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### CHURN

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#### ABSTRACT

*From biopharmaceuticals to information technology, patents play a powerful role in the birth, death, and renewal of innovative industries. While patent scholarship has fruitfully explored the impact of exclusive rights on individual acts of invention, this Article explores patent law’s underappreciated contributions to evolutionary economic change. It argues that patents promote churn—a continual process in which new innovations and firms challenge incumbents, which must constantly innovate or face displacement. The concept of churn both builds upon and diverges from the influential economic theory of “creative destruction” and provides a more nuanced account of patent law’s contributions to industrial evolution. This Article contends that the availability of an exclusive, time-limited right to technology promotes a baseline level of churn by both spurring the entry of new firms and disciplining patentees that stop innovating. At the “front end,” patents aid the formation and entry of new technology firms that compete against incumbents. At the “back end,” impending patent expirations compel patentees to continuously innovate or risk extinction.*

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*This Article further argues that beyond these baseline functions, patent law accelerates churn in more powerful ways. At the front end, patent law subsidizes patent acquisition by small entities, which empirical studies show are disproportionately innovative. These patent subsidies help facilitate a steady stream of highly innovative entrants to challenge incumbents. At the back end, dynamic doctrines such as patent misuse and the equitable standard for granting injunctions prevent patentees from asserting exclusive rights in overreaching or strategic ways. These pressures come together to encourage innovation in both insurgent and incumbent firms, thus driving churn. Having explored how the patent system promotes churn, this Article suggests ways of improving patent law's contributions to industrial evolution. It advocates orienting the patent system toward stimulating new entry by small entities, and it proposes a framework for subsidizing patent acquisition by such entities based on the innovation dynamics of particular industries. It also argues for shoring up the patent misuse doctrine and denials of injunctive relief to discipline overreaching by existing patentees.*

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“The essential point to grasp is that in dealing with capitalism we are dealing with an evolutionary process.”<sup>1</sup>

“Out with the old, in with the new.”<sup>2</sup>

## INTRODUCTION

Genentech and Marion Merrell Dow represent two ends of a process by which patents promote evolutionary economic change. Genentech started in 1976 as a small, research-based biotechnology startup.<sup>3</sup> As a biotechnology pioneer, Genentech applied genetic engineering to develop large-molecule therapeutic compounds.<sup>4</sup> This innovative approach differed from that of traditional pharmaceutical companies, which utilized chemical processes to synthesize small-molecule drugs. Early on, Genentech applied for several patents, and the company has stated that patent protection “ensured the company’s future and made possible the development of the biotech industry itself.”<sup>5</sup> It is no exaggeration to say that Genentech and other biotech firms revolutionized the pharmaceutical industry, forcing large incumbents to adapt to the new technology or face extinction. One pharmaceutical company that failed to participate in the biotech revolution is Marion Merrell Dow.<sup>6</sup> The company was formed in 1989 from Dow Chemical’s acquisition of Marion Laboratories, which faced impending patent expirations on key drugs with no innovations to replace them.<sup>7</sup> Following the acquisition, Marion Merrell Dow continued to face financial

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1. JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 82 (3d ed., 1994) [hereinafter SCHUMPETER, CAPITALISM].

2. Traditional proverb.

3. Jeannette Colyvas, Annetine Gelijns & Nathan Rosenberg, *Intellectual Property Rights and Academic Health Centers*, in ECONOMICS, LAW AND INTELLECTUAL PROPERTY: SEEKING STRATEGIES FOR RESEARCH AND TEACHING IN A DEVELOPING FIELD 155, 160 (Ove Granstand ed., 2003).

4. Genentech cofounder and USCF scientist Herbert Boyer helped discover recombinant DNA technology. See generally Stanley N. Cohen, Annie C. Y. Chang, Herbert W. Boyer & Robert B. Helling, *Construction of Biologically Functional Bacterial Plasmids In Vitro*, 70 PROC. NAT’L ACAD. SCI. 3240 (1973); Sally Smith Hughes, *Making Dollars Out of DNA: The First Major Patent in Biotechnology and the Commercialization of Molecular Biology, 1974–1980*, 92 ISIS 541, 541–42 (2001).

5. Rory J. O’Connor, *Patent, then Publish*, GENENTECH (July 21, 2016), <https://www.gene.com/stories/patent-then-publish> [<https://perma.cc/63N8-ZSHS>]; U.S. Patent No. 4,342,832 (filed July 5, 1979); see generally JONATHAN M. BARNETT, INNOVATORS, FIRMS, AND MARKETS 120 (2021).

6. Louis Galambos & Jeffrey L. Sturchio, *Pharmaceutical Firms and the Transition to Biotechnology: A Study in Strategic Innovation*, 72 BUS. HIST. REV. 250, 278 n.79 (1998); see Aron S. Spencer & Bruce A. Kirchoff, *Schumpeter and New Technology Based Firms: Toward a Framework for How NTBFs Cause Creative Destruction*, 2 INT’L ENTREPRENEURSHIP & MGMT. J. 145, 153 (2006) (noting that chemistry-based pharmaceutical companies have struggled from competition by biotech-based companies).

7. Sally Streff Buzbee, *Marion, Dow Officials Say Merger Fit is Perfect*, ASSOCIATED PRESS (July 18, 1989), <https://apnews.com/article/5da0ee0e680685b1bd43208ac3ec5efb> [<https://perma.cc/6FGP-DHX2>]; 9 INT’L DIRECTORY OF CO. HIST. 328 (1994).

distress from impending patent expirations.<sup>8</sup> Eventually, it was acquired by Hoechst in 1995.<sup>9</sup> Comparing Genentech and Marion Merrell Dow highlights the role of patents in promoting cycles of industrial evolution. While patent protection enables market entry by revolutionary companies like Genentech—which can reshape entire industries—the expiration of patents contributes to the demise of companies that cease innovating like Marion Merrell Dow.

From biopharmaceuticals to information technology, patents play a powerful role in the birth, death, and renewal of innovative industries. This Article explores patent law’s underappreciated contributions to evolutionary economic change. It argues that patents contribute to churn—a continual process in which new innovations and firms challenge incumbents, which must constantly innovate or face displacement. Ultimately, the insurgents become the incumbents, and the cycle starts anew. These competitive pressures force firms to “innovate or die,” thus providing maximal incentives to innovate.

In considering patent law’s contribution to churn, this Article moves beyond patent scholarship’s traditional micro-level focus on individual invention and explores the impact of patents on macro-level economic and industrial change. In so doing, it offers a novel interpretative gloss on many seemingly disparate elements of the patent system that contribute, both directly and indirectly, to advancing churn. The role of patents in promoting industrial churn is particularly important today given widespread policy concern over industry consolidation and enormous market power wielded by entrenched incumbents.<sup>10</sup> While such issues are ordinarily the province of antitrust law, patents contribute significantly to industrial evolution in which innovative insurgents continually challenge and ultimately displace incumbents, thereby rejuvenating industries.

Two processes form the heart of churn, and patents contribute to both of them. First, at the “front end,” robust entry of new innovations and entities

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8. Milt Freudenheim, *Marion Merrell Chief Braces for Patent Fight*, N.Y. TIMES (Jan. 14, 1992), <https://www.nytimes.com/1992/01/14/business/business-people-marion-merrell-chief-braces-for-patent-fight.html> [<https://perma.cc/5VTU-KDQZ>].

9. Milt Freudenheim, *A \$7.1 Billion Hoechst Deal For Dow Unit: Would Create World’s 2d-Largest Drug Maker*, N.Y. TIMES (May 5, 1995), <https://www.nytimes.com/1995/05/05/business/a-7.1-billion-hoechst-deal-for-dow-unit.html> [<https://perma.cc/9U83-RS3Z>].

10. See, e.g., Cecilia Kang & Mike Isaac, *U.S. and States Say Facebook Illegally Crushed Competition*, N.Y. TIMES (Dec. 9, 2020) [<https://perma.cc/ZE69-7P2A>] (describing antitrust actions against Facebook for acquiring rivals and suppressing competition); Press Release, U.S. Dep’t of Just., Justice Department Sues Monopolist Google For Violating Antitrust Laws (Oct. 20, 2020), <https://www.justice.gov/opa/pr/justice-department-sues-monopolist-google-violating-antitrust-laws> [<https://perma.cc/CDH7-EVM7>].

generates a steady stream of competitors to challenge incumbents.<sup>11</sup> As this Article will argue, patents stimulate such entry, though the precise role of patents in promoting entry varies by industry. Second, at the “back end,” incumbents face harsh penalties—including possible displacement—if they fail to keep innovating. Patent law also promotes ongoing incentives to innovate through the expiration of exclusive rights and by disciplining patentees that assert patents in overreaching and strategic ways. By both enabling the appropriation of economic value and taking it away, patents promote the twin processes that drive churn.

In advancing the theory of churn, this Article reinterprets patents’ role in evolutionary economic change. Students of economic history will recognize distinct parallels between the concept of churn and economist Joseph Schumpeter’s influential theory of “creative destruction.”<sup>12</sup> According to Schumpeter, constant competition creates waves of creative destruction in which new firms displace existing incumbents and reshape industries. Schumpeter’s theory embodies some elements of churn, as it helps explain “the sudden displacement of the old by the new.”<sup>13</sup> As discussed further below, however, churn deviates from several central principles of creative destruction. For example, while large firms are the primary innovators in Schumpeter’s most influential articulation of creative destruction, small entities drive evolutionary change in the theory of churn.<sup>14</sup> Furthermore, while Schumpeter described patents as a kind of “restrictive practice[]” that curbs competition,<sup>15</sup> the theory of churn recognizes a much more dynamic role for patents in promoting competition as well.<sup>16</sup>

This Article argues that patent law promotes both the birth of innovative firms and the demise of ones that grow complacent. At a fundamental level, the mere availability of an exclusive, time-limited right to technology promotes a baseline level of churn. Exclusive rights on new technologies aid firm entry in many industries, and the expiration of patents provides an incentive for patentees to continually innovate or risk displacement.

However, this Article argues that patent law goes further to accelerate both the front-end entry of new entities and the back-end punishment of complacent patentees. At the front end, the patent system selectively

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11. See Bruce A. Kirchoff, *Creative Destruction among Industrial Firms in the United States*, 1 SMALL BUS. ECON. 161, 161 (1989) (“[N]ew firm entry is a required component if long run market concentration and declining innovation rates are to be avoided.”).

