

Regulatory Monopoly and Differential Pricing in the Market for Patents

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Abstract

Patents are limited-term monopolies awarded to inventors to incentivize innovation. But there is another monopoly that has been largely overlooked at the heart of patent law: the monopoly of the U.S. Patent and Trademark Office (PTO) over the granting of patents. The present Article addresses this situation by introducing the broader notion of a regulatory monopoly, where a single governmental actor has the power to set prices in a regulatory area.

The Article explains how regulatory monopolists like the PTO could enhance social welfare via differential pricing—by charging regulated entities differing fees based on their willingness and ability to pay. In particular, the Article shows how the PTO could increase its revenues and promote innovation by charging different patent “prices” for inventions in different industries. Such pricing could also be used to tailor effective patent term across industries, an emergent goal for many patent scholars.

The Article then applies the author’s recent empirical research to generate potential differential patent price structures. This research takes advantage of a natural experiment—a change in patent term rules due to enactment of the TRIPS agreement in 1995—to measure the relative importance of patent protection across different industries. The Article concludes by discussing how recent patent reform (the America Invents Act of 2011) provides a legal basis for the PTO to conduct differential pricing.

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I. Introduction

Patent law is inextricably tied to the economics of monopolies, as patents are legal monopolies awarded to inventors to incentivize innovation.¹ By allowing an inventor to exclude others from making, using, or selling his invention for a limited period of time,² we encourage the inventor to spend the fixed costs necessary to generate the invention in the first place. Unfortunately, patents often allow inventors to set higher prices than would otherwise exist in a competitive market. This tradeoff between incentivizing innovation and allowing monopoly pricing is a fundamental and contentious topic debated by patent scholars.³

Despite the centrality of monopoly to patent law, scholars have largely overlooked another crucial role that monopoly plays in the patenting process. This Article addresses that situation by explaining how the U.S. Patent and Trademark Office (PTO)—which is the sole regulatory entity charged with awarding patents in the United States—has a monopoly over the granting of patent rights.⁴ If patents are viewed as products in a market,

1. See 35 U.S.C. § 271(a) (2012) (stating that a U.S. patent enables an inventor to prevent offers for sale of the patented invention within the United States as well as importation of the patented invention into the country).

2. See *id.* (granting inventors a legal monopoly over the use, sale, and creation of their inventions). Although a legal monopoly may form the basis of an economic monopoly, the two concepts are distinct. See Richard A. Posner, *Intellectual Property: The Law and Economics Approach*, 19 J. ECON. PERSP. 57, 68 (2005) (“A legal monopoly is not necessarily an economic monopoly; if close substitutes exist for a patented product, the patent may confer little power over price.”).

3. See, e.g., Gideon Parchomovsky & Michael Mattioli, *Partial Patents*, 111 COLUM. L. REV. 207, 213–19 (2011) (overviewing the evolution of scholarly discussion concerning the various benefits and costs of patents); Alan O. Sykes, *Public Health and International Law: TRIPS, Pharmaceuticals, Developing Countries, and the “Doha” Solution*, 3 CHI. J. INT’L L. 47, 58 (2002) (noting that “legislatures around the world have for centuries confronted the essential monopoly/innovation tradeoff of the patent system”). “Although critics at times suggest that patent protection is excessive, and others find it inadequate, there is surely no consensus on the matter as a general proposition.” *Id.*

4. This point was nicely made in Michael B. Abramowicz & John H. Duffy, *Ending the Patenting Monopoly*, 157 U. PA. L. REV. 1541 (2009), which is a rare article discussing the PTO’s monopoly power. Abramowicz and Duffy focus on ways in which the PTO could be demonopolized. See *id.* at 1579–1604 (offering preliminary assessments of mechanisms used to demonopolize the patent

then the PTO is the only place where they can be obtained. And to receive patent protection, patent applicants and patentees must pay the fees the PTO charges to fund its operations.⁵

More generally, this Article develops the concept of a *regulatory monopoly*, where a single governmental actor has the power to set prices in a regulatory area. The PTO is a paradigmatic example of such a monopolist.⁶ It exercises its regulatory monopoly powers when it mandates payments such as maintenance fees, which are periodic payments a patentee must make to prevent an already-issued patent from lapsing.⁷ The Article discusses in detail the operation of the PTO and highlights other regulatory monopolies at the federal, state, and local levels.

Like a traditional monopolist, a regulatory monopolist can engage in differential pricing by charging different amounts to different people depending on how much they are willing to pay and how much it costs to serve them.⁸ Unlike a traditional monopolist, however, a regulatory monopolist ideally uses differential pricing to further the public good. The Article explains the prerequisites for differential pricing and discusses

market). I focus instead on how the PTO could use its monopoly power to set differential prices to improve social welfare.

5. See 35 U.S.C. § 41 (2012) (listing numerous fees associated with patent applications); see also Abramowicz & Duffy, *supra* note 4, at 1551–60 (describing the role of the PTO).

6. See Abramowicz & Duffy, *supra* note 4, at 1545 (stating that the PTO has a monopoly over the granting of patents in the United States).

7. See 35 U.S.C. § 41(b) (providing for maintenance fees); see also *USPTO Fee Information: Current Fee Schedule*, U.S. PATENT AND TRADE OFFICE, <http://www.uspto.gov/web/offices/ac/qs/ope/fee010114.htm> (last visited May 19, 2014) (providing maintenance fee payment schedules) (on file with the Washington and Lee Law Review).

8. See Daniel J. Gifford & Robert T. Kudrle, *The Law and Economics of Price Discrimination in Modern Economies: Time for Reconciliation?*, 43 U.C. DAVIS L. REV. 1235, 1241–42 (2010) (discussing the varieties of differential pricing). Economists also refer to differential pricing as price discrimination, of which there are several types. See *infra* Part II.C.1 (discussing the prerequisites for differential pricing). This Article is primarily concerned with a type known as third-degree price discrimination, which involves charging people different amounts based on their membership in a group. See William W. Fisher III, *When Should We Permit Differential Pricing of Information?*, 55 UCLA L. REV. 1, 4 (2007) (“Today, firms in many industries regularly engage in differential pricing.”).

how regulatory monopolists can use such pricing to better fulfill their regulatory goals.

Unfortunately, regulatory monopolies often fail to harness the power of differential pricing. For instance, instead of differentially pricing patents, the PTO charges patent applicants and patentees uniform fees that do not depend on the underlying invention type.⁹ This is inefficient because, as has been shown empirically, inventors in different industries value patent rights differently,¹⁰ and the PTO's cost of reviewing patent applications varies across these industries.¹¹

This Article explains how the PTO could instead use its power as a regulatory monopoly to differentially price patents across industries. Using insights from both neoclassical and behavioral economics, the Article focuses on two primary ways in which this kind of pricing could enhance social welfare. First, differential pricing across industries, particularly with respect to patent maintenance fees, would increase PTO revenues.¹² In particular, the PTO could increase maintenance fees on patentees in industries that, on average, care more about patent protection. An increase in these late-stage fees would enable the PTO to

9. See 35 U.S.C. § 41 (setting uniform fees for patent applications).

10. See Neel U. Sukhatme & Judd N. L. Cramer, *How Much Does Patent Term Matter? Cross-Industry Differences in Term Sensitivity* (Princeton Univ. Dep't of Econ., Working Paper, 2014), available at <http://ssrn.com/abstract=2293245> (deriving empirical measures of the importance of patent term across industries).

11. See Michael D. Frakes & Melissa F. Wasserman, *The Failed Promise of User Fees: Empirical Evidence from the U.S. Patent and Trademark Office*, 11 J. EMP. L. STUD., Table A1 (forthcoming 2014) [hereinafter Frakes & Wasserman, *Failed Promise*] (listing the average number of hours it takes to review a patent application along with the estimated cost for patent applications within thirty-seven industry subcategories).

12. Recent research suggests the PTO's reliance on fees from patent applicants and patentees to fund its operations might be financially straining the organization, which in turn might cause a backlog in the processing of patent applications. See generally *id.* (purporting that certain fee schedules create financial risk that the PTO will not cover its operational costs); Michael D. Frakes & Melissa F. Wasserman, *Does Agency Funding Affect Decisionmaking?: An Empirical Assessment of the PTO's Granting Patterns*, 66 VAND. L. REV. 65, 76 (2013) [hereinafter Frakes & Wasserman, *PTO's Granting Patterns*] (arguing that the PTO is incentivized to grant patents to make its revenue match its expenses). Section III, *infra*, discusses how differential patent pricing has the potential to improve the PTO's financial standing and hence alleviate the present backlog at the PTO.

lower front-end patent application fees for everyone, thereby reducing the total cost of patenting for most applicants. Alternatively, the PTO could use the additional revenues to improve its application review process, such as by hiring additional examiners to expedite review. To the extent we believe heightened availability of patent protection or a more efficient patent review process leads to more inventive activity, differential patent pricing could promote innovation.¹³

Second, the Article explains how the PTO could use differential pricing to tailor patent term across industries. In the United States, patents receive a one-size-fits-all baseline term of twenty years from the date of patent application filing. Many scholars have recognized problems with this approach because a uniform term seems at odds with the fact that the social costs and benefits of patenting likely differ across industries. Accordingly, some have suggested patent term should be tailored, with term shortened for some categories of inventions.¹⁴

This Article uses differential patent pricing to suggest a more flexible and practical approach to term shortening: to reduce term on patents within a particular industry, one could raise maintenance fees on patents in that industry to the point where patentees no longer renew their patents. In other words, if a maintenance fee is sufficiently high for patentees in a particular

13. This is not a settled point; some prominent commentators take the strong view that patents do not incentivize innovation at all. See Michele Boldrin & David K. Levine, *The Case Against Patents*, 27 J. ECON. PERSP. 3, 3 (2013) (“The case against patents can be summarized briefly: there is no empirical evidence that they serve to increase innovation and productivity, unless productivity is identified with the number of patents awarded—which, as evidence shows, has no correlation with measured productivity.”).

14. See *id.* at 19 (“If the US economy is to have patents, we may want to start tailoring their length and breadth to different sectoral needs. Substantial empirical work needs to be done to implement this properly, although a vast legal literature is already pointing in this direction.”); Benjamin N. Roin, *The Case for Tailoring Patent Awards Based on the Time-to-Market of Inventions*, 61 UCLA L. REV. 672 (2014) (describing how patent length should be tied to the public benefit); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575 (2003) (claiming that although patent rules are largely one-size-fits all, in practice, they are applied in a technology-specific manner); Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155 (2002) (arguing that a major issue with patents is that they do not differentiate between different technologies and the time needed to recover research and development costs).

industry, then those patentees will stop paying this fee and their patents will lapse. The Article highlights advantages of using differential pricing to limit term in this manner, such as increased flexibility to update prices as technology evolves, heightened control over the number of patents within an industry that terminate at a particular time, and ease of implementation from a political economy standpoint.

Even though differential patent pricing is a potentially powerful tool, it requires the PTO to know certain information. In particular, it requires the PTO to know which industries have patentees that, on average, care more about patent protection. Put differently, the PTO needs an objective measure of the relative value of patent protection across industries. This Article provides an overview of my recent empirical research, which provides such a measure.¹⁵

In particular, my research exploits a natural experiment—the 1994 passage of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).¹⁶ TRIPS changed the way patent term was measured for the first time in over 130 years. Before TRIPS, patent term was measured from the date a patent was *granted*; after TRIPS, it was measured from the date a patent application was *filed*.¹⁷ Thus, applicants in industries in which patent term was more valuable were more likely to speed up patent prosecution after TRIPS because the time an application was pending would now cut into total patent term.

I use differences in the rate at which applicants sped up prosecution across industry categories to create an industry-level measure of patent term sensitivity. Applicants who care more about patent term sped up more post-TRIPS vis-à-vis applicants who cared less. This measure, along with two others I have developed and discuss in the Article,¹⁸ can be used to identify

15. See generally Sukhatme & Cramer, *supra* note 10 (describing patents as monopolies granted to inventors that promote innovation with social costs).

16. See *Trade-Related Aspects of Intellectual Property Rights*, PATENTLENS, <http://www.patentlens.net/daisy/patentlens/415.html> (last visited May 20, 2014) (describing the obligations of people who join the TRIPS agreement) (on file with the Washington and Lee Law Review).

17. See *infra* Part IV.A.1 (delineating how patent terms are measured under TRIPS).

18. I generate three measures, all of which are highly correlated. *Infra* Part IV.A. The first is the applicant delay measure described here. A second measure

categories of inventions for which applicants care more about patent term. Once these categories are identified, the Article explains how these empirical measures can be translated into actual differential patent prices.

The final section of the Article tackles a crucial, underlying legal question: Even if differential patent pricing is socially optimal, is there a legal basis for implementing it? The Article answers this question affirmatively, explaining how the PTO recently gained fee-setting authority as part of the America Invents Act (AIA), a comprehensive patent reform bill passed in 2011.¹⁹ In particular, § 10 of the AIA enables the PTO to alter its fees to recover its aggregate estimated patent examination and processing costs.²⁰ The statutory language, as well as the PTO's recent interpretation of its fee-setting authority,²¹ indicates the agency has the power to differentially price patents based on industry category.²²

is the differential stock market response of companies in response to additional patent term provided to many patentees as a consequence of TRIPS. *Infra* Part IV.A.2. The third is the ratio of patentees within a given industry that pay patent maintenance fees to keep their patent in force after it has issued. *Infra* Part IV.A.3. Any of these three empirical measures could be used to generate differential patent prices.

19. See Leahy-Smith America Invents Act, Pub. L. 112-29, § 10(a)(1), 125 Stat. 284 (2011) (establishing and defining the PTO's fee-setting authority).

20. See *id.* ("The Director may set or adjust by rule any fee established, authorized, or charged under [patent law] for any services performed by or materials furnished by the Office . . . only to recover the aggregate estimated costs to the Office . . ."). The PTO also has its own industry-level measure of the amount of time allocated to patent processing, and Michael Frakes and Melissa Wasserman have used this measure to generate an average measure of examination costs across industry categories. See Frakes & Wasserman, *Failed Promise*, *supra* note 11, online app. A, at 9–10. This Article describes how both these measures are highly correlated with my cross-industry patent sensitivity measure. In other words, the industries with applications that take the most time (and cost the most) to evaluate are the same industries with applicants who care the most about patent term. This further bolsters the rationale for differential pricing. See *infra* Part III.A.4.

21. See *generally* Setting and Adjusting Patent Fees, 78 Fed. Reg. 4212-01 (Jan. 18, 2013).

22. This conclusion holds if the PTO uses differential pricing to alter its revenue flow. It is less clear whether the PTO could differentially price patents to effectively limit patent term for certain industries. This type of differential pricing might require additional authorization from Congress. See *infra* Part V (discussing the PTO's authority to differentially price); see also *id.* n.241

II. Regulatory Monopolies and Differential Pricing

A. The Concept of a Regulatory Monopoly

The PTO stands in a unique position as the only patent-granting institution in the United States.²³ To receive a patent, an applicant must apply to the PTO and pay all of its required fees. As the sole gatekeeper of patent rights, the PTO has a regulatory power that can be viewed as a monopoly. More generally, this Article defines this sort of power as a *regulatory monopoly*—a single locus of regulatory authority with the ability to set prices on regulated actors.

A monopolist has market power because it is the sole seller of a particular good or service.²⁴ Customers cannot purchase that good or service elsewhere, at least at comparable cost.²⁵ For a

(addressing potential argument that TRIPS itself might limit industry-specific tailoring of patent laws).

23. See 35 U.S.C. § 2 (2012) (granting the PTO exclusive authority to issue patents and to register trademarks). An inventor who is denied patent rights by the PTO can appeal the rejection to the U.S. Court of Appeals for the Federal Circuit. See *id.* § 141 (allowing appeals to the Federal Circuit); see also Jonathan Masur, *Patent Inflation*, 121 YALE L.J. 470, 473 (2011) (describing how potential for appeal creates asymmetric incentives in favor of the PTO granting more patents than it perhaps should). But this is very rare. For example, in fiscal year 2013, only 132 cases were appealed to the Federal Circuit, and only 8% of pending cases were reversed. *U.S. Court of Appeals for the Federal Circuit—Appeals Filed, Terminated, and Pending During the Twelve-Month Period Ended September 30, 2013*, <http://www.cafc.uscourts.gov/images/stories/the-court/statistics/FY13/appeals%20filed%20term%20pend%209.30.13.pdf>.

Compare that with the 542,815 utility patent applications filed in calendar year 2012. *U.S. Patent Statistics Chart, Calendar Years 1963–2013*, http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm (last visited May 20, 2014) (on file with the Washington and Lee Law Review). Nonetheless, the presence of alternative routes to obtain patent protection in a few cases does not change the analysis here—the PTO has a near monopoly on the granting of patent rights. So long as the PTO has significant market power, it can engage in differential patent pricing.

24. See Phillip Areeda & Donald F. Turner, *Predatory Pricing and Related Practices Under Section 2 of the Sherman Act*, 88 HARV. L. REV. 697, 702–03 (1975) (noting that a monopoly determines market price by varying the output of a certain good). The word “monopoly” comes from the Greek *monopōlion*, from *monos*, meaning “single,” and *pōlein*, meaning “to sell.” MERRIAM-WEBSTER DICTIONARY (2014).

25. See Gifford & Kudrle, *supra* note 8, at 1244 (noting that the lack of competition gives monopolies the power to control the price of goods and services).

regulatory monopoly, the “good” at issue is regulatory approval. In the case of the PTO, the good can be conceptualized as “patent rights” over a particular inventive idea.

