

RECOUPMENT PATENT*

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The patent system aims to encourage innovation while keeping its own administrative costs to a minimum. Considering the centrality of innovation to twenty-first century economic activity, patent law is widely viewed as a crucial element of our legal system. And yet, by any standard, our patent system is broken. At present, the United States patent system encourages filing a plethora of low-quality patents that have no true innovative value, is plagued by opportunistic patent trolls, and produces endless amounts of costly litigation. Thus, the patent system stalls, rather than encourages, innovation.

This Article demonstrates how these phenomena are due to central design flaws in the current system. First, although the patent system is designed to encourage investment in innovation, it lacks a mechanism for directly examining an inventor's level of investment. This major flaw systematically ignores investment in innovation, which is the single most important factor the patent system seeks to promote. Second, the current system offers one-size-fits-all protection, granting the same twenty-year monopoly to any and all inventions. This inflexible legal standard is outdated and inappropriate given the wide variety of inventions it addresses and the immense differences between them.

The core of this Article proposes structural reform designed to remedy these fundamental flaws. First, we suggest that the patent system must explicitly consider the investment made in each specific invention when deciding what level of legal protection each invention merits. Second, we advocate a departure from the current one-size-fits-all model in favor of a more tailored approach, offering different periods of protection for different inventions. These two solutions would produce a system in which inventions are granted protection for a duration that depends on the level of investment each invention requires. We

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call this model a “recoupment patent” and highlight its advantages over the current system.

Under the recoupment patent model, filing for patent protection will require documentation of investment in the invention, which will serve as the basis for determining duration of protection. Protection will expire once the investment is recouped and a fixed percentage of profit is earned. Filing and renewal fees will also be calculated based on documented investment. Additionally, investment will serve as a basis for calculating royalties (or damages in subsequent litigation). Under this proposed regime, the patentee bears the burden of demonstrating the level of investment in the invention. This regime is more accurately tailored to incentivize innovation while avoiding the excessive protection under the current one-size-fits-all system. This new regime also incorporates mechanisms to prevent inventors from misstating their investment. Throughout the Article, we address the challenges created by our proposed recoupment patent model and highlight its advantages over the existing system and over other reform proposals. We also discuss extensions and possible refinements to the basic conception outlined above.

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INTRODUCTION

Patent law aims to encourage innovation.¹ Patent protection grants an inventor exclusive rights to use, sell, or license her invention for a limited time period of twenty years.² This provides incentive for investment in innovation by allowing the inventor to enjoy the fruits of her labor.³ Yet, the patent system has been under fire in the last few decades by critics highlighting its major flaws and negative effects on innovation.⁴ The current system is criticized for being overly rigid—offering identical treatment to radically different inventions.⁵ This means patent protection is often either too narrow or overbroad.

Patent protection is too narrow when it offers insufficient incentive for inventors to invest in research and development. This problem is especially pronounced with pharmaceutical companies, for which the costs of developing a new drug are often estimated in the millions.⁶ When innovation is that costly, the standard twenty-year patent protection is often simply not enough for inventors to recoup their investment.⁷ In such cases, the company cannot afford to invest, and the public is denied a new and improved medical solution.⁸

On the other hand, patents can also be overbroad, granting protection when it is not needed.⁹ In such cases, patent protection can be destructive,

1. U.S. CONST. art. I, § 8, cl. 8 (granting Congress the enumerated power “[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”).

2. See 35 U.S.C. § 271(a) (2018) (explaining that once a patent has been granted, the patent owner has the exclusive right to make, use, sell, offer for sale, or import the claimed invention into the United States).

3. See Christopher A. Cotropia, “*After-Arising*” Technologies and Tailoring Patent Scope, 61 N.Y.U. ANN. SURV. AM. L. 151, 168–71 (2005) [hereinafter Cotropia, *After-Arising*] (discussing how patent protection provides patentees an opportunity to invent and have exclusive control over their invention); Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129, 129–31 (2004) [hereinafter Lemley, *Ex Ante*] (protecting inventors’ investments in their ideas).

4. See JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 2 (2008) (showing that while patents provide incentives to invest in research, development, and commercialization, for most businesses today, patents fail to provide predictable property rights); Maureen K. Ohlhausen, *Patent Rights in a Climate of Intellectual Property Rights Skepticism*, 30 HARV. J.L. & TECH. 103, 110–11 (2016).

5. DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 3–5, 136–37 (2009) (showcasing the existence of a patent crisis, where patents calibrated to the needs of the pharmaceutical industry are not able to accommodate information technologies, and vice versa, and suggesting that courts should make industry-specific inquiries to provide an appropriate level of incentive for each industry).

6. *Id.* at 204 n.1.

7. *Id.* at 7–8.

8. See BESSEN & MEURER, *supra* note 4, at 88.

9. See Maayan Perel, *Reviving the Gatekeeping Function: Optimizing the Exclusion Potential of Subject Matter Eligibility*, 23 ALB. L.J. SCI. & TECH. 237, 242–43 (2013) [hereinafter Perel, *Gatekeeping Function*].

hindering downstream innovation.¹⁰ The phenomenon of patent thickets is emblematic of this problem.¹¹ Patent thickets are created when different inventors make small cumulative contributions to the same product.¹² The current patent system offers full patent protection for each such fragmental contribution to the invention, thus creating a multitude of overlapping patents that cover a single product.¹³ Since a single entity would have extreme difficulty collecting licenses from all the patent owners, the existence of patent protection can effectively prevent both commercialization and further development of the invention.¹⁴ In this way, patent protection hinders innovation rather than promotes it.¹⁵

The issue of overprotection under the existing patent system is related to the more general problem of low patent quality.¹⁶ Low patent quality means that many patents offer protection for negligible technological developments that are close to being obvious or were created with little to no effort.¹⁷ Such low-quality patents offer owners the same level of protection as do high-quality patents, barring nonowners from utilizing many technologies and products. This means that the patent system routinely grants patent owners the power to interfere with the innovative activity of others, even when these patent owners made little to no scientific contribution.¹⁸ Low-quality patents thus obstruct innovation and progress rather than stimulate them and are generally perceived as inventions that do not require patent incentives.¹⁹

Moreover, with low-quality patents, substantial uncertainty attends their validity, scope, and enforcement, imposing heavy costs on those who make decisions based on patents such as “patentees, prospective licensees, investors,”

10. See *id.* at 282–88 (explaining other incentives for invention that could be hindered by patent protections).

11. BURK & LEMLEY, *supra* note 5, at 78.

12. *Id.*

13. See *id.*

14. See Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, 1 INNOVATION POL’Y & ECON. 119, 121–22 (2000).

15. *Id.* at 121.

16. See R. Polk Wagner, *Understanding Patent-Quality Mechanisms*, 157 U. PA. L. REV. 2135, 2140–41 (2009) (discussing the problems created by low patent quality).

17. See Perel, *Gatekeeping Function*, *supra* note 9, at 272–73 (explaining that even when an invention appears to lack novelty or be obvious under sections 102 and 103 of the Patent Act, there is a real problem of retrieving the invalidating prior art necessary to execute a novelty or nonobviousness rejection). This problem is bolstered by objective limitations of patent examiners that have only limited time to review and apply the prior art. See *id.*

18. *Id.* at 282–84 (describing such patents as ones that cover inventions whose development is not dependent on the Patent Act’s pecuniary incentives). Such patents are unworthy because “they fail to reflect an appropriate ‘balance between the *ex post* costs of short-term monopoly and the benefits of higher *ex ante* incentives to innovate.” *Id.* at 282 (quoting *The Supreme Court, 2009 Term—Leading Cases*, 124 HARV. L. REV. 370, 376–77 (2010)).

19. Wagner, *supra* note 16, at 2138.

and others.²⁰ Furthermore, “a low-quality patent system is characterized by a large number of errors in the patent-granting process.”²¹ In addition to inappropriate grants, inappropriate denials of patentable inventions can prevent the full commercialization of important innovations.²² Finally, low-quality patents also impact litigation.²³ The uncertainty that surrounds low-quality patents increases litigation and promotes more complex and expensive disputes, which increases the costs of the entire system.²⁴ It is no surprise that the demand to improve patent quality is the centerpiece of many current calls for patent reform.²⁵ Scholars have previously suggested that the problem of low-quality patents is especially pronounced in the context of business method and software patents, and patent quality in these areas is hotly debated.²⁶ To date, discussions have yielded many proposals for reform, some of which have been fully or partly adopted.²⁷ However, these types of patents still threaten general patent quality.²⁸

Overbroad patent protection is also problematic because it fuels the activity of “patent trolls”—entities who abuse patent protection to secure short-term gains with no relation to innovative activity.²⁹ Patent trolling is associated with the generation of income, not through commercialization, but through aggressive licensing and litigation of patents by nonpracticing entities (“NPEs”).³⁰ Recent empirical work shows that most patent lawsuits are indeed asserted by NPEs, suggesting that the problem of patent trolling is yet to be solved.³¹ While encroaching upon the constitutional mandate to “promote the

20. *Id.* at 2140.

21. *Id.* at 2141.

22. *Id.*

23. *Id.* at 2142 (observing the correlation between increased litigation and low-quality patents).

24. *Id.* at 2140–43 (discussing the effects of low-quality patents).

25. *Id.* at 2136. Most efforts and proposals in this context view patent quality as mainly an administrative concern. *Id.* at 2158–61 (discussing the administrative changes on which patent reform is focused). Other proposals focus on reforming the prosecution process. *Id.* at 2162 (describing the proposed prosecution-focused patent reform).

26. See BESSEN & MEURER, *supra* note 4, at 187–214 (discussing software and business method patents).

27. BURK & LEMLEY, *supra* note 5, at 100–08 (discussing patent reform initiatives).

28. See BESSEN & MEURER, *supra* note 4, at 21–24 (discussing the problematic nature of software patents).

29. John R. Allison, Mark A. Lemley & David L. Schwartz, *How Often Do Non-Practicing Entities Win Patent Suits?*, 32 BERKELEY TECH. L.J. 237, 242–44 (2017) (discussing different definitions for patent trolls); Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117, 2117 (2013).

30. Lemley & Melamed, *supra* note 29, at 2163–65 (criticizing lawyers that file patent infringement claims against companies). Some scholars have suggested that NPEs may serve a useful function in supporting the creation of a market for patent rights. See David L. Schwartz & Jay P. Kesan, *Analyzing the Role of Non-Practicing Entities in the Patent System*, 99 CORNELL L. REV. 425, 444 (2014).

31. Shawn P. Miller et al., *Who’s Suing Us? Decoding Patent Plaintiffs Since 2000 with the Stanford NPE Litigation Dataset*, 21 STAN. TECH. L. REV. 235, 271 (2018).

Progress of Science and useful Arts,”³² patent trolls divert investment from research and development to potentially unwarranted licensing fees or litigation.³³ Patent trolling is often facilitated by the granting of low-quality patents that cover overly broad claims.³⁴

Patent trolls assert “overbroad, obvious, or non-novel patents” to force alleged infringers to pay licensing fees for a patent that they believe is invalid or otherwise face “costly and protracted litigation.”³⁵

Unfortunately, the current regime tolerates patent trolling.³⁶ Modern patent law does not require that inventors “manufacture[], sell, or market their writings or ideas” in exchange for patent protection³⁷ but rather affords patentees exclusive rights over their inventions without demanding that they exploit their inventions to the benefit of the public in return.³⁸ Additionally, it does not impose any limitation on the ultimate price of licensing that patent owners may demand. The moment a patent is issued, its owner is afforded an unlimited right to exploit it for her own narrow financial benefit.³⁹

32. U.S. CONST. art. I, § 8, cl. 8 (providing that authors and inventors have exclusive rights to their respective works).

33. For an opposite position, suggesting that NPEs have a positive role in serving as efficiency-enhancing business intermediaries between inventors and commercializers, see generally Ryan T. Holte, *Trolls or Great Inventors: Case Studies of Patent Assertion Entities*, 59 ST. LOUIS U. L.J. 1 (2014); James F. McDonough III, *The Myth of the Patent Troll: An Alternative View of the Function of Patent Dealers in an Idea Economy*, 56 EMORY L.J. 189 (2006); Michael Risch, *Licensing Acquired Patents*, 21 GEO. MASON L. REV. 979 (2014); and Daniel F. Spulber, *Patent Licensing and Bargaining with Innovative Complements and Substitutes*, 70 RES. ECON. 693, 711 (2016).

34. Susan Walmsley Graf, Comment, *Improving Patent Quality Through Identification of Relevant Prior Art: Approaches To Increase Information Flow to the Patent Office*, 11 LEWIS & CLARK L. REV. 495, 498–99 (2007) (arguing that patent trolling is driven by issuance of poor-quality patents and explaining how poor-quality patents containing broad claims are used offensively to obtain licenses or bring infringement lawsuits).

35. *Id.* at 498.

36. See Katherine E. White, *Preserving the Patent Process To Incentivize Innovation in Global Economy*, 13 SYRACUSE SCI. & TECH. L. REP. 1, 1–2 (2006) (suggesting major amendments to the Patent Act in order to make patent laws more favorable to patentees and disadvantageous patent trolls). It has been argued that the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified in scattered sections of 35 U.S.C.), which made it more difficult to join defendants in patent infringement suits, does not address the problem of patent trolls that Congress had sought to resolve. See Holly Forsberg, *Diminishing the Attractiveness of Trolling: The Impacts of Recent Judicial Activity on Non-Practicing Entities*, 12 PITT. J. TECH. L. & POL’Y 1, 3–4 (2011); Tracie L. Bryant, Note, *The America Invents Act: Slaying Trolls, Limiting Joinder*, 25 HARV. J.L. & TECH. 673, 687–88 (2012).

37. White, *supra* note 36, at 5.

38. *Id.* (noting that manufacture and sale of products are not required under the Patent Clause of the U.S. Constitution). Note also that this has not always been the legal practice because throughout most of the twentieth century courts were able to limit protection for nonpracticing entities under the “paper patent” doctrine. See John F. Duffy, *Reviving the Paper Patent Doctrine*, 98 CORNELL L. REV. 1359, 1363 (2013) (showing that the abolition of the paper patent doctrine benefited patent trolls and was a bane to true innovators).

39. White, *supra* note 36, at 11 (emphasizing that the exclusive rights of patent owners include their ability to demand any price for their own benefit).

Many scholars have perceived these challenges as a “patent crisis” or “patent failure,” insisting on a comprehensive reexamination of the current system.⁴⁰ These challenges introduce significant costs for patentees, innovation, and society at large.⁴¹ Scholars and policymakers have made numerous attempts to introduce different types of reforms to address these challenges.⁴² Such attempts range from providing discretion to courts to tailor protection to different technologies on a case-by-case basis,⁴³ to calls for a comprehensive legislative reform of the patent system,⁴⁴ and even more drastic calls to abolish the patent system and introduce an alternative regime of prizes and rewards.⁴⁵

In this Article, we attribute the failure of the patent system to fundamental design flaws in its current structure. First, the patent system does not require the patentee to prove that the invention required significant investment, or any investment at all for that matter. This undermines investment in innovation, which is the primary goal of the patent system.⁴⁶ Second, our system awards all patentees uniformly, once they meet the Patent Act threshold requirements, with a twenty-year government sanctioned monopoly over their purported invention.⁴⁷ This one-size-fits-all approach often results in either overprotection or underprotection and is inherently unfair because it provides the same level of compensation to all patentees without taking into account the great differences in levels of investment required by different inventions.

40. BESSEN & MEURER, *supra* note 4, at 235–53 (suggesting a series of reforms to improve the notice function of patent law); BURK & LEMLEY, *supra* note 5, at 3.

41. *See, e.g.*, BESSEN & MEURER, *supra* note 4, at 46–72, 147–64 (demonstrating how patents fail to provide predictable legal boundaries to their owners); BURK & LEMLEY, *supra* note 5, at 3–6 (arguing that the current patent system is in a crisis because it does not incentivize innovation properly); Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809, 1837 (2007) (“One response is that trolls already impose a tax on innovation . . .”).

42. BURK & LEMLEY, *supra* note 5, at 100–08 (concluding that courts might be more effective than Congress in achieving some patent reform by tailoring patent law to specific industries through different policy levers and common law doctrines).

43. *Id.* at 103–04.

44. *See, e.g.*, BESSEN & MEURER, *supra* note 4, at 235–52 (discussing legislative reforms to improve patent system).

