, diminished commercialization—not to mention, unnecessary deadweight losses. Second, although Kronz's proposal is limited to commercialized products, Kingston's subject matter—"anything that can be bought and sold"—is vague and subject to complicated line-drawing.[342] Third, Kingston's proposal relies on "*commercial* equivalence" in determining infringement,[343] which could be very costly and difficult to implement.[344] Similarly, Kingston's recommendation for a new and independent "innovation" patent office to administer the warrants could significantly raise costs and increase complexity.[345] Fourth, Kingston and Kronz advocate a patent term that is adjusted on an application-by-application basis, which is hopelessly idealistic.[346]

Despite the practical limitations of implementing innovation patents and warrants, both scholars have clearly made a major contribution to the field by exploring the potential boundaries of IP rights designed to directly encourage commercialization.[347] In the following Part, I build upon their insights, as well as those of Abramowicz, Duffy, and others, to propose a new kind of commercialization patent, which I contend substantially overcomes the problems of their proposals.

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342. Kingston, *supra* note 328, at 61. For example, it is unclear whether Kingston's definition would include professional services, financial instruments, and other non-tangible items that can be "bought and sold." *Id.*

343. *Id.* at 73-74 (emphasis added).

344. *Cf.* Abramowicz & Duffy, *supra* note 64, at 407-08 (noting the difficulties of the Patent Office applying commercial, instead of technical, standards).

345. *See* Silberston, *supra* note 337, at 209 ("[O]nly confusion can be caused by two parallel systems.").

346. *See* Wright, *supra* note 337, at 240-42 (expressing doubt that "modern accounting methods and panels of experts . . . can accurately and efficiently judge the prospects of innovations").

347. Like Kingston and Kronz, Oren Bar-Gill and Gideon Parchomovsky have suggested "decoupling" the patent system. Oren Bar-Gill & Gideon Parchomovsky, *A Marketplace for Ideas?*, 84 TEX. L. REV. 395, 397, 401-02, 407 (2005). However, they effectively reverse the direction of Kingston's and Kronz's proposals to suggest a separate form of intellectual property right for abstract "ideas" that would exist alongside traditional patents for later-stage invention and development. *See id.* Nonetheless, because of the structural similarity of all of these proposals, several of the attractive features of Bar-Gill and Parchomovsky's approach appear in the proposal offered herein. *See infra* notes 365, 374, 379. For another structurally similar proposal, see Allen K. Yu, *Why It Might Be Time to Eliminate Genomic Patents, Together with the* Natural Extracts Doctrine *Supporting Such Patents*, 47 IDEA 659, 750-51 (2007) (proposing, briefly, a "commercialization permit," which would "compensate entities for taking on commercialization risks such as being a marketing pioneer").

B. *Proposing a New Form of Commercialization Patent*

This Part describes the main features of a commercialization patent that not only provides direct incentives for commercialization at a low administrative cost, but also—by weakening traditional, "invention" patents—reduces transaction costs in inventor-commercializer bargaining. Although this Part examines the general benefits and drawbacks of the proposal, the following description is not meant to address all of the nuances of how a commercialization patent system might be implemented; rather, it shows that such a system could provide a new policy lever to substantially increase the number of commercialized inventions in a way that is generally efficient and serves important distributive concerns.

1. *The scope of patentable subject matter*

Ideally, if commercialization patents are to protect any risky and costly aspect of the innovation process in need of protection, patentable subject matter would be expanded to cover new forms of market experimentation, product testing, marketing, sales methods, and even the innovative identification of problems in need of solutions. As explained in the previous Part, however, such a radical expansion of patentable subject matter would be very difficult to administer and could lead to excessive patenting and unwarranted deadweight losses. Even adding a few new categories to the existing types of patentable subject matter would very likely entail difficult line-drawing exercises. Thus, patentable subject matter should be no more than traditional patentable subject matter, excluding processes.[348] Thus, a commercialization patent should protect any "machine, manufacture, or composition of matter, or any new and useful improvement thereof."[349] Although this scope of subject matter would fall short of spurring optimal commercialization, it would be no additional work for the Patent Office and courts to apply. Moreover, limiting the scope of subject matter protects against unintended effects that could lead to large deadweight losses and the unnecessary taxing of third-party commercialization.