Unlike a traditional monopolist, a regulatory monopolist (hopefully) does not give its regulatory approval simply in response to receiving money or fees from a user. Rather, a regulatory monopolist presumably makes its decisions based on law and policy—should a regulated entity be allowed to perform a certain action or be granted a particular right, taking into account applicable laws and social welfare? While regulatory monopolists need not charge their users anything, our focus here is on government institutions that charge fees in addition to exercising sole regulatory authority over a particular area.

Applying this definition, we can see the PTO is hardly unique as a regulatory monopolist. Indeed, there are many examples of regulatory monopolies at all levels of government. For example, consider the Food and Drug Administration’s (FDA) role in approving new drugs. Absent FDA approval, a pharmaceutical company cannot sell, and a doctor cannot prescribe, a new drug for treating a disease.²⁶ So the FDA has the sole gatekeeping authority in determining which drugs are approved. Moreover, as part of its approval process, the FDA requires applicants to pay fees.²⁷ In the parlance of this Article, the FDA has a regulatory monopoly over the granting of new drug compounds in the United States and the associated fees that companies seeking regulatory approval must pay.

Regulatory monopolies also abound at the state level. For example, states typically require people who wish to hunt or fish to first obtain a license from a state wildlife agency.²⁸ Without

26. See *Development and Approval Process (Drugs)*, U.S. FOOD AND DRUG ADMINISTRATION, <http://www.fda.gov/drugs/developmentapprovalprocess/> (last visited May 20, 2014) (detailing the FDA approval process) (on file with the Washington and Lee Law Review).

27. See Elizabeth C. Price, *Teaching the Elephant to Dance: Privatizing the FDA Review Process*, 51 FOOD DRUG L.J. 651, 652 (1996) (“For those companies seeking to market new drugs, food additives, or medical devices, the FDA is the only game in town.”) “As with any other monopolist, the FDA has unfettered ability to raise the ‘price’ and limit the ‘supply’ of its services (i.e., product approval), to force purchasers (i.e., product manufacturers) to engage in tying arrangements, and to boycott or refuse to deal with regulated entities.” *Id.*

28. See *Federal, State, and Provincial Wildlife Agencies*, NWTF,

such a permit, one cannot legally engage in these activities in the state. These wildlife agencies also generally charge users a fee for this permit, and there is usually only one such agency in each state. Accordingly, state wildlife agencies are examples of state-level regulatory monopolists.

Local governments have regulatory monopolies as well. When an individual seeks a building permit for a house, or a license to operate a taxicab or to sell liquor in a city, she generally must receive approval from a local government agency. Such institutions often charge a fee for a permit, and these fees can be quite substantial. These unitary local authorities also exercise regulatory monopoly power, since absent their approval, the individual cannot engage in the regulated activity.

B. Other Regulatory Market Structures

While the concept of a regulatory monopoly is typically overlooked,²⁹ it fits into a more general discussion on “regulatory

http://www.nwtf.org/in_your_state/AllAgencies.html (last visited May 20, 2014) (listing state and federal wildlife agencies) (on file with the Washington and Lee Law Review).

29. The concept has been recognized by some scholars, primarily relating to the Securities and Exchange Commission. *See, e.g.*, Chris Brummer, *Post-American Securities Regulation*, 98 CALIF. L. REV. 327, 382 (2010) (“Scholars have long viewed the SEC as wielding a virtual regulatory monopoly over the provision of securities laws both at home and abroad.”); Eric J. Pan, *Harmonization of U.S.–EU Securities Regulation: The Case for a Single European Securities Regulator*, 34 LAW & POL’Y INT’L BUS. 499, 527–28 (2003) (“[A]lthough the SEC has a regulatory monopoly over the U.S. securities market, the SEC does not behave like a monopoly.”); *see also* David A. Hyman, *Health Insurance: Market Failure or Government Failure?*, 14 CONN. INS. L.J. 307, 320–21 (2008) (discussing state regulatory monopolies over insurance regulation); Price, *supra* note 27, at 652–53 (describing the FDA’s power to raise prices, limit supply, and ultimately force manufacturers to engage in certain behavior); *see generally* Frederick Tung, *Lost in Translation: From U.S. Corporate Charter Competition to Issuer Choice in International Securities Regulation*, 39 GA. L. REV. 525 (2005) (discussing regulatory monopoly and regulatory price discrimination relating to corporate charters). More often, “regulatory monopoly” has been used to describe monopolies generated by law and awarded to public utility companies, such as AT&T. *See, e.g.*, Christopher Wyeth Kirkham, Note, *Busting the Administrative Trust: An Experimentalist Approach to Universal Service Administration*, 98 COLUM. L. REV. 620, 624 (1998) (describing the divestiture of AT&T Bell companies).

competition,” which has been studied in more detail.³⁰ For example, there is a rich literature on the effect of state competition in the context of corporate governance laws.³¹ This competition arises because corporations can choose where to incorporate, and the laws of the state of incorporation often govern subsequent shareholder or other corporate litigation.³² Many scholars argue this competition has created incentives for certain states to adopt more corporate-friendly laws to entice companies to incorporate in their states.³³ As a consequence, states can get caught up in a “race to the bottom”—because companies can choose among many states where to incorporate, they pick ones with more lax governance rules, which in turn incentivizes states to lower governance standards further.³⁴

30. See, e.g., Brummer, *supra* note 29, at 382 (“Recent scholarship has demonstrated that traditionally dominant regulators, like the SEC, have to compete for transactions by offering attractive securities laws because foreign markets have become more economically significant. This observation has enabled a binary regulatory monopoly/competition framework for describing the SEC’s regulatory power.”).

31. See, e.g., Lucian Arye Bebchuk, *Federalism and the Corporation: The Desirable Limits on State Competition in Corporate Law*, 105 HARV. L. REV. 1435, 1437 (1992) (arguing that state competition fails in certain aspects of corporate law, and advocating greater federal intervention in corporate law); Frank H. Easterbrook, *Managers’ Discretion and Investors’ Welfare: Theories and Evidence*, 9 DEL. J. CORP. L. 540, 549–50 (1984) (arguing that state competition leads to more effective corporate law).

32. See William L. Cary, *Federalism and Corporate Law: Reflections Upon Delaware*, 83 YALE L.J. 663, 663–68 (1974) (discussing the historical evolution of state corporate law).

33. See *id.* at 668 (describing Delaware as a state that draws most of its revenue from corporations). Reasons why states might want to become a locus for incorporation include the franchise fees that corporations must pay and the extra legal work it generates for the local bar. See *id.* (arguing that the “raison d’être” for Delaware’s corporate-friendly legal atmosphere is revenue for the state).

34. See *id.* (portraying Delaware law as favorable because of its judiciary and body of case law). Other scholars claim that managers of corporations compete with one another in a way that actually generates a race to the top. See generally Ralph K. Winter, Jr., *State Law, Shareholder Protection, and the Theory of the Corporation*, 6 J. LEGAL STUD. 251 (1977); see also Robert B. Ahdieh, *Trapped in a Metaphor: The Limited Implications of Federalism for Corporate Governance*, 77 GEO. WASH. L. REV. 255, 256–57 (2009) (arguing that discussion on whether federalism leads to a race to the bottom or a race to the top in corporate law is misguided); Mark J. Roe, *Delaware’s Competition*, 117 HARV. L. REV. 588, 610–12 (2003) (arguing that federal law, not other states’ laws, is the primary competition for Delaware corporate law); Marcel Kahan &

Other regulatory market structures may fall between a regulatory monopoly and regulatory competition. To illustrate, consider premerger regulation under the Hart–Scott–Rodino Antitrust Improvements Act (HSR).³⁵ Prior to certain mergers or tender offers, the parties involved must file a report with two separate regulatory agencies—the Federal Trade Commission (FTC) and the Antitrust Division of the Department of Justice (DOJ Antitrust). If either the FTC or DOJ Antitrust believes the proposed transaction has significant anticompetitive consequences, then either agency can request more information and block the merger.³⁶ Moreover, the party proposing the acquisition must pay a large fee, set by the FTC, depending on the size of the proposed transaction.³⁷

Because the FTC and DOJ Antitrust both have a veto over a potential merger, their regulatory power is not as complete as that of a regulatory monopolist such as the PTO. For example, if DOJ Antitrust generally favors mergers but the FTC is anti-merger, then the FTC might hinder the DOJ’s ability to allow what it perceives are socially beneficial mergers.³⁸ This

Ehud Kamar, *The Myth of State Competition in Corporate Law*, 55 STAN. L. REV. 679, 681 (2002) (“Race-to-the-top scholars argue that companies incorporate where their value is the highest and that states accordingly compete by offering laws that afford optimal shareholder protection.”).

35. See Steven K. Bernstein & Jeff L. White, *Federal Antitrust Review of Generic Drug Mergers: A Proposal for a More Flexible Approach*, 4 N.Y.U. J.L. & BUS. 465, 466–68 (2008) (laying out the notification, filing fee, and other statutory requirements of the HSR).

36. See *id.* (describing the statutory waiting period where the FTC and DOJ analyze the proposed transaction).

37. As of February 2013, the HSR fee was \$45,000 for transactions between \$70.9 and \$141.8 million, \$125,000 for transactions between \$141.8 and \$709.1 million, and \$280,000 for transactions over \$709.1 million. *FTC Premerger Notification Program, Filing Fee Information*, FEDERAL TRADE COMMISSION, <http://www.ftc.gov/enforcement/premerger-notification-program/filing-fee-information> (last visited May 21, 2014) (on file with the Washington and Lee Law Review).

38. Concerns about regulatory competition between the FTC and DOJ Antitrust have been relatively minimal in recent years as the agencies have agreements and clearance procedures with one another to prevent stepping on each other’s toes. U.S. DEPT OF JUSTICE, ANTITRUST DIVISION, ANTITRUST DIVISION MANUAL, VII-3—VII-8 (5th ed. 2014); see also Fred S. McChesney, *Talking ‘Bout My Antitrust Generation: Competition for and in the Field of Competition Law*, 52 EMORY L.J. 1401, 1426 n.106 (2003) (referencing the recent harmony between the FTC and DOJ). The two agencies also specialize in

“regulatory duopoly” structure forces its two “competitor” regulators to consider each other’s actions when determining their own policy.³⁹

C. The Economics of Differential Pricing

Monopolies often (deservedly) have a bad reputation. But regulatory monopolies like the PTO have the potential to use their monopoly power to fulfill their regulatory purpose and promote the general good. Much of the positive potential of regulatory monopolies stems from their ability to conduct differential pricing. To fully understand how this works requires a brief primer on the economics of monopolies and differential pricing, which is the subject of this subsection.

1. Prerequisites for Differential Pricing

A regulatory monopoly like the one enjoyed by the PTO allows it to exercise more individualized forms of regulatory power. In particular, because the PTO controls the flow of patent rights, and because it recently gained some ability to control the fees it charges patent applicants, it can tailor some of the fees that it charges based on underlying characteristics of the

different areas. See, e.g., *The Enforcers: The Federal Government*, FED. TRADE COMM’N, <http://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/enforcers> (last visited May 21, 2014) (“Both the FTC and [DOJ Antitrust] enforce the federal antitrust laws. In some respects their authorities overlap, but in practice the two agencies complement each other. Over the years, the agencies have developed expertise in particular industries or markets.”) (on file with the Washington and Lee Law Review). Nonetheless, the potential for conflicts between the two regulatory agencies still exists. See Mark D. Whitener, *Advice, Unsolicited*, 22 ANTITRUST ABA 6, 6 (2008) (“[T]he ‘dual enforcement’ debate may be quiet for now, but it is never far from the surface.”).

39. See McChesney, *supra* note 38, at 1426 n.106 (noting that the FTC and DOJ Antitrust divided their regulatory authority, assigning each industry to one enforcement agency or the other). The FTC’s and DOJ Antitrust’s merger authority differs in one important way from a standard duopoly as regulated parties cannot pick which authority regulates them. In other words, unlike a buyer who can choose from one of two sellers, merging companies are subject to regulation by both regulatory agencies. Nonetheless, conceptualizing this market as a regulatory duopoly helps us see how the actions of one agency affect another tasked at regulating the same conduct.

applicant.⁴⁰ It can charge more to certain applicants (e.g., those whose patent applications cost more to process or those who care more about patent rights) than to others (e.g., those whose applications cost less to process or those who care less about patent rights). In economic terms, this is referred to as price discrimination or differential pricing.⁴¹

Differential pricing works because buyers differ in their willingness to pay for certain goods. To illustrate, consider the market for a new type of tennis racquet with a better balance of control and power than existing brands. Suppose it costs me, the racquet manufacturer, \$100 to produce each additional racquet; in economics terms, we say the marginal cost of each racquet is \$100. Additionally, assume that potential consumers of this new racquet fall into four camps differentiated by the amount they would be willing to pay. Group 1 would be willing to pay \$200; group 2, \$150; group 3, \$120; and group 4 would pay nothing at all.

How would pricing work if this were a perfectly competitive market?⁴² Basic economics teaches us that in such a market, the maximum price a seller can charge depends on the price other sellers charge. If a competitor undercuts me, I am forced to lower

40. See Richard A. Posner, *The Social Costs of Monopoly and Regulation*, 83 J. POL. ECON. 807, 817–20 (1975) (discussing examples of monopolies and regulatory monopolies changing prices).

41. For a discussion of differential pricing, see Patricia M. Danzon & Adrian Towse, *Differential Pricing for Pharmaceuticals: Reconciling Access, R&D, and Patents*, 3 INT'L J. HEALTHCARE FIN. & ECON. 183, 184–87 (2003) (explaining that price differentials emerge in the pharmaceutical industry because buyers are willing to pay unusual amounts due to the fact that pharmaceutical companies operate in a monopolistic market). Furthermore, despite the negative connotation of the term “price discrimination,” it is not necessarily a bad thing. As explained below, in many situations, price discrimination can increase social welfare by increasing the number of beneficial transactions that take place. In other words, absent price discrimination, some people who would like to purchase a good or service would be priced out of the market.

42. A perfectly competitive market is one in which no producer of a particular good is large enough to exert market power over the price of the good. See Israel M. Kirzner, *Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach*, 35 J. ECON. LIT. 60, 63 (1997) (describing a perfectly competitive market in microeconomics as one where no actor dictates price). In the context of tennis racquets, a perfectly competitive market might be approximated by one in which multiple competitors are able to copy the design of the racquet after any patents on its structure have expired.

my price or else customers will buy from the competitor instead. Sellers will compete with one another to lower the price until it reaches the marginal cost of the good.⁴³ At that point, sellers will not lower the price any further as doing so will result in selling the product at a loss, and it would be better to sell nothing rather than to sell at a loss. So in the tennis racquet example described above, the price in a perfectly competitive market would be \$100, and people in groups 1, 2, and 3 would buy the racquet (and people in group 4 would not).

Accordingly, in a competitive market, there is no room for differential pricing. A basic law of economics—the law of one price⁴⁴—governs, and the market-clearing price will not depend on consumers’ willingness to pay for a product. The price will be the marginal cost of the good.⁴⁵

When there is a monopoly, however (or more generally, when a seller has some market power), pricing decisions change.⁴⁶ As a monopolist, I do not have to worry about what my competitors will charge because I do not have any competitors.⁴⁷ Instead, my

43. See Areeda & Turner, *supra* note 24, at 702 (noting that firms in a perfectly competitive market maximize profits by increasing output to the point where marginal cost equals the market price).

44. The law of one price provides that the same good must sell for the same price in all locations. See Owen A. Lamont & Richard H. Thaler, *Anomalies: The Law of One Price In Financial Markets*, 17 J. ECON. PERSP. 191, 191 (2003) (“The Law [of one price] states that identical goods must have identical prices.”). If the law did not hold true, then one could make unlimited profits by buying the item in the cheaper location and reselling it in the more expensive location. Doing this would increase the demand for the item in the cheaper location (thereby raising the price there) and increase the supply of the item in the more expensive location (thereby lowering the price there) until the two prices were equal. See *id.* at 192 (describing this phenomenon as arbitrage—the ability of individuals to purchase a product in one market and sell it in another).

45. See Areeda & Turner, *supra* note 24, at 702 (noting that this is the point at which firms in a competitive market will maximize profit).

46. See Lamont & Thaler, *supra* note 44, at 191 (stating that the law of one price holds exactly in “competitive markets with no transaction costs and no barriers to trade”).

47. As a practical matter, I almost always have some competitors—it is just a matter of degree. For example, even if a company had a monopoly over all forms of automotive transportation, some people would have still alternate means of travel, such as riding a bike, taking the train, or walking. So demand for automobiles is not completely inelastic, and if the price of driving were high enough, people who would otherwise drive would shift over to other modes of transportation.

pricing depends solely on my customers' willingness to pay, along with the cost of producing the good. In the language of economics, the market-clearing price is one in which the marginal cost of the good equals the revenue generated from producing one additional unit of the good. That is, a monopolist produces goods such that marginal cost equals marginal revenue.⁴⁸

An important corollary of this is that in monopoly, customers who would otherwise buy a product in a competitive market are priced out of the market.⁴⁹ To illustrate this phenomenon more concretely, suppose I have some degree of monopoly power in the tennis racquet market discussed above.⁵⁰ Instead of setting a price of \$100 (the marginal cost), I instead calculate that I can use my market power to maximize my profits by pricing my racquet above marginal cost, at \$150. In that case, people in groups 1 and 2 would buy my racquet, but people in group 3 would not.

Note that this outcome is not the best one for the monopolist—it costs him only \$100 to produce the racquet, and the individuals in group 3 would be willing to pay \$120 for it, but because the price is \$150, they never purchase it. But if the monopolist charges \$120 instead of \$150, he will be losing money on the people in groups 1 and 2, who would be willing to pay \$200 and \$150, respectively. So what should the monopolist do?

If the monopolist has information on his customers' willingness to pay, then he could charge each customer a different amount for the racquet. In other words, the monopolist could charge the individuals in group 1, \$200; individuals in group 2, \$150; and individuals in group 3, \$120. This is the essence of differential pricing—charging people different prices that reflect their differing willingness to pay.