45. BURK & LEMLEY, *supra* note 5, at 44–45; Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 119–20 (2003) (advocating for a reward system to complement existing IP protection) [hereinafter Abramowicz, *Patent Prizes*]; Mark D. Janis, *Patent Abolitionism*, 17 BERKELEY TECH. L.J. 899, 939–41 (2002).

46. *See infra* Section II.A (explaining how investment and innovation are tied together in patent theory). For economic literature showing a linear relationship between investment and increased innovation, see generally Valentina Meliciani, *The Relationship Between R&D, Investment and Patents: A Panel Data Analysis*, 32 APPLIED ECON. 1429 (2000).

47. The term of patent rights lasts until twenty years from the date the patent application is filed, with special term extensions available if the prosecution of the patent was unreasonably delayed or if regulatory approval of a drug consumed a portion of the patent term. 35 U.S.C. §§ 154(a)(2), (b), 155–156 (2018); Maayan Perel, *From Non-Practicing Entities (NPEs) to Non-Practiced Patents (NPPs): A Proposal for a Patent Working Requirement*, 83 U. CIN. L. REV. 747, 754 (2015).

We propose to remedy these flaws by introducing a novel regime of differential, investment-based patents. Under this new model, the patentee must prove the level of investment in each invention, and the duration of the patent will depend on that investment. Investment includes any expense incurred in the process of research and development of the invention, including employee salaries, equipment and materials, lab services, consulting services, administrative costs, regulatory costs, commercialization costs, and other costs incurred while developing an invention. This will establish a time frame to recoup investment and earn some level of profit. Such a regime will tailor the protection it offers patentees specifically to match the required economic incentive, thus avoiding both underprotection and overprotection. It will address the problem of low-quality patents by limiting their duration or altogether refusing them protection. This regime will also prevent opportunistic behavior by patent trolls, who rely heavily on the ability to acquire cheap, old, or low-quality patents.⁴⁸

Our proposal offers a structural reform to the patent system that is also a natural and fitting legal change. To support the feasibility of our proposal, we show that similar regimes designed to allow recoupment of investment in innovation have existed in the past. The Patent Act of 1836 established the key elements of the patent system as we still know them today⁴⁹: a patent office,⁵⁰ the process of patent application,⁵¹ the hiring of professional examiners,⁵² and a library of prior art.⁵³ The 1836 Act also introduced the possibility to extend the period of patent protection beyond the term for which it was originally granted when inventors were able to prove that the existing patent did not allow them “reasonable remuneration” for their expenses and ingenuity.⁵⁴ This provision was later abandoned, mainly for evidentiary reasons and due to its high administrative cost.⁵⁵ As technological advancements have radically cut such costs since the nineteenth century, and in light of the current crisis in the patent

48. Introducing short-term patent protection will reduce patent trolling, as it has been shown that patent trolls typically litigate older patents. See Brian J. Love, *An Empirical Study of Patent Litigation Timing: Could a Patent Term Reduction Decimate Trolls Without Harming Innovators?*, 161 U. PA. L. REV. 1309, 1322–27 (2013) (providing empirical evidence showing that, while product-producing companies usually enforce their patents soon after issuance, NPEs begin asserting their patents relatively late in the patent term and frequently continue to litigate until expiration).

49. John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 507–09 (2004); Chauncey Smith, *A Century of Patent Law*, 5 Q.J. ECON. 44, 47–48 (1890).

50. Smith, *supra* note 49, at 47.

51. *Id.*

52. Max Stul Oppenheimer, *Progress or Profit: Reconsidering the Shortened Statutory Period Scheme*, 36 CARDOZO ARTS & ENT. L.J. 427, 429 n.19 (2018).

53. *Id.*

54. See Patent Act of 1836, ch. 357, § 18, 5 Stat. 117, 125; see also Smith, *supra* note 49, at 48.

55. Smith, *supra* note 49, at 49.

system, we argue that the time is now ripe for a version of this long-lost provision to be reintroduced into the patent system.⁵⁶

We advocate for built-in safety valves that will prevent abusive behavior by patentees. These include calculating filing and renewal fees based on the level of investment documented by the patentee.⁵⁷ Similarly, licensees' royalties and damages for patent infringement might also be partially calculated based on the patentee's level of investment. The Article also explores the possibility of tailoring patent duration according to other metrics besides investment. Such alternative routes might be appropriate to offer protection for those rare inventions that have great economic value but did not require great investment, such as "spark of genius" inventions.

The Article proceeds as follows: Part I reviews the current model of patent protection, exploring the flaws of its one-size-fits-all approach. This part demonstrates that the failure of the existing system can be attributed to fundamental structural flaws. In particular, the existing system seeks to incentivize innovation but never directly observes, verifies, or considers the level of investment or ingenuity in such innovation. We demonstrate the impracticality of this type of institutional arrangement. Part II introduces the proposed differential model: an investment-based patent regime. It discusses the characteristics and details of such a regime, proposing safeguards required for its operation. This part also explores the mechanisms and institutions that can be used to measure and evaluate investment in patents. Part III evaluates the merit of the proposed model, comparing its advantages and disadvantages. We show that a tailored investment-based patent regime brings the patent system closer to a system of rewards and prizes, allowing inventors to recoup the investment of their invention while disincentivizing the filing of low-quality and valueless patents. Part III thus highlights the advantages of the proposed model as a potential solution to the key problems of the current patent system. It also discusses some counterarguments and challenges prompted by our proposal, mainly addressing the arguably significant administrative costs necessary for the operation of our tailored approach. Part IV compares our model to other proposals for reform and highlights the advantages of our proposal over those alternatives.

56. See *Promoting the Useful Arts: How Can Congress Prevent the Issuance of Poor Quality Patents?: Hearing Before the Subcomm. on Intellectual Property of the S. Comm. on the Judiciary*, 116th Cong. (2019) (statement of Andrew Hirschfeld, Commissioner for Patents USPTO), <https://www.judiciary.senate.gov/imo/media/doc/Hirshfeld%20Testimony.pdf> [https://perma.cc/F6UQ-FMT7]; Udi Cohen, *Artificial Intelligence Will Help To Solve the USPTO's Patent Quality Problem*, I.P. WATCHDOG (Nov. 23, 2019), <https://www.ipwatchdog.com/2019/11/23/artificial-intelligence-will-help-solve-usptos-patent-quality-problem/id=116302/> [https://perma.cc/6PUF-B87B].

57. This is contrary to Love's reform proposal to generally increase the frequency and magnitude of maintenance fee payments in the latter half of the patent term. See Love, *supra* note 48, at 1357.

I. THE EXISTING REGIME AND THE PATENT CRISIS

Patents are granted to incentivize innovation.⁵⁸ They provide their owners with a reward in the form of a bundle of exclusive rights over their inventions, allowing owners exclusive economic benefits.⁵⁹ Without such protection, inventors may have insufficient incentive to invest, fearing they will not be able to enjoy the fruits of their labor.⁶⁰ Patent protection is therefore necessary for the advancement of human knowledge, science, and technology.⁶¹ Yet, the social gain of enhanced innovation comes with a price. To incentivize innovation, society grants inventors exclusive ownership of their inventions.⁶² This results in excessively high prices of goods subject to monopolistic patent protection as well as consequentially low production.⁶³ Patent law seeks to resolve this cost-benefit tension by limiting the duration of exclusivity.⁶⁴ The current system applies a one-size-fits-all approach, according the same twenty-year period of protection to all inventions irrespective of their value.⁶⁵ In addition to this time limitation, patent law provides statutory and doctrinal safeguards against potential imbalances in the costs vis-à-vis benefits of patents, such as specified requirements for patentability and the availability of compulsory licensing in special circumstances of social need.⁶⁶

The current approach to patent protection grants equal potential protection to inventions that meet the statutory requirements of subject matter eligibility,⁶⁷ utility,⁶⁸ novelty,⁶⁹ and nonobviousness.⁷⁰ Patentees have similar exclusive rights to use, sell, offer for sale, and import patented inventions⁷¹ for a limited period. Under the current regime, the same duration of patent protection applies to all inventions. However, affording all inventors identical rights of exclusivity, without taking into account the cost of the invention, creates several problems.

58. See U.S. CONST. art. I, § 8, cl. 8.

59. See 35 U.S.C. § 271(a) (2018).

60. See Cotropia, *After-Arising*, *supra* note 3, at 168–71; Lemley, *Ex Ante*, *supra* note 3, at 129–30.

61. See BURK & LEMLEY, *supra* note 5, at 8.

62. *Id.*

63. *Id.* at 68, 71.

64. 35 U.S.C. § 154(a)(2) (2018).

65. See Abraham Bell & Gideon Parchomovsky, *Reinventing Copyright and Patent*, 113 MICH. L. REV. 231, 234 (2014).

66. 35 U.S.C. § 101 (2018); Gianna Julian-Arnold, *International Compulsory Licensing: The Rationales and the Reality*, 33 IDEA 349, 349–55 (1993) (defining common compulsory license agreements).

67. 35 U.S.C. § 101.

68. *Id.*

69. *Id.* § 102.

70. *Id.* § 103.

71. *Id.* § 154(a)(1).

First, the current system undermines the constitutional mandate on which it is based. Article 1, Section 8 of the United States Constitution establishes that “Congress shall have power . . . To 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.”⁷² But the current one-size-fits-all system also protects low-investment inventions, incentivizing research and development where they are not needed “[t]o promote the Progress of Science and useful Arts.” More specifically, if an invention can be created at a low cost, or with virtually no cost at all, no incentive is required in order “to promote” it.⁷³ Similarly, as such low-quality inventions typically contribute very little to the “Progress of Science,” no constitutional mandate exists to incentivize their creation. As one of the authors has argued elsewhere, the current system occasionally issues patents whose development is not dependent on the Patent Act’s pecuniary incentives.⁷⁴

Second, a closely related issue arises from the fact that the current patent system grants the same level of protection to both high- and low-quality patents, thus failing to balance ex post costs of short-term monopoly and ex ante benefits of higher incentives for innovation.⁷⁵ The decreased competition and increased costs associated with patent monopoly thus exceed the societal benefits from increased innovation.⁷⁶

To appreciate this point, consider the costs imposed by the current system. Economic and legal scholarship has established that patents inflict deadweight loss on society.⁷⁷ Patentees enjoy the benefit of selling the rights to their inventions at monopolistic prices, which are higher than competitive prices.⁷⁸ This prevents the optimum balance between sellers and buyers associated with competitive markets. Specifically, users who value the invention at more than the competitive price but less than the monopolistic price will forgo transacting with the patentee, consequently eliminating the potential profit the patentee would have earned were she to sell her invention at a competitive price.⁷⁹ Such

72. U.S. CONST. art. I, § 8, cl. 8.

73. See Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 13–14 (2005) (noting that without patent protection, “copiers would be able to appropriate much of the value embodied in inventions without incurring the considerable costs of research and development”).

74. See Perel, *Gatekeeping Function*, *supra* note 9, at 282–88.

75. *Id.* at 282.

76. See David S. Olson, *Taking the Utilitarian Basis for Patent Law Seriously: The Case for Restricting Patentable Subject Matter*, 82 TEMP. L. REV. 181, 193–94, 196 (2009).

77. See WILLIAM A. MCEACHERN, *ECONOMICS: A CONTEMPORARY INTRODUCTION* 204–05 (7th ed. 2006).

78. See *id.*

79. See Steve P. Calandrillo, *An Economic Analysis of Property Rights in Information: Justifications and Problems of Exclusive Rights, Incentives To Generate Information, and the Alternative of a Government-Run Reward System*, 9 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 301, 304 (1998) (illustrating the loss that occurs when those who value goods below the monopolistic price but above the marginal cost of

forgone transactions impose a loss on both consumers and producers, represented by the combined surplus the parties would have received in a competitive market.⁸⁰

Under a free competitive regime, lower investment costs associated with invention would lower the licensing or sale price of the invention. With optimal market conditions of full transparency and low transaction costs, the competitive price of a good is reflected in its marginal cost of production.⁸¹ In a perfect competitive market, a patentee who spent \$100 in developing an invention would sell her patent for exactly \$100 to cover her expenses.⁸² However, thanks to the benefit of exclusivity ensured by patent protection, the patentee can sell her patent for \$100,000, \$100,000,000, or even more as long as she locates buyers who are willing to pay the monopolistic price. As the rich literature on patent holdups and on rent-seeking by patent trolls explains, agreeing to pay excessive licensing fees is not a genuine exercise of free will but a coerced last resort.⁸³ Since the current one-size-fits-all system of patent protection does not align the costs of investment or value of an invention with ultimate patent earnings, low-investment inventions impose greater deadweight losses on society.⁸⁴ To illustrate this point, consider two patents that are offered for sale at the price of \$100,000 each. The investment costs associated with developing patent *A* were \$1000, while the investment costs associated with developing patent *B* were \$50,000. This means the deadweight loss from the low-investment invention *A* equals \$99,000 and is therefore much larger compared to the deadweight loss from the high-investment invention *B*, which equals only \$50,000. In other words, under competitive market conditions, many more people would have been able to buy, use, and enjoy invention *A* (the low-investment invention).

Of course, costs imposed by the patent system may be justified in order to promote innovation. Thus, deadweight loss is unavoidable in monopolistic

production forgo a transaction). In a truly competitive market with optimal conditions, the competitive price of a good is reflected in its marginal cost of production. See Robert E. Hall, *The Relation Between Price and Marginal Cost in U.S. Industry*, 96 J. POL. ECON. 921, 921 (1988).

80. MASSIMO MOTTA, *COMPETITION POLICY: THEORY AND PRACTICE* 41–42 (2004).

81. See Calandrillo, *supra* note 79, at 304–05; Hall, *supra* note 79, at 921.

82. Importantly, the analysis here refers to the sale of the patent itself and not the sale of any product that is based on the patent. The price of such products is determined based on the marginal cost of production, regardless of the cost of research and development required for the creation of the patent.

83. See Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 1993 (2007) (showing that an injunction threat can enable a patent holder to negotiate royalties far in excess of the patent holder's true contribution); Michael J. Meurer, *Controlling Opportunistic and Anti-Competitive Intellectual Property Litigation*, 44 B.C. L. REV. 509, 541–43 (2003) (arguing that opportunistic patent litigation by nonmanufacturing “trolls” is more common in some industries than others).

84. Calandrillo, *supra* note 79, at 327–28.

markets and might be necessary to ensure the provision of public goods. A so-called “public good” has two related characteristics: (1) nonrivalry, which means that consumption by one person does not leave less for any other consumer, and (2) nonexcludability, which is the high cost of excluding nonpaying beneficiaries who consume the good.⁸⁵ Nonexcludability means that the cost of barring others from the use of the good is so high that no private profit-maximizing firm will ultimately be willing to supply it.⁸⁶ As a result, the production of public goods may be insufficient due to the relative ease and low costs of use, as compared with production. Rational producers will not expend resources to produce public goods in a competitive market when they cannot make back the cost of their investment in production.⁸⁷ Economists refer to this as the “public goods problem” and suggest solving it by subsidizing the production of underproduced goods.⁸⁸ Inventions are considered public goods, and, therefore, monopoly protection for patent rights is meant to afford inventors the opportunity to recoup the fixed cost of invention, namely, the initial cost of inventing the goods.⁸⁹ In this way, our patent system ensures the constant “Progress of Science and useful Arts.”⁹⁰

Indeed, to justify the grant of patent rights, the monopoly costs entailed in the deadweight loss to society must be outweighed by the social benefit of increased innovation.⁹¹ However, with low-investment inventions, this balancing equation seems to collapse.⁹² When the process of inventing depends on relatively low monetary expenses, the inventor is likely to invent regardless of the pecuniary incentive embedded in the right to exclude rivals from entering the market for her invention.⁹³ With no substantial need to recoup her costs of

85. Parchomovsky & Wagner, *supra* note 73, at 13.

86. In regard to intellectual creations, Wendy Gordon identifies both an initial condition of market failure stemming from appropriability (and its consequent free-rider problem) and a subsequent condition due to the inabilities of users or other second comers to form markets once creators obtain incentives to overcome the free-rider problem. See Wendy J. Gordon, *Asymmetric Market Failure and Prisoner's Dilemma in Intellectual Property*, 17 U. DAYTON L. REV. 853, 854–59 (1992) (discussing conditions for market failure); Wendy J. Gordon, *On Owning Information: Intellectual Property and the Restitutionary Impulse*, 78 VA. L. REV. 149, 223–24, 230–38 (1992) (discussing asymmetrical market failure).