12. Schumpeter described creative destruction as a “process of industrial mutation . . . that incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one.” SCHUMPETER, *CAPITALISM*, *supra* note 1, at 83.

13. Spencer Weber Waller & Matthew Sag, *Promoting Innovation*, 100 IOWA L. REV. 2223, 2223 (2015).

14. See *infra* Part I.B.

15. SCHUMPETER, *CAPITALISM*, *supra* note 1, at 87–88.

16. See *infra* Part IV.B.

promotes patent acquisition by small entities. Empirical studies reveal that small entities are disproportionately innovative, and their entry maximizes competitive pressure against incumbents. Patent law charges small entities lower fees to prosecute, adjudicate, and maintain patents. Furthermore, the grace period provisions of the novelty requirement, provisional applications, and the doctrine of constructive reduction to practice all increase access to the patent system for small and under-resourced entities.<sup>17</sup> At the back end, patent law possesses dynamic doctrines to curtail exclusive rights when patentees wield them in overreaching or strategic ways. For example, the patent misuse doctrine renders patents unenforceable when used in certain anticompetitive ways. Furthermore, the equitable framework for injunctive relief can deny injunctions when, among other circumstances, a patentee attempts to leverage the right to exclude to obtain holdup value.<sup>18</sup>

The role of patents in promoting industrial churn has several important implications. First, it sheds new light on the nature of patents themselves. The conventional view of patents as property rights envisions them as fixed, unitary rights. Commentators have fruitfully challenged this view by revealing that courts apply patent doctrines flexibly to tailor patent law to particular industries.<sup>19</sup> This Article goes further. It shows that patent law formally discriminates based on the identity of the party seeking exclusive rights. And rather than being fixed and unitary, patents change depending on how a patentee uses them. In a fitting irony, legal instruments aimed at fostering technological dynamism also exhibit dynamism themselves. Second, churn casts new light on the relationship between patent law and competition. Patents have been characterized as inhibiting competition and creating tensions with antitrust law.<sup>20</sup> Certainly, broad patent thickets and the stockpiling of patents by incumbents can depress competition. However, this Article emphasizes that patents can also promote competition by both affirmatively facilitating new entry and disciplining complacent, overreaching, and strategic behavior by existing patentees.

Turning to normative concerns, this Article argues in favor of churn as an overarching objective of industrial policy. Focusing more specifically on patent law's contributions to churn, it distinguishes between its contributions to front-end and back-end innovation. Regarding front-end innovation, this Article argues for orienting the patent system to promote the entry of small technology firms, which are disproportionately

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17. See *infra* Part III.A.

18. See *infra* Part III.B.

19. Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1641–58 (2003).

20. See, e.g., Thomas F. Cotter, *The Procompetitive Interest in Intellectual Property Law*, 48 WM. & MARY L. REV. 483, 483 (2006); Michael A. Carrier, *Unraveling the Patent-Antitrust Paradox*, 150 U. PA. L. REV. 761 (2002) (examining perceived tensions between patent and antitrust law).

innovative. However, it observes that patents are less important for facilitating entry in some industries than in others. Furthermore, subsidizing patent acquisition may in some contexts even exacerbate patent thickets that threaten innovation.<sup>21</sup> In other industries where subsidizing patent acquisition by small entities is more clearly warranted, simply discounting patent fees may be inadequate in light of the significant expense of patent attorneys or agents required to obtain patents. Regarding back-end innovation, this Article argues that doctrines such as patent misuse and the equitable framework for granting injunctive relief play a salutary role in disciplining overreaching by patentees and should be expanded.

Drawing on this normative analysis, this Article proposes several prescriptions to improve patent law's contributions to churn.<sup>22</sup> At the front end, it proposes a new system of patent fees that *increases* fees for large entities.<sup>23</sup> In the aggregate, this change would decrease the number of patents overall (thus mitigating innovation-dampening patent thickets) while increasing the proportion of patents owned by small entities versus large ones. In parallel, it proposes a more tailored set of subsidies that decreases discounts to small entities in industries, such as software, where patents are less necessary for entry or may exacerbate patent thickets. Conversely, it proposes much greater subsidies (including potentially covering costs for patent attorneys or agents) for small entities in industries where patents are critical for entry and the threat of patent thickets is diminished, such as biopharmaceuticals. At the back end, this Article proposes incorporating considerations of churn in doctrines that can curtail overreaching by patentees. It argues for shoring up the patent misuse doctrine to prevent undue leveraging of patent rights. It also argues for considering the size and market position of litigants in the equitable framework for injunctions. Furthermore, it proposes aggressively asserting that framework to deny injunctions to patentees who attempt to leverage exclusive rights to obtain holdup value.

This Article proceeds in six parts. Part I introduces the concept of churn, an industrial process wherein new innovations and firms challenge incumbents, which must either continue innovating or face displacement. It

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21. See generally Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, in 1 *INNOVATION POLICY AND THE ECONOMY* 119 (Adam B. Jaffe, Josh Lerner & Scott Stern eds., 2001).

22. This Article focuses on reforms to patent law that can improve churn. As such, it acknowledges that other policy levers play important roles in promoting churn, such as antitrust enforcement that prevents large firms from acquiring small upstarts in certain circumstances and laws governing venture capital markets that can boost funding for new firms. See *infra* note 298.

23. While the patent system already offers discounts to so-called small and micro entities, see *infra* Part III.A.i., this Article proposes a more granular system of fees and subsidies calibrated to particular industries. See *infra* Part VI.A.

explores the similarities and differences of this concept relative to Schumpeter's theory of creative destruction. Furthermore, it emphasizes the role of small, highly innovative entities in driving churn. Part II explores how the availability of an exclusive, time-limited right to technology promotes a baseline level of churn. Part III goes further to argue that patent law accelerates churn beyond this baseline level by selectively promoting the entry of small entities (which tend to be highly innovative) and disciplining established patentees that assert exclusive rights in overreaching or strategic ways.

Part IV considers several implications of churn, which illustrates the dynamic nature of patents and reveals their underappreciated contribution to competition. Part V turns to normative analysis. It defends churn as an overarching objective of industrial policy, but it critiques some elements of the patent system's contribution to churn, namely its rigid system of subsidizing patent fees for small entities. Part VI offers prescriptions for improving patent law's contributions to churn. It proposes a more granular system of patent fees that would shift patent ownership toward small entities while calibrating patent acquisition subsidies based on the innovation dynamics of particular industries. It also proposes expanding the patent misuse doctrine, explicitly considering the size and market position of litigants in the equitable framework for injunctive relief, and applying that equitable framework to deny injunctions to overreaching patentees.

## I. CHURN

### A. *The Theory of Churn*

This Article elaborates the concept of churn, a dynamic process of evolutionary economic change. Churn refers to a process by which new innovations and entities challenge existing incumbents, which must either continually innovate or face extinction.<sup>24</sup> Ultimately, the challengers become the incumbents, and the process begins anew. In articulating the concept of churn, this Article draws on a long lineage of "evolutionary" theories of economic change, most notably Joseph Schumpeter's theory of

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24. Such innovation could occur internally or through acquiring and cultivating external innovation. Incumbents also seek to maintain market dominance through other, less innovative means, such as by patenting trivial modifications of existing inventions or acquiring upstart firms to squash their innovations. The effectiveness of churn in promoting innovation depends on reducing these non-innovative options for incumbents to maintain market share. *See infra* notes 326–330 and accompanying text (discussing reforms to constrain non-innovative means to extend exclusivity); *see infra* note 298 (discussing the need to curtail innovation-dampening mergers and acquisitions).

creative destruction (discussed further below).<sup>25</sup> As with other evolutionary theories, churn rejects the notion that economic systems will eventually settle upon determinate equilibria.<sup>26</sup> Instead, churn envisions a dynamic, ever-shifting system of economic birth, challenge, death, and renewal.

Drawing parallels to biological systems, the theory of churn analogizes economic competition to a process of natural selection that winnows out maladaptive firms and rewards adaptive ones.<sup>27</sup> Further reflecting an evolutionary perspective, the theory of churn focuses on long-term change and operates at both micro and macro levels.<sup>28</sup> Just as adaptive traits in individual organisms ultimately reshape populations, through the process of churn, successful upstarts ultimately reshape entire industries. In this evolutionary view, the function of competition “is to reward and enhance the choices that prove good in practice and to suppress the bad ones. Over the long run, one hopes, the competitive system would promote firms that choose well on the average and would eliminate, or force reform upon, firms that consistently make mistakes.”<sup>29</sup>

Innovation is the animating force driving churn. Innovation allows new entrants to challenge incumbents, which can try to stave off competition by innovating themselves. Many of the key concepts of churn are found in the management literature on innovation. Management scholar Peter Drucker succinctly summarizes the competitive pressures facing firms in his maxim “innovate or die.”<sup>30</sup> Elements of churn are also evident in Professor Clayton Christensen’s theory of disruptive innovation. As originally coined, disruptive innovation refers to a process by which a small, under-resourced firm successfully challenges an established incumbent.<sup>31</sup> Such entrants arise from the “low-end” of markets by providing a “good enough” product to less-demanding customers or by creating a market where none had previously existed.<sup>32</sup> One example is Netflix, which originally provided mail-order movies for consumers who did not need same-day rentals from

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25. See SCHUMPETER, *CAPITALISM*, *supra* note 1. Schumpeter’s writings influenced subsequent generations of evolutionary theories of economic change. See, e.g., RICHARD R. NELSON & SIDNEY G. WINTER, *AN EVOLUTIONARY THEORY OF ECONOMIC CHANGE* (1982); see generally Kirchhoff, *supra* note 11, at 162–65 (surveying several evolutionary economic theories).

26. SCHUMPETER, *CAPITALISM*, *supra* note 1, at 79; see also NELSON & WINTER, *supra* note 25, at 8, 10; Kirchhoff, *supra* note 11, at 161; Spencer & Kirchhoff, *supra* note 6, at 145–46.

27. See NELSON & WINTER, *supra* note 25, at 4 (“And over time, the economic analogue of natural selection operates as the market determines which firms are profitable and which are unprofitable, and tends to winnow out the latter.”).