348. Although processes are used commercially, they are not manufactured and sold, and determining whether a given patentee has actually commercialized a process could prove challenging. Moreover, commercialization patent prior art analyses—which would only examine those processes in commercial use, *see infra* Part IV.A.3—would be difficult, because processes are not usually performed in public. Thus, it seems inadvisable to allow commercialization patents on processes, especially when many process-oriented inventions can be claimed as products. *See* Kingston, *supra* note 328, at 40-41 (describing how a process can be protected "through its components").

349. 35 U.S.C. § 101 (2000).

2. *Disclosure, claiming, and infringement*

Like patentable subject matter, the disclosure and claiming requirements should mostly track the existing requirements for invention patents, with a few important glosses. First, because the subject matter is a commercial product, the patentee should disclose sufficient "written description . . . to enable any person skilled in the art . . . to make" the commercialized product.[350] Again, because this doctrine is essentially the same as that for invention product patents, it would not be difficult to implement. Moreover, it would provide an incentive to disclose how to build commercially viable products, which is notably absent from today's regime.

Second, claims should be drafted according to the same principles as any product claim in an invention patent, again to minimize the costs of implementing the new system. Although this might limit the types of commercial innovations that could be covered, the effects would likely be minimal. Unlike invention patents, however, the claims *should be limited exactly to the product described in the specification*. The justification for commercialization patents is to encourage the development of specific products not currently in the marketplace, not to promote the conception of embryonic inventions. Of course, the counter-argument to this position is that the risky and costly work involved in commercializing one product could be appropriated by third parties for similar, substitute products. On this view, claims should cover any product that is arguably enabled by the disclosure under the traditional doctrine. Like Part III's finding that broad invention patent claims can substantially diminish commercialization, so too would broad commercialization patent claims, because—like invention—commercialization is a cumulative, on-going process.

Thus, a balance must be achieved between preventing free riding and encouraging third parties to develop commercial improvements. One way to do so is to incorporate the doctrine of equivalents from traditional patent law into the infringement analysis of commercialization patent claims in order to effectively enlarge their scope. While commercialization patent claims would literally cover only the embodiments disclosed in the specification,[351] either the same or any "substantially equivalent" product made and sold in the market would infringe. Ideally, substantial equivalence would be determined by the degree to which the potentially infringing product *economically* substituted for the claimed product. On the other hand, it would be easier and less costly to adopt the *technological* approach commonly used for traditional patents—namely, the "function-way-result" test, which generally asks whether the

350. 35 U.S.C. § 112 (2000).

351. In this regard, there would be little ability to multiply those embodiments, because only embodiments actually made and sold in substantial numbers could be claimed. *See infra* Part IV.B.3.

accused product "performs substantially the same function in substantially the same way to obtain substantially the same result" for each element of the asserted claim.[352] Although it is far from a perfect test, because the doctrine of equivalents is well-known in current law, and given the balancing of initial and follow-on commercialization, it seems desirable to adopt it wholly, perhaps with the caveat that it should be applied more vigorously than some courts are currently wont to do.[353]

3. *(Substantial) novelty and (the lack of) non-obviousness*

In addition to the enablement and written description requirements mentioned earlier—and perhaps a utility and best mode requirement[354]—there would be a working requirement and review for "substantial novelty." The working requirement is straightforward: commercialize the invention or lose the patent. The commercialization patentee would be given a reasonable time period, perhaps three years from filing (adjusted for regulatory delay), to make and sell the patented product in significant numbers.[355] Additionally, commercialization by a licensee or a proven infringer would suffice.[356] The Patent Office would maintain an online, commercialization database that traditional and commercialization patentees would be required to update with the names of any products they are aware of that embody (or potentially embody) the claims of a patent.[357]

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352. Schoell v. Regal Marine Indus., Inc., 247 F.3d 1202, 1209-10 (Fed. Cir. 2001). Presumably, if the accused product simply achieves the same result as each claimed element, the two products would be commercial substitutes. Thus, one possibility is expanding the doctrine of equivalents to a pure "result" test. Again, however, such an expansive approach could stifle follow-on commercialization.