48. See William M. Landes & Richard A. Posner, *Market Power in Antitrust Cases*, 94 HARV. L. REV. 937, 939 (1981) (noting that monopolies maximize profit when marginal revenue equals marginal cost).

49. See Peter Lee, *The Evolution of Intellectual Infrastructure*, 83 WASH. L. REV. 39, 98 n.323 (2008) (indicating that consumers are priced out of the market because monopolies charge prices higher than those charged in competitive markets).

50. For example, if I have a patent over the structure of the tennis racquet, I can prevent competitors from copying the design.

Put differently, differential pricing allows the monopolist to get the best of both worlds. The monopolist can sell to all people who value the good at issue more than the marginal cost—in the case of the tennis racquet, that is people in groups 1, 2, and 3. At the same time, he can charge more to people who want the product more. Thus, differential pricing enables a monopolist to maximize his revenues while selling to all customers who value the product more than the cost of producing it.⁵¹

To differentially price, however, having market power and information on people's willingness to purchase is not enough. A monopolist must also be able to block buyers of his product from selling to one another.⁵² For instance, even if a monopolist correctly identified consumers by their willingness to pay, a group 3 person could buy a tennis racquet for \$120 and turn around and resell it to a group 2 person for somewhere between \$120 and \$150. Both the group 3 person and the group 2 person would be better off by this transaction than if the group 2 person simply bought the racquet from the monopolist for \$150.⁵³ So differential pricing works only if a seller can block arbitrage—if it can block buyers of products from selling to one another.⁵⁴

2. Varieties of Differential Pricing

Market power, information on customers' willingness to pay, and the ability to block arbitrage give sellers the power to engage in differential pricing (or as it is often called, price

51. See Richard A. Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 548, 570 (1969) (arguing that price discrimination may be the only feasible method of ensuring efficient allocation of resources under conditions of natural monopoly).

52. See Michael J. Meurer, *Copyright Law and Price Discrimination*, 23 CARDOZO L. REV. 55, 59 (2001) (discussing the requirements for price discrimination and explaining why it cannot be met in many markets).

53. See R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 15 (1960) (articulating the Coase theorem—the idea that, absent transaction costs, private parties will bargain to place goods in the hands of the person who values the goods the most); Richard A. Posner, *Rational Choice, Behavioral Economics, and the Law*, 50 STAN. L. REV. 1551, 1571 (1998) (defending the Coase theorem).

54. See Fisher, *supra* note 8, at 3–9 (stating that price discrimination is hard to engage in because a firm must have market power, arbitrage must be limited, and the firm must be able to differentiate between consumers).

discrimination).⁵⁵ As scholars have recognized, there are three major types of differential pricing: first-degree, second-degree and third-degree price discrimination.⁵⁶

First-degree price discrimination is the most direct kind of differential pricing. Here, a seller charges each buyer a different price that corresponds to that buyer's willingness to pay.⁵⁷ First-degree price discrimination is more of a theoretical benchmark as it is generally impossible for a seller to know each buyer's exact valuation of a product.⁵⁸ In the tennis racquet example above, first-degree price discrimination would occur if the seller knew the exact willingness to pay for all of his potential customers.

Second-degree price discrimination involves a situation where a seller cannot determine on its own how much potential buyers are willing to pay for its product.⁵⁹ Nonetheless, the seller is able to provide incentives to consumers that cause them to signal their willingness to buy through their purchasing decisions.⁶⁰

A quintessential example of second-degree price discrimination is product versioning. Here, a seller provides slightly different versions of a product that appeal to people with different levels of willingness to pay.⁶¹ For example, suppose the tennis racquet manufacturer ships the racquet in two versions—a regular version, and a deluxe version that costs twice the price but is signed by a star tennis player. Those who value the autographed racquet will buy the deluxe version; those who care

55. See *id.* at 3–4 (listing the three prerequisites to differential pricing).

56. See Gifford & Kudrle, *supra* note 8, at 1241 (discussing the three types of differential pricing).

57. See Meurer, *supra* note 52, at 68–69 (“In the idealized case of perfect (or first degree) price discrimination the seller can block arbitrage and transact at a different price with each buyer.”).

58. See Gifford & Kudrle, *supra* note 8, at 1241 (noting that first-degree price discrimination occurs only in rare, specialized circumstances).

59. See Meurer, *supra* note 52, at 71–80 (describing how in second-degree price discrimination sellers measure preferences by observing buyers' choices).

60. See Gifford & Kudrle, *supra* note 8, at 1241 (noting that a common incentive is two-tiered pricing, where all consumers pay an initial fee to enter the market and then pay a flat fee per unit purchased).

61. See Katherine J. Strandburg, *Free Fall: The Online Market's Consumer Preference Disconnect*, 2013 U. CHI. LEGAL F. 95, 136 (2012) (indicating that second-degree price discrimination induces consumers to reveal their willingness to pay).

only about receiving the racquet will buy the regular version. By creating two different versions of the same racquet, the seller has caused potential buyers to self-select into two different groups that roughly correspond to their desire to buy the racquet.⁶²

An advantage of second-degree price discrimination is that it automatically handles concerns about arbitrage between consumers. This is because versioning of the product is itself what separates consumers who differ in their willingness to pay.⁶³ For example, an individual who is willing to pay for only the regular version of the racquet will not buy the deluxe version from someone who has bought it, and an individual who wants the deluxe version will not buy the regular version from another customer.

Third-degree price discrimination involves a seller partitioning a market into segments and charging people within each segment the same price.⁶⁴ A common example of third-degree price discrimination is student discounts. Companies often know that students on average have less money than people who work full-time. Accordingly, by charging students less, a company is able to sell to students at a lower price (corresponding to their lower willingness to pay) while still charging nonstudents a higher price.⁶⁵ So long as the students' willingness to pay exceeds the marginal cost of producing the good, this kind of differential pricing is beneficial to the monopolist.⁶⁶

62. *See id.* (stating that second-degree price discrimination induces consumers to sort themselves by willingness to pay).

63. *See* Meurer, *supra* note 52, at 72–75 (discussing how second-degree price discrimination prevents arbitrage by separating consumers based on willingness to pay).

64. *See id.* at 69 (providing an example of third-degree price discrimination that illustrates how segments are formed and persons within each segment pay the same price).

65. *Cf.* Strandburg, *supra* note 61, at 136 (noting that movie theaters often engage in third-degree price discrimination by selling movie tickets at different prices to adults, seniors, students, and children).

66. *See* Meurer, *supra* note 52, at 69–71 (explaining that a monopolist produces a good to the point where marginal cost equals marginal revenue); *see also* Fisher, *supra* note 8, at 4 (providing that senior discounts also exhibit third-degree price discrimination in which the seller, despite a lack of knowledge about purchasing power, can separate buyers into groups based upon perceived wealth or eagerness).

One issue with third-degree price discrimination, as with first-degree price discrimination, is that sellers must be able to prevent arbitrage among consumers.⁶⁷ So third-degree price discrimination works well in environments in which sales of goods between customers can be easily blocked. Airline tickets are a good example. These tickets are generally nontransferable, which means the airline will not honor the ticket if it is given or sold to another person. Because a person's identity is easily verifiable when an individual boards a plane, third-degree price discrimination works well in this setting.⁶⁸

D. Differential Pricing in Regulatory Monopolies

The previous subsections discussed differential pricing in the context of traditional monopolies. But the same discussion applies to any regulatory monopoly, such as the PTO, which has market power over the prices it sets (user fees) on the goods it provides (patent rights). The regulatory monopolist can set these prices in such a way that they best enable it to fulfill its legal and regulatory purposes. And in some situations, an optimal regulatory price structure will involve differential prices.

Moreover, the three prerequisites for price discrimination—market power, the ability to distinguish users based on their willingness to pay, and the ability to prevent arbitrage—are often readily met in the regulatory monopoly context.⁶⁹ First, as noted, a regulatory monopoly has market power.⁷⁰ Indeed, as the single

67. See Meurer, *supra* note 52, at 68–71 (arguing that both first- and third-degree price discrimination are subject to arbitrage limits).

68. Here, the price discrimination is between business and leisure travelers. Airlines know business travelers often make travel plans with short lead time and are relatively price insensitive. On the other hand, leisure travelers can typically plan their trips much more in advance and are more price sensitive. By selling airline tickets at a cheaper price a few weeks before a flight, and then raising the price as the travel date gets closer, airlines are able to differentially price between both types of travelers.

69. See Fisher, *supra* note 8, at 3–4 (discussing the three prerequisites for price discrimination).

70. See Abramowicz & Duffy, *supra* note 4, at 1545 (describing the PTO as a “complete monopoly”).

locus of authority in a regulatory context, it often has unitary power to set fees that regulated entities must pay.⁷¹

Second, regulatory monopolies can often differentiate users based on their willingness to pay for a particular good, often through interaction with the entities they regulate. To illustrate, consider the Securities and Exchange Commission (SEC). The SEC has a great deal of information on the public companies it regulates—indeed, it requires these companies to disclose, on a regular basis, detailed information on their operations to the SEC and the public.⁷² If a company misbehaves, the SEC can use this information to impose a fine.⁷³ Here, the focus is not so much on a company's willingness to pay as much as its ability to pay. If a company is able to pay more, the SEC can propose a higher fine to fulfill its regulatory purpose to deter actors from engaging in malfeasance again.⁷⁴ Hence, the SEC can use information on the actors it regulates to tailor the fines it charges them.⁷⁵

Finally, preventing arbitrage between users is often relatively easy for regulatory monopolies. This is because there is generally no liquid market for the approval being given by the regulatory monopoly. For example, consider regulatory approval by the FDA for a new drug. A company cannot transfer approval of Drug A to another company that is seeking approval of Drug B. Rather, that company must obtain its own, individualized approval from the FDA. This works because the “product” being sold by the FDA is *sui generis*—there is no way to transfer

71. See *USPTO Fee Information: Current Fee Schedule*, U.S. PATENT AND TRADE OFFICE, <http://www.uspto.gov/web/offices/ac/qs/ope/fee010114.htm> (last visited May 19, 2014) (providing maintenance fee payment schedules) (on file with the Washington and Lee Law Review).

72. See 15 U.S.C. § 78m(a) (2012) (mandating disclosure of certain information in periodic reports filed with the SEC); see also *Filings and Forms*, SECURITIES AND EXCHANGE COMMISSION, <https://www.sec.gov/edgar.shtml#.U39gRqnZfww> (last visited May 23, 2014) (describing the various forms the SEC requires) (on file with the Washington and Lee Law Review).

73. See Edward Rock, *Securities Regulation as a Lobster Trap: A Credible Commitment Theory of Mandatory Disclosure*, 23 CARDOZO L. REV. 675, 702–03 (2002) (noting that companies can opt-out of SEC disclosure requirements by remaining a private company).

74. See *id.* (arguing that the SEC's history of strictly enforcing disclosure requirements contributes to its ability to prevent corporate impropriety).

75. See, e.g., *id.* at 703 (discussing SEC's monopoly over criminal sanctions in securities cases and the functions of the SEC disclosure systems).

regulatory approval from one product to another. Accordingly, issues with arbitrage are generally not as problematic for regulatory monopolists.⁷⁶

III. The Promise of Differential Pricing in the Market for Patents

A. The Pricing of Patents

To see the potential benefits of differential patent pricing, one must first understand how the PTO currently prices patents. Accordingly, this section provides a brief overview of the patent granting process and the fees the PTO charges applicants and patentees to fund its operations.

As noted throughout this Article, the PTO is the sole government institution in the United States in charge of granting patents.⁷⁷ To get a patent, an inventor must file a patent application with the PTO.⁷⁸ The PTO will then review the application and determine whether the described invention satisfies the statutory criteria for patentability—primarily,

76. Arbitrage may be possible for regulatory products that have a secondary market, such as taxicab medallions or liquor licenses. *See, e.g.,* Michael M. Grynbaum, *2 Taxi Medallions Sell for \$1 Million Each*, N.Y. TIMES (Oct. 20, 2011), <http://cityroom.blogs.nytimes.com/2011/10/20/2-taxi-medallions-sell-for-1-million-each/> (last visited May 24, 2014) (detailing one secondary sale of taxi medallions in New York City) (on file with the Washington and Lee Law Review).

77. *See* 35 U.S.C. §§ 171, 161 (explaining that the PTO grants three kinds of patents—utility, design, and plant). Design patents cover new and original ornamental designs in articles of manufacture, and plant patents cover certain types of invented or discovered plant species. The colloquial use of the term “patent” refers to utility patents, which cover all other patentable inventions. Utility patents make up over 90% of all patent filings and grants, and the vast majority of the PTO’s resources are spent on utility patent examination. *U.S. Patent Statistics Chart Calendar Years 1963–2013*, U.S. PATENT AND TRADEMARK OFFICE, PATENT TECH. MONITORING TEAM, http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm (last visited May 25, 2014) (on file with the Washington and Lee Law Review). So the focus of this paper is on utility patents.

78. An applicant may file an original patent application with the PTO, or they may file an application overseas at a foreign patent office under the Patent Cooperation Treaty, and subsequently file a “national stage” application with the PTO. *See* 35 U.S.C. §§ 111, 371 (2012). Regardless where the original application is filed, however, the PTO is the entity that determines whether a given invention will receive patent protection in the United States.

whether the claimed invention is useful,⁷⁹ novel,⁸⁰ and nonobvious to a person having ordinary skill in the relevant art.⁸¹ If the PTO determines an application meets the necessary criteria,⁸² it will send the applicant a notice of allowance, and upon payment of an issue fee by the applicant, the patent application will turn into a valid and enforceable patent.⁸³ Although there is significant variation across industry categories and over time, about 50% of filed patent applications eventually issue.⁸⁴

79. See *id.* § 101 (requiring patentable invention to be “new and useful”). This patentability requirement is referred to as the “utility” requirement. It is generally easily met by most applicants so long as the invention provides some kind of de minimis benefit and is at least theoretically capable of being used.

80. See *id.* § 102 (describing the “novelty” condition of patentability). A claimed invention lacks novelty if it was described in an earlier-filed patent or published patent application that names another inventor, or if it was “patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.” *Id.* § 102(a)(1)–(2). There are some exceptions, such as if the inventor himself makes the public disclosure less than one year prior to seeking patent protection. *Id.* § 102(b)(1)(A).

81. *Id.* § 103. Nonobviousness is typically the most difficult hurdle for a patent applicant to clear. See Jeanne C. Fromer, *The Layers of Obviousness in Patent Law*, 22 HARV. J.L. & TECH. 75, 76 (2008) (stating that the nonobvious element “requires that an invention represent a significant technological or scientific breakthrough compared to what is already known or doable”). Indeed, it is often referred to as the “ultimate condition of patentability.” *Id.* at 75 (citing NONOBVIOUSNESS—THE ULTIMATE CONDITION OF PATENTABILITY (John F. Witherspoon ed., 1980)).

82. Other patentability requirements include the enablement requirement, which requires the patent application to enable one having ordinary skill in the relevant art to make and use the claimed invention, and the written description requirement, which requires that the specification portion of the patent application adequately describe the invention. 35 U.S.C. § 112(a). The Federal Circuit has found the written description and enablement requirements to be separate and distinct from one another. See *In re Curtis*, 354 F.3d 1347, 1357 (Fed. Cir. 2004) (“We interpret 35 U.S.C. §112, ¶1 to require a written description requirement separate and apart from the enablement requirement.”).

83. See 35 U.S.C. § 151 (describing the issuance of a patent).

84. See U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE AND ACCOUNTABILITY REPORT FISCAL YEAR 2012, at 26 fig. 11 (2012) <http://www.uspto.gov/about/stratplan/ar/USPTOFY2012PAR.pdf> [hereinafter 2012 PTO REPORT] (showing a 12-month rolling average allowance rate between 41% and 52% in 2009–2012).

The PTO's chief patent-related expenses are the costs it incurs in reviewing patent applications.⁸⁵ Unlike other government institutions, the PTO must rely on user fees to pay these costs.⁸⁶ In other words, the cost of examining patent applications is borne by the applicants who seek review by the PTO and by the patentees who have already received patent protection. If the PTO does not receive sufficient funds from its users to cover its operations for a particular year, then it suffers a budgetary shortfall. If it receives an excess of funds, those funds are deposited in a Patent and Trademark Fee Reserve Fund, a new creation of the America Invents Act of 2011.⁸⁷ These fees are available to the PTO so long as Congress includes them in the PTO's annual appropriations bill.⁸⁸

The fees the PTO charges applicants fall into three main categories. First, the PTO charges filing, search, and examination fees (collectively called “front-end fees”), which are due when the patent application is filed.⁸⁹ These fees are paid by all patent applicants even if their patent never issues. Front-end fees are supposed to pay for the patent examination process—the process by which the PTO determines whether an application satisfies

85. *See id.* at 86 (showing program cost of patent optimization as substantially higher than other costs). As its name suggests, the PTO also processes trademark applications, though this forms a much smaller part of the organization. To illustrate, as the end of fiscal year 2012, the USPTO had a total of 11,531 employees, 7,935 of which were patent examiners and only 386 of which were trademark attorneys. *Id.* at 10. 89.8% of fiscal year 2012 revenue came from the patent sector, while 10.2% came from trademarks. *Id.* at 72.

86. *See id.* at 9 (noting that the PTO became fully dependent on user fees in 1990 as part of the Omnibus Budget Reconciliation Act (OBRA), Pub. L. No. 101-508, 104 Stat. 1388 (1990)).

87. *See* Leahy-Smith America Invents Act, Pub. L. 112-29, § 22, 125 Stat. 284 (2011) (codified at 35 U.S.C. § 42(c)(2) (2012)).