87. Olson, *supra* note 76, at 196.

88. See ROBERT COOTER & THOMAS ULEN, *LAW & ECONOMICS* 108 (Denise Clinton et al. eds., 5th ed. 2008).

89. See SUZANNE SCOTCHMER, *INNOVATION AND INCENTIVES* 36 (2004) (using intellectual property protection, which “is a solution to the problem of covering the development cost,” as a close analogy to the protection patent rights afford).

90. U.S. CONST. art. I, § 8, cl. 8.

91. See Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1824–25 (1984).

92. Perel, *Gatekeeping Function*, *supra* note 9, at 287–88.

93. See Alan Devlin & Neel Sukhatme, *Self-Realizing Inventions and the Utilitarian Foundation of Patent Law*, 51 WM. & MARY L. REV. 897, 898, 921, 951 (2009) (suggesting that there is no need for an incentive when no pecuniary resources were necessary for innovation).

invention, the inventor will invent so long as the prospective invention is anticipated to increase her personal utility.⁹⁴

Most importantly, the social costs of patents protecting low-investment inventions outweigh the benefits of such patents to society. If the cost of creating an invention is low, society achieves only a small gain from the fact that the patent system incentivizes an inventor to make this small investment. On the other hand, the patent system still forces society to pay a high monopolistic price for this small social benefit, assuming there is a demand for the product.⁹⁵ The social benefit does not outweigh a monopolistic price for low-cost inventions because society effectively overpays for something it could have obtained at a low price in a competitive market. So long as all patents receive identical statutory protection, they all generate profits for their owners. Society pays for these profits. Yet, the fact that society pays *equally* to promote *all* inventions, regardless of their respective investments, introduces inefficiency.

To illustrate this problem, consider the following stylized example. Assume a manufacturer requires the use of two separate patented inventions in order to manufacture its main product. The first invention, owned by Patentee *A*, required a significant investment of \$1,000,000. The second invention, owned by Patentee *B*, required an investment of only \$1000. Yet, if both inventions are necessary to the manufacturer, and assuming no substitutes for either are available, the manufacturer will have to buy both at a price that has nothing to do with the initial investment required for the creation of each invention. Both patentees have the power to bar the manufacturer from producing its main product and can thus demand high monopolistic prices for the use of their patents. For instance, both patentees can demand a payment of \$1,000,000 for the manufacturer's license to use their patents. This means the manufacturer's product will be much more expensive for consumers than it might have been if Patentee *B* was not awarded patent protection.

This illustration leads to the third problem raised by the current one-size-fits-all system. It distorts the incentive structure, frequently making development of low-investment inventions more profitable for inventors. In the example above, it is easy to see how the profits of Patentee *B*, who invested less, will be exponentially greater than those of Patentee *A*, who invested more in his invention. Both are offered the same power vis-à-vis the manufacturer, even though Patentee *A* bore a much greater investment.

94. See *id.* at 927–28.

95. See Bell & Parchomovsky, *supra* note 65, at 240. This is excluding “pirate” companies that simply elect to ignore patents and take their chances in court, hoping that they can avoid infringement or invalidate the patent. See *id.*; cf. Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19, 21–22.

If identical protection and potentially similar earning opportunities compensate for smaller and larger investments in research and development alike, rational inventors will likely minimize their investment costs and develop low-investment inventions.⁹⁶ This is especially true in light of currently thriving patent monetization opportunities. Owners of low-investment patents can always hold up inventors downstream to maximize profit or otherwise engage in profitable litigation practices.⁹⁷ At the same time, when enormous investments in research and development are required to develop a new invention, the current twenty-year protection period may not suffice to incentivize inventors.⁹⁸ This means that potential inventors will often refrain from inventing goods and services beneficial to society. This problem is especially pronounced in the context of the pharmaceutical industry, where firms are often unable to recoup their multibillion dollar research and development (“R&D”) investment under the standard twenty-year patent protection.⁹⁹

Moreover, since the current one-size-fits-all system of patent protection does not afford extra points or favorable protection for extensive investments in invention, inventors are effectively encouraged to minimize their overall research expenses as much as possible, consequently yielding low-quality inventions.¹⁰⁰ This, in turn, obviously reduces social welfare, as society is deprived of the benefit of high-value inventions. However, were patentees awarded protection that coincides with their investment, as we propose here, inventors would have a greater incentive to engage in complex, expensive, and, most importantly, valuable inventive activities.

The fourth problem arising from the current one-size-fits-all approach relates to its vulnerability to abuse by manipulative players in the patent ecosystem. Allowing patent owners to obtain licensing revenues highly

96. See Bell & Parchomovsky, *supra* note 65, at 239–40.

97. See Lemley & Shapiro, *supra* note 83, at 1992–93.

98. See Arti K. Rai, *The Information Revolution Reaches Pharmaceuticals: Balancing Innovation Incentives, Cost, and Access in the Post-Genomics Era*, 2001 U. ILL. L. REV. 173, 181–82 (discussing the expensive and lengthy process of drug development that would not be worthwhile for investors without a protection period).

99. See BURK & LEMLEY, *supra* note 5, at 3–4, 136–37, 204 n.1.

100. Arguably, the abandonment of constructive reduction to practice and the practice of early filing necessary for entrepreneurs seeking funding is also reducing *initial* research expenses. See, e.g., 2 JOHN W. SCHLICHER, *PATENT LAW, LEGAL AND ECONOMIC PRINCIPLES* § 13:31 (2d ed. 2015) (“[B]ecause writing patent applications is often less expensive and time-consuming than doing actual research, the law creates an incentive to file patent applications describing inventions before actual research involving them has been completed, and perhaps even begun. This constructive reduction to practice concept creates incentives to seek patents on purely theoretical designs and even guesses, rather than empirically tested, proven designs.”). *But see* Janet Freilich, *Prophetic Patents*, 53 U.C. DAVIS L. REV. 663, 716–17 (2019) (explaining why inventors might be better off investing in research in order to create working examples of their invention rather than filing early with a prophetic example of the invention).

exceeding their investment could hamper the ability of downstream innovators to fully commercialize the benefit of their knowledge.¹⁰¹ Because all patentees enjoy a similar potential to extract unlimited earnings during the twenty years of patent duration, they are free to generate income far in excess of their investment through injunctive threats and holdups.¹⁰² For a defendant who has already invested heavily in developing and commercializing her product, which allegedly includes an infringing feature, agreeing to excessive royalties is probably the most economical way for the defendant to respond.¹⁰³ Otherwise, if the patent is found to be valid and infringed, the injunction will generally be effective immediately, forcing the defendant to instantly stop commercializing her product.¹⁰⁴ By generating income through aggressive licensing and litigation instead of commercialization, such patent trolling ultimately hinders subsequent innovation at a cost to social welfare.

Yet, if what patentees were to receive for the technology they create reasonably resembled their actual investment, improper injunctive threats and strategic holdups could be drastically reduced.¹⁰⁵ If, as we suggest here, patentees were limited to recouping what they had originally invested, plus a fixed percentage of profit, we could restrict their ability to demand excessive licensing fees and effectively control their bargaining power. Because the investment originally made in the patent would become both transparent (the patentee's declared costs would be made publicly available) and known at the time of issuance, prospective licensees could not be pressed to pay extremely unreasonable fees for the exploitation of protected inventions.¹⁰⁶

A fifth and closely related problem is the anticommons dynamic prevalent in the current system.¹⁰⁷ Anticommons refers to the issue of overfragmentation of property rights.¹⁰⁸ Thus, an anticommons problem is created when too many owners hold rights that allow them to exclude others from a given asset.¹⁰⁹ In

101. See Lemley & Shapiro, *supra* note 83, at 2009–10.

102. *Id.* at 2009.

103. *Id.* at 1992–93.

104. See Mark A. Lemley, *Ten Things To Do About Patent Holdup of Standards (And One Not To)*, 48 B.C. L. REV. 149, 153–54 (2007).

105. *Id.* at 154.

106. See *infra* Part II.

107. See BURK & LEMLEY, *supra* note 5, at 75–77 (describing the anticommons challenges of the patent system); Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 624 (1998) (defining an anticommons as a situation in which “multiple owners each have a right to exclude others from a scarce resource and no one has an effective privilege of use”).

108. See Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. 698, 698–99 (1998) (discussing the effect that anticommons property has on biomedical research); Rai, *supra* note 98, at 192–94 (discussing how pharmaceutical companies often struggle to develop new treatments due to an inability to reach agreements with patent holders).

109. BURK & LEMLEY, *supra* note 5, at 76 (“The anticommons is characterized by fragmented property rights that must be aggregated to make effective use of the property.”).

the patent context, this is often the case when several different patents cover different elements that must be integrated in order to create one product or if different patents cover different steps in a cumulative innovative process.¹¹⁰ These anticommons easily lead to bargaining breakdowns whenever the development of a product requires permission from the owners of two or more elements.¹¹¹ In a more specific example, anticommons theory is highly relevant to DNA sequence patents,¹¹² where patentees currently hold hundreds of patents on DNA sequences that cover specific genes or fragments of genes.¹¹³ Any particular use of these patents will likely require the accumulation of many patents by one owner leading to anticommons problems.¹¹⁴ In such cases, innovation can be impeded if permission from too many patentee right-holders is required in order to produce or develop a new product.¹¹⁵ This problem is exacerbated under the current one-size-fits-all patent system, as the proliferation of multiple low-investment and low-quality patents contributes to the creation of anticommons in the patent system. If patent quality is improved, and, as we suggest, protection is granted only to patentees that made high investments, many anticommons will subsequently disappear.

110. *Id.*

111. *Id.* (“Aggregating such fragmented property rights entails high search and negotiation costs to locate and bargain with the many rights owners whose permissions are necessary to complete broader development. This type of licensing environment may quickly become dominated by ‘holdouts’ that refuse to license their component unless paid to do so. Because a given project will fail without their cooperation, ‘holdouts’ may demand a bribe close to the value of the entire project.”); see Rochelle Cooper Dreyfuss, *Varying the Course in Patenting Genetic Material: A Counter-Proposal to Richard Epstein’s Steady Course*, in PERSPECTIVES ON PROPERTIES OF THE HUMAN GENOME PROJECT 195, 197–98 (F. Scott Kieff ed., 2003) (describing research “blockades”); Lloyd Cohen, *Holdouts and Free Riders*, 20 J. LEGAL STUD. 351, 356 (1991). See generally MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION* (1961) (articulating disincentives to collective action). Different anticommons theorists suggest that the solution to this problem is either to consolidate ownership in a single owner or to preclude patent protection altogether for certain types of inventions, particularly upstream patent research tools. See BURK & LEMLEY, *supra* note 5, at 77; Philippe Jacobs & Geertrui Van Overwalle, Opinion, *Gene Patents: A Different Approach*, 23 EUR. INTEL. PROP. REV. 505, 505 (2001); Arti K. Rai, *Fostering Cumulative Innovation in the Biopharmaceutical Industry: The Role of Patents and Antitrust*, 16 BERKELEY TECH. L.J. 813, 838 (2001); cf. Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293, 1295 (1996) (arguing for organized private transactional mechanisms).

112. See BURK & LEMLEY, *supra* note 5, at 86; cf. Dan L. Burk, *Introduction: A Biotechnology Primer*, 55 U. PITT. L. REV. 611, 621–28 (1994) (describing the wide variety of commercial biotechnological applications).

113. See, e.g., S.M. Thomas et al., Commentary, *Ownership of the Human Genome*, 380 NATURE 387, 387–88 (1996).

114. See Rebecca S. Eisenberg, *Reaching Through the Genome*, in PERSPECTIVES ON PROPERTIES OF THE HUMAN GENOME PROJECT, *supra* note 111, at 266.

115. See BURK & LEMLEY, *supra* note 5, at 86–89 (analyzing the anticommons theory in the context of biotechnology and DNA sequence patents).

The issue of patent thickets is closely related to the anticommons problem.¹¹⁶ Patent thickets can be thought of as an extreme version of the anticommons problem, when an accumulation of overlapping patents covers a single product in a way that can potentially choke an industry.¹¹⁷ Patent thickets are naturally and inevitably created in the current system when different inventors make small cumulative contributions to the same product.¹¹⁸ As time goes by, it becomes nearly impossible to pierce the patent thicket and secure patentee consent, which is necessary for continued innovation.¹¹⁹ Our proposal, limiting patent protection for patentees who have made small contributions to a product, offers a direct solution to this type of problem. Patent thickets are also created when patent offices err in the issuing process, unintentionally granting overlapping patents to several inventors.¹²⁰ In the current patent system, such mistakes are a byproduct of the low quality of patents and their great number, which overwhelm patent offices. Our proposal, aimed at improving patent quality, will therefore also help reduce this type of patent thicket.

II. THE PROPOSED MODEL

The following discussion introduces in detail our proposed recoupment-patent regime as an alternative to the current one-size-fits-all system. Our model aims to adhere closely to the economic rationale for intellectual property protection in general and patent protection specifically and offers remedies to many of the challenges discussed in classical patent theories.

A. *Theoretical Background: The Importance of Investment in Light of Patent Theory*

Traditionally, the theoretical justification for the patent regime centers on incentives for innovation.¹²¹ The current patent system incentivizes innovation by providing inventors with a twenty-year period of market exclusivity, thereby allowing them to benefit from their investment. This economic rationale for patent protection suggests that, in the absence of patent protection, inventors cannot prevent others from copying their inventions and that, as a result, others can exploit their work for free.¹²² If inventors cannot benefit fully from their

116. *See id.* at 77–78, 89–92.

117. *See* Shapiro, *supra* note 14, at 121.

118. *See* BURK & LEMLEY, *supra* note 5, at 90.

119. *Id.* at 78 (“Like the anticommons problem, the patent thicket has the potential to prevent all parties from making a final product that incorporates multiple inventions.”).

120. *Id.* (suggesting that “[b]ecause patent examiners spend very little time with each patent, patents regularly issue that would not withstand more searching scrutiny, and indeed nearly half of all litigated patents are held invalid”).

121. *Id.* at 66–68.

122. *See id.* (describing the widely agreed-upon utilitarian theory of patent law).

inventions, they will lack sufficient incentive to invest time, effort, and money in developing new tools and ideas.¹²³ Our proposal, focusing on the investment of patentees in developing their ideas and products, thus easily follows in light of the most basic premise of patent law theory.

Extrapolating from this basic premise, scholars have fine-tuned accounts of the intricate connection between patent protection, economic incentive, and innovation.¹²⁴ Kenneth Arrow famously argued for narrow patent protection in order to minimize interference with competition and innovation.¹²⁵ He emphasized that patents delay downstream innovation and thus should grant patentees as little protection as possible.¹²⁶ This position stems from Arrow's general view, endorsing competition as the best means to spur innovation.¹²⁷ The underlying assumption here is that companies in a competitive marketplace will innovate in order to avoid losing out to competitors while monopolists lack such incentive. Therefore, Arrow's argument proposes limited patent protection in order to minimize associated monopolies.¹²⁸ Our proposal complements Arrow's prescriptive argument, as it endorses narrow patents, thereby creating short-term instead of long-term monopolies when possible.

Other economists and legal scholars have offered similar theories focusing on cumulative innovation, where a new product is the result of multiple improvements to an initial invention.¹²⁹ Robert Merges and Richard Nelson have proposed a model that tries to allocate rights among initial inventors and those who develop subsequent improvements.¹³⁰ Their theory of tailored incentives recognizes the importance of intellectual property rights and the incentives such rights offer both initial inventors and subsequent contributors to the innovation.¹³¹ The tailored incentives approach attends more closely to the particular allocation of rights to both initial and supplementary inventors.¹³² It argues that granting patents to both will normally balance incentives correctly but that in some cases the balance should be struck based on the relative

123. Another utilitarian justification for granting patents is encouraging the disclosure of inventions that might otherwise be kept secret. *Id.* at 66.

124. *See id.* at 68–75 (outlining multiple theories of the patent system).

125. *See* Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY* 609, 617 (Nat'l Bureau of Econ. Research ed., 1962); *see also* F. M. SCHERER & DAVID ROSS, *INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE* 660 (3d ed. 1990); Mark L. Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 *UCLA L. REV.* 925, 960–61 (2001).