28. *Cf. id.* at 10 (“The broader connotations of ‘evolutionary’ include a concern with processes of long-term and progressive change.”).

29. *Id.* at 276–77.

30. Adi Ignatius, *Innovation on the Fly*, HARV. BUS. REV., Dec. 2014 (quoting Peter Drucker).

31. CLAYTON M. CHRISTENSEN, *THE INNOVATOR’S DILEMMA* (2016); Clayton M. Christensen, Michael E. Raynor & Rory McDonald, *What Is Disruptive Innovation?*, HARV. BUS. REV., Dec. 2015.

32. Christensen, Raynor & McDonald, *supra* note 31.

Blockbuster.<sup>33</sup> Another example is the University of Phoenix, which pioneered for-profit, online education, and thereby provided a lower-cost alternative to traditional universities.<sup>34</sup> In both examples, innovative small entrants challenged established incumbents, forcing them to innovate or face extinction.

It is important to emphasize that churn does not necessarily entail the demise of incumbents and their replacement by new upstarts. Certainly, firm death is a very real element of evolutionary economic change and frequently occurs within churn. However, the more important point is that the prospect of death provides a powerful incentive for established firms to keep innovating. In this manner, competitive pressures produce significant benefits not only when innovative firms displace incumbents, but also when competition spurs incumbents to continue innovating, sometimes by reinventing themselves.<sup>35</sup> Churn is best understood as a process of constant competitive pressure that motivates all parties—small, large, new, and incumbent—to continually innovate.<sup>36</sup>

Churn is evident in several technology-intensive industries. For example, the information technology (IT) industry is marked by incremental innovation and occasional paradigm shifts that can displace incumbents.<sup>37</sup> Andy Grove, former CEO of Intel, referred to such shifts as “major inflexion points.”<sup>38</sup> Many once-leading companies, such as Control Data Inc., Digital Equipment Corp., Data General, and Prime Computer, have disappeared.<sup>39</sup> In addition to the radical innovation that visibly drives churn, more modest

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33. *Id.* While this Section focuses on general parallels between churn and disruptive innovation, it is worth noting that patents aided Netflix’s industry entry and ascendance. See Simon Abroz & Parminder Lally, *From Snail Mail to Streaming: The Netflix Intellectual Property Story*, APPLEYARD LEES (Jan. 22, 2021), <https://www.appleyardlees.com/the-netflix-intellectual-property-story/> [<https://perma.cc/5YSN-W6RH>].

34. Again, while this section focuses on the general phenomenon of upstarts challenging incumbents, it is interesting to note that the University of Phoenix regards patents as an important part of its business model. University of Phoenix, *University of Phoenix Online Platform Receives Patent from United States Patent and Trademark Office*, PR NEWSWIRE (Jan. 25, 2013 10:05 AM), <https://www.prnewswire.com/news-releases/university-of-phoenix-online-platform-receives-patent-from-united-states-patent-and-trademark-office-188352361.html> [<https://perma.cc/5AMA-Z83L>].

35. See Tim Wu, *Taking Innovation Seriously: Antitrust Enforcement If Innovation Mattered Most*, 78 ANTITRUST L.J. 313, 318 (2012) (noting that external innovation spurs internal innovation by large incumbents) [hereinafter Wu, *Taking Innovation Seriously*].

36. Schumpeter recognized this in his earlier writings, noting that competition leads some established firms to find new opportunities for expansion whereas others ultimately die. JOSEPH SCHUMPETER, *THE THEORY OF ECONOMIC DEVELOPMENT: AN INQUIRY INTO PROFITS, CAPITAL, CREDIT, INTEREST, AND THE BUSINESS CYCLE* 118 (1934) [hereinafter SCHUMPETER, *BUSINESS CYCLE*].

37. David J. Teece & Mary Coleman, *The Meaning of Monopoly: Antitrust Analysis in High-Technology Industries*, 43 ANTITRUST BULL. 801, 804 (1998).

38. *Id.*

39. Spencer & Kirchoff, *supra* note 6, at 152.

innovations in system architecture can also undercut incumbents.<sup>40</sup> For example, in the early photolithographic alignment equipment industry, four waves of architectural innovation led to a new entrant dominating each new product generation.<sup>41</sup> Paralleling the process of churn, Professors Aron Spencer and Bruce Kirchhoff describe a multi-step process by which new technology-based firms challenge and ultimately displace incumbents.<sup>42</sup> In addition to displacing incumbents, churn also spurs incumbents to react to shifts in demand and new technological opportunities.<sup>43</sup> IBM has reinvented itself several times, for instance by selling off its personal computer business and later embracing cloud computing.<sup>44</sup> In this fashion, churn provides competitive pressure that spurs otherwise conservative incumbents to keep innovating.<sup>45</sup>

Churn is also evident in the biopharmaceutical industry. Scientific advances in the germ theory of disease, medicinal chemistry, synthetic organic chemistry, virology, microbial biochemistry, and enzymology have propelled significant industry shifts, creating both winners and losers.<sup>46</sup> As noted, biotechnology—in which scientists engineer biological systems to produce therapeutic proteins and other valuable products—has again revolutionized the industry.<sup>47</sup> Small biotechnology firms (which rely heavily on patents) have fundamentally altered the development of therapeutics and diagnostics.<sup>48</sup> In some cases, large incumbents failed to adapt to the emergence of biotechnology and fell into decline.<sup>49</sup> In many other cases, however, large companies were forced to adapt by integrating with the biotechnology revolution, often by contracting with or acquiring small biotechnology firms.<sup>50</sup>

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40. Rebecca M. Henderson & Kim B. Clark, *Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms*, 35 ADMIN. SCI. Q. 9, 10 (1990).

41. *Id.* at 20.

42. Spencer & Kirchhoff, *supra* note 6, at 153.

43. Teece & Coleman, *supra* note 37, at 804.

44. See Spencer & Kirchhoff, *supra* note 6, at 152 (discussing IBM's sale of its personal computer business to Lenovo); Jay Greene & Robert McMillan, *IBM to Acquire Red Hat for About \$33 Billion*, WALL ST. J. (Oct. 28, 2018, 5:28 PM), <https://www.wsj.com/articles/ibm-in-advanced-talks-to-buy-red-hat-1540751279> [<https://perma.cc/AAG6-72ST>] (discussing IBM's acquisition of Red Hat to shore up its cloud computing business).

45. See Teece & Coleman, *supra* note 37, at 805 (“Incumbents have to be willing and able to abandon the old and embrace the new.”).

46. Galambos & Sturchio, *supra* note 6, at 251–52.

47. See *supra* notes 3–9 and accompanying text.

48. Martin Kenney, *Schumpeterian Innovation and Entrepreneurs in Capitalism: A Case Study of the U.S. Biotechnology Industry*, 15 RSCH. POL'Y 21, 21–22 (1986) [hereinafter Kenney, *Schumpeterian*].

49. Cf. Spencer & Kirchhoff, *supra* note 6, at 153 (noting that chemistry-based pharmaceutical companies have struggled in the face of competition from biotechnology).

50. Galambos & Sturchio, *supra* note 6, at 254.

### *B. Churn and Creative Destruction*

Students of economics will notice certain parallels between churn and Joseph Schumpeter's famous theory of creative destruction. Like churn, the theory of creative destruction is a dynamic, evolutionary account of economic change.<sup>51</sup> In Schumpeter's influential theory, capitalism consists of continuous cycles in which new firms and innovations displace existing incumbents and industries, only to be displaced again.<sup>52</sup> Schumpeter argued that capitalism is an intrinsically "evolutionary" process and that "[t]he fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates."<sup>53</sup>

Interestingly, patents play an important role in Schumpeter's theory of creative destruction. For Schumpeter, firms operate within "the perennial gale of creative destruction."<sup>54</sup> In the face of constant competition, "restrictive practices" such as patents allow monopolists or oligopolists to "steady the ship" and engage in long-term planning.<sup>55</sup> Among other functions, patents provide rightsholders with the breathing room to invest in innovation.<sup>56</sup> Patents allow firms to compete on innovation instead of just price, thus fueling the next round of creative destruction.

The theory of churn shares several similarities with Schumpeter's conception of creative destruction. Like creative destruction, churn is a dynamic theory in which innovative entities constantly challenge and displace incumbents. Both theories also recognize that innovation is a more significant source of economic growth and social welfare than mere price competition.<sup>57</sup> Additionally, the theories both posit that incumbents will use all means possible, including patents, to prevent displacement.<sup>58</sup>

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51. See, e.g., SCHUMPETER, *CAPITALISM*, *supra* note 1, at 79 (casting doubt on the existence of general, long-term equilibria in some economic systems).

52. Waller & Sag, *supra* note 13, at 2226 ("[T]he process of creative destruction typically involved a powerful incumbent firm being overwhelmed by new forms of innovation that radically changed the nature of competition.").

53. SCHUMPETER, *CAPITALISM*, *supra* note 1, at 82–83.

54. *Id.* at 84.

55. *Id.* at 76. See *id.* at 88 ("The main value to a concern of a single seller position that is secured by a patent or monopolistic strategy does not consist so much in the opportunity to behave temporarily according to the monopolist schema, as in the protection it affords against temporary disorganization of the market and the space it secures for long-range planning.").

56. *Id.* at 96.

57. *Id.* at 84; Waller & Sag, *supra* note 13, at 2226.

58. Waller & Sag, *supra* note 13, at 2224 ("Modern businesses are well aware of the threat of disruptive outsiders and, left unchecked, will do their utmost to prevent future waves of creative destruction from threatening the status quo.").

However, the theory of churn departs from creative destruction in several key respects. First, churn differs from creative destruction in positing a greater role for small entities in driving innovation.<sup>59</sup> Schumpeter's views shifted over time, and ironically, in earlier work he extolled the role of small, entrepreneurial firms in driving economic change.<sup>60</sup> In his later and more influential writings, however, large firms are the primary innovators and contributors to social welfare.<sup>61</sup> Schumpeter argued that large firms in concentrated industries can exploit restrictive practices that provide breathing space to invest in innovation amidst constant gales of competition.<sup>62</sup> Leveraging greater technical and financial resources, they can outcompete small firms.<sup>63</sup> On the contrary, the theory of churn posits that small, new entrants play a leading role in generating innovations that revolutionize industries. In so doing, it draws on empirical accounts of the disproportionately innovative nature of small entities, a topic explored further below.<sup>64</sup>

Second and relatedly, the theory of churn rejects Schumpeter's sanguine attitude toward restrictive practices by incumbents. While both churn and creative destruction recognize the need for some restrictive practices—such as patents—to encourage investments in innovation, Schumpeter viewed such restrictions much more positively. He believed that the threat of competition could discipline incumbents in concentrated industries,<sup>65</sup> and

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59. See *infra* Part II.C.