88. *See* 35 U.S.C. § 42(e) (2012) (requiring the PTO to submit to Congress annually certain information for appropriation purposes). In the past, excess funds received by the PTO were often siphoned away by Congress in a process known as fee diversion. *See* Frakes & Wasserman, *Failed Promise*, *supra* note 11, at 13 (discussing the fee diversion process). However, the PTO seems to believe that creation of the Patent and Trademark Fee Reserve Fund “mitigates the issue of fee diversion” and indicates that the PTO “will continue to work closely with Congress to ensure full access to fees paid by patent applicants and patentees, consistent with the AIA.” Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4255 (Jan. 18, 2013).

89. *See* 35 U.S.C. § 41 (explaining the patent fee structure).

the requirements of patentability.⁹⁰ However, as the PTO explains, to foster innovation and “encourage innovators to take advantage of patent protection, the Office sets basic ‘front-end’ fees . . . below the actual cost of carrying out these activities.”⁹¹ The PTO increased front-end fees for utility patents from \$1,260 to \$1,600 in 2013 when it exercised for the first time its new fee-setting authority under the America Invents Act. But these amounts are still below its \$3,569 estimated cost of reviewing a utility patent application in 2011.⁹² So application fees cover less than half the cost of examining a patent application, and the PTO must rely on other fees to cover this shortfall.

These other fees are of two varieties. The first are issue fees, which are fees an applicant must pay the PTO before an approved patent application actually issues and becomes enforceable.⁹³ Issue fees are paid only for patent applications that will actually issue (i.e., applications the PTO decides meet the legal standard of patentability) and not for patent applications that were filed but never issue.⁹⁴ Even though the PTO decreased issue fees from \$1,770 to \$960 in 2013, they still exceed the PTO’s estimated cost of \$257 for actually issuing the patent.⁹⁵ Accordingly, patent issue fees are priced well above the cost of patent issuance.

Patentees must also pay maintenance fees, which are payments a patentee must make to the PTO at certain intervals during the patent term to keep the patent from lapsing.⁹⁶ For all patents issued since 1981, the PTO has required three maintenance fee payments, due at three-and-a-half, seven-and-a-half, and eleven-and-a-half years after patent

90. *See id.* § 131 (addressing the examination process for patent applications).

91. Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4216 (Jan. 18, 2013).

92. *Id.* at 4227. In fiscal year 2012, 30.9% of total patent revenue came from front-end fees. 2012 PTO REPORT, *supra* note 84, at 72–73.

93. *See* 35 U.S.C. § 41 (describing issue fees).

94. *See id.* § 151 (“Upon payment of [the issue fee] the patent may issue . . .”).

95. Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4236 (Jan. 18, 2013). In fiscal year 2012, \$463.3 million (21.3% of total patent revenue) came from issue fees. 2012 PTO REPORT, *supra* note 84, at 72–73.

96. *See* 35 U.S.C. § 41 (2012) (describing maintenance fees).

issuance.⁹⁷ If a patentee elects not to pay a maintenance fee, then the underlying patent will lapse—it will not be a valid patent and will no longer be enforceable.⁹⁸ Put differently, failure to pay maintenance fees in effect shortens patent term such that it ends early.

Maintaining a patent costs the PTO nothing; nonetheless, three-and-a-half, seven-and-a-half, and eleven-and-a-half maintenance fees are \$1,600, \$3,600, and \$7,400, respectively (increased from \$1,150, \$2,900 and \$4,810, respectively, in 2013).⁹⁹ So the PTO prices maintenance fees significantly above cost to subsidize the below-cost pricing of front-end application fees.¹⁰⁰

Above-cost pricing of issue fees and maintenance fees also allows the PTO to give discounts to certain “smaller” inventors. As noted, applicants and patentees pay the same amount of fees regardless of the type of underlying invention, or the industrial category into which the invention fits. But the PTO does lower fees depending on the size of the patent assignee, which is the party that owns the patent right. In particular, if a patent assignee is an individual, or a small business or nonprofit organization that is small enough to meet certain criteria, then the assignee might qualify for “small-entity” status.¹⁰¹ Small entities pay one-half of the normal PTO fees as mandated by Congress.¹⁰² About 20% of patents issued between 2008 and 2012 were issued to small entities.¹⁰³

Additionally, as part of the recently-passed America Invents Act, Congress created a “micro-entity” status, which consists of two categories of inventors. First, it includes small-entity

97. *See id.* § 41(b)(1)–(2) (stating that patentees may receive a six-month grace period to pay maintenance fees, conditioned on payment of surcharges).

98. *See id.* (describing the effect of failure to pay maintenance fees).

99. Setting and Adjusting Patent Fees, 78 Fed. Reg. 4236 (Jan. 18, 2013).

100. In fiscal year 2012, \$697.9 million (\$32.1% of total patent revenues) came from maintenance fees. 2012 PTO REPORT, *supra* note 84, at 72–73.

101. *See* 37 C.F.R. § 1.27 (2013) (defining “small entity”).

102. *See* 35 U.S.C. § 41(h) (2012) (“[F]ees charged shall be reduced by 50 percent with respect to their application to any small business concern . . .”).

103. *See* 2012 PTO REPORT, *supra* note 84, at 185 Table 11 (showing the percent of utility patents issued to small entities was between 19.76% and 20.87% in 2008–2012).

inventors who have filed no more than four previous U.S. patent applications and have gross income for the previous year that does not exceed three times the median household income.¹⁰⁴ Second, it includes inventors who are employed by an institution of higher education and whose patent application is assigned, granted, licensed or otherwise conveyed to that institution.¹⁰⁵ The AIA mandates that micro entities pay only one-quarter of the standard PTO fees.¹⁰⁶

B. The Effect of Patent Prices on Innovation

One of the primary goals of the PTO is to promote innovation.¹⁰⁷ To the extent we believe patents incentivize innovation—something most commentators take for granted and the PTO certainly believes—improving access to the patent system should spur inventive activity.¹⁰⁸

One way the PTO could improve access would be to lower the fees it charges applicants and patentees. These could be front-end fees—filing, search, and examination fees paid when an applicant

104. See 35 U.S.C. § 123(a)–(c) (defining “micro-entity”). The provision also requires that the inventor not assign, license, or otherwise give an ownership stake in the patent application (or be in a contract requiring any of these actions) to any entity that exceeds the income limitation. *Id.* § 123(c).

105. See *id.* § 123(d) (providing that this obligation could be met if the employee of the higher education institution is under contract to assign, grant, license, or convey the application to the institution).

106. See Leahy–Smith America Invents Act, Pub. L. 112-29, § 10(b), 125 Stat. 284 (2011) (reducing fees “by 75 percent with respect to the application of such fees to entity”).

107. See 2012 PTO REPORT, *supra* note 84, at 8 (noting that the PTO’s mission is: “Fostering innovation, competitiveness and economic growth, domestically and abroad to deliver high quality and timely examination of patent and trademark applications, guiding domestic and international intellectual property policy, and delivering intellectual property information and education worldwide, with a highly skilled, diverse workforce”). The PTO also notes it is “uniquely situated to support the accomplishment of the Department [of Commerce]’s mission to *create the conditions for economic growth and opportunity by promoting innovation, entrepreneurship, competitiveness, and stewardship.*” *Id.* (emphasis in original).

108. See Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4214 (Jan. 18, 2013) (explaining how the patent laws operate to spur innovation). *But see* Boldrin & Levine, *supra* note 13, at 3 (arguing there is no evidence that patents increase productivity).

files her application—or back-end fees—issue fees paid when the patent issues or periodic maintenance fees paid to keep the patent in force after issuance. All else being equal, lowering any of these fees would lower the cost of obtaining and maintaining a patent. On the margin, this should increase patenting activity and spur innovation.¹⁰⁹

Of course, such a change might cause the PTO to lose revenue. For example, if the increase in patent applications filed under the reduced fee regime is not sufficient to make up for the revenue lost because fees are lower, then the PTO's revenue would decrease. To give a simple numerical example, suppose that 1 million patent applications would be filed if the cost of filing and obtaining a patent were \$5,000, and 1.2 million applications would be filed if this cost were lowered to \$4,000. Although the number of applications filed increased from 1 million to 1.2 million (20% increase) in response to the decrease in cost from \$5,000 to \$4,000 (20% decrease), the total revenue has decreased from \$5 billion to \$4.8 billion. So the patent office would lose \$200 million in revenue even though the number of applications filed has increased because this increase was not sufficient to make up for the reduced fees.

This possibility of lost revenue might create a serious problem because the PTO depends entirely on user fees for funding.¹¹⁰ So ideally, any change in fees should strive to be at least revenue-neutral. In particular, the goal should be to structure fees such that the PTO's balances its budget but innovation is maximally incentivized.

How could this be accomplished? In a recent rule, the PTO described its strategy:

The Office's current fee structure includes statutory fees (set by Congress) that provide lower, below cost fees on the front end of the patent process (e.g., filing, searching, and examination fees), which are in turn balanced out by higher,

109. See, e.g., Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1521 (2001) ("If we fail to issue good patents, we may reduce innovation incentives and interfere with the other socially valuable uses of patents, such as their financing function.").

110. See, e.g., Masur, *supra* note 23, at 499 (noting the importance of user fees); Frakes & Wasserman, *PTO's Granting Patterns*, *supra* note 12, at 76 (same).

above cost fees on the back end (i.e., issue and maintenance fees). This balance enables the Office to provide lower costs to enter the patent system, making it easier for inventors to pursue patents for their innovations, and these lower front-end fees are off-set by higher back-end fees. Congress set this balance when it established the existing statutory fee structure, and the Office continues to follow this model with the fee structure in this final rule, because a key policy consideration is to foster innovation by facilitating access to the patent system.¹¹¹

So the key is to subsidize lower front-end application fees with higher back-end issue fees and maintenance fees.

Why might this fee structure promote innovation? The answer to this question finds support in both neoclassical and behavioral economics. Traditional economics teaches us people discount events that happen in the future.¹¹² Suppose someone is asked whether they prefer to receive one dollar today versus one dollar tomorrow. Most people would prefer to receive the dollar today, not merely because of inflation but because an individual can use that dollar today to buy something.¹¹³ In economic terms, whatever activity the individual could use that dollar for today is the opportunity cost of receiving it tomorrow instead.¹¹⁴

Behavioral economics adds to this discussion by introducing something known as hyperbolic discounting, which describes how people are often inconsistent in discounting over time.¹¹⁵ In particular, many people are “present-biased”—their level of discounting is very steep for events in the near-future but much

111. Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4214 (Jan. 18, 2013).

112. See, e.g., Russell B. Korobkin & Thomas S. Ulen, *Law and Behavioral Economics: Removing the Rationality Assumption from Law and Economics*, 88 CAL. L. REV. 1051, 1119 (2000) (“Because of the time value of money, rational actors will discount future income.”).

113. See *id.* (“[T]o give up a dollar today, [rational actors] will demand something more than a dollar tomorrow.”).

114. See Rafael I. Pardo, *Reconceptualizing Present-Value Analysis in Consumer Bankruptcy*, 68 WASH & LEE L. REV. 113, 131 (2011) (noting that the time value of money reflects opportunity cost as well as any expected inflation).

115. See Korobkin & Ulen, *supra* note 112, at 1120 (indicating that, according to behavioral science literature, personal discount rates tend to increase as the expected reward is further delayed).

less-steep for events later on.¹¹⁶ So discounting can be important even when dealing with relatively short-run events.

A classic illustration of hyperbolic discounting comes from an extension to the dollar-today, dollar-tomorrow hypothetical. Suppose instead the operative questions are whether you would prefer: (1) a dollar today versus three dollars tomorrow; or (2) a dollar in one year versus three dollars in one year and one day. Many people would prefer receiving the dollar today in hypothetical (1) but the three dollars in hypothetical (2). This is referred to as time-inconsistent behavior and cannot be explained by traditional exponential discounting. Rather, one needs discounting that is very steep at first and then becomes shallower, which is the essence of hyperbolic discounting.¹¹⁷

Despite differences in the neoclassical and behavioral approaches, both point to the same conclusion: inventors' behavior will be more influenced by front-end rather than back-end patent fees. In other words, discounting (whether hyperbolic or not) suggests that changes in front-end fees will affect potential patent applicants' behavior more than similar changes to back-end fees.

This is why the PTO's basic pricing strategy makes sense. Front-end fees are most salient to potential inventors; hence, reducing them encourages patenting behavior and (hopefully) innovation.¹¹⁸ On the other hand, applicants are less affected by changes to back-end fees, so these fees can be increased to recover lost revenue. In economic terms, potential inventors' demand for patent protection is relatively elastic with respect to front-end fees (i.e., small changes in these fees will have a relatively large effect on patenting behavior) but is relatively inelastic with

116. See *id.* (noting that this principle leads people to consume more in the present even if they previously planned to consume less).

117. See R.H. Thaler, *Some Empirical Evidence on Dynamic Inconsistency*, 8 ECON. LETTERS 201, 202 (1981) (discussing work by R. Strotz, *Myopia and Inconsistency in Dynamic Utility Maximization*, 23 REV. ECON. STUD. 165, 165–80 (1955)).

118. See U.S. PATENT AND TRADEMARK OFFICE, USPTO SECTION 10 FEE SETTING—DESCRIPTION OF ELASTICITY ESTIMATES 10–12 (2013), http://www.uspto.gov/aia_implementation/aia_section_10_elasticity_supplement.pdf [hereinafter ELASTICITY ESTIMATES] (describing USPTO's estimates of price elasticity of demand for changes in user fees).

respect to back-end fees (i.e., small changes in these fees will have a relatively small effect on patenting behavior).¹¹⁹

C. Third-Degree Price Discrimination in the Market for Patents

The previous subsection described why the current fee structure, which charges patentees more on back-end versus front-end fees, arguably promotes innovation. But this fee structure is not optimal; indeed, this Article explains how it could be improved. In particular, the PTO could increase its back-end revenues by engaging in third-degree price discrimination, where it implements differential pricing of issue fees, maintenance fees, or both across industry categories.¹²⁰ The variation in fees across industries would stem from industry-level differences in patentees' willingness to pay to obtain and maintain patent protection. As discussed later, the PTO could use the increased revenue it receives from differential pricing to lower front-end fees or improve the services it provides to patent applicants, such as by hiring additional examiners to reduce application backlog.

To understand how third-degree price discrimination could help the PTO achieve its regulatory goals,¹²¹ recall that this form of differential pricing involves partitioning a market into segments and charging people within each segment the same price.¹²² Often this is done for identifiable groups that are less

119. See *id.* at 1 (explaining that price elasticity of demand measures how sensitive consumers—here, patent applicants—are to changes in price—here, user fees); see also Gaetan de Rassenfosse and Bruno van Pottelsberghe de la Potterie, *On the Price Elasticity of Demand for Patents*, 74 OXFORD BUL. OF ECON. AND STAT. 58 (2012) (analyzing effect of patent fees on patent demand).

120. See Fisher, *supra* note 8, at 4 (providing that third-degree discrimination allows for differential pricing regardless of knowledge about the individual buyer's purchasing power).

121. Theoretically, the PTO could also engage in first-degree price discrimination, in which it customizes fees for each applicant such that individuals charged exactly the amount they are willing to pay for patent protection. In reality, the PTO could not engage in this form of differential pricing because it would lack individualized information on patentees' willingness to pay. First-degree price discrimination is more of a theoretical benchmark than something achievable in practice. See Gifford & Kudrle, *supra* note 8, at 1241 (noting that first-degree discrimination occurs only in rare circumstances).

122. See Fisher, *supra* note 8, at 4 ("In third-degree price discrimination, the

likely to pay for a good; canonical examples include discounts for students or seniors.¹²³ Third-degree price discrimination allows a monopolist to charge more to people in groups that, on average, are willing to pay more for a particular good and to charge less to people in groups that, on average, are willing to pay less. The monopolist can therefore charge the former group a higher price while not pricing out the latter group from the market.¹²⁴

In the context of patents, the PTO could use third-degree price discrimination to charge different prices to applicants and patentees in different industries depending on their willingness to pay for patent protection.¹²⁵ For example, if pharmaceutical patentees care more about patent protection than mechanical patentees, the PTO could charge the former higher maintenance fees than the latter. Because the pharmaceutical patentees care more about patent protection, they will be willing to pay more, hence enabling the PTO to increase its revenues.

Applying the general discussion from Part I.C.1 to the present context, we see that, to implement third-degree price discrimination across industries, the PTO must satisfy three prerequisites: (1) it must have market power; (2) it must have industry-level information on users' willingness to pay; and (3) it must be able to prevent arbitrage between users.¹²⁶ Requirements (1) and (3) are easily met here. First, the PTO has a regulatory

seller does not know the purchasing power of the individual buyers, but is able to separate them into individual groups that correspond roughly to their wealth or eagerness.”).

123. *See id.* (explaining the common practice of third-degree price discrimination to create student and senior discounts).

124. *See* Posner, *supra* note 51, at 570 (noting that price discrimination helps monopolists maximize profits).

125. The PTO already engages in a limited form of third-degree price discrimination through its use of small-entity and micro-entity status. *See supra* notes 101–106 and accompanying text (discussing the requirements of small-entity and micro-entity status). Patent applicants and patentees who qualify as “small entities” pay one-half the regular PTO fees; individuals who qualify as “micro entities” pay one-quarter the regular fees. *Id.* It is reasonable to assume that given their small size, these individuals have a lower willingness or ability to pay PTO fees than other patent applicants. Accordingly, by charging these individuals less money, the PTO is, on the margin, allowing some small entities or micro entities to enter the market for patents when they would otherwise be priced out if they did not receive any discounts.