126. Arrow, *supra* note 125, at 619–20.

127. *Id.*

128. *See* Michele Boldrin & David K. Levine, *The Case Against Intellectual Property*, 92 *AM. ECON. REV. (PAPERS & PROC.)* 209, 209 (2002).

129. BURK & LEMLEY, *supra* note 5, at 73–75.

130. *See* Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 *COLUM. L. REV.* 839, 876–79 (1990).

131. *Id.*

132. *Id.*

importance of the initial invention and subsequent improvement.¹³³ Our proposal fits the dictates of their theory, as it allows different levels of protection for different patentees based on the levels of investment involved in their contributions to the invention as a whole. Thus, in light of the complexities introduced by theories of competitive innovation, cumulative innovation, anticommons, and patent thickets, basing patent protection on investment is worth exploring.

In his own theoretical writing, Ted Sichelman provides a detailed account of the different phases in the development of an invention.¹³⁴ He emphasizes that “[i]nnovation isn’t instant” and “involves numerous steps, many of which are fraught with uncertainty and great expense,”¹³⁵ then identifies several major phases in the innovative process.¹³⁶ The first phase is where the inventor identifies a problem that needs to be solved.¹³⁷ This process can be costly and labor intensive.¹³⁸ The second phase involves the moment of conception and development of a working prototype.¹³⁹ Conception is understood as the instance 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.”¹⁴⁰ Following conception, as long as the inventor files a patent application that offers a useful, novel, and nonobvious solution, the invention will qualify for patenting.¹⁴¹ “In reality, there is usually no single moment of conception but rather a series of steps that refine a potential solution.”¹⁴² Because patent law does not require a working prototype for a patent, a

133. See BURK & LEMLEY, *supra* note 5, at 75.

134. Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 347–54 (2010); see also 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.”).

135. Sichelman, *supra* note 134, at 347–48.

136. *Id.* at 347–54. Note that the innovation process varies across industries and firms within industries. For a more sophisticated account of the innovation process, see OFFICE OF TECH. ASSESSMENT, U.S. CONG., OTA-BP-ITC-165, INNOVATION AND COMMERCIALIZATION OF EMERGING TECHNOLOGIES 31–60 (1995), <https://ota.fas.org/reports/9539.pdf> [<https://perma.cc/2HLW-UN9D>].

137. Sichelman, *supra* note 134, at 348–49; see also Stephen J. Kline & Nathan Rosenberg, *An Overview of Innovation*, in THE POSITIVE SUM STRATEGY 275, 289–94, 289 fig.2, 290 fig.3 (Ralph Landau & Nathan Rosenberg eds., 1986) (suggesting that the first stage of innovation is identifying a need in a potential market).

138. Sichelman, *supra* note 134, at 348.

139. *Id.* at 349–50.

140. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986) (citations omitted) (internal quotation marks omitted); see *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227–28 (Fed. Cir. 1994) (“Conception is the touchstone of inventorship.”); Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 72 (2009) [hereinafter Cotropia, *Folly*] (“Conception, the first step of inventing, involves the mental formation of the complete invention.”).

141. 35 U.S.C. §§ 101–103 (2018).

142. Sichelman, *supra* note 134, at 350.

continuum contains the identification of the problem to the building of a working prototype upon which the single marker of conception can be placed.¹⁴³ Once this phase is complete, usually a patent application can be filed and granted.¹⁴⁴ The third phase, following the conception and prototype-development phase, is the stage of transforming a prototype into a commercial product.¹⁴⁵ In general, a company will undertake significant market testing to determine how to build a commercially successful product.¹⁴⁶ Often, the capital required for the market testing and product commercialization phase is substantial.¹⁴⁷ However, unlike the risks and costs associated with invention, “a patent does not directly protect the information generated during market testing and subsequent marketing,”¹⁴⁸ creating an ex ante disincentive to engage in these activities.¹⁴⁹

Subsequent phases relating to the development of inventions are distribution and product improvement.¹⁵⁰ Once a sale is made, the product is distributed to customers.¹⁵¹ Innovative and patented distribution methods can also introduce high costs to patentees who wish to commercialize their

143. NATHAN ROSENBERG, PERSPECTIVES ON TECHNOLOGY 192 (1976); Sichelman, *supra* note 134, at 350–51; .

144. Sichelman, *supra* note 134, at 350–51 (explaining that this is “because of the reward theory’s preference for early patenting and the weak disclosure standards applied by the Patent Office”); see Cotropia, *Folly*, *supra* note 140, at 73. *But see, e.g.*, Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991) (finding conception only upon the building of a working prototype).

145. Sichelman, *supra* note 134, at 351–52; *see also* VIJAY K. JOLLY, COMMERCIALIZING NEW TECHNOLOGIES 6 (1997); TOM KELLY & JONATHAN LITTMAN, THE ART OF INNOVATION 103–11 (2001) (describing the importance of prototyping to product development by highlighting stories from IDEO and Amazon).

146. *See* Sichelman, *supra* note 134, at 351–52; *see also* Robert G. Cooper & Elko J. Kleinschmidt, *An Investigation into the New Product Process: Steps, Deficiencies, and Impact*, 3 J. PRODUCT INNOVATION MGMT. 71, 75–76 & exhibit 2 (1986) (finding that in a study of over 200 new product launches, over 25% included a detailed marketing study and nearly 77% of the launches included a preliminary market assessment).

147. Sichelman, *supra* note 134, at 351; *see also* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 277 (1977) (“[M]arketing is a major cost in innovation.”).

148. Sichelman, *supra* note 134, at 351–52.

149. *Id.*; *see also* Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337, 339 (2008) (recognizing that a potential deficiency of patent law is its failure to protect “market experimentation” directly); Kitch, *supra* note 147, 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, 75–76, 81 (2006) (noting that “[i]n actuality, ‘business innovation’ is far broader in scope than product or technological innovation” and “takes considerable effort and time”).

150. Sichelman, *supra* note 134, at 352–54; *see also* Kline & Rosenberg, *supra* note 137, at 289 (describing the fifth stage in the innovation process as bringing new products and processes to market).

151. Distribution includes both physical shipping methods and digital routing methods. Sichelman, *supra* note 134, at 352 n.67.

inventions.¹⁵² Furthermore, soon after a product is launched, the company selling the product or some different entity may develop an improvement of the invention.¹⁵³ Under patent law, these improved products often fall under the scope of the patent covering the original product as well as qualifying for separate patent protection.¹⁵⁴ If a party independent of the original patentee creates the patentable improvement, the problem of “blocking patents” arises.¹⁵⁵ The second patent holder is blocked from making and selling the improved product by the first patent, and the first patent holder is blocked from doing the same by the second patent.¹⁵⁶ If the transaction costs of conducting the deal are lower than the benefit of the improvement, the two patent holders would presumably “come to an agreement and share the profits.”¹⁵⁷ However, “if transaction costs are high, the improvement may never be developed.”¹⁵⁸ This in turn may add additional costs to the development and commercialization of inventions.

Sichelman’s description of the different stages of innovation ties into our argument in two important ways. First, it highlights the fact that a single process or product may require multiple stages of development and therefore a multiplicity of patents. If patent protection should depend on the level of investment, this can help solve the problems of patent thickets and patent anticommons that often result from this multiplicity. Second, Sichelman’s description emphasizes the many types of costs that inventors face, thereby stressing the need to consider such investments seriously as part of the process of patent application and issuance. Our proposed model suggests that all the types of investment listed by Sichelman should be considered in determining appropriate patent duration.

Edmund Kitch offers an alternative theory to patent protection that focuses on the ex post benefits of patent protection.¹⁵⁹ In his view, absent patent protection, an invention has no owner, and thus no one has an incentive to

152. *Id.* at 353; *see also* Carl Shapiro, *Patent System Reform: Economic Analysis and Critique*, 19 BERKELEY TECH. L.J. 1017, 1034 (2004).

153. Sichelman, *supra* note 134, at 353; *see also* JOLLY, *supra* note 145, at 12.

154. Sichelman, *supra* note 134, at 353; *see also* Merges & Nelson, *supra* note 130, at 860–61.

155. Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 80 (1994); Merges & Nelson, *supra* note 130, at 860–62 (explaining the phenomenon of blocking patents).

156. Merges, *supra* note 155, at 80; Sichelman, *supra* note 134, at 353.

157. Sichelman, *supra* note 134, at 353; *see also* Ian Ayres & Gideon Parchomovsky, *Tradable Patent Rights*, 60 STAN. L. REV. 863, 871–72 (2007).

158. Sichelman, *supra* note 134, at 354; *see also* Ayres & Parchomovsky, *supra* note 157, at 872 (“On the margin, the higher fees may not leave enough profits to justify the investment in the innovation.”).

159. Kitch, *supra* note 147, at 265 (offering a new theory of the patent system that he believed would “reintegrate[] the patent institution with the general theory of property rights”).

invest in developing it further.¹⁶⁰ This is a classic “tragedy of the commons” or anticommons situation, as the common property or ownerless asset (in this case the invention) is not optimally managed.¹⁶¹ “Kitch’s prospect theory strongly emphasizes the role of a single patentee in coordinating the development, implementation, and improvement of an invention.”¹⁶² By granting ownership to the patentee, patents encourage downstream investment and innovation *after* a patent is granted. This account differs from traditional economic theory of patent law, as it suggests that patent monopoly is an advantage instead of a disadvantage, and focuses on encouraging investment *ex post*, after a patent was granted, rather than *ex ante*, before the patent is granted.¹⁶³ Our proposal offers benefits according to this theoretical perspective as well, despite the fact that Kitch’s theory is markedly different from other accounts described above and is therefore highly controversial. As we demonstrate below, our proposal includes mechanisms that allow consideration of investments occurring *after* the patent is granted and can thus also offer advantages under Kitch’s *ex post* theory of patent law while not providing the patentee prohibitively strong monopoly power.

B. *Investment-Based Patent*

The starting point for our analysis is the undisputedly low quality of patents in the existing system. Currently, estimates suggest that only around 10% of patents issued in the United States are of high economic value.¹⁶⁴ These estimates are based on renewal fee data.¹⁶⁵ Renewal at the twelve-year mark is another indicator of high-value patents.¹⁶⁶ In the United States, patents are eligible for renewal during years three, seven, and eleven from the date of issue.¹⁶⁷ Current data suggest that only about 40% of issued patents are renewed in the last period.¹⁶⁸ Many of those renewed patents are renewed for cross-licensing purposes.¹⁶⁹ Thus, low-value inventions account for the great majority of issued patents.¹⁷⁰

160. *Id.* at 276–77; see also Wendy J. Gordon, *Of Harms and Benefits: Torts, Restitution, and Intellectual Property*, 21 J. LEGAL STUD. 449, 473 (1992); Robert P. Merges, *Of Property Rules, Coase, and Intellectual Property*, 94 COLUM. L. REV. 2655, 2660–61 (1994).

161. BURK & LEMLEY, *supra* note 5, at 69–72.

162. *Id.* at 71.

163. *Id.* at 69.

164. See BESSEN & MEURER, *supra* note 4, at 100 (reviewing empirical data pertaining to U.S. patent value and showing that “the majority of patents are not worth more than a few thousand dollars”).

165. *Id.* at 99–100.

166. *Id.*

167. *Id.* at 99.

168. *Id.* at 100.

169. See *id.* at 115–17.

170. *Id.* at 100–01.

To solve these problems, we suggest that some deeper form of inquiry into patent quality is needed at the stage of patent application. Thus, under our proposed investment-based regime, patentees will continue filing for patents as they currently do. However, instead of receiving a fixed, twenty-year protection period, a patentee will be granted a protection period that will enable her to recoup her declared investment, as supported by evidence, plus an additional fixed percentage of profit. The applicant will be obliged to file investment recoupment reports upon renewals to ensure protection until she fully recoups her investment and additional fixed profits. For example, a pharmaceutical company will be able to file for its investment in developing a specific drug, recouping its high development costs, which can be as high as 2.4 billion dollars per drug, including failed attempts at development, which are currently not fully subsidized.¹⁷¹ This will make the existing regimes for the extension of pharmaceutical patents, which are clumsy and complex due to regulatory approval delays, redundant and unnecessary.¹⁷² Such a tailored regime will allow the company to recoup its investment while profiting, thus incentivizing companies to undertake the high costs involved in drug development. Conversely, a company engaged in developing computer software will be able to recoup its investment without receiving an excessive twenty-year term of protection unnecessary to recoup its presumably lower investment.¹⁷³

While the patent applicant will have to document the actual and anticipated investment both in advance and upon filing for the patent, her investment can be updated during the lifetime of the patent to reflect the patentee's actual investment. This feature of the model is critical because patent applications are usually filed at an early phase in the life of the invention¹⁷⁴ in order to preempt others under the first-to-file patent regime.

We propose that payment of filing and renewal fees be deferred to a point in time when the patentee actually makes an income, rather than being due immediately upon filing when the patentee does not necessarily have any income. Such an approach allows all patentees, especially entrepreneurial entities such as small startup companies with very little income, time to develop

171. It is estimated that the total time spent from the beginning of a research project to the marketing of a successful drug is twelve to fifteen years, 1.8 years of which is due to the FDA approval process. BURK & LEMLEY, *supra* note 5, at 204 n.1. Estimates of the average costs of drug development and testing range from \$150 million to over \$800 million. *Id.* For more recent drug development estimates, see Christopher P. Adams & Van V. Brantner, *Estimating the Cost of New Drug Development: Is It Really \$802 Million?*, 25 HEALTH AFF. 420–32 (2006). See also Emily Michiko Morris, *The Myth of Generic Pharmaceutical Competition Under the Hatch-Waxman Act*, 22 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 245, 258 (2012).

172. See BURK & LEMLEY, *supra* note 5, at 3–4, 136–37.

173. See *id.* at 84–85 (“The software industry also has relatively low fixed costs and a short time to market.”).

174. Cotropia, *Folly*, *supra* note 140, at 68–70.

income sources that will allow them to pay the relatively high fees in turn. However, some basic fees will be paid upon filing in order to sponsor the patent prosecution process within the United States Patent and Trademark Office (“USPTO”).¹⁷⁵

Our proposal is centered on the U.S. market. However, it may be applied internationally and is in line with current regional and international trends calling for regional and global patent protection.¹⁷⁶ For example, the European Patent Office (“EPO”) offers a regional scheme for patent protection for the Contracting States to the European Patent Convention.¹⁷⁷ The major advantage of this scheme is that the EPO provides a single patent grant procedure. Therefore, the patents granted are not European Union patents or even Europe-wide patents but a bundle of national patents that need to be separately enforced at the national level. If our model is applied internationally, it should be uniform and introduce a unitary reporting scheme for investment recoupment. Importantly, our proposal is aimed at offering tailored incentives. Therefore, if applied internationally, recoupment should be measured internationally. This means that if a patentee manages to recoup her investment, plus the designated level of profits in a certain country, she will not be able to apply for a patent elsewhere. If a patentee applies simultaneously for patent protection in many countries, she can recoup her investment from all of them; all patents will expire once she recoups her investment and profits. Such international investment recoupment has clear advantages over domestic recoupment. First, this means that in many cases it will not be worthwhile for patentees to file in multiple jurisdictions, thus saving significant administrative costs. Second, to maximize profits, most patentees will elect to recoup their investment in developed economies; this means that inventions will typically fall into the public domain much earlier in developing countries, thus resulting in distributional advantages and cheaper access to inventions.¹⁷⁸

175. *USPTO Fee Schedule*, U.S. PAT. & TRADEMARK OFF., (Jan. 1, 2020), <https://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule#Patent%20Fees> [<https://perma.cc/NVK6-TXZR>] (listing patent application filings fees).

176. See generally Amir H. Khoury, *The End of the National Patent Office*, 52 *IDEA* 197, 199–200 (2012) (introducing a global patent while suggesting abolishing national patent protection regimes); *The European Patent Convention*, EUR. PAT. OFF. (June 2016), <https://www.epo.org/law-practice/legal-texts/epc.html> [<https://perma.cc/2XV6-VBG9>] (describing the European Patent Office’s period of implementation including the goal of centralization).