60. SCHUMPETER, BUSINESS CYCLE, *supra* note 36, at 66 (“[T]hese new combinations are, as a rule, embodied, as it were, in new firms which generally do not arise out of the old ones but start producing beside them.”); see Kenney, *Schumpeterian*, *supra* note 48, at 21; Christopher Ziemnowicz, *Joseph A. Schumpeter and Innovation*, in 1 ENCYCLOPEDIA OF CREATIVITY, INVENTION, INNOVATION AND ENTREPRENEURSHIP 1171, 1172 (2013). Indeed, churn more closely corresponds to Schumpeter's earlier writings on innovation led by small entities (so-called Model 1) rather than his more famous writings positing that large firms lead innovation (so-called Model 2). Kenney, *Schumpeterian*, *supra* note 48, at 23.

61. SCHUMPETER, CAPITALISM, *supra* note 1, at 82, 106; Arti K. Rai, *Fostering Cumulative Innovation in the Biopharmaceutical Industry: The Role of Patents and Antitrust*, 16 BERKELEY TECH. L.J. 813, 819 (2001) (noting the association between Schumpeter's work and the view that “entities with monopoly or quasi-monopoly power are the major engines of innovation”); NELSON & WINTER, *supra* note 25, at 278 (describing the “Schumpeterian hypothesis” as the “claim that a market structure involving large firms with a considerable degree of market power is the price that society must pay for rapid technological advance”); Ziemnowicz, *supra* note 60, at 1173; *but see* BARNETT, *supra* note 5, at 101–03 (arguing that Schumpeter viewed innovation by large firms as an “imperfect solution” required because R&D investments were vulnerable to expropriation).

62. SCHUMPETER, CAPITALISM, *supra* note 1, at 96.

63. *Id.* at 101; Kenney, *Schumpeterian*, *supra* note 48, at 23; *see also* NELSON & WINTER, *supra* note 25, at 279 (articulating another evolutionary theory in which large firms enjoy “capability advantages,” such as those related to economies of scale, risk spreading, and access to finance).

64. See *infra* Part I.C.

65. SCHUMPETER, CAPITALISM, *supra* note 1, at 85.

he downplayed the harm of restrictive practices in raising barriers to entry.<sup>66</sup> In fact, he advocated using restrictive practices to “steady the ship” against destabilizing competition.<sup>67</sup> Not surprisingly, he was quite skeptical of antitrust enforcement.<sup>68</sup> On the contrary, competition (and its pro-innovation effects) plays a central and beneficial role in the theory of churn.

Third, the theory of churn emphasizes a different set of functions played by patents in evolutionary economic change. Within creative destruction, patents are a “restrictive practice[]” that protect rightsholders from competition, allowing them to invest in innovation.<sup>69</sup> Within the theory of churn, however, patents also serve two other important functions that promote competition. At the front end, patents frequently catalyze the formation and entry of new technology-based firms. At the back end, the expiration or curtailment of exclusive rights can contribute to an ongoing incentive to innovate for patentees or hasten their displacement by more innovative rivals. While patents are, from one perspective, a restrictive practice, they can also promote firm entry and firm demise, thus driving churn.

### *C. The Importance of Small Entities in Driving Churn*

Because small, new entrants play a central role in churn, some discussion of their innovative nature is helpful. At a basic level, new entry is important to churn by providing a steady stream of competitors to challenge incumbents. However, to the extent that new entrants are particularly innovative, the competitive pressures they exert on incumbents—and their contributions to social welfare—increase. New entrants in technological fields tend to be small entities, and small entities tend to be disproportionately innovative relative to established players. As such, an industrial policy that favors new entry by small entities promises significant innovation benefits.

Substantial theory and empirical evidence indicate that small entities are disproportionately innovative relative to large ones.<sup>70</sup> First, small entities have greater incentive to pursue radical innovations. Economist Kenneth Arrow famously argued that large incumbents have low incentives to

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66. *Id.* at 87 (“[B]oth as a fact and as a threat, the impact of new things—new technologies for instance—on the existing structure of an industry considerably reduces the long-run scope and importance of practices that aim, through restricting output, at conserving established positions and at maximizing the profits accruing from them.”).

67. *Id.* at 87–88.

68. *Id.* at 91–92.

69. *Id.* at 87.

70. See Spencer & Kirchhoff, *supra* note 6, at 148.

produce radical innovations that can displace existing product offerings.<sup>71</sup> In order to differentiate themselves from incumbents, however, small entities often focus inventive efforts on more substantial technological advances.<sup>72</sup>

Second, small firms enjoy organizational advantages that render them particularly innovative. The theory of the firm predicts that as organizations get larger, they entail greater internal costs of coordination.<sup>73</sup> Small firms are less burdened by bureaucracy and can operate in a nimbler fashion. Large organizations embed their knowledge in communication channels, information filters, and problem-solving strategies. They are also constrained by legacy technologies and the need to cater to existing customers.<sup>74</sup> Additionally, social attachments to underperforming projects may prevent bureaucrats from shutting them down quickly.<sup>75</sup> Large firms also face reputational pressures in capital markets that discourage risk taking.<sup>76</sup> Such organizational factors create inertia that prevents large entities from pivoting toward architectural or radical change.<sup>77</sup> Lacking these constraints, small firms can operate more dynamically. As a historical matter, the wide distribution of computing technology following the 1980s reduced costs for small entities and vastly increased their research and development (R&D) capacity.<sup>78</sup> Numerous empirical studies indicate that small firms are more efficient at producing innovation, particularly radical innovation, than large firms.<sup>79</sup>

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71. Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS* 609, 619–22 (1962); see also Spencer & Kirchoff, *supra* note 6, at 150–51 (summarizing reasons why incumbents engage in evolutionary rather than revolutionary innovation); Todd R. Zenger & Sergio G. Lazzarini, *Compensating for Innovation: Do Small Firms Offer High-Powered Incentives That Lure Talent and Motivate Effort?*, 25 *MANAGERIAL & DECISION ECON.* 329, 329 (2004).

72. Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 *U. PA. L. REV.* 1, 74 (2005).

73. R.H. Coase, *The Nature of the Firm*, 4 *ECONOMICA* 386, 395 (1937) (discussing “diminishing returns to management” in large firms).

74. Henderson & Clark, *supra* note 40, at 18; Spencer & Kirchoff, *supra* note 6, at 151–52.

75. Zenger & Lazzarini, *supra* note 71, at 329.

76. Bengt Holmstrom, *Agency Costs and Innovation*, 12 *J. ECON. BEHAV. & ORG.* 305, 306–07 (1989).

77. Henderson & Clark, *supra* note 40, at 18; see also Kenney, *Schumpeterian*, *supra* note 48, at 29 (“Venture capital appears to be a systemic response to the behavior of the large U.S. companies, many of which find it difficult to provide an internal environment conducive to radical innovation.”).

78. Robert M. Hunt & Leonard I. Nakamura, *The Democratization of U.S. Research and Development after 1980 I* (Sept. 2010) (unpublished manuscript) (on file with author).

79. E.g., Zenger & Lazzarini, *supra* note 71, at 329; MORTON I. KAMIEN & NANCY L. SCHWARTZ, *MARKET STRUCTURE AND INNOVATION* (1982); F. M. Scherer, *Firm Size, Market Structure, Opportunity, and the Output of Patented Inventions*, 55 *AM. ECON. REV.* 1097 (1965); Jacob Schmookler, *The Size of Firm and the Growth of Knowledge*, in *PATENTS, INVENTIONS AND ECONOMIC CHANGE* (1972); EDWIN MANSFIELD ET AL., *RESEARCH AND INNOVATION IN THE MODERN CORPORATION* (1971); Kirchoff, *supra* note 11, at 161 (citing several studies indicating that “small

Third, at a more granular level, small firms possess a more entrepreneurial culture and attract particularly innovative workers. Small firms and their employees are closer to “high-powered” market incentives rather than the muted, internal incentives in large bureaucracies.<sup>80</sup> Measuring individual contributions to overall firm performance is easier in small firms.<sup>81</sup> Furthermore, the lack of bureaucratic review and distortion allows small firms to tailor compensation more tightly to individual performance, which in theory translates to greater effort.<sup>82</sup> Empirical research has shown that small firms tend to reward employees based on ability, effort, and performance, while large firms rely more on age and seniority.<sup>83</sup> At a psychological level, many engineers and scientists prefer to work in “smaller and more intimate organizations” in which they feel greater autonomy.<sup>84</sup> Large bureaucracies may even undermine innovation by restricting experimentation and screening away innovative workers.<sup>85</sup> Summarizing a wide literature, Ashish Arora and Robert Merges argue that “smaller, more dynamic firms are in some cases especially innovative.”<sup>86</sup>

A comprehensive survey of fifty years of empirical research found that while R&D investments typically grow proportionately with firm size, the number of innovations does not grow proportionately with firm size.<sup>87</sup> These findings suggest that smaller firms enjoy greater innovation productivity than larger ones. Empirical research also reveals that the share of R&D devoted to incremental and process innovations tends to increase with firm size, which further suggests that small firms focus on more radical innovations.<sup>88</sup> Reviewing numerous innovations, economist William Baumol concluded: “One is, then, led to the plausible conjecture that most of the revolutionary new ideas of the past 2 centuries have been—and are

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firms are more efficient and productive innovators than large firms”); *but see* Zoltan J. Acs & David B. Audretsch, *Innovation in Large and Small Firms: An Empirical Analysis*, 78 AM. ECON. REV. 678, 687 (1988) (finding that the more an industry is comprised of large firms, the more innovative it generally is, but that increased innovative activity in such industries tends to arise from small firms).