353. *See* Univ. of Houston Law Ctr., PatStats.org, http://www.patstats.org/2007%20full%20year.htm (last visited Aug. 29, 2009) (noting that plaintiffs won doctrine of equivalents arguments in only 14 out of 145 cases in 2007).

354. Utility and best mode would arguably be unimportant, because it is hard to imagine a commercially viable product properly described that would not meet these requirements.

355. In the event the commercialization patent holder did not commercialize within the three-year period, it should arguably not only lose its patent but also incur a fine for holding up the commercialization process. (I thank Alex Reinert for this suggestion.) Additionally, although determining what is "significant" commercialization might be difficult, over time, as with working requirements in other countries, courts would develop a test to ferret out sham sales.

356. If infringement did not count as commercialization, then would-be licensees would simply ignore the commercialization patent holder, potentially reducing the *ex ante* value of the commercialization patent so much as to eliminate the holder's incentive to commercialize.

357. *See* Blair & Cotter, *supra* note 165, at 844-45 (proposing a "registry for commercialized patented inventions"). Patentees would need to list infringing products only if they desired to rely upon them to show commercialization. In general, a

The novelty issues are more difficult and raise two important questions. First, should novelty be judged according to "commercial" or "technical" standards? Second, what role, if any, should non-obviousness play? First adopting a "commercial" novelty standard would be difficult to implement, because it would require the Patent Office to judge market, not technological, criteria. Like patentable subject matter, although an ideal commercialization patent would turn on commercial considerations—such as whether a product was "commercially," as opposed to "technologically," novel—implementing such a system would be complex and costly. Although some commercially novel products might be excluded by using technological standards, it seems most would not, because new products would very likely contain some novel technological feature. For this reason, commercialization patents should use the same technological novelty standard as for traditional patents, with two important modifications.

The first important modification is that prior art would only include products currently sold in the United States, because the aim of commercialization patents is to make new products available to consumers, not to further technological progress. Even products that were once, but are no longer, available on the market would be excluded from the set of prior art.[358] Like the working requirement, courts would need to develop a suitable test to determine if a product is sufficiently "on sale" to count as prior art, but courts have done so for the current on-sale bar test,[359] and modifying that approach for commercialization patents should not be terribly problematic.

The second modification relates to whether obviousness should play a role in determining validity. Unlike an invention patent, which is designed to spur the creation of new knowledge that anyone of ordinary skill in the art would not have thought of anyway (i.e., that was not obvious), a commercialization patent aims to bring products to market that would not have been commercialized absent patent protection. Thus, novelty should turn on whether the same, or a substantially similar, product is currently available in the marketplace, not whether an existing product renders the new product obvious.[360] In other words, a "substantial novelty" test should be applied to

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commercialization database would be a significant improvement over the putative "notice" function served by the current requirement that a patentee mark its products or product packaging with patent numbers. *See* 35 U.S.C. § 287(a) (2000); Blair & Cotter, *supra* note 165, at 844-45.

358. Abramowicz & Duffy, *supra* note 64, at 398 ("[A] logical extension of the [market experimentation] theory would permit patents to issue on products that were technologically non-novel, provided that they did not already exist in the marketplace.").

359. *See* Pfaff v. Wells Elecs., Inc., 525 U.S. 55 (1998).