126. *See supra* Part II.C.1 (explaining the prerequisites for third-degree price discrimination).

monopoly over the granting of patent rights in the United States.¹²⁷ Moreover, to obtain a patent and keep it in force, an applicant must pay whatever fees the PTO charges.¹²⁸

Additionally, preventing patentees from arbitraging patent rights should not be a major concern for the PTO. This is primarily because patent rights are not fungible, and approval and continued validity of patents are not transferable rights. For example, an individual who receives approval of patent application A cannot transfer that approval to a different patent application B. Each patent application is evaluated independently on its own merits.¹²⁹ Hence, the PTO can differentially price patents without fear that applicants can get around this pricing by selling approved patent rights to one another.

The remaining requirement is the trickiest one—obtaining industry-level information on users’ willingness to pay. However, my recent empirical research (discussed in more detail in Section IV, *infra*) sheds light on this precise topic. In particular, my research uses actual patent applicant behavior to generate an objective, cross-industry measure of how much applicants care

127. See 35 U.S.C. § 2 (2012) (granting the PTO sole authority to issue patents and to register trademarks).

128. See *id.* § 41 (implementing fees for patent applications). Although the PTO has a regulatory monopoly over the granting of patent rights, trade secret protection is a substitute legal right that some inventors might pursue. See Mark A. Lemley, *Intellectual Property and Shrinkwrap Licenses*, 68 S. CAL. L. REV. 1239, 1268 (1995) (noting that trade secret law is a species of state common law). Trade secret law prevents the misappropriation of private information by competitors or others. See *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 474–75 (1974) (stating that a trade secret may consist of any formula, device, or compilation of information that gives a business an advantage over competitors who do not possess the trade secret). Of course, a trade secret works only if the product or service at issue cannot easily be reverse-engineered—if a competitor can buy the product and figure out the inventive or novel aspect of its design, then trade secret law provides the original inventor no protection against copying or replication of his product. A valid patent, on the other hand, allows an inventor to exclude his competitors from making, using or selling the invention, even if the competitor had been unaware of the existence of the patent prior to being sued for infringement. See *id.* at 474 (holding that federal patent law does not preempt state trade secret laws). But see 35 U.S.C. § 273 (2014) (introducing, as part of the America Invents Act of 2011, a limited defense to infringement based on prior commercial use).

129. See 35 U.S.C. § 131 (explaining the examination process of a patent application).

about patent protection. The PTO could use this information to restructure its patent fees so that patentees are charged based on how much they care about patent protection.

While the PTO could use differential pricing for any of the fees it charges, maintenance fees—particularly the final maintenance fee due at eleven-and-a-half years—might be the best one to price differentially. There are at least a couple reasons for this. First, to the extent we are concerned that higher fees might reduce incentives to innovate, it would be best to raise the fees charged latest in the patent lifecycle. Applicants are likely to discount these fees the most, and it seems unlikely that a modest increase in these fees would greatly affect their decision to engage in inventive activity.¹³⁰

Second, maintenance fees are relatively low compared to the revenues that a successful invention likely generates.¹³¹ Current maintenance fees at three-and-a-half, seven-and-a-half and eleven-and-a-half years are \$1,600, \$3,600 and \$7,400, respectively.¹³² Although there might be uncertainty when a patent issues whether it will be successfully commercialized, that uncertainty should be reduced or eliminated by the time the last maintenance fee is due. And because the present value (at the time of maintenance fee payment) of a commercially successful product is likely to exceed \$7,400, it is unlikely that a modest increase in maintenance fees would affect potential inventors' decisions whether to innovate.

D. Differential Pricing to Incentivize Innovation

The previous subsection described how the PTO could implement differential patent pricing across industry categories, and how this would increase PTO revenues. But how might the

130. See Korobkin & Ulen, *supra* note 112, at 1120 (arguing that personal discount rates tend to increase as the expected reward is further delayed).

131. See Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4237 (Jan. 18, 2013) (listing current maintenance fees).

132. See *id.* at 4236 (increasing fees most recently in 2013, from \$1,150, \$2,900 and \$4,810, respectively). In a follow-up empirical paper, I am researching whether patentees and patent applicants changed their behavior in response to this increase. I am also using the increase as a natural experiment to reveal information about relative patent values across industries.

PTO use these additional revenues to incentivize innovation or improve the patenting process?

First, the PTO could encourage innovative activity by using the additional funds received from differential pricing of back-end fees to reduce front-end fees, which are more likely to be salient in affecting inventors' decisions.¹³³ As discussed previously, to the extent patents incentivize innovation, lower front-end fees are likely to promote inventive activity.¹³⁴ Differentially higher back-end fees, on the other hand, are likely to have little negative effect on inventive activity.

Put differently, one can view differential pricing combined with revenue neutrality as a type of transfer payment. The PTO can charge those who derive more benefit from the patent system (i.e., those who care more about patent protection) a higher fee. It can transfer this additional revenue to individuals who care less about patent protection by reducing their fees. The groups that care more about patent protection are unlikely to change their behavior significantly as their demand for patent protection is inelastic. The groups that care less about patent protection, on the other hand, might increase innovative activity because the price of patenting has decreased for them.¹³⁵

Alternatively, the extra revenue obtained from differential pricing could be used more directly to improve the patent system.

133. See *supra* notes 110–119 and accompanying text (describing price elasticity as it applies to patent fees).

134. Jonathan Masur has argued that the relatively high cost of patent applications could be useful to screen out low-quality patent applications. See Jonathan S. Masur, *Costly Screens and Patent Examination*, 2 J. LEGAL ANALYSIS 687, 711–12 (2012) (explaining that a costly patent screening process prevents inefficiency and the over-granting of patents); cf. Ian Ayres & Paul Klemperer, *Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies*, 97 MICH. L. REV. 985, 986–87 (1999) (discussing how uncertainty in patent rights can be socially optimal by increasing social welfare while only weakly reducing incentives to invent generated by patent monopoly rights). To the extent one is concerned about too many junk patent applications, the PTO might instead consider lowering issue fees rather than front-end fees. This would only benefit those individuals whose patent applications actually meet the standards of patentability, thereby incentivizing innovation only for applicants who believe their patent will actually issue.

135. See ELASTICITY ESTIMATES, *supra* note 118, at 2–4 (discussing the elasticity of demand for patent services).

Legal scholars often talk of a patent system in crisis.¹³⁶ While patent trolls and escalating litigation costs grab headlines, a more prosaic concern is the increased delay and backlog of applications at the PTO.¹³⁷ Over the past fifteen years, the PTO has taken longer and longer to determine whether an applicant is deserving of a patent.¹³⁸

Recent research suggests the PTO's reliance on fees from patent applicants and patentees to fund its operations might be straining the organization financially, which in turn might cause this backlog. In particular, the PTO might be deferring patent applications that take longer to examine in favor of ones that take less time to manage its workload and maximize the fees it gathers.¹³⁹

Differential pricing has the potential to improve the PTO's financial standing and hence alleviate the backlog problem. For example, increased revenues obtained from differential pricing might be used to hire more examiners in technology groups with insufficient resources. By doing this, the workload of examiners in these areas might be alleviated, and delays that applicants face might be reduced. This reduction in PTO delay increases the value of patent protection to applicants.¹⁴⁰

136. See, e.g., DAN L. BURK & MARK A. LEMLEY, *THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT* (2009) (describing the current state of affairs as a "patent crisis"); JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* (2008) (same); Masur, *supra* note 23, at 477 (same). But see John M. Golden, *Proliferating Patents and Patent Law's Cost Disease*, 51 HOUS. L. REV. 455, 457 (2013) (suggesting claims of a patent "crisis" might be overstated).

137. See Dennis Crouch, *Patent Pendency Time Series and Why Care About Prosecution Delays* (Sept. 10, 2012), <http://www.patentlyo.com/patent/2012/09/patent-pendency-time-series-and-why-care-about-prosecution-delays.html> (last visited Mar. 24, 2014) (describing the growing issue of increased patent pendency) (on file with the Washington and Lee Law Review).

138. See *id.* (showing that median prosecution pendency for U.S. utility patents has increased from about 2 years in 1999 to about 3.25 years in 2012, with a peak over 3.6 years in 2009). Patent application pendency appears to have decreased a bit in the past few years, likely in part because the PTO has hired thousands of new patent examiner and also due to the 2007–2009 recession and the relatively weak U.S. economy. *Id.*

139. See Frakes & Wasserman, *Failed Promise*, *supra* note 11, at 10–12 (noting how the PTO operates under budget constraints).

140. See *id.* at 5 (explaining costs associated with examination delay).

Moreover, this sort of reform could improve the quality of the PTO's review process. If examiner workload were lessened, then examiners could devote more time to review each application they are assigned. More time to review applications could in turn reduce the granting of "bad patents"—patents the PTO should never have granted because they do not meet the statutory standards of patentability.¹⁴¹ A reduction in bad patents would in turn benefit society as a whole, as the costs these patents impose would be reduced.¹⁴²

E. Differential Pricing to Limit Patent Term

Our discussion thus far has focused on increasing PTO revenues through the use of differential patent pricing on back-end fees, and then using those revenues to lower front-end fees or otherwise improve the patenting process. But differential pricing can also be used to achieve a more fundamental goal: to create different effective patent terms for different categories of inventions.

1. The Rationale for Tailoring Term for Different Industries

Scholars have long debated the benefits and costs of patents. Most agree the primary benefit of patent protection is that it incentivizes innovation—awarding a patentee a legal monopoly over his invention allows him to recoup fixed costs incurred in producing his invention.¹⁴³ But patents also generate a number of

141. See, e.g., Jay P. Kesan and Andres A. Gallo, *Why "Bad" Patents Survive in the Market and How Should We Change? —The Private and Social Costs of Patents*, 55 Emory L.J. 61, 76 (2006) (discussing PTO's incentives to "grant patents without being unduly concerned about the quality of the examination process").

142. See Mark Lemley, Doug Lichtman & Bhaven Sampat, *What to Do About Bad Patents?*, 28 REG. 10, 10-11 (2005) (describing how an examiner spends on average only 18 hours reviewing each patent application and how more PTO funding might alleviate the bad patents problem). *But see id.* (describing why much of the money might be wasted on review of useless patent applications).

143. See, e.g., Burk & Lemley, *supra* note 14, at 1576 ("Patent law is our primary policy tool to promote innovation, encourage the development of new technologies, and increase the fund of human knowledge.").

costs. In addition to the deadweight loss caused by heightened monopoly pricing, a surfeit of patents increases the risk of inadvertent infringement and can lead to patent thickets, with multiple parties having overlapping patent rights.¹⁴⁴ Such thickets make it difficult for new innovators, who must obtain licenses from multiple patentees.¹⁴⁵ Moreover, the proliferation of patents increases the prevalence patent litigation, which is particularly costly in suits involving non-practicing entities (often pejoratively referred to as “patent trolls”). These entities do not produce anything but merely acquire patents to sue companies and extract monopoly rents from them.¹⁴⁶

One way in which the patent system balances the costs and benefits of patents is by limiting their term. This seems reasonable—we want to use patents to incentivize innovation but are also cognizant of their social costs, so we give inventors a monopoly over their inventions for a limited time.¹⁴⁷ Ideally, patent term would be invention-specific, and it would be only as long as necessary to incentivize invention and no longer as additional term merely gives a patentee excess monopoly rents and incurs social costs.¹⁴⁸

Of course, this is not how patent term is currently awarded. Rather, all inventions receive the same baseline patent term regardless of their underlying industry.¹⁴⁹ A new type of LED

144. See Sukhatme & Cramer, *supra* note 10, at 3 (explaining how patent thickets impose costs on society); Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, in 1 INNOVATION POL’Y & THE ECONOMY 119, 121 (2001) (acknowledging that the current patent system causes concern because of “excessively loose standards” at the PTO).

145. See Joseph Farrell et al., *Standard Setting, Patents, and Holdup*, 74 ANTITRUST L.J. 603, 608 (2007) (explaining how “standards hold-up” affects the patent market by requiring expensive licenses from multiple patentees).

146. See James Bessen et al., *The Private and Social Costs of Patent Trolls*, 34 REG. 26, 29 (2012) (providing a definition of “patent trolls” and introducing the problems they cause).

147. See Ayres & Klemperer, *supra* note 134, at 992 (noting that patentees have “unchecked monopoly power” during the patent term and then no legally enforceable market power after the patent expires).

148. See Alan Devlin & Neel U. Sukhatme, *Self-Realizing Inventions and the Utilitarian Foundation of Patent Law*, 51 WM. & MARY L. REV. 897, 903 (2009) (arguing that, in the context of certain business method patents, if an invention would be produced even if patent protection were unavailable, then it should not receive patent protection in the first place).

149. See 35 U.S.C. 135 (2012) (describing the uniform term of patents).

receives the same baseline term as a new plastic polymer, a new cancer drug, a new semiconductor chip, or a new type of garbage can: twenty years from the date the patent application was filed.¹⁵⁰

Regardless of one's perspective, it seems unlikely that, in an ideal world, patent term would be the same across all industry categories because the costs and benefits of patents vary across these categories.¹⁵¹ For example, a patented invention in a fast-moving technological field might be obsolete well before its term ends. In other fields, however, each additional week of patent term might translate into millions of dollars in additional sales.¹⁵²

Still, there are many good reasons for having a uniform patent term. One might worry about the extent to which politics or other considerations not related to social welfare affect the term awarded in certain industries.¹⁵³ Even without such concerns, it is very difficult to determine what terms are optimal for patents in different industries. Answering this question

150. See *id.* Congress has passed some industry-specific adjustments to patent term. See Burk & Lemley, *supra* note 14, at 1630–31 (noting that Congress has lengthened the patent term for pharmaceutical patents). Most notably, the Drug Price Competition and Patent Term Restoration Act of 1984 (Hatch–Waxman Act) enabled “pioneer drugs” to receive patent term extensions of one-half the time they spend in the investigational new drug period during FDA review. Pub. L. No. 98-417, 98 Stat. 1585 (1984). Nonetheless, such ad hoc extensions do not affect the twenty-year baseline term.

151. Laws governing the baseline patent term are almost never changed, suggesting that term is not updated in response to technological, societal, or legal changes. Since the Patent Act of 1790, when Congress established a term of fourteen years from patent issuance, the baseline term for a patent has changed only three times: in 1836 (increased to twenty-one years from patent issuance), 1861 (decreased to seventeen years from patent issuance), and 1995 (changed to twenty years from application filing date).

152. The most prominent example where patent term really seems to matter is pharmaceuticals, as a drug may not even be salable for years into its patent term due to the extensive regulatory approval process of the Food and Drug Administration.

153. See Michael W. Carroll, *One Size Does Not Fit All: A Framework for Tailoring Intellectual Property Rights*, 70 OHIO ST. L.J. 1361, 1398 (2009) (noting that altering a uniform patent term would require industry-wide consensus, which limits the ability to use patent term to benefit special interest groups); see also Michael W. Carroll, *One for All: The Problem of Uniformity Cost in Intellectual Property Law*, 55 AM. L. REV. 845, 847 (2006) (describing the problem of “uniformity cost” in patent law, which stems from its attempt to apply “a socially costly, uniform solution to problems of differing magnitudes”).

requires, for example, considering how the following vary across industries: incentives to invent, rates of technology obsolescence, presence of regulatory delays, time to commercialize a product, and patent-generated social welfare costs.¹⁵⁴

Still, it might be possible for these objections to be overcome. For example, in Part IV, I describe objective measures, which I derived using empirical methods, of the relative importance of patent protection across different industries.¹⁵⁵ Although I do not intend to suggest that these measures are by themselves dispositive as to what patent term should be—as noted above, determining industry-specific, optimal terms is likely to be a complicated, multi-factor inquiry—my research could nonetheless inform this discussion.¹⁵⁶

2. Differentially Raising Maintenance Fees to Limit Term

It is one thing to determine what constitutes an optimal term in a particular industry; it is another thing to actually implement it. Assuming policymakers wish to have industry-specific patent terms, they should use the more nuanced approach to implementing differential term described in this Article. Namely, they should use differentially higher maintenance fees to effectively limit term to the extent they desire.

To illustrate, suppose patentees in a particular industry face the following maintenance fee schedule: at three-and-a-half, seven-and-a-half, and eleven-and-a-half years, they must pay \$1,600, \$3,600, and \$74,000, respectively. The only difference between these hypothetical maintenance fees and actual current fees is the eleven-and-a-half year fee, which has been increased

154. See Burk & Lemley, *supra* note 14, at 1630–38 (providing numerous reasons against using industry-specific legislation to customize patent term).

155. See Part IV *infra* (discussing differential pricing and empirical methods for measuring value of patents across industries).

156. One key is to develop an objective measure of optimal patent term across industries; that is, a measure that is not subject to manipulation and can be updated using data. Ben Roin suggests one possible measure is the average time needed to take an invention to market. He claims this variable is a good proxy for many factors that play a role in determining optimal patent term. See Roin, *supra* note 14 (discussing factors that could help determine optimal patent term across different industries).

tenfold, from \$7,400 to \$74,000. As a practical matter, only the relatively few patentees who value their patent this highly would be willing to make this hypothetical eleven-and-a-half year maintenance payment.¹⁵⁷ For all other patentees, their patent would end at eleven-and-a-half years.

This hypothetical demonstrates how maintenance fees could be used to limit patent term in a controlled fashion. For example, if we want 50% of patents in a particular industry to expire at a particular time, we can raise maintenance fees on patents in that industry to the level at which we expect 50% of patentees to stop paying. If we want 90% of patents to expire, we can increase fees even more to achieve this goal. And if we want all patents within an industry to expire, we can make fees as high as necessary to ensure this happens. In such a scenario, forward-looking inventors will no longer assume that patent term is twenty years from the date of patent application but rather the length of time until the prohibitively high maintenance fee is due.