80. OLIVER WILLIAMSON, *THE ECONOMIC INSTITUTIONS OF CAPITALISM* 90 (1985).

81. Zenger & Lazzarini, *supra* note 71, at 331; *id.* at 332 (“Thus, the higher level of measurement accuracy, greater control over performance measures, and reduced comparison problems, enable small firms to more aggressively reward individual performance differences than large firms.”).

82. *Id.* at 330, 333.

83. *Id.* at 341.

84. CHRIS FREEMAN & LUC SOETE, *THE ECONOMICS OF INDUSTRIAL INNOVATION* 239 (3d ed. 2000).

85. Holmstrom, *supra* note 76, at 306.

86. Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUS. & CORP. CHANGE 451, 451–52 (2004).

87. Wesley M. Cohen, *Fifty Years of Empirical Studies of Innovative Activity and Performance*, in 1 HANDBOOK OF THE ECONOMICS OF INNOVATION 128, 137 (2010).

88. *Id.*

likely to continue to be—provided more heavily by independent innovators who, essentially, operate small business enterprises.”<sup>89</sup>

The dynamics of the information technology industry illustrate the disproportionately innovative nature of small firms. Studies of the early semiconductor industry revealed that new entrants were more likely to engage in product innovation, while incumbents focused on process innovation and enhancing manufacturing efficiency.<sup>90</sup> An early commentator on the software industry noted that “[m]ost of the innovation comes from very small companies.”<sup>91</sup> Owing to the disproportionately innovative nature of small firms, many technological fields have developed a division of labor in which small, “upstream” firms specialize in research-intensive invention while large, “downstream” companies focus on bringing those inventions to market. In the 1990s, Cisco essentially outsourced its upstream R&D by acquiring the most innovative startups in network technology.<sup>92</sup> The semiconductor industry has bifurcated into upstream “fabless” firms that design chips and downstream foundries that license those designs and manufacture chips.<sup>93</sup> Furthermore, Facebook, Google, and other large incumbents have been on a buying spree, acquiring numerous startups and essentially outsourcing the development of new innovations.<sup>94</sup>

The innovative nature of small firms is also evident in the biopharmaceutical industry. Small, entrepreneurial firms spearheaded the biotechnology revolution; such firms as well as universities represent the “hothouse” of innovation.<sup>95</sup> This pattern diverges from historical trends in which large, well-financed companies primarily led innovation.<sup>96</sup> According to Professor Martin Kenney, “the small biotechnology

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89. William J. Baumol, *Entrepreneurial Cultures and Countercultures*, 3 ACAD. MGMT. LEARNING & EDUC. 316, 323 (2004).

90. JOHN E. TILTON, *INTERNATIONAL DIFFUSION OF TECHNOLOGY: THE CASE OF SEMICONDUCTORS* (1971).

91. See David J. Wallace, *Zisman Takes the Helm of Lotus in the Post-Manzi Era*, PHILA. BUS. J., Nov. 10, 1995, at B2; see also Robert P. Merges, *Patents, Entry and Growth in the Software Industry 3* (Aug. 1, 2006) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=926204](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=926204) (stating that according to Dan Bricklin, co-founder of VisiCalc, most of the significant advances in the PC industry are the result of small firms or small development teams).

92. Ronald J. Gilson, *Locating Innovation: The Endogeneity of Technology, Organizational Structure, and Financial Contracting*, 110 COLUM. L. REV. 885, 910 (2010).

93. Jonathan M. Barnett, *Intellectual Property as a Law of Organization*, 84 S. CAL. L. REV. 785, 792–93 (2011) [hereinafter Barnett, *Organization*]; see Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979–1995*, 32 RAND J. ECON. 101, 119–20 (2001).

94. See Peter Lee, *Innovation and the Firm: A New Synthesis*, 70 STAN. L. REV. 1431 (2018) [hereinafter Lee, *Innovation and the Firm*].

95. Jeffrey L. Fox, *Biotechnology: A High Stakes Industry in Flux*, CHEM. & ENG’G NEWS 10, 14 (quoting life sciences lawyer S. Leslie Misrock).

96. Galambos & Sturchio, *supra* note 6, at 252.

companies with university-like atmospheres are much more conducive to creative scientific research.”<sup>97</sup> Tellingly, in the current COVID-19 pandemic, small biotech firms like BioNTech and Moderna first developed innovative mRNA-based vaccines.<sup>98</sup> As in other contexts, the biopharmaceutical industry has adopted a division of labor aimed at exploiting the unusually innovative character of small firms. As a general scheme, small biotechnology firms perform cutting-edge research to produce promising prophylactic and therapeutic compounds, leaving clinical trials and marketing to larger pharmaceutical companies.<sup>99</sup> This is evident, for example, in the partnership between BioNTech and major pharmaceutical company Pfizer.<sup>100</sup> Large companies obtain innovations from small firms in several ways, including licensing their patents, creating joint ventures, and simply acquiring those small firms directly.

Of course, in emphasizing the disproportionately innovative nature of small firms, one must not discount the tremendous innovativeness of large incumbents. From Bristol Myers Squibb to Apple to Google, large companies produce significant innovation. Large companies enjoy several advantages—including access to lower-cost financing, more information about their customers and industry, economies of scale and scope, and certain tax benefits—that bolster their innovative capacity relative to small entities.<sup>101</sup> In particular, the scale of large firms allows them to achieve unique breakthroughs that emerge from aggregating many incremental improvements.<sup>102</sup>

Nonetheless, the disproportionately innovative nature of small firms allows them to play a crucial role in churn. New entry provides the constant influx of new innovations to compete against established companies. The unusually innovative nature of small entities, moreover, amplifies the

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97. Kenney, *Schumpeterian*, *supra* note 48, at 28.

98. See Sharon LaFraniere, Katie Thomas, Noah Weiland, David Gelles, Sheryl Gay Stolberg & Denise Grady, *Politics, Science and the Remarkable Race for a Coronavirus Vaccine*, N.Y. TIMES (Nov. 21, 2020), <https://www.nytimes.com/2020/11/21/us/politics/coronavirus-vaccine.html> [<https://perma.cc/T54S-A2E3>].

99. Andrew W. Lo & Gary P. Pisano, *Lessons From Hollywood: A New Approach to Funding R&D*, MIT SLOAN MGMT. REV. (Dec. 14, 2015), <https://sloanreview.mit.edu/article/lessons-from-hollywood-a-new-approach-to-funding-rd/> [<https://perma.cc/D6N2-WPB9>].

100. LaFraniere et al., *supra* note 98.

101. Gilson, *supra* note 92, at 894–95.

102. Baumol, *supra* note 89, at 323 (citing Intel’s steady increase in microprocessor speed as an example).

competitive pressures they exert against incumbents, thus accelerating churn.

## II. PATENT LAW'S BASELINE CONTRIBUTION TO CHURN

This Article has explored the concept of churn, in which small entities enter industries and challenge incumbents, which then are forced to innovate or face displacement. This Part turns more directly to the role of patent law in promoting this process. As noted, in Schumpeter's theory of creative destruction, patents are restrictive mechanisms that inhibit competition, thus providing breathing space for firms to invest in innovation.<sup>103</sup> While acknowledging this function, the theory of churn also recognizes other, more pro-competitive functions played by patents in industrial evolution. As we have seen, churn relies on robust entry of new entities to challenge incumbents and existential threats to those incumbents to ensure they keep innovating. Patents contribute to both functions. At the front end, as in the example of Genentech discussed above,<sup>104</sup> patents can facilitate the formation and entry of new, innovative startups. At the back end, as illustrated by the demise of Marion Merrell Dow,<sup>105</sup> the expiration of patent rights provides an ongoing incentive to innovate or face extinction.

### *A. Promoting Front-End Innovation: Patents, Firm Formation, and New Entry*

The availability of an exclusive, time-limited right to a novel invention promotes some baseline level of churn. At the front end, independent inventors and small firms, enticed by the assurance of patent protection, invest in research and development, thus creating technologies that can compete against incumbents. In many cases, patents are critical to protecting a novel technology, and they can play an important role in obtaining outside financing. To the extent that they promote new firm formation and industry entry, patents contribute to a steady stream of new competitors to challenge incumbents.

In some contexts, patents are critical to establishing new firms and facilitating market entry. Patents are especially helpful for small entities, which lack traditional enablers of market entry such as manufacturing capabilities, marketing channels, and access to inexpensive credit.<sup>106</sup> As

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103. See *supra* Part I.B.

104. See *supra* notes 3–5 and accompanying text.

105. See *supra* notes 6–9 and accompanying text.

106. Stuart J.H. Graham, Robert P. Merges, Pamela Samuelson & Ted M. Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24

Professor Jonathan Barnett argues, large firms (particularly those that are vertically integrated) have greater capacity to appropriate value from their innovations where patent protection is weak or nonexistent.<sup>107</sup> Lacking these appropriation mechanisms, small entities are especially dependent on patents. Empirical research reveals that early-stage firms obtain patents for a wide variety of reasons, including to gain competitive advantage, prevent copying, secure financing, and enhance their reputation.<sup>108</sup>

The role of patents in attracting external financing may be particularly important. A comprehensive review of empirical research found that patent applications (whether granted or not) are associated with increased venture capital (VC) funding.<sup>109</sup> Economist Bronwyn Hall summarizes several reasons why patents may increase funding: 1) they can increase the appropriability of and expected profits from new innovation; 2) they provide external signals of underlying innovative quality; and 3) they provide salvage value for investors in case a new enterprise fails.<sup>110</sup> Furthermore, empirical evidence suggests that patenting is correlated with greater rates of survival and growth for startups.<sup>111</sup>

Connecting to the earlier discussion of industrial organization, patents enable the independent existence of small, “upstream,” research-based firms that lack the size and resources to bring technologies to market.<sup>112</sup> These small firms’ primary output is patents, which they license to larger companies for further development, manufacturing, and distribution. For example, patents in the semiconductor industry facilitated the entry of “fabless” firms that design chips and then license designs to outside foundries for manufacture.<sup>113</sup> Empirical analysis suggests that “stronger patent rights facilitated entry into the industry by specialized design firms for which capital intensity is a relatively unimportant predictor of patenting behavior.”<sup>114</sup> In biopharmaceuticals, patents have been critical to the

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BERKELEY TECH. L.J. 1255, 1259 (2009); *id.* at 1287 (“[P]atents appear to be supporting other activities crucial to *technology* startups: securing the necessary investment to develop and grow; increasing the odds and quality of a liquidity event, such as an acquisition or IPO; and serving strategic roles in negotiation and defending against patent infringement suits.”); *see* Scott Shane, *Technological Opportunities and New Firm Creation*, 47 MGMT. SCI. 205, 209 (2001); Barnett, *Organization*, *supra* note 93, at 788.