360. *Cf.* Roin, *supra* note 112, at 531 (contending that the "test for nonobviousness" dampens the incentives to commercialize pharmaceutical inventions, because it "does not consider the costs and risks of developing that invention into a marketable product").

commercialization patent claims.[361] Under this test, a claim would be invalid if there is currently available in the marketplace any product or its equivalents, under the same doctrine of equivalents test as used for infringement. If this test proved too lax, courts could enlarge the equivalence inquiry to find "substantial novelty" more often. Indeed, in the early nineteenth century, courts used a substantial novelty test to determine validity for invention patents, and it would not be difficult to resurrect this case law for commercialization patents.[362] Furthermore, as explained below, because the examination of commercialization patents would be at least an order of magnitude more vigorous than for invention patents, the number of "bad" commercialization patents issued should be relatively low.

4. *The interaction with invention patents*

One of the most difficult issues with launching a second type of patent is determining how that patent should interact with traditional patents. For example, petty patents are an additional layer of protection available to inventors. As Mark Janis and others have recognized, additive rights can stifle third-party development and commercialization as well as increase deadweight losses.[363] To date, it appears no proposal for a second form of protection, whether for commercialization or other goals, has been able to address this criticism directly. What is perhaps most original in the proposal here is that it contains not only negative rights to exclude others from making or selling the patented commercialized product, but also *positive rights* that assure that the commercialization patentee can make and sell the product without undue interference from—yet simultaneously compensating—invention patent holders.[364]

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361. *See* Duffy, *supra* note 99, at 503 ("Ultimately, [Kitch] endorsed a 'substantial novelty' test for invention because, he believed, any substantially new information may need some inquiry into ways to enhance its value. Such a view justifies patent protection based solely on post-patent effects . . . .").

362. *See, e.g.*, Edward C. Walterscheid, *The* Hotchkiss *Unobviousness Standard: Early Judicial Activism in the Patent Law*, 13 J. INTELL. PROP. L. 103, 110-15 (2005) (describing the "substantial novelty" test).

363. *See* Ben Depoorter, *The Several Lives of Mickey Mouse: The Expanding Boundaries of Intellectual Property Law*, 9 VA. J.L. & TECH. 4, 12 n.36 (2004) ("[S]econd tier patent protection is likely to produce a large number of stake holders, with high information and transaction costs . . . ."); Janis, *supra* note 330, at 203-05 (predicting that a second tier patent will increase transaction costs).

364. By default, the proposals of Kingston and Kronz provide positive rights by completely negating the rights of the traditional patentee that does not commercialize its patents. *See supra* note 341 and accompanying text. However, such an approach could suboptimally dampen incentives to invent. *See infra* notes 370-374 and accompanying text. The approach here suggests a novel middle ground to promote commercialization without unduly decreasing invention.

Specifically, the commercialization patent would provide complete immunity from injunctive relief from suits for invention patent infringement. Additionally, it would provide a cap on damages to reflect no more than a fixed, small percentage royalty, e.g., 1-2%, adjusted if the patented product is but a mere component of the overall product sold.[365] Although such an approach might appear radical, in actuality, it is not so different from current law and, especially, proposed patent reforms. First, if an invention is legitimately commercialized by a third party via a commercialization patent, the proposal aligns with Justice Kennedy's suggestion in *eBay* that non-practicing entities (NPEs) should not ordinarily be entitled to injunctive relief.[366] In other words, because an invention patent holder does not practice its claims—otherwise, the commercialization patent would be invalid—under a strict post-*eBay* rule, it would not be entitled to an injunction in any event.[367] Second, because the invention patentee is an NPE, it would not ordinarily be entitled to lost profits, instead being limited to a reasonable royalty.[368] Like the recommendation here, under proposed patent law reforms, reasonable royalties would be limited for patented components of products to the value attributable to the component.[369]

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365. *Cf.* Bar-Gill & Parchomovsky, *supra* note 347, at 415 (recommending that an "idea conceiver's share" be limited to a "small percentage" to promote development of the idea); Merges & Nelson, *supra* note 47, at 866 n.118 (remarking that the "most efficient way to deal with the problem" of blocking patents "would probably be a system of compulsory licensing").