177. See *European Patent Guide: How To Get a European Patent*, EUR. PAT. OFF., https://www.epo.org/applying/European/Guide-for-applicants/html/e/ga_c2_3.html [<https://perma.cc/77GH-2CR8>] (explaining how the European Patent Convention provides regional patent protection for all of Europe).

178. See Carlos M. Correa, *The Push for Stronger Enforcement Rules: Implications for Developing Countries*, in *ICTSD, ISSUE PAPER NO. 22, THE GLOBAL DEBATE ON THE ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS AND DEVELOPING COUNTRIES* 27, 31 (2009).

More generally, our proposal seeks to create a more balanced transaction between the inventor and the public.¹⁷⁹ The traditional one-size-fits-all deal is inherently unfair to both high-investment patentees and the public. High-investment patentees do not always get their fair share of the value of their inventions, and downstream inventors are often required to pay high prices for inventions even if they are of low quality and low investment. Our proposed regime introduces greater fairness regarding the patentee's reward and incentive structures.

Under such a regime, we believe patent quality will greatly improve. This change will resolve, or at least minimize, many of the existing challenges within the patent system. Patent quality will improve as fewer low-investment patents are filed. Additionally, the phenomenon of patent trolls might disappear or be minimized under such conditions because such patent holders will not be able to establish high investment for their inventions. Moreover, such a regime offers important information about the costs incurred in developing the invention. Such information affords important data for licensing and litigation purposes and can greatly prevent high licensing and litigation costs, therefore reducing information costs and transaction costs pertaining to patents filed under such a regime.

This approach also incentivizes patentees to commercialize inventions and bring them to market.¹⁸⁰ When a patentee knows that she can recoup her investment, she will have greater incentive to move forward with commercializing her invention. If we allow patentees to update their investment during the life of the patent application or the issued patent, we will see more commercialization compared to current commercialization rates, which are very low.¹⁸¹

C. *Risks and Safeguards*

The model we propose will be accompanied by various safeguards designed to prevent abuse, such as falsification or useless spending. Under this regime, companies would arguably be incentivized to report higher investment so that they can recoup higher returns. In order to address this concern, the following safety valves will be introduced: first, application and renewal fees will be keyed to the declared investment. Patentees will thus be required to pay

179. Patent protection is perceived as a second-best bargain between the public and the inventor, where the inventor provides the public with a disclosure of the invention in return for exclusivity for a limited time. BURK & LEMLEY, *supra* note 5, at 66 (discussing the secondary utilitarian justification for patent law, which is encouraging the disclosure of inventions that might otherwise be kept secret).

180. See generally Sichelman, *supra* note 134, at 341 (discussing the low rates of patent commercialization and proposing a new commercialization patent, granted in exchange for the commitment to make and sell a substantially novel product).

181. *Id.* at 343–47.

application and renewal fees that stand in relation to the level of protection they claim. To prevent abuse, fees will be calibrated to the level of investment. This flexible method for calculating filing and renewal fees will disincentivize flawed reporting. Furthermore, to the extent that several patent filings originate from the same research investment, the total investment will be divided in accordance with the number of filings, and each patentee will declare an equal portion of the total investment. Second, upon litigation and licensing of the patent, a patentee will bear the burden of proof to establish the level of investment, which will be the basis for calculating both damages and royalties.¹⁸² Such a burden will also contribute to the disincentivizing of flawed reporting. Additionally, beyond these two major safeguards, many existing schemes guarantee honest reporting of investment. For example, state and federal income tax filings,¹⁸³ SEC filings,¹⁸⁴ publicly traded companies' regulatory reporting schemes,¹⁸⁵ private companies' by-laws and reporting requirements,¹⁸⁶ etc., will impede false reporting. If a patentee knows that different reporting schemes will verify her statements, she will hesitate to abuse the system. This is especially valuable when looking at very high investment patents such as pharmaceutical patents. Most pharmaceutical companies and major technology companies are publicly traded¹⁸⁷ so false reporting is not a real concern, especially given these additional oversight tools.

The risk of false reporting may be aggravated in the case of global corporations because such corporations can attribute greater investment to a certain patent or attribute a certain investment to a few patent applications, especially if a recoupment model is adopted internationally. Similar reporting challenges came up in the context of the international taxation of global corporations with regard to transfer prices.¹⁸⁸ These challenges have been addressed by introducing a unified reporting scheme, which is workable and has

182. See Lisa Larrimore Ouellette, *Adjusting Patent Damages for Nonpatent Incentives*, 26 TEX. INTELL. PROP. L.J. 187, 187–88 (2017).

183. Tax filings require detailed reports pertaining to all aspects of a company's business operations. See generally Jeffrey A. Dubin & Louis L. Wilde, *An Empirical Analysis of Federal Income Tax Auditing and Compliance*, 41 NAT'L TAX J. 61 (1988) (discussing tax compliance issues and the effectiveness of tax filings, audits, and the IRS in ensuring accurate disclosure).

184. On the significance of SEC filings, see generally Earl K. Stice, *The Market Reaction to 10-K and 10-Q Filings and to Subsequent The Wall Street Journal Earnings Announcements*, 66 ACCT. REV. 42 (1991).

185. On the role of such requirements, see generally Ray Ball, *Infrastructure Requirements for an Economically Efficient System of Public Financial Reporting and Disclosure*, 2001 BROOKINGS-WHARTON PAPERS ON FIN. SERVS. 127, 127.

186. See *id.* (sketching the principal infrastructure requirements for an economically efficient system of public financial reports and disclosure).

187. See generally David J. Denis & Atulya Sarin, *Ownership and Board Structures in Publicly Traded Corporations*, 52 J. FIN. ECON. 187 (1999) (analyzing numerous different publicly traded corporations).

188. TSILLY DAGAN, INTERNATIONAL TAX POLICY 27–30 (2018).

proven to be successful.¹⁸⁹ If our recoupment regime is adopted internationally or by a large number of countries, a unified reporting scheme can be introduced and offer yet another safeguard against misstatements of investment.

Another question that must be addressed pertains to the precise definition of “investment.” The proposed regime must be based on a clear understanding of what constitutes investment and why we should employ it as a measure to fix the term for patent protection. For our purposes, investment includes any expense incurred in the process of research and development of the invention, which has been described in greater detail above.¹⁹⁰ Such expenses can differ greatly based on the type of the technology and can vary significantly among different patenting entities (corporations, individuals, etc.). Research and development costs, as well as any other costs involved in inventing, should be taken into account. Such costs may include employee salaries, equipment and materials, lab services, consulting services, administrative costs, regulatory costs, commercialization costs, and other costs incurred while developing an invention. Investment serves as a good basis for determining recoupment and a generally good way to protect inventors because it is probably the only measurable variable directly relating to the invention.¹⁹¹ Investment is also very responsive to the basic economic rationale for justifying patent protection. This suggests that if patentees are afforded the ability to recoup their investment, invention will take place with proper economic incentives.

Allowing recoupment of investment might incentivize inefficient investment in research and development because patentees know they can recoup their incurred investment regardless of their efficiency. Moreover, there may be some concern that a recoupment regime will incentivize patentees to slow down product sales in order to extend the duration of recoupment and, as a result, the duration of the patent monopoly. These two concerns are not significant because patentees have a natural incentive to recoup their investment and profit as quickly as possible, especially in light of possible market competition. Therefore, there is little risk that they will try to slow the recoupment process. Moreover, in most cases, patentees cannot really control the success of their products, their respective sales, and the pace of sales.¹⁹² Lastly, patentees will generally try to economize their costs and not overinvest in research and development, especially when they have limited knowledge

189. *See id.* at 156–58.

190. *See supra* Section II.A.

191. Mainly, investment is easier to measure relative to other factors, such as invention-value. *See* Janet Freilich, *The Uninformed Topography of Patent Scope*, 19 STAN. TECH. L. REV. 150, 162 (2015) (pointing out the difficulties in assessing the value of inventions *ex ante*).

192. There are some exceptional cases in which companies might be able to control the pace of sales. For example, brand-name pharmaceutical companies will often stop selling their drugs just before generic companies would be able to enter the market. Since generic drugs can only be prescribed if there is an approved brand-name drug, this ends up preventing generic entry.

regarding future income from the sales of their invention, or when they face pressure from competitors in the race to be the first to patent the invention.

Another possible concern is that introducing this new patent regime might incentivize inventors to rely on trade secrecy and avoid patent protection altogether. The proposed model might thereby undermine the goal of encouraging the disclosure of inventions that might otherwise be kept secret. These concerns are unrealistic, and it is unlikely that the proposed model will change existing incentives to rely on trade secrecy and patents because the decision on which protection scheme to utilize is complex and depends on many considerations.¹⁹³ When applicants can safely rely on trade secrecy, they will not file a patent application, regardless of the specifics of the patent regime in place.¹⁹⁴ Conversely, when applicants cannot maintain secrecy, they will have to apply for a patent.¹⁹⁵ The proposed model offers a more tailored and fair regime to all patentees and removes the distortion created by the one-size-fits-all regime. If an invention is the fruit of significant labor, the applicant will have incentives in place to apply for patent protection in order to recoup her investment. Additionally, very few scientists obtain technical knowledge from patents, and scientists at many companies are actually discouraged from reading patents.¹⁹⁶ Therefore, the informational value of patent documents is less significant than one might imagine it to be.

D. *Spark-of-Genius Inventions and Value-Based Patents*

A possible objection to our investment-based approach is that inventions might be the product of accidental innovation, spark of genius, or other actions that do not necessarily reflect high investment of resources. However, this objection is overstated. First, it is currently estimated that only a very small fraction of inventions, around 0.5%, represent spark-of-genius inventions that reflect both low investment and high value.¹⁹⁷ In some sectors, such as business methods or information technologies, this estimate is probably 1% of issued patents.¹⁹⁸ Second, even if an invention supposedly represents a spark of genius, it might still be priced highly when one estimates the actual dollar investment required to create it. For example, if a gifted employee comes up with an invention that is of great economic value by a spark of genius, we may assume that this employee's costs would reflect her innovative capabilities.

193. See David S. Levine & Ted Sichelman, *Why Do Startups Use Trade Secrets?*, 94 NOTRE DAME L. REV. 751, 754–70, 797–801 (2018) (discussing the multitude of considerations that drive startups to use trade secrecy).

194. *Id.* at 810.

195. *Id.* at 770–73.

196. BURK & LEMLEY, *supra* note 5, at 66.

197. *Id.*

198. *Id.*

Additionally, we can adopt a flexible measure to assess the investment in such rare cases by including employee education, training, and other contributions in the investment that can be recouped because capacity to innovate stems from a large set of factors. Third, even if spark-of-genius inventions do exist, it does not follow that they merit increased patent protection. In fact, if such inventions do not require investment, there is no need to incentivize them, so the principal rationale for patent protection is missing. Thus, the mere fact that an accidental invention contributed to society does not mean the inventor is entitled to this accidental benefit at the expense of all others.

Nevertheless, to reflect the contribution of these inventors to society, one might still wish to reward spark-of-genius inventors regardless of the need to incentivize investment. We show that this can be done, using some of the valuation methods described below, which are designed to estimate the value of an invention rather than the investment required to create it. Under such a regime, patentees might have a choice between an investment-based route, as described above, or a value-based route. Under the value-based route, the economic value of an invention (as opposed to its investment) will be assessed at the time of patent application, and the protection period will be determined according to this value. The patentee will have to pay a fixed fee for the valuation of her invention. This approach offers the inventor a fair reward for the economic value of her invention at the time of issuance. Similar to the model proposed above regarding an investment-based approach, such a scheme should also include built-in safety valves, such as filing and renewal fees, which are keyed to the economic value of the invention. Under such a two-tier system, which offers two routes for patent protection—investment-based and value-based patents—the incentive to file for a patent can be summarized as follows:

Invention Value	Inventor Investment	Patent Filing Route
High	High	Either investment-based or value-based filing, whichever is higher
High	Low	Value-based filing
Low	Low	Probably no filing
Low	High	Investment-based filing or no filing

This two-tier regime provides incentive to file for patent protection if the patent required high investment, is of high economic value, or both. However, while we show that such a regime is possible, we do not advocate its use. As we show below, the value of an invention (as opposed to the investment required

to create it) is costlier to measure.¹⁹⁹ Therefore, a value-based patent regime for tailoring patent protection will come at unnecessarily high administrative costs and is inadvisable. Additionally, the incentive structure created under such a regime is distorted in allowing the continued filing of low-investment patents. As we explain above, there is no need to use the patent system to incentivize inventions that required very low investment.

E. *Existing Patent Valuation Methods*

This section discusses the valuation component of our proposal and describes a list of methods currently used to quantify the worth of patents and inventions in monetary terms.²⁰⁰ These methods, which adopt a positive economic perspective,²⁰¹ are primarily used for licensing purposes.²⁰² Theoretically, any of the different economic measures listed below, which determine the worth of specific inventions, can be used to tailor the duration of patent protection. In this section, we review these possible economic measures, including rules of thumb, the market method, competitive advantage valuation, discounted cash flow method, option pricing, and investment in the invention. We argue that, while these methods are all possible, the measure of investment in developing the invention is the preferable route for keying patent duration. The reason for this is that investment is relatively easy to measure, compared to other financial metrics and is also the most important factor to consider in light of the goals of the patent system.

1. Rules of Thumb

“Rules of thumb” are often used to price patents for purposes of licensing, especially for royalty rate payments.²⁰³ In particular, when the parties are uncertain about whether the invention can be profitably exploited, it makes sense for them to “agree to enter into a profit-sharing license rather than fix a

199. See *infra* notes 241–48 and accompanying text.

200. Josh Lerner & Anne Layne-Farrar, *Valuing Patents for Licensing: A Practical Survey of the Literature 2–7* (Mar. 3, 2006) (unpublished manuscript) (on file with the North Carolina Law Review) (examining when industry assumptions drive firms to license and how patents are ultimately licensed while noting myriad ways of payment for value of patents).

201. Richard S. Toikka, *Patent Licensing Under Competitive and Non-Competitive Conditions*, 82 J. PAT. & TRADEMARK OFF. SOC’Y 279, 279–80 (2000) (describing the impact of competitive markets on licensee’s profits and overall patent value).

202. See Anna Boman & Jonas Larsson, *Patent Valuation in Theory and Practice*, EKONOMISKA INSTITUTIONEN 1, 42–45 (2003) (discussing crucial factors affecting current valuation methods and noting various factors that affect licensing value).

203. See Lerner & Layne-Farrar, *supra* note 200, at 7 (describing industry practices for pricing patents).

price for the patent and engage in a sales transaction.”²⁰⁴ Generally, patent holders receive 5% of sales revenues or 25% of operation profit margins.²⁰⁵ Another frequently used rule calls for a 25%/75% split of profits.²⁰⁶ These rules of thumb provide a one-size-fits-all approach that is simple and easy to apply.²⁰⁷ On the other hand, they ignore the specific characteristics of the patent being licensed.²⁰⁸ As such, this method of valuation applies a rule of profit sharing irrespective of the underlying patent’s quality or potential to promote follow-on innovation.²⁰⁹ As a result, such an approach cannot be the default valuation method for our tailored protection regime because it does not provide a specific price tag and fails to offer a valuation of the specific patent.

2. The Market Method

The valuation of an asset is commonly established via an estimate of its price or the amount paid for it in a market exchange.²¹⁰ The market method is a comparative pricing approach according to which “the best metric for determining the worth of a patent is the range of prices garnered in the sale of similar technologies.”²¹¹ Theoretically, this method may be more considerate of the potential economic benefit of the specific patent.²¹² However, the market method assumes a positive economic point of view²¹³ and does not always account for the patent’s quality compared to similar technologies.²¹⁴

204. See F. Russel Denton & Paul J. Heald, *Random Walks, Non-Cooperative Games, and the Complex Mathematics of Patent Pricing*, 55 RUTGERS L. REV. 1175, 1191 (2003) (noting techniques parties can use when there is uncertainty about an invention’s profitability).

205. Damien Geradin & Anne Layne-Farrar, *Patent Value Apportionment Rules for Complex, Multi-Patent Products*, 27 SANTA CLARA COMPUTER & HIGH TECH. L.J. 763, 778 (2011) (noting a common rule used for valuing licensed patents).

206. See LAUREN JOHNSTON STIROH & RICHARD T. RAPP, MODERN METHODS FOR THE VALUATION OF INTELLECTUAL PROPERTY 6–7 (1998), <https://www.nera.com/content/dam/nera/publications/archive1/3864.pdf> [<https://perma.cc/PMX7-U2CL>] (describing general formulas for profit splitting).