107. BARNETT, *supra* note 5, at 3; *see also* NELSON & WINTER, *supra* note 25, at 279 (emphasizing the manufacturing, marketing, and financial advantages of large firms).

108. Graham et al., *supra* note 106, at 1297.

109. Bronwyn H. Hall, *Is There a Role for Patents in the Financing of New Innovative Firms?*, 28 INDUS. & CORP. CHANGE 657, 661–64, 670 (2019); *see also* Graham et al., *supra* note 106, at 1279–80, 1305.

110. Hall, *supra* note 109, at 658.

111. *See id.* at 664–65 (summarizing studies).

112. *See supra* notes 92–99 and accompanying text.

113. Barnett, *Organization*, *supra* note 93.

114. Hall & Ziedonis, *supra* note 93, at 119.

formation and ongoing viability of small, research-intensive biotech firms that license patented compounds to larger pharmaceutical firms for commercialization.<sup>115</sup> As Barnett observes, “patents have played a critical role in supporting the formation of scientist-founded start-ups.”<sup>116</sup> Historical examples from the German chemical industry also illustrate the importance of patents to forming specialized engineering firms that developed process innovations and licensed them to other firms.<sup>117</sup>

While patents are important for startup formation and entry in many technological industries, their importance varies by context.<sup>118</sup> In the software industry, the situation is more complex. Professor Ronald Mann argues that patents are particularly likely to benefit small software firms rather than large firms and contribute to industry fragmentation.<sup>119</sup> However, he distinguishes between different kinds of software startups. The earliest-stage, pre-revenue startups often do not prioritize obtaining patents (which can be very expensive) relative to hiring and product development.<sup>120</sup> However, as software startups mature, patents become more important to promoting market entry.<sup>121</sup> An influential survey of entrepreneurs concluded, however, that patents help early-stage companies compete in most fields *other* than the software and Internet sector.<sup>122</sup> Indeed, a review of several empirical studies revealed that relatively few firms in technology-intensive sectors applied for patents.<sup>123</sup> Due to the abundance of software tools and cloud-based operations, the cost of starting a software-based startup has decreased dramatically.<sup>124</sup> The low cost of establishing such startups lessens the importance of patents to facilitating entry in such industries.

Despite the general importance of patents to promoting firm entry, it is also important to note that patents can inhibit new entry in some contexts. In some industries, broad patent thickets raise the cost of product

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115. Arora & Merges, *supra* note 86.

116. BARNETT, *supra* note 5, at 117.

117. Ulrich Marsh, *Strategies for Success: Research Organization in German Chemical Companies and IG Farben Until 1936*, 12 HIST. & TECH. 25 (1994).

118. It bears emphasizing as well that small entities tend to patent in different technological areas relative to larger ones. See John R. Allison & Mark A. Lemley, *Who's Patenting What? An Empirical Exploration of Patent Prosecution*, 53 VAND. L. REV. 2099, 2128 (2000) (reporting that small entities patented over half of the medical devices and mechanical inventions in the authors' study but patented less than one-third of every other type of invention).

119. Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEX. L. REV. 961, 967–68 (2005).

120. *Id.* at 981–85.

121. *Id.*

122. Graham et al., *supra* note 106, at 1295.

123. Hall, *supra* note 109, at 660.

124. Martin Kenney & John Zysman, *Unicorns, Cheshire Cats, and the New Dilemmas of Entrepreneurial Finance*, 21 VENTURE CAP. 35, 39 (2019).

development to an extent that discourages new entry.<sup>125</sup> The role of patents in inhibiting new entry is most acute in industries featuring component technologies in which product development requires aggregating many different patented assets. Additionally, in the software industry, empirical research shows that from 1990 to 2004, a 10% increase in the number of patents reduced entry by 3–8%.<sup>126</sup> Furthermore, segments of the software industry featuring the most patents per incumbent had the smallest increase in entry.<sup>127</sup> Summarizing their findings, Professors Ian Cockburn and Megan MacGarvie concluded that “[p]atent thickets, at least as measured here, thus appear to substantially raise entry costs.”<sup>128</sup> Importantly, however, the inhibitory effects of patent thickets are mitigated when new entrants have their own patents,<sup>129</sup> further shoring up the importance of patents to firm entry.

*B. Promoting Back-End Innovation: Patent Expiration and Ongoing Incentives to Innovate*

Patents encourage firms to innovate both by conferring exclusivity and by taking it away. Later in a firm’s life cycle—at the back end—the time-limited nature of patents contributes to churn by providing ongoing incentives to invent. In general, patents last for twenty years from the date of filing.<sup>130</sup> Commentators have long recognized the competitive benefits of patent expiration.<sup>131</sup> Such accounts typically focus on the benefits of patent expiration to parties *other* than the patentee—namely competitors and consumers who get greater access to a previously protected technology. This Article highlights the less appreciated, but important, impact of patent expiration on the patentee itself. Expiration of the patent term provides patentees with a strong incentive to engage in continual innovation. Firms are ongoing concerns, and they invest in personnel, facilities, equipment, and infrastructure in contemplation of continuing operations into an indefinite future. Patent expirations and attendant revenue decreases threaten a firm’s ongoing existence, and they therefore provide a powerful incentive to continue innovating.

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125. Shapiro, *supra* note 21; Peter Lee, *Reconceptualizing the Role of Intellectual Property Rights in Shaping Industry Structure*, 72 VAND. L. REV. 1197 (2019).

126. Iain M. Cockburn & Megan J. MacGarvie, *Entry and Patenting in the Software Industry*, 57 MGMT. SCI. 915, 915 (2011).

127. *Id.* at 920.

128. *Id.* at 931.

129. *Id.* at 915–16.

130. 35 U.S.C. § 154(a)(2).

131. See, e.g., W. Nicholson Price II, *Expired Patents, Trade Secrets, and Stymied Competition*, 92 NOTRE DAME L. REV. 1611, 1612 (2017).

As mentioned, most of the literature on patent expiration focuses on the benefits of patent expiration on a patentee's competitors and the public at large.<sup>132</sup> Much of this literature addresses the pharmaceutical industry. In that industry, patent expirations on brand medicines typically lead to significant market entry as generic companies begin offering medicines at far below their patent-inflated prices. Patent expirations thereby significantly enhance consumer welfare. Within six months of launch, a generic drug is typically available at a 20% discount relative to the patented version of a drug,<sup>133</sup> and in the long run, most generics are available at an 80–85% discount.<sup>134</sup> The Food and Drug Administration (FDA) estimates that generic competition resulted in savings of \$1.68 trillion for U.S. consumers from 2004 to 2014.<sup>135</sup> Clearly, expiration of the patent term and resulting competition can lead to significant welfare gains for competitors and consumers.

While generic entry has enormous importance for decreasing price, increasing access, and enhancing consumer welfare, its direct *innovation* gains are rather limited. By definition, generic competition consists of products that duplicate formerly patented technologies rather than being truly innovative.

That being said, in an indirect fashion patent expiration can induce more innovation-based competition that drives churn. Patent expiration on key technological *inputs* to innovation can reduce cost and raise access to these generative resources, thus facilitating second-order innovation. For instance, if a patented drug is an input into the manufacture of an improved or innovative drug, patent expiration can help that innovation come to market. On a broader scale, the expiration of patents also helps alleviate the innovation-inhibiting effects of patent thickets.<sup>136</sup> Given that new patents are issued on a continual basis, patent expiration serves an important role in clearing out old patents and preventing gridlock.<sup>137</sup>

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132. *Id.*

133. Ernst R. Berndt & Murray L. Aitken, *Brand Loyalty, Generic Entry and Price Competition in Pharmaceuticals in the Quarter Century After the 1984 Waxman-Hatch Legislation*

4, 6 (Nat'l Bureau of Econ. Rsch., Working Paper No. 16431, 2010), <http://www.nber.org/papers/w16431.pdf>.

134. See *Generic Drug Facts*, U.S. FOOD & DRUG ADMIN., <http://www.fda.gov/Drugs/generic-drugs/generic-drug-facts> [<https://perma.cc/QK9P-5ML6>].

135. *Examining Generic Drug User Fee Amendments, Focusing on Accelerating Patient Access to Generic Drugs: Hearing Before the S. Comm. on Health Educ., Lab., and Pensions*, 114th Cong. 6 (2016) (statement of Janet Woodcock, Director, Center for Drug Evaluation and Research, U.S. Food & Drug Administration).

136. See generally Shapiro, *supra* note 21, at 119–22.

137. Additionally, the absence of patent protection on valuable *products* can spur firms to pursue new, innovative, and patentable *processes* to create those products. In this fashion, the absence of product patents on pharmaceutical compounds prior to India's acceptance of the Agreement on Trade-

While patent expiration has important impacts on parties other than the patentee, it also significantly affects the incentives and behavior of the patentee itself. Here again, most of the relevant studies focus on the pharmaceutical industry. Not surprisingly, one response of firms facing patent expiration is to engage in strategic behavior to extend exclusivity with little or no new innovation.<sup>138</sup> Pharmaceutical patentees engage in “lifecycle management” by launching “authorized” generics prior to patents expiring on their brand drugs, practicing “evergreening” by which they patent incremental variations of a base drug, and obtaining FDA approval for new uses of existing drugs for which patents will soon expire.<sup>139</sup> Pharmaceutical companies facing impending patent expiration have also engaged in “reverse payment” settlements with generic companies to delay the latter’s entry into the market.<sup>140</sup> In other cases, firms facing patent expirations engage in mergers and acquisitions to shore up market share and revenues while actually decreasing aggregate expenditures on R&D.<sup>141</sup> In short, impending patent expiration can motivate patentees to extend exclusivity in minimally innovative (and sometimes innovation-dampening) ways.<sup>142</sup>

Importantly, however, patent expiration can also motivate patentees to continue innovating. In this sense, impending expiration provides the constant pressure to innovate at the heart of churn. Technology firms are ongoing concerns that assume debts, lease facilities, and build up reliance interests on the expectation of continued revenue streams sustaining their operations. While the unit of analysis in patent law is usually a single innovation, a dynamic view of business lifecycles reveals that no

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Related Aspects of Intellectual Property Rights (TRIPS) encouraged firms to pursue process innovations to make those compounds. Nagesh Kumar, *Intellectual Property Rights, Technology and Economic Development*, 38 ECON. & POL. WKLY. 209, 218 (2003).