366. *See* eBay, Inc. v. MercExchange, L.L.C., 547 U.S. 388, 396-97 (Kennedy, J., concurring) ("When the patented invention is . . . employed simply for undue leverage in negotiations, legal damages may well be sufficient to compensate for the infringement and an injunction may not serve the public interest."); Abramowicz & Duffy, *supra* note 64, at 400-01 (finding Justice Kennedy's pronouncement in *eBay* to be "consistent with a market experimentation theory").

367. *See* Golden, *supra* note 248, at 2113 & n.12 (2007) ("Since . . . *eBay*, district courts appear to have consistently denied permanent injunctions in cases where an infringer has contested the patent holder's request for such relief and the infringer and patent holder were not competitors.").

368. *See* Wechsler v. Macke Int'l Trade, Inc., 486 F.3d 1286, 1293 (Fed. Cir. 2007) ("'Normally, if the patentee is not selling a product, by definition there can be no lost profits.' The only exception is where the patentee has the ability to manufacture and market a product, but for some legitimate reason does not. Even in these situations, though, 'the burden on a patentee who has not begun to manufacture the patented product is commensurately heavy.'" (citations omitted) (quoting Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1548 (Fed. Cir. 1995) (en banc) and Hebert v. Lisle Corp., 99 F.3d 1109, 1120 (Fed. Cir. 1996))).

369. *See* Patent Reform Act of 2009, H.R. 1260, 111th Cong. § 5 (2009) (requiring courts, when calculating damages, to apply a reasonable royalty "only to the portion of the economic value of the infringing product or process properly attributable to the claimed invention's specific contribution over prior art"); The Patent Reform Act of 2007, H.R. 1908, 110th Cong. § 5 (2007) (same); Patent Reform Act of 2007, S. 1145, 110th Cong. § 5 (2007) (same).

The final feature, limiting the royalty to a fixed, low percentage, diverges from current and proposed law, and could significantly diminish the *ex ante* incentives of invention patent holders to invent.[370] Yet, if one believes the *ex post* theorists' view—and there are some good reasons to do so—then patents do not play a significant role in motivating invention, but instead are mostly valuable to post-invention commercialization.[371] Since commercialization patents would carry the weight of this task, the role of invention patents would become much less important to the overall patent system. Thus, diminishing their role would not seem problematic. Even so, if one were worried about these effects, it seems a viable remedy would be to give the invention patent holder a head start to commercialize its invention, for example, three years after issuance, extended for regulatory and Patent Office delays during the commercialization process.[372] If the invention patentee or a licensee did not commercialize by then—roughly five to eight years after filing—it seems difficult to argue that providing that opportunity to a third party willing to do so under a low, but reasonable, royalty prejudices the patentee.[373] Indeed, in many

370. In this regard, one might question whether these positive rights would run afoul of the United States Constitution's IP Clause, which states "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors *the exclusive Right* to their respective Writings and Discoveries." U.S. CONST. art. I, § 8, cl. 8 (emphasis added). Specifically, one could argue that a commercialization patent's positive rights would deprive an inventor of her "exclusive rights" in her "discoveries." However, recent case law indicates that Congress could use its Commerce Clause power to override this limitation. *See* United States v. Martignon, 492 F.3d 140, 149 (2d Cir. 2007) (holding that "Congress exceeds its power under the Commerce Clause by transgressing limitations of the [IP] Clause only when (1) the law it enacts is an exercise of the power granted Congress by the [IP] Clause and (2) the resulting law violates one or more specific limits of the [IP] Clause"); United States v. Moghadam, 175 F.3d 1269, 1280 (11th Cir. 1999) ("We hold that the Copyright Clause does not envision that Congress is positively forbidden from extending copyright-like protection under other constitutional clauses, such as the Commerce Clause, to works of authorship that may not meet the fixation requirement inherent in the term 'Writings.'").

371. *See supra* Part II.B.