Put differently, limiting patent term is equivalent to mandating an infinite maintenance fee at the time one wishes a patent to expire. Viewed this way, proposals to limit patent term are essentially limiting cases of the general principle enunciated here: that is, the PTO can arbitrarily control how many patents remain in effect in a particular industry by using differential patent pricing appropriately.

Differential patent pricing gives policymakers a bevy of ways in which to limit term. Even if just the current maintenance fee date schedule is used, one could limit patent term in a particular industry to: (1) three-and-a-half years from patent issuance; (2) seven-and-a-half years from patent issuance; (3) eleven-and-a-half years from patent issuance; or (4) twenty years from patent application filing. Moreover, a policymaker could increase maintenance fees in such a way that not all

157. One might argue that some patentees would make this payment but might be capital constrained and unable to do so. Presumably, if such patentees believe this payment would be worthwhile, they would have access to capital markets and would be able to borrow the money necessary to make the payment. Regardless, the basic point holds: Only people who value their patent more than this amount will renew the patent. That does not necessarily mean that everyone else who does not renew does not value the patent that highly.

patents expire but rather some desired percentage of patents are not renewed.¹⁵⁸

If one wishes to customize patent term across industries, there are a number of advantages to using differential patent pricing to achieve this goal rather than simply mandating that patents in certain industries have a reduced duration. First, differential patent pricing enables policymakers to have heightened flexibility to deal with outlier inventions. Regardless of the industry at issue, there will likely be unusual inventions for which additional patent term is crucially important. Instead of dictating that these inventions have some limited term, the use of differential patent pricing allows patentees of very valuable inventions to extend their term as desired.

Second, limiting term for patents in particular industries is a drastic shift that would require congressional action. This would seem difficult to achieve in practice as those industries would likely fight such a law with full force. Allowing the PTO to use differential patent pricing to achieve the goal of limiting patent term might also require congressional action, but it is a more limited and nuanced step that seems more likely to be achievable in practice.¹⁵⁹

Third, differential patent pricing allows for more dynamic changes than a scheme that simply limits patent term. For example, suppose there is a push to limit term for software patents to eight years from the date of patent issuance. Instead of limiting patent term for this group of inventions, the PTO could simply increase the seven-and-a-half year maintenance fee. The PTO could then monitor how patentee renewal decisions are affected as well as decisions by prospective inventors regarding future innovation in this field. If innovation appears to be greatly harmed by this fee increase, then maintenance fees could be

158. David Olson recently suggested that maintenance fees could be increased based on the number of non-practicing patents within a patent owner's portfolio. The idea is that increased fees will deter non-practicing entities, often referred to as patent trolls, from amassing patents. See David S. Olson, *Removing the Troll from the Thicket: The Case for Enhancing Patent Maintenance Fees in Relation to the Size of a Patent Owner's Non-Practiced Patent Portfolio*, B.C. LAW SCH. LEGAL STUDIES RES. PAPER SERIES NO. 303, at 2 (2013), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2318521 (last visited July 12, 2014) (on file with the Washington and Lee Law Review).

159. See *infra* Part V for legal analysis of this issue.

reduced. If there appears to be no effect on innovation, then the fees could be increased more.¹⁶⁰

Despite these advantages, there are limits to what differential pricing of maintenance fees can accomplish in terms of tailoring patent term. If we feel that patent term is insufficient in certain industries,¹⁶¹ then differential pricing of maintenance fees would be unable to provide this additional term.

Even so, other forms of differential patent pricing might be able to handle this situation. For example, while the present discussion has focused on differential patent pricing of maintenance fees, the same logic can be applied to other prices in the patent system. Suppose patent applicants were asked, when they apply, to choose how much patent term they wished to have. Some might be willing to pay more to get a longer term. Such a pricing scheme would essentially be second-degree price discrimination—the PTO would offer multiple versions of patents that differ by term. Applicants would reveal their willingness to pay based on which patent term they choose.¹⁶²

160. Introducing cross-industry variation into maintenance fees would also have the ancillary benefit of generating rich data on the relative importance of patents across industries. This could be used to perform more research on the relationship between patents and innovation, which in turn could be used to improve the patent system.

161. This might be true, for example, with respect to pharmaceuticals, which take a tremendous amount of time and money to develop. *See* Burk & Lemley, *supra* note 14, at 1631 (noting that Congress extended the patent term for certain pharmaceutical patents). *But see* Boldrin & Levine, *supra* note 13, at 13–14 (arguing for the abolition of pharmaceutical patents).

162. *See supra* Part II.C.2 (explaining second-degree pricing discrimination). Somewhat relatedly, Mark Lemley and Carl Shapiro have suggested the PTO could offer applicants two types of patents: ordinary patents and “super patents,” which undergo a more rigorous examination by the PTO. *See* Mark A. Lemley & Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSP. 75, 85–86 (2005) (stating that such a system would depend upon courts giving less weight to the standard patent than the super patent). A patentee who opts for a super patent could receive a stronger presumption of validity in subsequent litigation. *Id.*; *see also* Lemley et al., *supra* note 142, at 10–13 (proposal to have a “gold-plated” patent review, where applicants who want a stronger presumption of validity for their patents could opt for a more searching (and costly) review).

IV. The Empirical Basis for Differential Patent Pricing

This Article has shown how the PTO could use differential patent pricing to better achieve one of its core regulatory purposes—to promote innovation through the U.S. patent system. In particular, the Article has explained how setting industry-specific maintenance fees might be a good way to implement differential pricing.¹⁶³

But an important question remains: even if the PTO can set differential patent prices, what prices should it set? The present section tackles that issue. It begins with an overview of my recent empirical research, which quantifies the extent to which patent applicants in different industries actually care about patent term.¹⁶⁴ This is important because it shows us the industries in which patent term matters more, and in particular, the industries in which patentees might be willing to pay more for patent protection. After discussing how these empirical estimates were obtained, the Article explains how they can be translated into actual differential patent prices.

A. Measuring How Much Patents Matter Across Industries

My empirical research focuses on the following basic questions: how much do patent applicants and patentees care about patent term? On average, do applicants in various industries differ in how much they care about term? And if so, can we quantify these differences?

Many scholars have speculated on the industries in which patents are believed to be more or less important. For example, most scholars believe patent term is particularly important for pharmaceuticals because it costs a tremendous amount to develop a drug and receive FDA approval,¹⁶⁵ but it costs relatively little to

163. See *supra* Part III.D (arguing that differential pricing could increase innovation).

164. *Infra* Part IV.A. See generally Sukhatme & Cramer, *supra* note 10, at 33 (studying the effects of The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) on the speed of patent prosecution in different industries).

165. See Joseph A. DiMasi, Ronald W. Hansen & Henry G. Grabowski, *The Price of Innovation: New Estimates of Drug Development Costs*, 22 J. HEALTH

produce or copy an approved drug.¹⁶⁶ Absent patent protection, most scholars believe there would be little incentive for companies to produce new drugs because they could not charge monopoly prices to recoup their fixed costs.¹⁶⁷

Regarding other industries, scholars have concluded patents are less important, or even harmful. For example, many scholars have suggested that patents are unnecessary in the context of software.¹⁶⁸ They assert that new software can be produced at relatively low fixed cost.¹⁶⁹ They also claim most software becomes obsolete in a short period of time, and hence patent protection (or at least a long patent term) is unnecessary to incentivize innovation.¹⁷⁰

Much of the conventional wisdom on the relative importance of patent term might be correct, but it has remained virtually untested. In other words, while scholars might believe patents are more or less important to applicants in particular industries, there has been little empirical evidence to back these assertions.

My empirical work seeks to test the conventional wisdom. To do this, I take advantage of a natural experiment: the ratification

ECON. 151, 181 (2003) (estimating that a drug whose research and development was started in 2001, with approval 12 years later, would have preapproval capitalized costs of \$1.9 billion).

166. See Joan Costa-Font, Alistair McGuire & Nebibe Varol, *Price Regulation and Relative Delays in Generic Drug Adoption*, J. HEALTH ECON. (forthcoming 2014) (manuscript at 1) (noting that generic drugs are cheaper to produce than branded products) (on file with the Washington and Lee Law Review).

167. See Emily Michiko Morris, *The Myth of Generic Pharmaceutical Competition Under the Hatch-Waxman Act*, 22 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 245, 257 (2012) (indicating that, absent patent protection, firms may be incentivized to copy old drugs rather than develop new drugs). *But see* Boldrin & Levine, *supra* note 13, at 13–14 (pointing out that the first-mover advantage in drugs might be larger than conventionally realized and that some combination of public funding and a reward system could replace the patent system).

168. See, e.g., Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1025–26 (1990) (questioning the need for software patents). *Cf.* Devlin & Sukhatme, *supra* note 148, at 906–10 (arguing against awarding patent protection for certain business method patents).

169. See Burk & Lemley, *supra* note 14, at 1687 (“Software inventions tend to have a quick, cheap, and fairly straightforward post-invention development cycle.”).

170. See *id.* at 1689 (claiming software patents should be limited in scope).

by the United States of The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) on December 8, 1994.¹⁷¹ As discussed below, I use this natural experiment to measure how much patent applicants care about patent term within particular industries.¹⁷² I also use a separate natural experiment related to TRIPS to measure the stock market value of additional years of patent term.¹⁷³ Finally, I derive a third, related measure using data on maintenance fees.¹⁷⁴ I discuss all three measures in turn below.

1. Patent Applicant Behavior Post-TRIPS

TRIPS was a landmark agreement that changed how patent term was calculated for the first time in over 130 years.¹⁷⁵ Before TRIPS, a patent had a fixed, seventeen-year term that began from the date the patent was granted by the PTO.¹⁷⁶ The date an inventor filed his patent application did not influence the length of term he received.

After TRIPS, however, patent term became twenty years from the date the application was filed.¹⁷⁷ So post-TRIPS, the

171. Uruguay Round Agreements Act, Pub. L. No 103-465, 108 Stat. 4809 (codified as amended in scattered sections of 15, 17, 19, and 35 U.S.C.).

172. *Infra* Part IV.A.1.

173. *Infra* Part IV.A.2.

174. *Infra* Part IV.A.3. This measure is not related to TRIPS.

175. See *The Agreement on Trade-Related Aspects of Intellectual Property Rights*, PATENTLENS, <http://www.patentlens.net/daisy/patentlens/415.html> (last visited May 20, 2014) (describing the obligations of people who join the TRIPS agreement) (on file with the Washington and Lee Law Review). TRIPS also changed some rules on establishing an invention date and allowed term extensions in some limited circumstances involving patent interference proceedings, secrecy orders, or successful appellate reviews. Additionally, TRIPS generated a new type of patent application known as a provisional patent application, which is a simplified application that establishes a priority date for an applicant. See Sukhatme & Cramer, *supra* note 10, at 35 (describing the benefits of a provisional patent). In my empirical paper, I address each of these changes and explain why they do not confound my results.

176. See 35 U.S.C. § 154 (1988) (current version at 35 U.S.C. § 154(a)(2) (2012)) (“Every patent shall . . . grant to the patentee . . . for the term of seventeen years . . .”).

177. See *id.* § 154(a)(2) (“[S]uch grant shall be for a term beginning on the date on which the patent issues and ending 20 years from the date on which the application for the patent was filed . . .”).

prosecution time of an application reduced the total term a patentee would receive. Accordingly, TRIPS created an incentive to speed up patent prosecution because prosecution time would now eat into total patent term.¹⁷⁸

My hypothesis is simple: an applicant who especially cares about patent term is more likely to speed up prosecution post-TRIPS as compared to an applicant who cares less about patent term. Put differently, industries in which term is more important will see average prosecution time decrease more than industries in which term is less important. So by measuring how much applicants sped up patent prosecution across different industry groups, we can get a relative sense of how much they value patent term.

It is not that easy, however, to measure applicant delay during patent prosecution. This is because prosecution is a back-and-forth process between the applicant and the PTO, so total prosecution time depends both on applicant delay and PTO delay. To illustrate, after an applicant files his application, the ball is in the PTO's court. The applicant then waits for the PTO to issue an office action, in which the agency either accepts or rejects the patent claims.¹⁷⁹ If the applicant receives a rejection, he usually has three months to respond to the office action, though he can pay a fee and request an extension (which is almost always granted) to extend his response time to six months.¹⁸⁰

178. David Abrams wrote what appears to be the only other paper that uses TRIPS as a natural experiment. David S. Abrams, *Did TRIPS Spur Innovation? An Analysis of Patent Duration and Incentives to Innovate*, 157 U. PA. L. REV. 1613, 1613–17 (2009). He suggested patent classes with shorter average pendencies (i.e., time between application filing and issuance) would benefit disproportionately from the change in law because they would receive longer patent term extensions on average after TRIPS. *See id.* at 1635 (“This indicates that patent classes with longer extensions due to TRIPS tended to have a greater increase in patents following TRIPS than those classes with shorter extensions.”).

179. *See* 37 C.F.R. § 1.104 (2013) (describing the actions an examiner may take).

180. *See id.* § 1.134 (“Unless the applicant is notified in writing that a reply is required in less than six months, a maximum period of six months is allowed.”); *id.* § 1.136(a) (stating that applicant may request to extend the time period to reply if the original time period was less than maximum period set by statute).

So to accurately measure applicant delay, one must parse out prosecution time that is attributable to the applicant versus time attributable to the PTO. I accomplish this by looking at detailed transaction histories for 331,162 issued patents filed in 1994–1996. These histories, which chronicle every major event during prosecution, allow me to parse out measures of applicant delay, such as the amount of time an applicant takes to respond to an office action, the number of extensions requested by an applicant, and the amount of time an applicant takes to pay an issue fee once he receives a notice of allowance.¹⁸¹

After generating these measures, I test how they changed before and after TRIPS within different industry categories, which lets me assess the relative importance of patent term across industries. For example, if applicants in industry X respond to TRIPS by speeding up their office action responses more (or requesting fewer extensions) than applicants in industry Y, that suggests patent term is more important in industry X. Additionally, I compare these measures with one another and perform numerous robustness checks, and I find my results are consistent across specifications.¹⁸²

The first column of Table 1 (titled “Post-TRIPS”) in the Appendix shows the results from one of my specifications.¹⁸³ This column shows how applicants within particular industry subcategories¹⁸⁴ changed their prosecution speed after TRIPS

181. See Sukhatme & Cramer, *supra* note 10, at 14, 25 (conducting a statistical analysis based on these factors).

182. Details on these robustness checks are in the full empirical paper, but just to give an example, one might be concerned that some applicants might have anticipated the passage of TRIPS and changed their prosecuting behavior, which could skew measures of applicant delay. To address this selection concern, in some specifications I exclude data in certain “inner windows” around the enactment of TRIPS, such as applications filed in 1995 or applications filed between December, 8, 1994, (the date TRIPS was enacted) and June 8, 1995 (the date TRIPS went into effect). *Id.* at 28. Results generally remain similar and significant across these specifications. See *id.* at 28–31 (showing results).

183. *Infra* Table 1.

184. When a patent is filed, it is assigned to a patent class by the PTO. The industry subcategories shown here are higher-level groupings of these patent classes. The subcategories were generated for a National Bureau of Economics Research database. See Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools* 414–16 (Nat’l Bureau of Econ. Research, Working Paper No. 8498, 2001) (discussing the creation of the patent categories and subcategories).

went into effect.¹⁸⁵ A negative value indicates that applicants in an industry sped up prosecution on average after TRIPS; a positive value indicates that they slowed down prosecution.

To illustrate, we see a coefficient of “-5.22” for the “Information Storage” subcategory.¹⁸⁶ This coefficient suggests these applicants sped up patent prosecution, on average, by about 5.22 days post-TRIPS. Compare that to “Drugs,” which has a coefficient of -8.55.¹⁸⁷ This coefficient is significantly more negative, which suggests that applicants in this industry sped up prosecution more than those in “Information Storage.”

Notice that almost all the coefficients in column 1 are negative.¹⁸⁸ This is what we predicted—because prosecution time reduces patent term after TRIPS, applicants will generally speed up prosecution.¹⁸⁹ Also notice the subcategories with statistically significant coefficients in which patent applicants sped up the most are the following:¹⁹⁰

Genetics (-25.75)
 Drugs (-8.55)
 Semiconductor Devices (-7.36)
 Electronic Business Methods and Software (-6.39)
 Information Storage (-5.22)
 Computers—Hardware and Software (-5.03)
 Resins (-4.99)

185. TRIPS went into effect on June 8, 1995, six months after it was ratified. The main independent variable I use in my regressions is a dummy variable that takes the value “1” if the patent application was filed post-TRIPS (on or after June 8, 1995) and “0” if the application was filed pre-TRIPS (before June 8, 1995). The “Post-TRIPS” coefficient is the ordinary least squares coefficient on this variable. It measures how much applicants sped up after TRIPS.

186. *Infra* Table 1.

187. *Infra* Table 1.

188. *Infra* Table 1.

189. Mark Lemley first made this prediction in a paper he wrote twenty years ago. See Mark A. Lemley, *An Empirical Study of the Twenty-Year Patent Term*, 22 AIPLA Q.J. 369, 386–87 (1994) (hypothesizing that patent attorneys will be pressured to file responses to office actions more quickly and therefore reduce the prosecution time on patent applications). My empirical paper is the first to apportion prosecution time between the applicant and the PTO; it is therefore the first paper to test (and confirm) his prediction. See Sukhatme & Cramer, *supra* note 10, at 2–3 (discussing methods).

190. *Infra* Table 1. See also Sukhatme & Cramer, *supra* note 10, at Tbls. 6 and 7.