138. Cf. Wu, *Taking Innovation Seriously*, *supra* note 35, at 319 (“Exclusion, if cheap enough, is actually an alternative to innovation, particularly for a monopolist.”).

139. See generally John A. Pearce II, *How Companies Can Preserve Market Dominance After Patents Expire*, 39 LONG RANGE PLAN. 71 (2006); see, e.g., Dmitry Karshedt, *The More Things Change: Improvement Patents, Drug Modifications, and the FDA*, 104 IOWA L. REV. 1129, 1132 (2019) (discussing “product hopping”); Rebecca S. Eisenberg, *The Role of the FDA in Innovation Policy*, 13 MICH. TELECOMM. & TECH. L. REV. 345, 354 (2007) (describing evergreening); Angelo DePalma, *Patent Expiration: Innovate or Die*, REUTERS EVENTS: PHARMA (Feb. 3, 2011) (describing exclusivity extensions by obtaining authorization for pediatric use, improving on an existing drug, and combining two drugs to make an integrated product).

140. See Drug Price Competition and Patent Term Restoration (Hatch-Waxman) Act of 1984, Pub. L. No. 98-417, 98 Stat. 1585 (codified as amended in scattered sections of 21 U.S.C. and 35 U.S.C.) (creating statutory scheme that encourages generic firms to challenge the patents of brand drug companies); see generally Robin Feldman & Evan Frondorf, *Drug Wars: A New Generation of Generic Pharmaceutical Delay*, 53 HARV. J. ON LEGIS. 499 (2016) (describing several generations of reverse payment settlements).

141. Peter Lee, *Innovation Consolidation*, 54 U.C. DAVIS L. REV. 967, 1008–09 (2020).

142. It should be noted that some incremental innovations, such as an extended-release version of a drug, can be quite therapeutically beneficial. See Karshedt, *supra* note 139, at 1141–42.

technology firm can long sustain itself with just a single innovation. Furthermore, given the long time required to develop innovations and the probability that many of them will fail, firms cannot wait for a key patent to expire before initiating the next round of research and development. Rather, expiration of the patent term provides an impetus for established firms to innovate continuously.

A study by the European Union found that because impending patent expiration limits the time during which companies can recoup investments, “originator companies are incentivized to constantly search for new medicines.”<sup>143</sup> Other commentators assert that the “patent cliff” of upcoming expirations “induced the pharmaceutical industry into a new wave of product innovation.”<sup>144</sup> A decade ago, the pharmaceutical industry faced impending patent expirations on forty biologics valued at \$60 billion in annual sales.<sup>145</sup> Merck responded to these upcoming expirations by investing \$1.5 billion in Merck BioVentures, which aimed to discover new and follow-on biologics.<sup>146</sup> Many incumbents with expiring patents switched from a “blockbuster” strategy to a “niche buster” strategy, shifting research and development to specialty drugs with lower substitution potential.<sup>147</sup> Particularly if non-innovative and strategic approaches to prolong exclusivity are curtailed, patent expiration can play an important role in motivating continual innovation by rightsholders, thus contributing to churn.

### III. PATENT LAW FEATURES ACCELERATING CHURN

The previous Part showed that the fundamental design of the patent system—which confers an exclusive, time-limited right over technology—promotes a baseline level of churn. While real-world practice sometimes deviates from design, in its formal structure, the patent system promotes new entry and creates a credible threat of economic harm for rightsholders that stop innovating. In conjunction, these functions create the constant pressure to innovate that drives churn.

This Part goes further to argue that the patent system does more to promote churn. Conventional accounts of patents, including Schumpeter’s discussion of patents in his theory of creative destruction, implicitly regard patents as fixed, “unitary,” exclusive rights that operate the same for all

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143. EUR. COMM’N, PHARMACEUTICAL SECTOR INQUIRY FINAL REPORT 36 (2009), [https://ec.europa.eu/competition/sectors/pharmaceuticals/inquiry/staff\\_working\\_paper\\_part1.pdf](https://ec.europa.eu/competition/sectors/pharmaceuticals/inquiry/staff_working_paper_part1.pdf).

144. Chie Hoon Song & Jeung-Whan Han, *Patent Cliff and Strategic Switch: Exploring Strategic Design Possibilities in the Pharmaceutical Industry*, 5 SPRINGERPLUS 1, 4 (May 23, 2016).

145. DePalma, *supra* note 139.

146. *Id.*

147. Song & Han, *supra* note 144, at 4.

parties over the patent term.<sup>148</sup> This Part, however, delves into the nuances of the patent system to reveal several dynamic features that accelerate both new entry and ongoing innovation by patentees. At the front end, the patent system selectively favors patent acquisition by small entities, which tend to be disproportionately innovative relative to large entities.<sup>149</sup> A patent system that favors small entities helps accelerate both the constitutional objective of promoting technological progress and the goal of promoting industrial churn. At the back end, the patent system possesses dynamic doctrines that curtail exclusive rights if rightsholders utilize patents in overreaching or strategic ways. In so doing, the patent system helps ensure that patentees cannot leverage past achievements into undue exclusivity, thus maintaining ongoing incentives to invent. By shoring up new entry of disproportionately innovative entities and eliminating exclusivity where it is not warranted, the patent system accelerates churn past the previously discussed baseline level.

*A. Accelerating Front-End Innovation: Selectively Favoring Small, Highly Innovative Firms*

As we have seen, small entities tend to be disproportionately innovative, and they play a central role in driving churn.<sup>150</sup> In a variety of ways, patents are particularly important to small entities. As noted, small entities generally lack the alternate mechanisms to appropriate returns from innovation enjoyed by larger entities, thus relying more on patents to serve that function.<sup>151</sup> Furthermore, patents are useful in obtaining external financing, which is particularly important to small entities lacking internal resources for technological development.<sup>152</sup> Empirical research shows that patents are especially important for new entrants trying to break into fields where patent thickets raise entry costs.<sup>153</sup>

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148. See SCHUMPETER, CAPITALISM, *supra* note 1, at 96.

149. See *supra* Part I.C.

150. See *supra* Part I.C.

151. See *supra* note 107 and accompanying text.

152. See *supra* notes 108–111 and accompanying text.

153. Cockburn & MacGarvie, *supra* note 126, at 915–16. Notably, there is some debate over whether patents obtained by small entities are, on average, more valuable than those obtained by large entities. James Bessen acknowledges the common assertion that small-entity patents are more valuable, but his empirical findings suggest that “patents owned by small entities are dramatically less valuable than patents owned by large entities.” James Bessen, *The Value of U.S. Patents by Owner and Patent Characteristics*, 37 RSCH. POL’Y 932, 937 (2008). However, this study included patents initially issued in 1991, which predated the significant increase in patenting by large entities that would, all things being equal, tend to decrease the average value of such patents. *Id.* Furthermore, Bessen acknowledges that these findings merely suggest that small inventors are able to realize less value from their patents, not that the underlying patented inventions are less valuable. *Id.* Finally, Bessen notes that the gap in values

In several ways, the patent system accelerates churn by preferentially promoting patent acquisition by small entities, which in many cases aids their industry entry. In this sense, patent law deviates from its perception as a “unitary” right that applies equally to all parties. Most explicitly, the patent system directly subsidizes patent acquisition by so-called small and micro entities by charging them lower patent fees. Additionally, special consideration for small and under-resourced entities informs general rules of novelty that help such entities obtain patents. Furthermore, provisional applications and constructive reduction to practice also favor patent acquisition by small entities. By preferentially facilitating patent acquisition by small entities, the patent system can in many contexts assist their entry into technological industries, which accelerates churn.

### *I. Small and Micro Entity Designations*

The most explicit way that the patent system promotes patent acquisition by small entities is by charging them reduced fees. The United States Patent and Trademark Office (USPTO) charges numerous fees to patent applicants to cover application, examination, extensions, and requests for continued examination.<sup>154</sup> While the total fees paid by a particular applicant vary depending on its application, the full-price charge for such services can easily run into several thousands of dollars. Participation in post-issuance proceedings can add several thousands more in fees.<sup>155</sup> Additionally, once a patent is granted, patentees must pay periodic maintenance fees that would total over \$10,000 over the full term of a patent.<sup>156</sup> It is important to note that fees paid to the USPTO are often considerably less than the cost of hiring a patent agent or attorney to prosecute a patent. Various estimates place the total cost of patent prosecution in the range of \$10,000 to \$38,000, which suggests that fees for patent agents and attorneys constitute a significant share of expenses.<sup>157</sup> That being said, patent fees charged by the USPTO are substantial, especially for under-resourced entities. Empirical

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may not be so great where efficient licensing markets enable small entities to derive value from their patents. *Id.* at 938. Other evidence reveals that patents owned by individuals and small entities are “far more likely” to be litigated than those originally granted to large firms. John R. Allison, Mark A. Lemley, Kimberly A. Moore & R. Derek Trunkey, *Valuable Patents*, 92 GEO. L.J. 435, 465 (2004). However, it is unclear if this is because technologies originating from small entities are more innovative, small entities have less to lose by entering litigation, or some other reason. *Id.* at 467–70.

154. See *USPTO fee schedule*, USPTO, <https://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule#Patent%20Fees> [https://perma.cc/UP84-3BCP].

155. *Id.*

156. *Id.*; see also 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, 78–80 (2013) (describing numerous fees paid by patent applicants and patentees).

157. Graham et al., *supra* note 106, at 1311.

research shows that cost is a significant reason why startups do not patent.<sup>158</sup> And it is here that the patent system explicitly favors small entities.