372. *See* O.J. FIRESTONE, ECONOMIC IMPLICATIONS OF PATENTS 102-03, 348-49 & tbl.7-8 (1971) (finding that 89% of worked patents were commercialized by the time of issuance and 98% within five years of issuance); Jeffrey L. Brandt, *Capturing Innovation: Turning Intellectual Assets into Business Assets*, *in* FROM IDEAS TO ASSETS: INVESTING WISELY IN INTELLECTUAL PROPERTY 65, 78 (Bruce Berman ed., 2002) (noting inventions often precede "market adoption" by three to five years); Christopher Palmberg, *The Sources and Success of Innovations—Determinants of Commercialisation and Break-Even Times*, 26 TECHNOVATION 1253, 1259 tbl.4 (2006) (finding in an empirical study that average commercialization times ranged from 2.5 to 4.1 years in a variety of industries other than chemicals); *cf.* 35 U.S.C. §156(a), (d)(5)(E) (2000) (providing for patent term extensions of up to five years for time spent in the FDA approval process).

373. Although three years from issuance should be a sufficient window to commercialize the inventions, *see supra* note 372, it might be advisable to implement a small number varying windows by technology type, longer windows for small entities, and purchasable extensions, so as to not to unduly diminish incentives to invent. I plan to address

cases, inventors would actually benefit from a fixed, low royalty rate, because it would set an enforceable reserve price for the invention, which would reduce strategic negotiation and overall bargaining costs, increasing the odds of consummating a deal.[374]

The positive rights granted to a commercialization patent holder would solve many problems in the existing patent system.[375] First, they would significantly lower transaction costs stemming from strategic licensing and litigation that hamper commercialization under the present-day system. Paper patents of no initial value that remain uncommercialized three years after issuance would have no injunctive value and would garner small damage awards against the commercialization patent holder. Competition between the invention patent and commercialization patent holder for licenses to non-patentee commercializers would also reduce overall costs.[376] If the invention patentee attempted to license prior to the expiration of the three-year term to work the invention patent, the prospective licensee's threat of a compulsory license in the event a deal were not consummated would tend to diminish license fees and bargaining costs, achieving greater commercialization.

Thus, a commercialization patent's positive rights to practice stand between the traditional, non-exclusive compulsory licenses available in many countries if a patentee does not work its patent and a full exclusive license to the patent, as available in the open market. In this way, the commercialization patent can improve incentives to commercialize, yet introduce competition in the market for commercial embodiments of the original patent. Specifically, a commercialization patent overcomes the collective action problem that arises when a compulsory license is available to any taker, which—when significant *ex post* effort is needed to commercialize the invention patent—results in no one willing to take a compulsory license for fear of third-party free riding. Simultaneously, the commercialization patent provides narrow enough protection that a second-comer can apply for a separate commercialization patent on an alternative commercial embodiment of the original invention

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such nuances to the proposal herein in a follow-up article.

374. *See* Bar-Gill & Parchomovsky, *supra* note 347, at 415 ("Importantly and counterintuitively, restricting the ex post price may well be in the interest of the idea conceiver. Since a high price might prevent development of the idea, leaving the idea conceiver with zero profit, a more conservative damage measure will often increase the ex ante value of the idea conceiver's entitlement.").

375. *Cf.* Adam Mossoff, *Exclusion and Exclusive Use in Patent Law*, 22 HARV. J.L. & TECH. 321, 349-360 (2009) (contending that patents historically encompassed a positive use-right).

376. Although the invention patentee could not provide a license over the product covered by the relevant commercialization patent, nor practice the patent itself, it could provide a license to an embodiment covered by the invention patent but *not* by the commercialization patent. To the extent this alternative embodiment was an economic substitute for the embodiment covered by the commercialization patent, the invention patentee and commercialization patentee could compete in the licensing market.

patent, resulting in the potential for increased competition and lowered deadweight losses.

Second, commercialization patents would reduce the problems caused by broad claims and concomitant blocking patents. If a prospective invention patentee and others have not commercialized the original patented invention, an improvement inventor willing to commercialize its invention could file for a commercialization patent, thereby limiting the invention patent holder's exclusive rights and making commercialization of the improvement much less costly.