207. Lerner & Layne-Farrar, *supra* note 200, at 7 (describing a one-size-fits-all approach to patent valuation).

208. *Id.* (noting the drawbacks of using the rule of thumb for patent valuation).

209. Denton & Heald, *supra* note 204, at 1190 (discussing the drawback of valuation based on profit sharing regardless of patent quality).

210. Ted Hagelin, *Competitive Advantage Valuation of Intellectual Property Assets: A New Tool for IP Managers*, 44 IDEA 79, 80 (2003) (“The valuation of an asset is an estimation of its price. The price of an asset is the amount paid for an asset in a market exchange.”).

211. Lerner & Layne-Farrar, *supra* note 200, at 8.

212. Russell L. Parr & Gordon V. Smith, *Quantitative Methods of Valuing Intellectual Property*, in THE NEW ROLE OF INTELLECTUAL PROPERTY IN COMMERCIAL TRANSACTIONS 39, 55–58 (Melvin Simensky & Lanning G. Bryer eds., 1994) (analyzing the benefits of the use of the market method when valuing patents).

213. *Id.* at 58 (explaining the assumption that best efforts are used to expand application of intellectual property).

214. *Id.* (showing how uniqueness of certain patents makes using the market approach more difficult).

3. Competitive Advantage Valuation (“CAV”)

A patent provides an exclusive right of limited duration over a new, nonobvious invention, where the right to sue others for infringement is granted in return for publication of the invention.²¹⁵ Therefore, “the direct financial value of a patent or patent application per se, must be the value of the potential extra profits obtainable from fully exploiting the invention defined by the patent’s claims in the patent’s presence compared with those obtainable without patent protection.”²¹⁶ Accordingly, the major premise of the CAV method is that the value of an intellectual property asset should be derived entirely from the value of the product, process, or service that utilizes it.²¹⁷ The CAV method assumes that the value of such an asset can be best measured by the competitive advantage that it contributes to a product, process, or service.²¹⁸ This competitive advantage is defined as the advantages or disadvantages of an asset in comparison to an average substitute intellectual property asset.²¹⁹ While this model is based on a logical association of variables and utilizes simple input values,²²⁰ it necessarily requires a significant degree of speculation. The main variables in the CAV method are the net present value of the product, process, or service incorporating the intellectual property asset and the competitive advantage contribution of the asset to the net present value.²²¹

4. The Discounted Cash Flow Method

The discounted cash flow method relies on the same kinds of calculations that financiers employ in ascribing value to other kinds of investment opportunities.²²² In particular, this method determines that the price of a patent can be expressed as the present value of the future stream of economic benefits derived from ownership.²²³ Regardless of this method’s accuracy, it is a purely economic method of valuation that includes “projected sales of products based

215. Robert Pitkethly, *The Valuation of Patents: A Review of Patent Valuation Methods with Consideration of Option Based Methods and the Potential for Further Research* 2 (Judge Inst., Working Paper No. 21/97, 1997).

216. *Id.*

217. Hagelin, *supra* note 210, at 81 (describing the general principles of the competitive advantage valuation method).

218. *Id.* at 81–82 (identifying competitive advantage as the main contributing factor to the value of an intellectual property asset).

219. *Id.* at 82 (defining competitive advantage contribution as the difference between a given asset and an average replacement).

220. *See id.* at 112–13 (concluding that CAV can be used in multiple valuation contexts).

221. *Id.* at 82 (describing the key variables in the CAV method).

222. Lerner & Layne-Farrar, *supra* note 200, at 10 (describing the discounted cash flow method).

223. *Id.* (describing how a patent price is expressed under the discount cash flow method).

on the patent over its expected life or any increased share of sales as compared to competitors, net of any capital requirements of production.”²²⁴

5. The Option Pricing Method

Another type of valuation method described in the literature is based on option valuation formulas,²²⁵ which were primarily developed for use in pricing financial options.²²⁶ These methods were found also applicable to patents due to the many similarities between these two types of assets.²²⁷ Both patents and financial options establish a future right to exploit an asset and exclude others from it.²²⁸ The owner of a stock option has a right to obtain “an exclusive . . . equity interest in the underlying firm.”²²⁹ Similarly, the owner of a patent has “the right to exclude others from using the underlying invention, and further investment is required to exploit its commercial potential.”²³⁰ Additionally, financial options and patents are rights of limited duration: patents are limited by their expiration dates, and options are limited by their exercise dates.²³¹ Furthermore, both patents and financial options are directly linked to an underlying asset—an innovation or a firm, respectively—and both can be used to leverage or hedge against variance in prices.²³² Lastly, similar valuation challenges exist with regard to both assets in that both offer potential future earnings that cannot be priced accurately without making a complex series of economic predictions.²³³

In 1973, Myron Scholes and Fischer Black published their option valuation formula, which offered for the first time exact and prompt option pricing solutions.²³⁴ Options on an underlying asset can be valued, according to Scholes and Black, if information exists regarding different items: the current price of the asset, the exercise price of the option, the expiration date of the option, the standard deviation of the underlying asset returns, and the risk-free interest rate

224. *Id.* (describing the challenge of separating purely economic value from other factors affecting sales and profitability).

225. See generally Ariel Pakes, *Patents as Options: Some Estimates of the Value of Holding European Patent Stocks*, 54 *ECONOMETRICA* 755, 755 (1986) (developing a model that allows recovering the distribution returns from holding patents at each age over the lifespan of patents from information on patent renewals to enable value calculations).

226. See Pitkethly, *supra* note 215, at 10 (indicating the primary function of option pricing).

227. See Denton & Heald, *supra* note 204, at 1185 (referring to the usefulness of the market valuation method for patent valuation).

228. *Id.* at 1194 (stating that stock options and patents represent future rights to exploit and exclude).

229. *Id.*

230. *Id.*

231. *Id.*

232. *Id.* (comparing stock options to patents in relation to the underlying assets).

233. *Id.* (providing examples for valuation difficulty for patents and options).

234. Fischer Black & Myron Scholes, *The Pricing of Options and Corporate Liabilities*, 81 *J. POL. ECON.* 637, 640–53 (1973) (introducing a formula for pricing an option).

and distribution function for the asset price.²³⁵ Option pricing methods “account for total risk, including the impact of uncertainty on the value of the patent,” while providing “managers with more flexibility in evaluating the strategic possibilities entailed in licensing” a patent.²³⁶ Yet, scholars also highlight some of this method’s shortcomings.²³⁷

6. Patent Investment

Patent investment is currently measured under the cost method for patent valuation. The cost method approach for valuing patents simply calculates the cost of developing and patenting the invention in question.²³⁸ Currently, this method considers only historic costs of acquisition while ignoring future benefits that may accrue from the patent and influence its value.²³⁹ While it does consider one important indicator of patent quality—the cost of developing the underlying invention—it does so from a positive economic perspective.²⁴⁰ We argue that the cost method is the preferable approach for the investment-based route described in this Article. However, under our regime the patentee should be able to recoup more than historic costs of acquisition, and the cost method will be adjusted to include any expense incurred in creating the invention.

Measuring patent investment using the cost method is preferable to other methods described above that attempt to capture the benefit produced from the invention, rather than its cost. In particular, while the cost method utilizes information regarding out-of-pocket expenses (in all stages of the work on the invention), the methods described above, focusing on the benefit of the patent (rather than its cost), necessitate some speculation regarding future earnings or comparative advantage of the invention resulting from its use. Thus, true estimation of the value of any asset, as opposed to the investment required to create it, is of necessity an uncertain prediction.²⁴¹ This is especially true

235. See Pitkethly, *supra* note 215, at 12 (highlighting the advantages of the Black and Scholes approach).

236. Lerner & Layne-Farrar, *supra* note 200, at 12.

237. *Id.* at 11–12 (suggesting that one of the shortcomings of the option-pricing method is lack of appropriate inputs). For example, it can be argued that option-pricing methods do not account for the normative question of how to value the patent based on its quality. See *id.*

238. *Id.* at 8 (discussing the method of valuing patents based on the cost method).

239. Pitkethly, *supra* note 215, at 6 (explaining the drawbacks of the cost method of patent valuation).

240. It should be noted that patent valuation can be manipulated in different ways, affecting overall patent quality. Denton & Heald, *supra* note 204, at 1183 (recognizing the cost method’s limitations when valuing a patent).

241. Hagelin, *supra* note 210, at 80 (explaining the correlation between the estimated patent value and actual prices).

regarding the value of intellectual property assets.²⁴² Indeed, predicting the value of intellectual property assets is especially indeterminate for a few major reasons.²⁴³ First, established markets for the exchange of intellectual property assets do not yet exist.²⁴⁴ Second, intellectual property assets are rarely comparable.²⁴⁵ Third, the terms and conditions of intellectual property exchanges vary widely, and the details of such exchanges, especially prices, are rarely available to the public.²⁴⁶ Fourth, there exists a “multiplicity of factors that affect patents’ value over time.”²⁴⁷ Thus, establishing an accurate model of patent valuation is rather elusive.²⁴⁸ Therefore, while possible to use, valuation methods not based on investment are significantly costlier and introduce additional uncertainty. While such methods can be used to assess the value of the patent upon approval and issuance, we believe their use will overburden applicants and officials alike. The cost method described here, or some variation of it, is therefore the best approach for keying patent duration in terms of administrative costs and realization of the goals of the patent system.

F. *Regulating the Process of Patent Valuation*

Under our proposed model, when a patent is approved, it will undergo a valuation process to determine its level of investment. Such determinations will provide a tool to assess patent duration. Rather than fixing a one-size-fits-all term of twenty years from filing, under this regime the duration of the patent will be determined based on the period of time needed to recoup patentee investment, plus a predetermined percentage of profit. The patentee and the valuation agency will assess how much time is needed given the declared investment. It is important to note that providing an estimate regarding the duration of each patent upfront is needed so that the innovative community has a clear sense regarding the expiration dates of such patents as well as when they will enter the public domain, which is the engine for future innovation.²⁴⁹ Our proposal suggests nominating a regulating body that would tag each issued patent with an appropriate protection period according to the level of investment. Appointing such a regulator would ensure objectivity,

242. *Id.* (discussing why intellectual property asset valuation is more uncertain than real or personal property valuation).

243. *Id.*

244. *Id.* (acknowledging that intellectual property markets have not been established yet).

245. *Id.* at 80–81 (explaining why intellectual property assets are difficult to compare).

246. *Id.*

247. Denton & Heald, *supra* note 204, at 1175 (acknowledging the difficulty of establishing the value of a patent).

248. *Id.*

249. See generally James Boyle, *The Second Enclosure Movement and the Construction of the Public Domain*, 66 LAW & CONTEMP. PROBS. 33 (2003) (discussing the centrality of the public domain for the production of culture and knowledge and the effects of copyright and patent policy on the public domain).

predictability, stability, and proficiency in applying the proposed scheme.²⁵⁰ It would also protect against price manipulations by those possessing strong bargaining power because it provides full disclosure of information pertaining to the cost of developing the underlying invention.

The most suitable body to implement the proposed model is the USPTO. Under the proposed model, valuation is conducted upon approval and prior to issuance. As the entire process of patent examination is performed at the USPTO, it makes sense to nominate the USPTO as the body in charge of performing the valuation.²⁵¹ Additionally, because the USPTO is the governmental body responsible for examining patent applications according to the statutory requirements for patentability, it is optimally situated to execute the task of investment assessment, using eligible valuation agencies. Such assessment would be managed through a new special division of the USPTO.

Several existing valuation agencies can perform the process of patent valuation required in the proposed model.²⁵² The USPTO may elect a few agencies that will conduct valuations under its auspices. Applicants will have to elect a qualified agency working with the USPTO to conduct the valuation and will bear the costs of valuation. The patentee will provide the agency with information required for valuation, as well as providing her own valuation if interested. The process of assessing the investment of the patent will essentially resemble the process of determining patentability: the patent applicant will be required to submit, in addition to her application and required fees, all relevant evidence that may assist the agency in determining patent investment. After the valuation is completed, the patent will be issued, and its duration will be determined based on the estimated time needed for recouping the investment. The patent owner will then have thirty days to contest this valuation and submit her opposition, paying an additional fee processing this challenge. Within this period of time, the patent will remain valid. A board of appeals that consists of valuation agency members will review the opposition and issue a final patent valuation. This board's determination will be final. It should be noted that the determination of investment is subject to updating, as detailed above, because most patents are filed early in the life of an invention before significant investment is incurred.²⁵³

250. See Michael S. Kramer, *Valuation and Assessment of Patents and Patent Portfolios Through Analytical Techniques*, 6 J. MARSHALL REV. INTELL. PROP. L. 463, 469–70 (2007) (noting that a consistent regulatory system will provide for stability).

251. See Beth Simone Noveck, "Peer to Patent": *Collective Intelligence, Open Review, and Patent Reform*, 20 HARV. J.L. & TECH. 123, 134–35 (2006) (describing the resources available to the USPTO).

252. See, e.g., *Forbes Top 25 Intellectual Property Valuation Firms*, CONSOR.COM (Aug. 7, 2017), <http://consor.com/forbes-top-25-intellectual-property-valuation-service-firms/> [https://perma.cc/R85P-YEN2].

253. Cotropia, *Folly*, *supra* note 140, at 68–70, 72–81.

Establishing the recommended special division may impose additional administrative costs on the patent system generally and on patent applicants specifically.²⁵⁴ Indeed, pursuant to the above proposal, additional costs will be introduced into the patent prosecution process. These additional administrative costs would be financed either by patent applicants through elevated patent application fees or by the general public through taxation.²⁵⁵ Note, however, that in the long term these heightened administrative costs will ultimately be mitigated due to the prospective decrease in low-quality patent applications.²⁵⁶ Indeed, since the proposed model aims to create a direct linkage between patent protection and patent investment, it would decrease the incentive to file low-investment patent applications, while increasing the incentive to file high-investment ones.²⁵⁷ Assuming it is generally costlier and harder to develop high-quality inventions than low-quality ones, the number of patent applications should eventually decrease.²⁵⁸ Such a prospective decrease in the number of overall patent applications should, in turn, reduce the volume of human capital necessary to administer the examination process.²⁵⁹ Conceivably then, the initial increase in administrative costs should only be temporary²⁶⁰ and tolerable, especially if a substantial improvement in patent quality follows.²⁶¹ In any event, the fact that prosecution costs may increase should not deter the filings of patents—not even filings by independent inventors and small businesses—as payment could be postponed until the patentee begins to profit from her invention.

254. U.S. PATENT & TRADEMARK OFFICE, 2007 ANNUAL REPORT OF THE PATENT PUBLIC ADVISORY COMMITTEE 16 (Nov. 30, 2007), https://www.uspto.gov/sites/default/files/web/offices/com/advisory/reports/ppac_2007annualrpt.pdf [<https://perma.cc/L6JS-EPH2>].

255. It is important to note that since 1990 the USPTO has been fully fee-funded as a result of the Omnibus Budget Reconciliation Act of 1990. Pub. L. No. 101-508, § 10101, 104 Stat. 1388, 1389–91. This means fees collected from patentees currently cover the full operational needs of the USPTO. GLENN J. MCLOUGHLIN, CONG. RESEARCH SERV., RS20906, U.S. PATENT AND TRADEMARK OFFICE APPROPRIATIONS PROCESS: A BRIEF EXPLANATION 1 (2014), <https://fas.org/sgp/crs/misc/RS20906.pdf> [<https://perma.cc/UD65-5LB9>].

256. See U.S. PATENT & TRADEMARK OFFICE, REGULATORY IMPACT ANALYSIS: SETTING AND ADJUSTING PATENT FEES IN ACCORDANCE WITH SECTION 10 OF THE LEAHY-SMITH AMERICA INVENTS ACT 95 (Jan. 18, 2013) (suggesting that an increase in patent application fees could reduce the number of patent applications).

257. See *id.* (analyzing the benefits of increased patent application fees).

258. *Id.*

259. See *id.* at 15 (concluding that an increase in the number of patent applications that are filed will necessarily bring about higher USPTO expenses on salaries and human capital).

260. See *id.* at 5 (suggesting a “three-month patent operating reserve” to support sustainable funding).

261. See *id.* at 95 (acknowledging that potential costs to society will bring about reduced innovation and inefficient research and development).