Communications (−4.87)
 Organic Compounds (−4.86)
 Computer Peripherals (−4.17)
 Power Systems (−2.51)
 Miscellaneous Chemicals (−2.40)

Many of these results support the conventional wisdom. For example, it is not surprising that two prominent pharmaceutical-related subcategories (“Genetics” and “Drugs”), chemical subcategories (“Resins” and “Organic Chemicals”) and “Semiconductor Devices” were among the groups in which inventors sped up prosecution the most. More surprising is the presence of “Electronic Business Methods and Software,” “Information Storage,” and “Computer—Hardware and Software” as the subcategories with the fourth-, fifth- and sixth-fastest speed-ups in prosecution, respectively. That applicants in these fields responded more to TRIPS suggests inventors of new software products and business methods might care more about patent term than was previously appreciated.

2. Stock Market Value of Additional Patent Term

My empirical research also takes advantage of another natural experiment in TRIPS. In addition to changing patent term prospectively, TRIPS also retroactively changed the term of already-existing patents based on their previous prosecution time.¹⁹¹ In particular, TRIPS gave patentees of already-issued but not-expired patents the greater of (a) their current term (which was awarded under the old rules) and (b) the term the patentee would have received under the new rules.¹⁹² This adjustment was done automatically by the PTO, and it went into effect on December 8, 1994, when TRIPS was signed into law.¹⁹³

To illustrate, consider a patent application filed in 1983 that issued two years later in 1985. Under the old term regime, the patent would expire in 2002, seventeen years after it issued.

191. See 35 U.S.C. § 154(b) (2012) (detailing the patent term adjustment).

192. See *id.* at § 154(c)(1) (adjusting term on outstanding patents).

193. See 37 C.F.R. § 1.705 (2014) (implementing the patent term adjustment under TRIPS).

Under the new regime, the patent would expire one year later, in 2003, because patent term under the new rules runs until twenty years after application filing. TRIPS awarded the patentee the longer of these two terms; therefore, this patentee received a one-year term extension because of TRIPS.¹⁹⁴

This kind of retroactive change is an ideal natural experiment for measuring the monetary value of increased patent duration. TRIPS was not something a patentee in the late 1970s or 1980s could have anticipated. Yet thanks to TRIPS, many these patentees (along with patentees in the early 1990s) received an unexpected gift of additional term.

I take advantage of this unanticipated term increase by testing how much publicly traded firms' stock market values increased based on the total amount of additional term those firms received. For example, suppose a firm owned 200 nonexpired patents in 1994 and received 100 additional years of patent term cumulatively over those patents thanks to TRIPS. All else being equal,¹⁹⁵ we might think this firm would receive a larger stock market bump than a similar firm that received only ten additional term years. Indeed, my empirical results show there are small but positive and significant effects to receiving increased patent term.¹⁹⁶ In particular, I find that the median

194. See 35 U.S.C. § 154(c)(1) (providing a term of the longer of either twenty years from filing or seventeen years from issuance). This patentee received additional term because his prosecution took just two years. If the applicant's prosecution time had exceeded three years, then he would not have received any additional term because the old term regime (which guaranteed seventeen years from issuance) would exceed what the new term regime would offer (twenty years from filing).

195. We might think all else is equal here because the additional term a firm receives depends on how long the firm took to prosecute its patent applications, which is something we might think is uncorrelated with other firm characteristics that affect stock market value. Nonetheless, one might still be concerned about selection—for example, one might worry there is something special about firms that prosecuted their patent applications faster that systematically affected how their stock price changed around the passage of TRIPS. My empirical paper addresses these concerns using both a standard technique (the use of control variables) as well as a more advanced and relatively new empirical procedure known as regression kink design. See Sukhatme & Cramer, *supra* note 10, at 34, 39–41 (discussing various controls used).

196. See *id.* at 42 (discussing the paper's findings on the effects of a firm's market capitalization).

(mean) firm increased in value by about \$648,000 (\$8.3 million) for each additional year of patent term it received.¹⁹⁷

The two natural experiments described here investigate different responses to changes in patent duration: applicant behavior and market pricing, respectively. But if one cross-checks these measures, one finds they tell a unified story: the industry categories in which applicants sped up prosecution the most (to gain more patent term) are the same categories in which firms' stock market values increased the most.¹⁹⁸ This cross-validation provides more confidence in the accuracy of both measures.

3. Maintenance Fee Measure

There are other empirical measures of patent value that do not rely on natural experiments. The second column of Table 1 (titled "% Maintained") presents such a measure based on maintenance fee payments.¹⁹⁹ As discussed previously, maintenance fees must be paid by a patentee to prevent a patent from lapsing.²⁰⁰ The measure presented here is the percentage of patentees within an industry category who maintain their patents through the last maintenance fee payment, due eleven-and-a-half years after patent issuance. In other words, column two reports the percentage of patents within industry subcategories whose patent term did not end early for failure to pay maintenance fees.²⁰¹

I use this maintenance fee measure as another way to compare the relative value of patents across industries.²⁰² The

197. See *id.* at 39, 42 (discussing the paper's findings).

198. See *id.* at 44–45 (“[W]e find that the patent subcategories in which applicants sped up prosecution the most (in order to gain more patent term) are the same subcategories in which stock values increased the most when firms received exogenous term extensions.”).

199. *Infra* Table 1.

200. See *supra* note 96–97 and accompanying text (discussing maintenance fees).

201. *Infra* Table 1.

202. Other scholars have also used data on maintenance fee payments as a proxy for patent value. See Jean O. Lanjouw, Ariel Pakes & Jonathan Putnam, *How to Count Patents and Value Intellectual Property: The Uses of Patent Renewal and Application Data*, 46 J. INDUS. ECON. 405, 407 (1998) (noting that because “patent rights are seldom marketed, application and renewal data are

idea is that if a patentee pays a maintenance fee, we can infer he believes the discounted expected benefit from keeping the patent alive exceeds the present cost of the maintenance fee. If more patents are renewed in certain industries relative to others, we can conclude patent term is, on average, more valuable in those industries. For example, if pharmaceutical patents are more likely to be maintained on average than mechanical patents, then we might conclude that pharmaceutical patents are on average more valuable than mechanical patents.

Of course, there are limitations to this approach because patents that are maintained are only the ones near the top end of the patent value distribution—those patents whose value exceeds the maintenance fee threshold amount. Conclusions drawn from maintenance fees might not hold true for less valuable patents within an industry.²⁰³ Nonetheless, cross-industry renewal rates offer some insight as to the average patent value within those industries.

Looking at Table 1, we can see that subcategories with renewal rates greater than 50% are the following:²⁰⁴

Electronic Business Methods and Software (64.57)
 Semiconductor Devices (63.84)
 Computer Peripherals (62.70)
 Genetics (61.66)
 Computers — Hardware and Software (60.72)
 Communications (60.68)
 Information Storage (60.41)
 Surgery & Medical Instruments (57.81)
 Miscellaneous Electronics (57.00)

one of the few sources of information on the value of patent protection available”); Mark Schankerman, *How Valuable is Patent Protection? Estimates by Technology Field*, 29 RAND J. ECON. 77, 78 (1998) (“Under the assumption that patentees make a profit-maximizing renewal decision, data on patent renewal rates and fees can be used to infer the private value of patent protection.”).

203. See, e.g., David S. Abrams, Ufuk Akcigit & Jillian Popadak, *Patent Value and Citations: Creative Destruction or Strategic Disruption?* 27 (PIER Working Paper 13-065, 2013), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2351809.

204. *Infra* Table 1. Based on percentage of issued patents filed in 1994–1996 and maintained through 11 ½ years. See Sukhatme & Cramer, *supra* note 10, at Tbls. 6 and 7.

Miscellaneous Drugs and Medical (53.47)
 Power Systems (53.02)
 Nuclear & X-rays (51.82)
 Electrical Devices (51.65)
 Resins (50.63)
 Optics (50.12)

We can see significant overlap between the subcategories here and the ones where patent applicants sped up prosecution the most after TRIPS. For example, “Genetics,” “Semiconductor Devices,” and “Electronic Business Methods and Software,” rank highly under both measures.²⁰⁵ This overlap suggests the two measures are capturing a real effect and that patent term indeed matters more in these subcategories.²⁰⁶

4. Industry-level PTO Costs

The discussion here has thus far focused primarily on patentees: how much does patent term matter to patentees in different industries? A related, important question relates to the PTO: does it cost more for the PTO to examine certain types of applications as compared to others?

It turns out it does. In particular, the PTO allocates a certain number of hours for patent examiners to review applications within different technology groups.²⁰⁷ In a recent empirical piece, Michael Frakes and Melissa Wasserman generated examiner hour estimates for the same industry subcategories I have discussed throughout this section.²⁰⁸ These hour estimates are shown in column 3 of Table 1 (titled “Hours”).²⁰⁹

205. *Infra* Table 1.

206. One can run quantitative tests to confirm the two measures are highly correlated. In my paper, I also use more advanced empirical methodologies (including one technique known as difference-in-difference estimation) and multiple controls to confirm the correlation between the two measures. *See* Sukhatme & Cramer, *supra* note 10, at 33 (using a difference-in-difference analysis to test the relationship between patent renewal rates and changes in applicant delay due to TRIPS).

207. *See* Frakes & Wasserman, *Failed Promise*, *supra* note 11, online app. A, at 9 (noting that the PTO assigns a certain amount of hours to examine a patent depending on the technology group a patent is in and the examiner’s pay grade).

208. *See id.* Table A1 (listing technology categories). In particular, these

Looking at these estimates, we can identify the subcategories that cost the PTO the most in terms of examiner hours spent reviewing applications. In particular, here are the subcategories for which the PTO allocates more than twenty hours of application review time:²¹⁰

Electronic Business Methods and Software (27.4)
 Genetics (24.8)
 Computers—Hardware and Software (24.0)
 Computer Peripherals (21.9)
 Gas (21.7)
 Semiconductor Devices (21.0)
 Coating (20.9)

It is striking that the subcategories here are largely the same ones that topped the previous two lists in this section. In other words, the subcategories in which applicants care the most about patent protection are the same as the subcategories that cost the PTO the most in terms of application review time.

The overlap between these measures further bolsters the case for differential pricing. As discussed earlier, it makes sense for the PTO to use its regulatory monopoly status to charge higher fees to: (1) applicants who value patent protection more; and (2) applicants for whom examination takes more time by the PTO. The above discussion tells us these two groups are often in fact the same ones.²¹¹ In other words, the subcategories in which applicants care more about patent protection are the same ones that have more costly applications to review.²¹²

authors showed how many hours were allocated to an examiner to review a patent application within each of the same thirty-seven subcategories I use here. *Id.*

209. *Infra* Table 1.

210. Frakes & Wasserman, *Failed Promise*, *supra* note 11, at Table A1.

211. Calculation of correlation coefficients confirms these measures are related.

212. Frakes and Wasserman also develop a more complicated measure of examination costs by subcategory. See Frakes & Wasserman, *Failed Promise*, *supra* note 11, online app. A, at 9–11 (reviewing construction of examination cost measure). This measure accounts for examiner salaries and the distribution of GS pay grades across subcategories. *Id.* The relative ranking of subcategories under either the hours-spent measure (as shown in column 3 of Table 1) or the Frakes–Wasserman cost measure is almost identical, and both correlate with my applicant delay and maintenance fee measures. *Compare* Table 1

B. Generating Differential Patent Prices

The previous section showed three independent ways of measuring patent term sensitivity, which informed us of the relative importance of patent term across industries.²¹³ Additionally, we saw how the subcategories in which applicants cared the most about patent term were the same subcategories with applications that cost the PTO the most to review.²¹⁴

Next, we can use our patent sensitivity measures to generate differential patent prices. In particular, as described in Part III, the optimal approach likely involves scaling the third maintenance fee (due at eleven-and-a-half years) by the applicants' measured desire for patent protection. There are a number of ways in which differential prices could be generated but I focus on two examples presently.²¹⁵

First, one simple way to generate prices would be to use the desired measure itself to scale the eleven-and-a-half year maintenance fee. This could be done on all of the industries, or just a subset of them. For example, one could increase maintenance fees only on applicants in industries that had a significant negative coefficient on the "Post-TRIPS" measure described in Part III.A.1. In other words, fees would increase only on patentees in the 11 subcategories with significant negative coefficients, since those applicants responded the most to the change in patent term instituted by TRIPS.²¹⁶

How large should this fee increases be? One straightforward approach would be to generate the increase based on the deviation of the relevant coefficient from zero. To illustrate, "Communications" has a coefficient of -4.87 ; hence, we could increase maintenance fees in "Communications" by 4.87% relative

(measuring change in patent prosecution delays and percent of patents maintained), *with* Frakes & Wasserman, *Failed Promise*, *supra* note 11, Table A1 (measuring examination costs by technology).

213. *Supra* Parts IV.A.1– IV.A.3.

214. *Supra* Part IV.A.4.

215. The fees discussed in this section are the default ones for large entity patentees; as noted, small entities and micro entities pay one-half and one-quarter of these fees, respectively. See 35 U.S.C. § 41(h) (2012) (setting forth the fees charged to small entities).

216. *Infra* Table 1.

to the current maintenance fee of \$7,400.²¹⁷ Column 1 of Table 2 (titled “Proposal 1”) shows the proposed increases under this approach. As one can see, it involves only modest increases, with a maximum increase of just \$1,906 for “Genetics.”²¹⁸

This approach could also be altered to accommodate larger fee increases. For example, suppose the PTO calculates differential prices based on the second measure described in the previous section—the percentage of applicants within industry subcategories who maintained patents through eleven-and-a-half years (values in column 2 of Table 1, titled “% Maintained”).²¹⁹ Subcategories with more maintained patents will have patentees who typically care more about patent protection. That is, their demand for patents is likely to be more inelastic, so individuals in those subcategories could be charged higher maintenance fees.²²⁰

To illustrate how this approach might be implemented, suppose the PTO decides to keep the eleven-and-a-half maintenance fee at \$7,400 for applicants in the subcategory with the lowest renewal rate (“Furniture and House Fixtures,” which only has a 27.94% renewal rate) but increases fees proportionately for everyone else. Then, for example, “Electrical Device,” patentees, who have a 51.65% renewal rate, would see their fees increase by 23.71% (51.65% minus 27.94%), and “Organics Compound” patentees, who have a renewal rate of 44.30%, would see their fees increase by 16.36% (44.30% minus 27.94%).²²¹ This approach would yield a fee schedule as shown in the second column of Table 2 (titled “Proposal 2”).²²² The fee increases in Proposal 2 cover all subcategories of inventions and

217. *Infra* Table 1; see 37 C.F.R. § 1.20 (2013) (setting the current maintenance fee).

218. *Infra* Table 2.

219. See *supra* Part IV.A.3 (arguing that patentees in industries that tend to maintain patents through eleven-and-a-half years generally value patent protection more than patentees in industries that do not maintain patents for the same time period).

220. See ELASTICITY ESTIMATES, *supra* note 118, at 1 (explaining that inelastic demand means that consumers are generally indifferent to changes in price).

221. *Infra* Table 1.

222. *Infra* Table 2.

are larger, ranging up to an increase of \$2,711 for “Electronic Business Methods and Software.”²²³

The approaches described here are flexible and could be altered in a number of ways. For example, instead of targeting maintenance fees at the subcategory level, one could tailor them at the broader category level (i.e., the six categories of “Chemicals,” “Drugs and Medical,” “Others,” “Electrical,” “Computers and Communications,” and “Mechanical”).²²⁴ Alternatively, fees could be set at the finer patent class level, which is determined by the PTO when a patent application is filed.

Still, it is apparent there is some guesswork in the tailoring of maintenance fees. In particular, it might not always be clear whether fee adjustments are too high or too low for a particular subcategory. Fortunately, this concern is surmountable because differential patent prices can be adjusted over time. If, for example, the PTO notices that patentees severely decrease the number of patents renewed in response to a modest increase in maintenance fees, then that suggests the increase in maintenance fees was too much. On the other hand, if patentees barely respond to the increase in maintenance fees—if they maintain their patents at approximately the same rate as before—then that suggests a further increase in maintenance fees might be appropriate. Accordingly, the PTO has significant ability to tweak prices as needed to ensure it achieves its goals of increasing revenue and incentivizing innovation.

223. *Infra* Table 2. The proposals here show how the PTO could use differential maintenance fees to charge more to patentees who care more about patent term. As discussed in Part III.E above, differential patent pricing could also be used to limit patent term by increasing maintenance fees to such a degree that few patentees renew their patents. For example, to limit patent term on “Optics,” to three-and-a-half years, the PTO could increase the three-and-a-half year patent term by some large value (e.g., a ten-fold increase) to effectively limit term for most “Optics” patentees.

224. One might be concerned about patentees “gaming” the system by writing their applications in such a way as to take advantage of lower fees. Differentially pricing along larger category boundaries would make this more difficult. For example, an inventor might be able to frame his application as an “Information Storage” invention instead of a “Computer—Hardware and Software” invention to avoid higher maintenance fees in the latter subcategory. But it would be much harder for him to frame his application such that it falls outside the broader, “Computer and Communications” category.

V. *The Legal Basis for Differential Patent Pricing*

The previous parts of this Article showed how differential pricing could improve social welfare, and how such prices might be set across different industry categories. The present section discusses the legal authority for the PTO to set such prices. In particular, the Article explains how many of the changes specified above could be implemented by the PTO using newly gained fee-setting authority under the America Invents Act of 2011.

A. *The America Invents Act and the PTO's Fee-Setting Authority*

Until recently, the PTO had little control over the fees it charged patent applicants or patentees. Filing fees, maintenance fees, or other fees owed to the PTO were set by statute, and any change to these fees needed to be approved by Congress.²²⁵ Moreover, since 1991, Congress has effectively required the PTO to fund itself through these user fees.²²⁶

This situation was problematic. If the PTO must fund itself but has no control over what it can charge, then as its workload increases, it might take extraordinary measures to ensure it stays within budget. Indeed, Michael Frakes and Melissa Wasserman recently suggested that the PTO did this by granting more patents in areas that tended to have higher renewal rates (and hence, more maintenance fees to collect),²²⁷ and by prioritizing patent applications in technologies that are quicker to

225. See 35 U.S.C. § 41 (2012) (setting fees for patent applications); Frakes & Wasserman, *PTO's Granting Patterns*, *supra* note 12, at 76 (discussing how the PTO was historically funded).