Third, commercialization patents—like the Orphan Drug Act—would provide incentives to commercialize undeveloped inventions that serve important distributive interests. Because commercialization patents would apply to any product not currently available in the market, regardless of whether the product were covered by an invention patent, it would provide the exclusivity often necessary to commercialize products not otherwise in high demand, but that are profitable given, for example, newly available complementary technologies that lower production prices. Moreover, unlike the Orphan Drug Act, commercializers would be protected from most of the costs of invention patent suits, providing further incentives to produce new products for these "long-tail" demands.[377]

5. *The term of commercialization patents*

As noted earlier, the term of a commercialization patent would be relatively short, lasting five to eight years, because its aim is only to provide incentives to commercialize an already existing invention. Other than for pharmaceuticals, there seems little empirical justification to protect commercial products for a longer period, especially when merely "substantially novel," but obvious, improvements over the original commercialization patent would qualify for additional protection. As for pharmaceuticals, invention patents in many ways act like commercialization patents—specifically, because traditional patents on drugs typically contain single component claims, effectively providing a positive right to make and sell the drug—pharmaceutical companies could continue to rely on the twenty-year term of invention patents to protect their *ex post* commercialization efforts.

Because invention patents last twenty years from filing, a commercialized product might continue to infringe an invention patent after expiration of the commercialization patent term. Obviously, a return to full damages could seriously diminish incentives to commercialize. For this reason, although the

377. *See generally* CHRIS ANDERSON, THE LONG TAIL: WHY THE FUTURE OF BUSINESS IS SELLING LESS OF MORE (2006) (describing the growing phenomena of businesses providing goods and services to niche markets).

negative exclusive right of commercialization patents should expire after five to eight years, the positive right to practice should continue. Thus, after expiration of a commercialization patent, the holder would continue to be immune from injunctive relief and limited in damages to a low reasonable royalty. Indeed, such an immunity should extend to any potential infringer of the invention patent; otherwise, the holder might continue with a *de facto* monopoly on sales of the product, since it would enjoy a differential advantage relative to potential competitors.

6. *Administering a commercialization patent system*

The "fine-tuning" of the patent system described above seems nearly impossible by adjusting the scope, duration, or timing of traditional, invention patents. By providing an additional policy lever through the grant of a different set of rights directly in exchange for a commitment to make and build a product, commercialization patents offer the hope of improving commercialization incentives without significantly diminishing invention incentives or increasing deadweight losses. Of course, adding a new set of rights means more administrative costs and complexity.

Because commercialization patents as proposed here, however, incorporate doctrines already in use for invention patents, or straightforward modifications thereof, implementation at the Patent Office would not be complex. Moreover, because applicants for commercialization patents would commit to making and selling a substantial number of products, they should be willing to pay very high filing fees when applying for the patent. For example, the Patent Office might charge $25,000 to large entities and $10,000 to small entities, well more than an order of magnitude greater than the current fees.[378] If these fees were more than the expected net value of the commercialized product, then arguably society would not have much to lose from letting the invention remain uncommercialized. In addition to these high fees preventing a proliferation of new patent applications, the Patent Office could use them to engage in exhaustive prior art searches and analyses, which would likely lead to relatively few "bad" commercialization patents when compared with the ostensible number of questionable invention patents issued today.[379] Furthermore, it is

378. *See* United States Patent And Trademark Office FY 2009 Fee Schedule (Oct. 2, 2008), http://www.uspto.gov/web/offices/ac/qs/ope/fee2009september15.htm#patapp. Additionally, with such high fees, it is unlikely that firms would acquire large numbers of commercialization patents for "strategic" purposes, such as improving negotiating power in cross-licensing negotiations. *See* Graham & Sichelman, *supra* note 221, at 1079-81 (discussing the strategic uses of patents).