III. BENEFITS AND CHALLENGES OF THE MODEL

This part discusses the benefits of the proposed model and offers responses for some possible counterarguments. Overall, even though the proposed regime introduces some costs, these costs are worthwhile considering the current crisis in the patent system and the urgent need to improve its function.

A. *Benefits*

Our proposed recoupment patent system promotes a few objectives: improving patent quality, enhancing patent commercialization, preventing abusive acts of price manipulation, mitigating the problem of deadweight loss, attenuating the effects of anticommons and patent thickets phenomena, reducing litigation costs, and bringing the system closer to a system of prizes and rewards. These objectives are discussed in greater detail below. First, our proposal will improve overall patent quality. Bolstering the correlation between patent investment and patent protection through the proposed system would incentivize high-quality innovation while suppressing exclusivity over low-quality innovation. Moreover, the proposed system introduces an additional screening mechanism for inventions above and beyond their current examination for patentability. Such a system may disincentivize or minimize the effects of defensive and cross-licensing patenting, incentivizing in their place the filing of patents that allow immediate recoupment, usually inventions that are commercialized.

Second, the proposed system will enhance patent commercialization, breaking the business model of NPEs and patent trolls. Specifically, under the proposed model, holding noncommercialized patents for licensing and litigation purposes will become unprofitable and actually impossible from the moment the patentee recoups her investment. Recall that the level of investment is adjustable during the lifetime of the patent, and this should encourage investment in commercialization, which exceeds patent protection, over licensing and litigation, which add nothing to the investment, and therefore effectively shortens patent protection. Since the proposed system matches patent holders' ability to extract licensing fees and earn litigation fees with the level of investment in the patent, keeping patents noncommercialized will keep their overall investment level—and consequently the potential fees they could generate—low.²⁶²

Third, a recoupment patent scheme will prevent abusive acts of price manipulation. By creating limitations on the recoupment to which a patentee is eligible, the proposed method can stop patent owners from obtaining more licensing revenue than the investment in the process of invention justifies.

262. See *supra* Part I.

Once information regarding patent investment is publicly disclosed, it will affect licensors' ability to extract excessive royalties.

Fourth, and closely related, the proposed regime will mitigate the problem of deadweight loss associated with patent monopolies. Since low-investment patents will only entitle patentees to short-duration protection, patentees will only be able to sell such patents for a low price, thereby limiting the costs society has to pay for these inventions.

Fifth, such a regime will attenuate the effects of both the anticommons phenomenon and patent thickets. Unlike the one-size-fits-all regime, under a recoupment patent regime, the ability of patentees to extract excessive royalties and hold out will be significantly reduced, and, as a result, the effects of anticommons tragedies or patent thickets will be very limited. To illustrate this, consider again the situation in which several patentees hold patent rights on different components that are necessary inputs for the production of a single product. Under a recoupment regime, these patentees will have limited power to hold out and extort rents from the producer, as they typically will not be entitled to a twenty-year period of protection for a patent that only reflects a small investment.

Sixth, this proposal will reduce litigation and related costs because it limits patent damages, linking them to the investment in the development of the invention. This in turn will bring about greater certainty and clarity regarding patent validity and, as a result, will reduce both the rates and costs of litigation.

Finally, the proposed model brings the patent system closer to a system of prizes and rewards. By tailoring protection according to the investment in the development of the invention, we essentially assign greater value to high-investment inventions and lesser value to low-investment inventions, thus operating in a way that resembles the way prizes and rewards would operate. While this does not provide the full advantages of prizes and rewards, such as the lack of the invention's exclusivity, our system nevertheless offers benefits that do not exist under regimes of prizes and rewards, such as avoiding the financial burden on the state that prizes and rewards would entail and affording a more egalitarian system for rewarding innovation.

B. *Challenges*

Many potential challenges to the proposed model must be addressed. First, unlike the relatively low administrative costs of the one-size-fits-all model,²⁶³ our tailored model may entail higher administrative costs of two types: high costs for licensing negotiations and costs stemming from patentee

263. Bell & Parchomovsky, *supra* note 65, at 247.

attempts to manipulate the system.²⁶⁴ As Louis Kaplow suggested, rewarding a more valuable invention with stronger protection can entail high administrative costs.²⁶⁵ Specifically, some scholars contend that the more uniform the scope of the patent protection, the less costly the process of negotiating, drafting, and policing licensing agreements.²⁶⁶ Conversely, when patent rights are specific to the invention, the negotiating parties must be more precise in defining the scope of the license. Additionally, a single standard of patent protection also spares the litigation costs of third parties who seek to challenge the boundaries of protection.²⁶⁷ As Bell and Parchomovsky put it, variations in patent protection mean that “[c]ourts will have to expend efforts after the fact to determine the boundaries of the different rights, and legislators will have to do the same *ex ante*. Together, these efforts can impose substantial costs on society.”²⁶⁸ Additionally, the investment recoupment regime may introduce costs pertaining to manipulation of the system, such as attempts by patentees to game the system with their investment, reporting higher investment costs for their inventions. The problem can be even more significant in large and global corporations, which can distribute costs between different jurisdictions.

Nevertheless, in the long term, any increase in the costs of administering our proposed invention-tailored protection should be mitigated by an overall decrease both in the filing of extremely low-value patents and in the assertion of such patents against competitors.²⁶⁹ As we have shown above, the one-size-fits-all system entails many challenges and costs, and it is generally agreed that the current system is inherently unfair. The current system is considered unfair in that it distorts incentives for innovation and, in the end, does not appropriately reward high-value and high-investment innovation. Many of the problems created by the existing system cannot be priced economically, but their negative impact on innovation is immense.²⁷⁰ Moreover, many of the concerns raised may be addressed by the safeguards we have introduced, such as filing and renewal fees, reporting duties, etc. Additionally, manipulation by global corporations may be avoided by introducing uniform international reporting standards and information sharing between national patent offices, which have been effective in other contexts, such as international taxation of global corporations. Accordingly, while a tailored system is arguably more time

264. See Duffy, *supra* note 49, at 507–09 (arguing against any arrangement that allows patentees to renegotiate patent protection).

265. Kaplow, *supra* note 91, at 1828 (discussing the social costs of rewarding more valuable inventions stronger protection).

266. Michael W. Carroll, *One Size Does Not Fit All: A Framework for Tailoring Intellectual Property Rights*, 70 OHIO ST. L.J. 1361, 1399 (2009).

267. *Id.* at 1425.

268. Bell & Parchomovsky, *supra* note 65, at 248.

269. *Infra* Part IV.

270. See BESSEN & MEURER, *supra* note 4, at 91–93.

consuming and introduces higher costs of examination and evaluation, we believe these costs are not excessive given the advantages and the cost-savings the system introduces.

Second, and more specifically, our proposed system may introduce high costs for inventors in documenting investments and valuation, as well as higher filing and renewal fees. This new system may raise litigation and licensing costs if inventors have to establish their investment as a precondition to licensing or for establishing damages during litigation. An investment-based regime may plausibly require separate documentation for each and every invention, requiring the inventor to separate the costs introduced by each project and attributing costs to each project when there are costs that pertain to multiple projects. Inventors, however, especially corporate inventors, who file for and are issued the majority of patents,²⁷¹ usually document their activities anyway, regardless of the patent regime in place. Such documentation is usually done to establish priority and credit for the invention. Therefore, it seems unlikely that the proposed regime will introduce prohibitively high costs.

Third, another popular argument in support of a one-size-fits-all approach is that it reduces information costs.²⁷² “The more variance there is, the greater the informational burden with which the public must contend.”²⁷³ Since patent rights apply against everyone, allowing private players to determine the scope of their rights independently allegedly raises information costs for third parties. Nonetheless, as we demonstrate, there are ways to overcome information deficiencies in investment-tailored regimes of patent protection, especially by subjecting patentees to transparent declaration requirements, under which they must provide periodic statements of their earnings, and also by imposing on patentees the burden of proving their statements of incurred costs during licensing and litigation.²⁷⁴

Fourth, it may be argued that the USPTO is not the right agency to administer and enforce the proposed patent system effectively. The USPTO is arguably not equipped to estimate patent value; the examiners are overworked and spend very little time evaluating applications.²⁷⁵ They also lack policy experience and, as a result, would face the kind of public choice problems with which Congress might be better positioned to grapple.²⁷⁶ Therefore, it might be argued that it is unlikely that the USPTO can master such a recoupment regime.

271. Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools* 11 (Nat'l Bureau of Econ. Research, Working Paper No. 8498, 2001) (showing that corporate inventors file the majority of patents).

272. See Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The Numerus Clausus Principle*, 110 YALE L.J. 1, 2 (2000).

273. Bell & Parchomovsky, *supra* note 65, at 249.

274. *Infra* Part IV.

275. BURK & LEMLEY, *supra* note 5, at 23–24.

276. *Id.* at 24–25.

While such arguments are convincing with regards to the system described by scholars such as Lemley and Burk,²⁷⁷ they are less convincing regarding our proposed model. Our model relies more on applicant filings and reporting as well as external agencies' objective valuations and less on the USPTO's actual involvement or public choice assessment.

IV. THE RECOUPMENT MODEL AND ALTERNATIVE REFORM PROPOSALS

Several scholars have recently highlighted the crisis in the patent system and advanced their own proposals for reform.²⁷⁸ Such writers contend that according all inventions the same monopolistic protection irrespective of their inherent differences results in society paying too high a price for innovation and more monopoly losses than are strictly necessary to incentivize innovation.²⁷⁹ While we support this contention, we believe our proposal does a better job at addressing the inefficient asymmetry between the nature of a given invention and the type of protection it receives.

Bell and Parchomovsky introduced a prominent criticism of the efficacy of the current, one-size-fits-all patent system. They proposed replacing the current general regime of patent protection with one that allows patentees to choose the level of protection from a menu of options, with varying degrees of protection terms, scopes, and remedies.²⁸⁰ Accordingly, patentees whose inventions portend a rather short commercial life would be able to purchase a shorter term of protection and perhaps waive their right to injunctive relief, while paying a relatively low price for their patents.²⁸¹ Such a "[v]oluntary relinquishment of protection, either in terms of time or scope, would result in social net gain by reducing the deadweight loss associated with patent protection."²⁸² Importantly, the scheme proposed by Bell and Parchomovsky differentiates legal protection entirely based on the choice of the patentee. Unlike our proposal, Bell and Parchomovsky's offers no connection between the duration of protection and the objective investment or value of the patent.

Unsurprisingly, it is this absolute freedom to choose the desired length and scope of protection, which Bell and Parchomovsky afford patentees and view as one of the major advantages of their proposal, that actually constitutes the model's main drawback. Without any objective guidelines or external review, a nonregulated, self-tailored regime of patent protection can easily miss its goals. First, patentees may choose to pay less for a shorter term of protection and perhaps even give up their right to injunctive relief but demand royalties

277. *Infra* Part IV.

278. *See, e.g.*, BESSEN & MEURER, *supra* note 4, at 2–4; BURK & LEMLEY, *supra* note 5, at 1, 4–6.

279. *See, e.g.*, Bell & Parchomovsky, *supra* note 65, at 234.

280. *Id.*

281. *Id.*

282. *Id.* at 235.

far in excess of what they would have demanded were they automatically granted the original patent duration of twenty years. This might be done in order to maximize patentee profits during this shortened period of patent protection. In such instances, Bell and Parchomovsky's model would effectively increase rather than reduce the deadweight loss that patent protection inflicts on society.

Second, and much more important, for powerful patent holders and especially patent trolls, the need to pay more for broader protection may not be sufficiently threatening. With enormous potential gains from patent monetization, patentees may uniformly find it worthwhile to elect the highest rate possible in order to receive the maximum patent protection available. Patent trolls will thereby purchase high patent protection and then use it to litigate aggressively, as they do now. In fact, because Bell and Parchomovsky's model is expected to cost them more for the same scope and length of protection that they would have received under today's one-size-fits-all system, it is reasonable to assume that strategic players will pass this increase in expenses on to users by raising their rent-seeking monetary demands. To compensate for the increased price of patent protection, patentees would increase their demands for royalties during licensing negotiations and intensify their litigation threats. In contrast to Bell and Parchomovsky's objective, this sort of strategic behavior would raise the price of patents and their respective litigation costs, while diminishing instead of enhancing social welfare. This objection seems to us sufficient to reject Bell and Parchomovsky's proposal.

Third, Bell and Parchomovsky's self-tailored regime may favor experienced, powerful patentees over small, independent inventors. The relatively high price of broader patent protection may discourage small and independent inventors from engaging in research and development in the first place. For such inventors, agreeing to a reduced patent duration or a narrower scope of protection could frustrate their ability to recoup their initial investment costs. These inventors would be consequently discouraged from engaging in any inventive activity in the first place. Hence, it may turn out that a self-tailored regime, under which patentees are free to pay for extended patent protection without any external oversight, would effectively impair the position of small inventors without having any meaningful effect on big corporations, which have the financial ability to pay whatever it takes to perfect their protection.

Our proposed model succeeds where Bell and Parchomovsky's model collapses. Specifically, our investment-tailored system not only differentiates between different types of inventions, correlating between patent investment and patent duration, but also promotes external screening. It introduces a crucial component of *objectivity* that is currently missing from alternative proposals for invention-tailored protection. This element of objectivity means that patent trolls will not have the option, available to them under Bell and

Parchomovsky's regime, to pay high fees for strong patent protection over low-quality inventions. Under our model, patent investment will be determined objectively, based on formal estimates of external professionals that are accepted by the USPTO. Additionally, the model will apply several safeguards to ensure patentees do not overstate their costs. First, the proposed model will make filing and renewal fees dependent on declared patentee investment. The higher the costs of investment associated with a specific invention, the higher the attached filing and renewal fees. Second, during licensing and litigation, patentees will bear the burden of proof that they actually accrued their declared costs. These two mechanisms will discourage patentees from providing excessive declarations of invention costs.

Our proposed combination of external patent valuations with internal safeguards ensures that the investment model will not favor larger, more experienced corporations over small, independent inventors. Even though the latter might have limited resources for investment in innovation, they can search for external investors who can support their project all the way through the filing of a patent. Moreover, our model will be able to reduce deadweight loss from patent protection effectively, as our model is anticipated to not only shorten the duration of invaluable patents but, even more importantly, limit their prospective profits. Patentees who file valueless inventions will not be able to earn more than what external valuation models will allow them to earn. At the same time, inventors who invested very little resources in developing their claimed inventions will also be restricted from inflicting excessive monopoly prices on users. Such meaningful limitations over the future financial gains of worthless patents will result in a direct increase in social welfare: it will spare the excessive costs of low-value patents that cannot be justified by the underlying invention's technological contribution.

Dan Burk and Mark Lemley present a different proposal for a technology-specific system of patent protection,²⁸³ as part of the growing literature advocating technology-specific patent law to generate patent reforms.²⁸⁴ Burk

283. See generally Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155 (2002) (describing recent trends of increasing divergence between the ways patent law rules are applied in different industries).