226. See Frakes & Wasserman, *PTO's Granting Patterns*, *supra* note 12, at 76 (discussing the funding of the PTO through user fees).

227. See *id.* at 102–05 (finding their results are consistent with the general prediction that the PTO would more likely grant patents in categories with a high maintenance fee renewal rate). The PTO recently disputed this assertion, claiming that higher renewal rates in particular industries have no effect on its patent granting decisions. See *Setting and Adjusting Patent Fees*, 78 Fed. Reg. 4211, 4251 (Jan. 18, 2013) (“[T]he Office’s fee schedule and financial positions are not the drivers of patent examination practice [P]atent examiners make independent patentability determinations in accordance with statutory requirements by comparing the prior art to the claimed invention as a whole, without regard to budgetary pressures of the USPTO.”).

review (and hence, allowing the PTO to churn through applications quicker and earn more fees).²²⁸

Things changed in 2011, when the PTO was given fee-setting authority with the passage of the America Invents Act (AIA).²²⁹ The AIA was the culmination of years of scholarly and legislative debate on patent reform. It resulted in numerous changes to the patent system, most notably a shift from a first-to-invent to a first-to-file system of patent priority, so a patent application filing date and not the actual invention date is now what determines who has priority among different inventors who claim the same invention.²³⁰

More importantly for our purposes, the AIA gave the PTO control over the fees it charges. The most important AIA provision relevant to fee-setting is § 10(a), which allows the PTO to “set or adjust by rule any fee” for patent-related services or materials provided by the PTO, so long as any such change is used “to recover the aggregate estimated costs to the Office for processing, activities, services, and materials relating to patents.”²³¹ In other words, the PTO can alter its fees, but the

228. See Frakes & Wasserman, *Failed Promise*, *supra* note 11, at 5 (finding that when the PTO is in financial difficulty, it begins to give “preferential examination-queuing treatment to those technologies that cost the Agency the least to examine”).

229. See Leahy–Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified in scattered sections of 35 U.S.C.) (giving the PTO limited fee-setting authority).

230. See 35 U.S.C. § 102 (2012) (stating the requirements for the novelty element of patentability). The AIA also eliminated patent interferences, which were proceedings used by the PTO to determine priority between different inventors. *Id.* §§ 134, 145, 146, 154, 305. Additionally, the AIA gave outside parties the ability to challenge patents in the PTO for up to nine months after the patent issues. *Id.* § 321.

231. 35 U.S.C. § 41(d)(1)(A). The full provision as it relates to patents states:

(a) FEE SETTING

(1) IN GENERAL. The Director may set or adjust by rule any fee established, authorized, or charged under title 35, United States Code, . . . for any services performed by or materials furnished by, the Office, subject to paragraph (2).

(2) FEES TO RECOVER COSTS. Fees may be set or adjusted under paragraph (1) only to recover the aggregate estimated costs to the Office for processing, activities, services, and materials relating to patents (in the case of patent fees) . . . including administrative costs of the Office with respect to such patent . . . fees (as the case may be).

changes must be related to the PTO's actual costs—the goal is for the PTO to have sufficient flexibility to take care of its own expenses, not to turn it into a money-making machine.

Moreover, § 10(d) of the AIA specified procedures the PTO must take before it can exercise its fee-setting authority. First, the PTO Director must submit a proposed fee to the nine-member Patent Public Advisory Committee, which was first created by the American Inventors Protection Act of 1999.²³² The Director must engage the Committee at least forty-five days before publishing the proposed rule and ensure that the Committee has thirty days to consider the fee proposal.²³³ The Committee must hold a public hearing during this thirty-day period and produce a public written report of its comments, advice and recommendations, which the Director must then consider.²³⁴

If the Director decides to proceed with the fee change, she must notify Congress (via the Chair and Ranking Member of the Committees on the Judiciary of the Senate and the House of Representatives) about the proposed change and publish the proposed fee in the Federal Register, describing its rationale and possible benefits.²³⁵ After a public comment period of at least forty-five days, the Director can then publish a final rule in the Federal Register and Official Gazette of the PTO.²³⁶ Absent a congressional override, the new fee can then go into effect at “the end of the 45-day period beginning on the day after the date” on which the final rule was published.²³⁷

Section 10(c) of the AIA also gave the PTO the ability to reduce fees in certain fiscal years, provided the PTO Director

Id.

232. See 35 U.S.C. § 5(a) (establishing the Advisory Committee); The Committee is selected by the Secretary of Commerce and consists of individuals “chosen so as to represent the interests of diverse users of the [PTO] with respect to patents.” *Id.* § 5(b).

233. See Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 10(d)(1), (2)(A), 1245 Stat. 284, 317 (2011) (requiring the Committee's input on fee changes).

234. See *id.* § 10(d)(2)(B), (d)(3), (d)(4) (providing notice and comment proceedings for proposed fee changes).

235. See *id.* § 10(e)(4) (implementing notification requirements for fee changes).

236. See *id.* § 10(e)(3) (providing public hearing for fee changes).

237. *Id.* § 10(e)(4)(A).

consults with the Patent Public Advisory Committee on the advisability of reducing these fees first.²³⁸ So the Director does not have to go through the general notice and comment procedure described in the paragraphs above if the change is just a reduction in fees.

B. Differential Patent Pricing Under the AIA

There is good reason to believe the PTO can use its § 10 authority to set differential patent prices across industry categories. Although the statute mandates certain pre-fee-setting procedures, it gives the PTO a great deal of flexibility in actually setting the fees. Indeed, the PTO has the final say over what fees are implemented.

In particular, the statute allows the agency to set or adjust any fee to recover its *aggregate* estimated patent-related costs.²³⁹ There is no requirement that each PTO technology group or division subsist on its own budget; rather, the agency is free to choose fees and reallocate funds to best enable it to meet its aggregate expected patent-related costs.

Additionally, the PTO has already recognized its ability to use fee setting to promote innovation. For example, when the PTO first exercised its new fee-setting authority in 2013, it noted, “To encourage innovators to take advantage of patent protection, the Office sets basic ‘front-end’ fees (e.g., filing, search, and examination) below the actual cost of carrying out these activities.”²⁴⁰ Differential patent pricing on maintenance fees is merely a more efficient way for the PTO to do what it already

238. See *id.* § 10(c) (allowing for fee reductions in certain fiscal years).

239. See *id.* § 10(a)(2) (“Fees may be set or adjusted . . . only to recover the aggregate estimated costs to the Office . . .”).

240. Setting and Adjusting Patent Fees, 78 Fed. Reg. 4211, 4216 (Jan. 18, 2013). The Patent Public Advisory Committee also recognized that the AIA grants the PTO power to shape patent applicant behavior through fee structuring. See U.S. PATENT & TRADEMARK OFFICE, PATENT PUBLIC ADVISORY COMM. FEE SETTING REPORT 6 (2012), http://www.uspto.gov/aia_implementation/120924-ppac-fee-setting-report2.pdf (“Within the ambit of overall aggregate revenue recovery, the AIA allows the USPTO to set individual fees at levels to encourage or discourage behaviors by applicants.”).

does: increase back-end revenues to subsidize lower front-end fees.²⁴¹

Furthermore, as discussed in section Part IV.A.4 above, the industry subcategories in which patentees care more about patent protection correspond quite closely to the subcategories that cost the PTO the most in terms of examiner resources. So differential maintenance fees can also be justified as a way to deal with differential costs across industry subcategories. For example, a higher maintenance fee on the “Genetics” subcategory is justified not only because applicants in that category generally care more about patent protection (and hence are likely to pay more for patent protection) but also because it costs the PTO more to review a “Genetics” application. So increasing the back-end fees charged to “Genetics” patentees takes into account that these individuals are imposing higher costs on the PTO in the first place.

Although the PTO can likely use its § 10 authority to differentially price maintenance fees across industries, it is less clear whether it could use the same authority to differentially limit patent term. As discussed in Part III.E.2 above, the PTO could effectively limit patent term on an industry-by-industry

241. One potential concern with industry-specific tailoring relates to a provision in TRIPS, which prohibits member states from discriminating in granting patents based on technology type. See *Trade-Related Aspects of Intellectual Property Rights*, Art. 27, PATENTLENS, <http://www.patentlens.net/daisy/patentlens/415.html> (last visited May 20, 2014) (“[P]atents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.”) (on file with the Washington and Lee Law Review). This provision, however, has never been carefully followed by the United States or the European Union. See BURK & LEMLEY, *supra* note 136, at 97. For example, the United States has passed numerous industry-specific statutes, particularly in relation to pharmaceuticals, biotechnology, and semiconductors. See *id.* at 95–96 (citing nine industry-specific U.S. statutes, including 35 U.S.C. §§ 155, 156 (2000) (lengthening term for most pharmaceutical patents); 35 U.S.C. § 103(b) (2000) (relaxing obviousness standard for biotechnological processes); 17 U.S.C. §§ 901-14 (2000) (Semiconductor Chip Protection Act)). Indeed, TRIPS has never been enforced against countries for enacting industry-specific statutes, and as a practical matter, modest tailoring like the customized maintenance fees described here seems likely to be compatible with TRIPS. See *id.*; see also Roin, *supra* note 14, at 706 n.155 (suggesting industry-specific patent terms would not violate TRIPS); Graeme B. Dinwoodie & Rochelle C. Dreyfuss, *Diversifying Without Discriminating: Complying With the Mandates of the TRIPS Agreement*, 13 MICH. TELECOMM. & TECH. L. REV. 445, 453 (2007).

basis by greatly increasing maintenance fees for patentees in some industries. This sort of policy would not be an attempt by the PTO to generate revenue to reduce other costs;²⁴² rather, such an increase would further the direct policy objective of limiting excess term in some industry categories. It seems likely that such an increase would be too much of a stretch of the PTO's § 10 authority.²⁴³ Hence, further congressional action might be necessary before the PTO could greatly increase maintenance fees as a way to limit patent term.²⁴⁴

Even if such legislation is required, however, that has no impact on the benefits of limiting patent term in the manner described here. In particular, recognizing that increasing patent maintenance fees is a more flexible way to differentially limit patent term is an insight that policymakers should remember if they ever seek to institute industry-specific patent terms.

VI. Conclusion

There is a hidden monopoly that lies dormant within many regulatory bodies. This Article tries to shed light on that monopoly and reveal its power to conduct differential pricing. In particular, the Article describes the economic factors that give regulatory monopolists the ability to differentially price regulatory "goods," and explains how these monopolies can use such pricing to enhance social welfare.

242. Indeed, unless current maintenance fees are tremendously underpriced, one might expect a very large increase in maintenance fees would end up decreasing PTO revenues.

243. See U.S. PATENT & TRADEMARK OFFICE, *supra* note 240, at 6

As a policy matter, the PPAC advised that while some use of fees to encourage or discourage behavior may be appropriate, significant use of this ability to set fees at very high levels to discourage actions is not recommended because it is not clear that the USPTO will always take into consideration the factors driving applicants to certain behaviors, which may be at cross-purposes with particular desires of the USPTO.

244. If a huge increase in maintenance fees were applied to already-issued patents, there might also be an argument that this increase constitutes a regulatory taking under the Fifth Amendment of the U.S. Constitution. See, e.g., *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1019 (1992) (stating that a regulation that deprives a property owner of all economically beneficial uses of her property constitutes a regulatory taking).

The Article then applies these concepts to the market for patents. The PTO is a quintessential regulatory monopoly, with the sole power to provide a regulatory good (i.e., patent rights) and set related prices (i.e., patent fees). The Article explains how the PTO could differentially price patents across industries to increase revenues and promote innovation. Additionally, it describes how differential pricing of maintenance fees provides a flexible way to achieve a policy goal sought by many scholars: the customization of patent terms across industries.

The third part of the Article details my recent empirical work, which provides the foundation for setting differential patent prices. In particular, my research measures the relative importance of patent term to applicants and patentees in different industries. I approach this question from different empirical angles and find consistency in my results. This consistency provides comfort that we have indeed identified the industries in which patent term is more important. Using these results, I then generate examples of differential pricing structures.

The last section of the Article describes the legal framework for differential pricing. Namely, it describes how the America Invents Act—the recent manifestation of a years-long push toward patent reform—empowers the PTO to set different prices for patentees in different industries.

Differential pricing is not necessarily easy to implement, nor is it always desirable. Nonetheless, regulatory monopolies would do well to recognize that such pricing can be a powerful tool that enables agencies to better fulfill their regulatory goals. This is particularly true in the market for patents, where differential pricing has the potential to make the U.S. patent system better at achieving its core purpose: Incentivizing innovation.

VII. Appendix

Table 1: Post-TRIPS Coefficient, Percent of Patents Maintained, and PTO Examination Hours Allocated Across Subcategories

Subcategory	Post-TRIPS ^a	% Maintain ^a	Hours ^b	Subcategory	Post-TRIPS ^a	% Maintain ^a	Hours ^b
Chemicals				Electrical			
Agric., Food, Textiles	-2.00	36.65	19.2	Electrical Devices	-1.18	51.65	17.9
Coating	1.07	47.83	20.9	Electrical Lighting	-1.40	41.53	18.8
Gas	0.92	44.37	21.7	Measuring and Testing	-1.99*	47.31	18.0
Organic Compounds	-4.86***	44.30	18.8	Nuclear & X-rays	0.03	51.82	19.8
Resins	-4.99***	50.63	19.2	Power Systems	-2.51**	53.02	18.7
Chem.-Misc.	-2.40***	45.93	18.4	Semiconductor Devices	-7.36***	63.84	21.0
				Elec.-Misc.	-0.74	57.00	18.0
Drugs and Medical				Comp. and Comm.			
Drugs	-8.55***	48.75	17.6	Communications	-4.87***	60.68	19.0
Surgery & Med Inst.	1.65	57.81	14.4	Comp. Hard. & Software	-5.03***	60.72	24.0
Genetics	-25.75***	61.66	24.8	Computer Peripherals	-4.17***	62.70	21.9
Drugs and Med.-Misc.	-1.45	53.47	18.8	Information Storage	-5.22***	60.41	16.2
				Elec. Bus. Meth. & Soft.	-6.39***	64.57	27.4
Others				Mechanical			
Agric., Husbandry, Food	-0.61	35.64	18.6	Mat. Proc. & Handling	1.11	41.37	19.1
Amusement Devices	4.50***	28.64	15.9	Metal Working	0.80	45.91	19.2
Apparel & Textile	-1.90	30.39	17.4	Motors & Engines + Parts	-0.28	45.57	18.4
Earth Working & Wells	1.50	49.53	17.6	Optics	-2.20	50.12	17.5
Furniture, House Fixtures	-1.02	27.94	16.6	Transportation	-1.23	36.18	16.9
Heating	-1.00	40.48	13.7	Mech.-Misc.	1.39	41.09	17.9
Pipes & Joints	-0.49	47.82	16.6				
Receptacles	-1.10	32.98	15.3				
Other-Misc.	-0.91	40.88	18.4				

^aNeel U. Sukhatme & Judd N.L. Cramer, *Who Cares About Patent Term? Cross-Industry Differences in Term Sensitivity*, Princeton Univ. Econ. Dept., Working Paper, 2014, available at <http://ssrn.com/abstract=2293245>. *** P<0.01, ** P<0.05, * P<0.1.

^bMichael D. Frakes & Melissa F. Wasserman, *The Failed Promise of User Fees: Empirical Evidence from the U.S. Patent and Trademark Office*, *J. EMP. L. STUD.*, Table A1 (2014) (hours allocated by PTO for examiner to review application)

Table 2: Proposed Differential Increases for 11½ Year Maintenance Fee

Subcategory	Proposal 1	Proposal 2	Subcategory	Proposal 1	Proposal 2
Chemicals			Electrical		
Agric., Food, Textiles	\$0	\$645	Electrical Devices	\$0	\$1,755
Coating	\$0	\$1,472	Electrical Lighting	\$0	\$1,006
Gas	\$0	\$1,216	Measuring and Testing	\$0	\$1,433
Organic Compounds	\$360	\$1,211	Nuclear & X-rays	\$0	\$1,767
Resins	\$369	\$1,679	Power Systems	\$186	\$1,856
Chem.-Misc.	\$178	\$1,331	Semiconductor Devices	\$545	\$2,657
			Elec.-Misc.	\$0	\$2,150
Drugs and Medical			Comp. and Comm.		
Drugs	\$633	\$1,540	Communications	\$360	\$2,423
Surgery & Med Inst.	\$0	\$2,210	Comp. Hard. & Software	\$372	\$2,426
Genetics	\$1,906	\$2,495	Computer Peripherals	\$309	\$2,572
Drugs and Med.-Misc.	\$0	\$1,889	Information Storage	\$386	\$2,403
			Elec. Bus. Meth. & Soft.	\$473	\$2,711
Others			Mechanical		
Agric., Husbandry, Food	\$0	\$570	Mat. Proc. & Handling	\$0	\$994
Amusement Devices	\$0	\$52	Metal Working	\$0	\$1,330
Apparel & Textile	\$0	\$181	Motors & Engines + Parts	\$0	\$1,305
Earth Working & Wells	\$0	\$1,598	Optics	\$0	\$1,641
Furniture, House Fixtures	\$0	\$0	Transportation	\$0	\$610
Heating	\$0	\$928	Mech.-Misc.	\$0	\$973
Pipes & Joints	\$0	\$1,471			
Receptacles	\$0	\$373			
Other-Misc.	\$0	\$958			

Current 11½ year maintenance fee is \$7,400. Proposals show suggested increases in this fee, by subcategory.