379. Moreover, by setting a ninety-day window for multiple applicants to apply once the three-year period on an underlying, uncommercialized invention patent lapsed, overall fees could be increased by allowing the applicants to bid for the commercialization rights. In particular, if any of the commercialization patent applications contained claims that covered

unlikely the burden on the courts would be substantially increased. As with the Patent Office, courts would not have to learn or apply new doctrines. Because commercialization patent claims would only narrowly cover the disclosed product, they would not be as vague or ambiguous as invention patent claims. The clearer scope of commercialization patent claims would likely lead parties to enter into pre-litigation licensing agreements and post-litigation settlements much more readily than with invention patents. Because commercialization patents would reduce the power of invention patents, the volume and duration of invention patent litigation should also decrease, very likely counterbalancing any increase in court filings from commercialization patent litigation.

Finally, because commercialization patents would apply in the same manner to all patentable subject matter, the incentives for industry-specific rent-seeking would be eliminated. If Congress were to consider adopting commercialization patents, although there would almost certainly be lobbying by the pharmaceutical, medical device, software, financial services, and other industries now heavily involved in patent reform, the incentives for Congress to differentially change patent law would not likely deviate from where they stand today. If anything, because it is very likely that a higher share of valuable pharmaceutical patents are commercialized than software patents[380]—making commercialization patents less important to pharmaceutical companies—any rent-seeking would probably lead to relatively narrow commercialization patents that strongly reduce the force of undeveloped invention patents. Thus, commercialization patents should be viewed not as an additional layer of "sui generis" IP rights, but as a new form of patent right that applies to all patentable subject matter and that inherently limits the power of traditional patent rights.[381]

7. *Easing patent reform*

If the broad scope and strong rights of traditional patents are indeed welfare-decreasing, as many have argued, commercialization patents offer a middle ground in patent reform efforts not available today. In particular, opponents of patent reform have stressed the importance of strong patents not so much to *ex ante* invention, but rather to *ex post* commercialization. By dividing the incentive functions of the patent system between invention and

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the same or substantially similar products, the Patent Office could auction off the patent, with the income going to the Patent Office and, perhaps, to the invention patentee. *Cf.* Abramowicz, *supra* note 253, at 824-25; Bar-Gill & Parchomovsky, *supra* note 347, at 401-02.

380. *See supra* note 135 and accompanying text.

381. To reduce the risk in implementing commercialization patents, a small, random selection of uncommercialized invention patents across various classes could be used as test candidates. (I thank Michael Abramowicz for this suggestion.)

commercialization patents, each of which can be tailored independently to promote policy goals, the strength of traditional patents could be greatly reduced without harming commercialization interests. For instance, by limiting the unintended effects of more radical proposed reforms, commercialization patents might allow (1) enablement requirements for invention patents to be raised, thereby narrowing claim scope; (2) the doctrine of equivalents to be eliminated (though not for commercialization patents for the reasons discussed earlier); (3) obviousness to be further strengthened; and (4) even certain types of invention—but not commercialization—patents, e.g., for software and business methods, to be banished. Specifically, although these measures on their own might have a positive effect on the inventive process, in the absence of commercialization patents, they could significantly diminish commercialization. The outlet of commercialization patents provides a way to implement these reforms, yet still retain robust incentives for commercialization.

CONCLUSION

The goal of this Article is not to solve the under-commercialization problem overnight. Rather, its aims are to offer some reasons for the problem—such as early filing, high transaction costs, weak enablement requirements, and overly strong patent rights—and to sketch a new solution that aims to overcome the defects of previous ones. Commercialization patents of the sort proposed here would fundamentally alter the patent system's single-minded approach to a multi-faceted problem. Elucidation of the details of commercialization patents surely requires testing, empirical study, and refinement. Yet, by decoupling the traditional patent into an invention patent, granted in exchange for the disclosure of new and non-obvious knowledge, and a commercialization patent, granted in exchange for the manufacture and sale of a substantially new product, the patent system could offer more optimal incentives for invention and commercialization alike.