284. E.g., BURK & LEMLEY, *supra* note 5, at 97; Michael Abramowicz, *Orphan Business Models: Toward a New Form of Intellectual Property*, 124 HARV. L. REV. 1362, 1406–07 (2011); Michael J. Burstein, *Rules for Patents*, 52 WM. & MARY L. REV. 1747, 1761–62 (2011); Daniel R. Cahoy, *An Incrementalist Approach to Patent Reform Policy*, 9 N.Y.U. J. LEGIS. & PUB. POL'Y 587, 635–36 (2006); Michael W. Carroll, *One for All: The Problem of Uniformity Cost in Intellectual Property Law*, 55 AM. U. L. REV. 845, 847–49 (2006); Eric E. Johnson, *Calibrating Patent Lifetimes*, 22 SANTA CLARA COMPUTER & HIGH TECH. L.J. 269, 290–93, 297–300 (2006); Amir H. Khoury, *Differential Patent Terms and the Commercial Capacity of Innovation*, 18 TEX. INTELL. PROP. L.J. 373, 407 (2010); Jonathan S. Masur, *Regulating Patents*, 2010 SUP. CT. REV. 275, 321–26; Peter S. Menell, *A Method for Reforming the Patent System*, 13 MICH. TELECOMM. & TECH. L. REV. 487, 495, 508 (2007); Peter S. Menell & Michael J. Meurer, *Notice Failure and Notice Externalities*, 5 J. LEGAL ANALYSIS 1, 50 (2013); Joshua D.

and Lemley suggest that courts subject different technological fields of invention and industries to different patent doctrines.²⁸⁵ Using the software and biotechnology industries to demonstrate this concept, Burk and Lemley argue that the application of the legal standard of the “person having ordinary skill in the art” can lead to totally different results regarding validity and scope in diverse industries.²⁸⁶ Therefore, they claim that it is important to ensure that the wide variety of different legal rules is exploited optimally in different technological contexts.²⁸⁷

While we agree with Burk and Lemley’s observations regarding the way courts handle patent cases in different technological fields and agree that different technological fields of invention share many common characteristics, we do not believe that inventions within a specific industry are necessarily similarly valuable. We take a more fine-grained approach that distinguishes between patents within industries. For example, a specific invention within the computer science industry can be a pioneering one, having an extremely high anticipated value, while a different computer science invention may be close to worthless. Granting both inventions equal protection imposes an excessive burden on society: the social benefit of the later invention is outweighed by the costs it imposes on competitors and the general public. As a result, society overpays for the provision of a low-value patent. Additionally, because both inventions are expected to confer similar benefits on their owners, future inventors would be encouraged to invest their talent and resources in the least expensive and complicated projects, further diminishing social welfare. On the other hand, inventions in totally different industries may have similar economic value or may otherwise inflict similar costs of invention on inventors. Such inventions should merit similar patent protection, even though they pertain to different technological fields.

Furthermore, under Burk and Lemley’s model, patentees will likely try to game the system and draft their purported invention to appear pertinent to a technological field that affords better patent protection.²⁸⁸ This is precisely what

Sarnoff, *The Patent System and Climate Change*, 16 VA. J.L. & TECH. 301, 307–09 (2011); F.M. Scherer, *Nordhaus’ Theory of Optimal Patent Life: A Geometric Reinterpretation*, 62 AM. ECON. REV. 422, 427 (1972); William Fisher III, *The Disaggregation of Intellectual Property: How the Laws of Intellectual Property Have Grown—and Grown Apart*, HARV. L. BULL., Summer 2004, at 24, 29–31; Frank Partnoy, *Finance and Patent Length* 12–17, 29 (U. San Diego Law & Econ., Research Paper No. 19, 2001), <http://papers.ssrn.com/abstract=285144> [<https://perma.cc/2T8J-N4NG>]; Richard A. Posner, *Why There Are Too Many Patents in America*, ATLANTIC (July 12, 2012, 10:20 AM), <http://www.theatlantic.com/business/print/2012/07/why-there-are-too-many-patents-in-america/259725/> [<https://perma.cc/7SKG-AFBS>].

285. Burk & Lemley, *supra* note 283, at 1158–85.

286. *See id.* at 1156, 1185, 1189–91.

287. *Id.* at 1194–96.

288. *See* Bell & Parchomovsky, *supra* note 65, at 275.

happened in the fields of software and business method patents.²⁸⁹ Because technology-specific regimes entail no means to guarantee the cooperation of patentees, they are very likely to become extremely burdensome on judges, who would struggle to classify the industry to which a given invention belongs. Sophisticated and experienced patentees are expected to use confusing claim drafting to receive favorable treatment, making the process of claim construction even more encumbered and time consuming than it already is.²⁹⁰

A technology-tailored system of patent protection also suffers from several practical implementation barriers. First, the boundaries between technologies are highly ambiguous and mutable.²⁹¹ In fact, many inventions simultaneously fall within multiple distinct technological categories.²⁹² Second, technological and market conditions evolve rapidly, further complicating the task of designing and implementing technology-specific patent laws that keep pace with these changes.²⁹³ Additionally, and no less importantly, we still lack a clear and coherent analysis of how patent protection affects progress and innovation in different industries. Therefore, it appears that the time is not ripe for tailoring patent awards according to technological characteristics.²⁹⁴ Indeed, technological differentiation is significantly more involved than merely dividing between pharmaceutical and software patents. There are over 260,000 distinct categories of technology recognized by the USPTO.²⁹⁵ It is highly doubtful that these could ever be ranked properly according to their need for protection based solely on their technological characteristics.²⁹⁶ Note, however,

289. See Benjamin N. Roin, *The Case for Tailoring Patent Awards Based on the Time to Market of Inventions*, 61 UCLA L. REV. 672, 710–12 (2014). Roin demonstrates that when courts initially prohibited pure software patents, patentees responded by drafting software claims as “computer systems” that implemented software to get around the restriction. *Id.* Likewise, when the PTO created a “second look” program for business method patents to provide for a more rigorous examination process, patent applicants simply reframed their business method claims so they could file their application in a different PTO division. *Id.*

290. Wagner, *supra* note 16, at 2146 (suggesting that under the current patent regime, patentees have an incentive to “draft patent applications that effectively obscure the true scope of the invention and its relationship to the prior art”).

291. BURK & LEMLEY, *supra* note 5, at 97–99; Roin, *supra* note 289, at 710.

292. JAE HUN PARK, PATENTS AND INDUSTRY STANDARDS 162–63 (2010); Raj Bawa, *Nanotechnology Patent Proliferation and the Crisis at the U.S. Patent Office*, 17 ALB. L.J. SCI. & TECH. 699, 707 (2007) (discussing the multiple technological categories of nanotechnology inventions); Mark A. Lemley, *Patenting Nanotechnology*, 58 STAN. L. REV. 601, 614–15 (2005).

293. PARK, *supra* note 292, at 162–63.

294. See Anna B. Laakmann, *An Explicit Policy Lever for Patent Scope*, 19 MICH. TELECOMM. & TECH. L. REV. 43, 45 (2012).

295. See U.S. PATENT & TRADEMARK OFFICE, COOPERATIVE PATENT CLASSIFICATION 14 (2012), <http://www.cooperativepatentclassification.org/publications/UsptoUserDayGeneralIntro.pdf> [<https://perma.cc/8MN7-7K9Q>].

296. See Roin, *supra* note 289, at 709.

that we do not challenge the practice common in courts to take into account the technological field of the invention while applying different patent doctrines.²⁹⁷

Our patent model clearly correlates investment and patent protection on a case-by-case basis. Hence, it is much less likely to err in determining the appropriate scope of patent protection. Every invention will be examined and evaluated independently, regardless of the industry to which it supposedly belongs. Such a high degree of individualization in defining the duration of patent protection will ensure patentees do not receive more than they deserve for their specific contributions. This will subsequently guarantee that society does not overpay for worthless inventions. In addition, our model encourages the cooperation of patentees with the USPTO in three important ways. First, it requires all patentees to submit a periodic statement of earnings to allow both the USPTO and third parties to estimate the remaining patent duration.²⁹⁸ Second, under our proposed model, filing and maintenance fees are derived from the patentee's declared investment costs; therefore, any exaggeration from the side of the patentee will be reflected in the fees she will subsequently owe the USPTO. Third, in our model, patentees bear the burden of proving the declared costs of their invention during licensing and litigation. As such, any misstatement from the patentee will increase her litigation costs and possible responsibilities for damages.

A related, but more advanced, proposal for a tailored system of patent awards has been advanced by Benjamin Roin.²⁹⁹ Noting that “[c]ertain types of inventions take much longer to develop than others, and a lengthier time-to-market strongly correlates with an increased need for patent protection and a lower risk that patents will stifle subsequent innovation,”³⁰⁰ Roin suggests differentiating between protections granted to patents in accordance with the inventions' time-to-market. This factor is arguably capable of matching the need for protection with the risk of patents stifling subsequent innovation.³⁰¹ Roin defines inventions' “time-to-market” as the “time it takes to move from the initial idea to its first sale as a commercialized product,”³⁰² suggesting that this factor is an observable proxy for optimal, technology-based patent strength. At the crux of Roin's proposal stands the proposition that “inventions' time-to-market strongly correlates with optimal patent strength.”³⁰³ Yet, it is possible to

297. Burk & Lemley, *supra* note 283, at 1156.

298. *Infra* Section II.E.

299. Roin, *supra* note 289, at 672.

300. *Id.* at 676.

301. *Id.* at 684.

302. *Id.*

303. *Id.*

think of instances where worthless inventions take longer to mature into marketable goods.³⁰⁴

According to Roin, the optimal patent award for inventions is primarily a function of their R&D costs, the risk of failure in R&D, the anticipated future revenue streams from the projects if they succeed, and the potential for imitation by rivals.³⁰⁵ Roin further argues that an invention's time-to-market is a reliable indicator for all these factors.³⁰⁶ Yet, while longer time-to-market is probably a reliable indicator of higher *commercialization* costs, we are not sure to what extent it adequately reflects the inventor's incurred costs of *invention*. An inventor does not need to provide proof of actual sales in order to secure a patent.³⁰⁷ This means that her initial costs of invention may reflect only a small portion of her ultimate *commercialization* costs, which Roin generally, but with slight imprecision, describes as R&D costs.³⁰⁸ Moreover, according to Roin, "Inventions that generate lower annual sales revenues likely need stronger protection to be profitable, since it takes more time for the invention to produce enough revenue for the firm to recover its R&D costs."³⁰⁹ However, extended time-to-market is obviously not the sole reason for low sales revenue. The economic value of the invention, its prospective market, the invention's technological contribution, and effective consumer demand are no less, if not more, important in determining the prospective annual earnings of a given patent.

Furthermore, we are not persuaded that affording stronger patent protection to inventions that take longer to reach the market is a socially desirable policy lever. Strengthening patent protection inevitably results in enhanced access barriers, which subsequently stifle innovation.³¹⁰ Consumers bear the increased deadweight loss of stronger patents, and subsequent inventors are impeded from improving and advancing the strongly protected invention.³¹¹ Arguably, providing stronger protection to patents having longer time-to-market is not the optimal way of incentivizing their provisions.

304. See, e.g., Daniel C. Rislove, Comment, *A Case Study of Inoperable Inventions: Why Is the USPTO Patenting Pseudoscience?*, 2006 WIS. L. REV. 1275, 1302–04 (discussing the development of the inoperable cold fusion invention).

305. Roin, *supra* note 289, at 684.

306. *Id.*

307. BURK & LEMLEY, *supra* note 5, at 11 ("But an inventor need not have actually 'reduced to practice' the invention—that is, need not have built or physically tested the claimed invention in order to file a patent application.").

308. See Roin, *supra* note 289, at 728–29.

309. *Id.* at 699.

310. Arrow, *supra* note 125, at 616–17.

311. See generally BESSEN & MEURER, *supra* note 4, at 1–28 (arguing empirically that the patent system provides poor notice, which causes harm because it subjects technology investors to unavoidable risk of disputes and litigation, thus resulting in a patent system which provides negative incentives to invest in innovation); Heller & Eisenberg, *supra* note 108, at 700–01 (applying the "tragedy of

An additional reform proposal suggests instituting prizes and rewards in lieu of patent protection. The rich literature concerning patent prizes includes various suggestions on how an agency should determine, *ex ante*, the value of the prize to be awarded to the inventor for the development of her invention as an alternative mechanism to the exclusive rights granted by patents.³¹² These valuation methods are *ex ante* in the sense that they are applied before the invention turns into a desired commercial product, which is also the case for many patents that are filed very early in the life of inventions. For example, Steven Shavell and Tanguy van Ypersele described a prize system that inventors could opt into instead of the patent system.³¹³ Similarly, Michael Kremer has described a system in which patent recipients would agree to give up their patents in exchange for compensation that would be determined through a unique auction process.³¹⁴ Doug Lichtman has suggested that the government could achieve the benefits of a prize system with much lower costs by keeping the patent system and subsidizing consumers who would value patented products above marginal cost but could not afford them at the monopoly price.³¹⁵ Michael Abramowicz's proposal goes in a different direction and suggests that a claimant will receive her prize at a later point in time when the true commercial potential of her invention is known.³¹⁶

These different *ex ante* reward systems provide inventors with prizes instead of exclusive rights, and as such, they are outside the realm of patent licensing. This *ex ante* valuation approach fits with our model, which also seeks to reward inventors for their efforts but keeps a patent-based scheme. Prizes are desirable for many reasons; however, our regime is superior to prizes in that it awards tailored patent protection, which is sponsored by the market rather than the state.

Lastly, Maayan Perel has also proposed a novel, *ex ante* method of patent valuation for licensing purposes.³¹⁷ Very much like the proposal in this Article, she suggests that the value of patents should correlate with their technological

commons" concept to biomedical research patents); Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 990 (1997) (discussing the difference between improvement and imitation).

312. BURK & LEMLEY, *supra* note 5, at 44–45; Abramowicz, *Patent Prizes*, *supra* note 45, at 119–20 (reviewing the literature suggesting prizes as an alternative to the current patent system); Janis, *supra* note 45, at 939–41.

313. Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 525–27 (2001).

314. Michael Kremer, *Patent Buyouts: A Mechanism for Encouraging Innovation*, 113 Q.J. ECON. 1137, 1146 (1998).

315. Douglas Gary Lichtman, *Pricing Prozac: Why the Government Should Subsidize the Purchase of Patented Pharmaceuticals*, 11 HARV. J.L. & TECH. 123, 123–24 (1997).

316. Abramowicz, *supra* note 45, at 172–77.

317. Maayan Perel, *An Ex Ante Theory of Patent Valuation: Transforming Patent Quality into Patent Value*, 14 J. HIGH TECH. L. 148, 196–222 (2014).

contribution to adequately reward innovation. Her proposed method deviates from existing methods in at least four aspects.³¹⁸ First, it adopts a social-normative perspective instead of a positive economic one. It essentially asks what should be the license value, from the standpoint of the patent system and not what that value would be in a world with no regulatory intervention. Second, it is performed *ex ante*, upon the grant of patent protection, long before any licensing negotiations are initiated. Third, it recommends flexible limitations on the ultimate license value rather than setting a single, fixed price. Fourth, it suggests subjecting the process of patent valuation to external regulation instead of leaving it to the exclusive control of free market powers. Perel advances a two-step, novel method of patent valuation, determining the quality of a given patent according to proposed quality indicators and then assigning flexible price limitations that correlate with such quality. Such a method would promote four objectives.³¹⁹ First, translating patent quality into a numerical patent value would encourage high-quality innovation and improve patent quality. Second, setting *ex ante* limitations on the licensing price the patentee may ultimately demand would downgrade patent trolling. Third, determining the price of a patent upon issuance would neutralize the manipulative effect of external factors, such as the identity of negotiating parties and their respective bargaining powers, as well as the circumstances surrounding licensing negotiations. As a result, such a model could hamper patentees' ability to hold up subsequent innovation and impede future research. Fourth, in the long term, this method would also reduce litigation costs and litigation rates for the benefit of the public as a whole. We share many of the underlying assumptions of Perel's article regarding the desirability of an *ex ante* approach to patent valuation. However, her article is limited to licensing. Here, we present comprehensive proposals pertaining to the patent system as a whole. As such, Perel's proposal is of limited value for our purposes.

Our proposed system is the only proposal to tie patent protection directly to patent investment, recognizing the crucial role of investment for the aims of patent law and policy. Other reform proposals either ignore investment or are based on proxies for investment and therefore offer less accurate results.

CONCLUSION

This Article proposes a novel model for patent protection designed to overcome the epidemic of low-quality patents and the crisis it is currently creating. It introduces the recoupment patent system, with its significant safeguards, highlighting its advantages and disadvantages, and suggests that, if we want to follow the wording and spirit of the constitutional mandate to

318. *Id.* at 196–235

319. *Id.* at 181–96.

incentivize innovation, we should aspire to have higher patent quality. This differentiated, invention-specific regime should be carefully designed in order to achieve its ambitious goals. The proposed scheme is the right step in this direction. The Article also explores alternative schemes that have been proposed over the years as a way to either improve or replace the system, pointing to their strengths and weaknesses. Our proposed framework offers differentiated length of patent protection, tailored according to patent investment. We demonstrate that this mechanism fits well with the dictates of patent theory and with the goals of the patent system, and adequately addresses the current patent crisis.

This promising system can also be applied in other fields of intellectual property law: mainly copyright law, trade secrecy, database law, and design law. It offers a thoughtful way to afford incentives while not compromising downstream innovation. However, the extension of our proposed model to other fields of intellectual property should be the subject of other research projects.