As far back as 1983, congressional appropriations for the USPTO allocated funds to reduce patent fees by 50% for independent inventors, nonprofits, and small businesses.<sup>159</sup> In 1999, as part of the American Inventors Protection Act (AIPA), Congress formally codified a 50% fee reduction for small entities.<sup>160</sup> Concern for small entities continued with the 2011 America Invents Act (AIA), the most sweeping patent reform in over fifty years. To understand how this concern for small entities manifested itself, one must first consider the AIA's broader reforms. Among other changes, the AIA altered the novelty requirement of patentability. It transitioned the United States from a first-to-invent jurisdiction, which determined novelty based on an inventor's date of invention, to a first-inventor-to-file jurisdiction, which determines novelty based on the date an inventor files a patent application.<sup>161</sup> This shift was controversial in part because it was seen as disadvantaging small inventors, who lacked the resources to file a patent application (rather than simply relying on indicia of invention) to establish a priority date.<sup>162</sup> Put differently, the shift placed greater pressure on small entities to file (costly) patent applications to maintain novelty. To help alleviate this burden, the AIA created a new category of "micro entities" that received even steeper discounts on patent

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158. *Id.* at 1310–12.

159. Act of Aug. 27, 1982, 182 Pub. L. No. 97-247, 96 Stat. 317; *see* 128 CONG. REC. H3203 (1982).

160. *See* American Inventors Protection Act of 1999, Pub. L. No. 106-113, §§ 4711–12, 113 Stat. 1501A–552, 1501A–572 to 1501A–575 (codified as amended at 35 U.S.C. § 41(h)(1)). Under USPTO regulations, small entities include: 1) for-profit entities of not more than 500 persons, unless they have assigned invention rights to entities other than other small entities, independent inventors and nonprofits, and 2) independent inventors and nonprofit organizations. 13 C.F.R. § 121.802 (2020); 35 U.S.C. § 41(h)(1).

161. *Compare* 35 U.S.C. § 102 (2010), *with* 35 U.S.C. § 102 (2013).

162. *See* Letter from Todd O. McCracken, President, Nat'l Small Bus. Ass'n, to Susy Tsang-Foster, Legal Advisor, Office of Patent Legal Admin. USPTO (Oct. 5, 2012), [http://www.uspto.gov/patents/law/comments/nsba\\_20121005.pdf](http://www.uspto.gov/patents/law/comments/nsba_20121005.pdf) ("By repealing the invention date as the priority date, compared to prior art, the AIA will dramatically increase the pressure on small businesses to establish filing date priority and require them to file more frequently and at every stage of development without the opportunity to perfect their inventions. The costs of these filings (including the hiring of patent attorneys, new patenting costs, etc.) and the considerable amount of time involved with more frequent invention reviews, preparation and related filings will be felt most strongly by the small business community."); *see* David S. Abrams & R. Polk Wagner, *Poisoning the Next Apple? The America Invents Act and Individual Inventors*, 65 STAN. L. REV. 517, 521 (2013) (finding a decrease in patenting by individual inventors when Canada switched from a first-to-invent to a first-to-file system); JOSH LERNER, ANDREW SPEEN & ANN LEAMON, *THE LEAHY-SMITH AMERICA INVENTS ACT: A PRELIMINARY EXAMINATION OF ITS IMPACT ON SMALL BUSINESSES* 6 (2015).

fees than small entities.<sup>163</sup> The AIA maintained the 50% fee reduction for small entities but reduced fees by 75% for micro entities.<sup>164</sup>

Income plays a critical role in qualifying for at least one category of micro entities. One class of micro entities encompasses small entities that have not been the named inventors on more than four previously filed patent applications and that do not have a gross income exceeding three times the median household income in the year prior to filing an application.<sup>165</sup> Among other implications, this definition seeks to assist patent acquisition by relatively small players lacking extensive patent holdings. Additionally, patent applicants employed by higher education institutions or under an obligation to assign patent rights to such institutions, such as university scientists, also qualify as micro entities.<sup>166</sup>

The legislative history of this provision reveals a clear intent to enhance access to the patent system for small and under-resourced entities. A House of Representatives report states that “[a]s part of the ongoing effort to nurture U.S. innovation, Congress has long recognized that certain groups, including independent inventors, small business concerns, and non-profit organizations (collectively referred to as ‘small business entities’) should not bear the same financial burden for filing patent applications as larger corporate interests.”<sup>167</sup> The legislative history further characterizes micro entities as “only true, independent inventors.”<sup>168</sup> While patent fee reductions do not address the considerable expense of retaining a patent attorney or agent, they reflect a deliberate attempt to subsidize patent acquisition by small entities. It should be noted that patent ownership is still heavily skewed toward large entities: in 2020, large entities received 77.5% of all U.S. patents, small entities received 20%, and micro entities received 2.5%.<sup>169</sup> Nevertheless, these fee reductions reflect a desire to subsidize patent acquisition by small entities, which are particularly innovative and play a central role in driving churn.

## 2. *Grace Period Provisions of the Novelty Requirement*

The patent system also favors patent acquisition by small entities in its recently reformed novelty requirement. As noted, the AIA altered the novelty requirement of patent law by transitioning the United States from a

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163. *AIA Changes: Micro Entity New Fees*, USPTO: INVENTORSEYE (Feb. 2013), <https://www.uspto.gov/custom-page/inventors-eye-advice> [<https://perma.cc/MFN5-VVHQ>].

164. 37 C.F.R. § 1.16 (2020).

165. 35 U.S.C. § 123(a)(3).

166. § 123(d)(2).

167. H.R. REP. NO. 112-98, pt. 1, at 50 (2011), *reprinted in* 2011 U.S.C.C.A.N. 67, 80.

168. S. REP. NO. 111-18, at 22 (2009).

169. USPTO, FY 2020 PERFORMANCE AND ACCOUNTABILITY REPORT 206 tbl. 11 (2020).

first-to-invent jurisdiction to a first-inventor-to-file system.<sup>170</sup> However, the AIA stops short of creating a “pure” first-to-file system in which any prior art before the date of filing would destroy novelty. And it is here that the AIA reflects a special solicitude for small entities. Under the traditional first-to-invent system, a party could rely on common indicia of invention—such as laboratory notebooks, records, and test results—to establish an invention date for novelty purposes. Therefore, the pressure for small entities to quickly file expensive patent applications was reduced, since they had alternative avenues to demonstrate they had invented first. However, under a “pure” first-to-file regime, a party would have to go through the expensive process of drafting and filing a patent application in order to establish a priority date. This could disadvantage small entities that had invented first but lacked the thousands of dollars to file a patent application before a large entity that invented later but filed first.<sup>171</sup>

Due in part to this potential burden on small entities, the AIA created a grace period and other exceptions to the novelty requirement. The AIA does not create a “pure” first-to-file system.<sup>172</sup> Under the AIA grace period provisions, an otherwise novelty-defeating disclosure made one year or less before an inventor’s filing will not count as prior art if: 1) the disclosure came directly or indirectly from the inventor<sup>173</sup> or 2) that disclosure was preceded by a prior public disclosure coming directly or indirectly from the inventor.<sup>174</sup>

The upshot of this complicated provision is that an inventor need not file a patent application before a prior art reference in order to establish novelty. If a prior art reference comes directly or indirectly from the patent applicant, she has one year in which to file an application to maintain novelty. If an independent party discloses the invention within the year before a patent applicant files, the applicant can eliminate that prior art reference if she had previously (directly or indirectly) disclosed her technology in public. In essence, the AIA creates a system in which an inventor’s prior disclosure serves as a “placeholder” to maintain novelty for a later filing.

This system offers a decided advantage to small and under-resourced entities. A small entity seeking to patent a new technology need not pay the expense of drafting and filing a patent application to establish a priority

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170. See *supra* note 161–164 and accompanying text.

171. As discussed *supra* Part III.A.i., this burden prompted Congress to expand fee reductions for micro entities.

172. See Robert P. Merges, *Priority and Novelty Under the AIA*, 27 BERKELEY TECH. L.J. 1023, 1027–30 (2012).

173. 35 U.S.C. § 102(b)(1)(A); *cf.* § 102(b)(2)(A) (establishing an analogous safe harbor if the otherwise anticipating disclosure is a U.S. patent application).

174. § 102(b)(1)(B); *cf.* § 102(b)(2)(B) (establishing an analogous safe harbor if the otherwise anticipating disclosure is a U.S. patent application).

date. Merely publishing or otherwise publicly disclosing the invention is enough to establish priority and prevail against another (perhaps larger) party that files a patent application first. Among other implications, a small entity can publicly disclose a technology (relatively cheaply) and then enjoy a year in which to determine whether to prosecute a patent.

The legislative history of the grace period provision reveals a clear intent to assist small entities.<sup>175</sup> Several members of Congress believed that a pure first-to-file regime would hurt small inventors, for whom the cost of filing patent applications to establish priority was quite burdensome.<sup>176</sup> The background section of the 2011 Committee Report noted the importance of the grace period to small inventors and universities, for whom it allowed early disclosure of inventions and time to obtain funding and draft patent applications.<sup>177</sup> A desire to assist small entities thus informed the design of general rules of novelty that apply to all patentees.

The AIA possesses numerous other features that reflect Congress's interest in enhancing access to the patent system by small entities. As part of the AIA, Congress mandated that the Small Business Administration study the impact of the shift to a first-inventor-to-file system on small businesses.<sup>178</sup> Furthermore, the AIA created a Patent Ombudsman Program to provide "support and services relating to patent filings to small business concerns and independent inventors."<sup>179</sup> The AIA also directed the Director of the USPTO to "work with and support intellectual property law associations across the country in the establishment of pro bono programs designed to assist financially under-resourced independent inventors and small businesses."<sup>180</sup> In its grace-period rules and other provisions, the AIA exhibits a marked commitment to facilitating patent acquisition by small entities.

### 3. *Provisional Applications*

Aside from the AIA, certain longstanding features of the patent system also facilitate patent acquisition by small entities. Under U.S. patent law, a

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175. Interestingly, some senators believed that a first-to-file regime favored small entities; in the first-to-invent regime, priority disputes between inventors were resolved through interferences, costly administrative proceedings in which small entities rarely prevailed. *See* 157 CONG. REC. S1032-33 (daily ed. Mar. 1, 2011) (statement of Sen. Coons); *id.* at S1036 (statement of Sen. Klobuchar); *id.* at S1040-41 (statement of Sen. Kyl); 157 CONG. REC. S1176-77 (daily ed. Mar. 3, 2011) (statement of Sen. Leahy).

176. *See, e.g.*, 157 Cong. Rec. H4992 (daily ed. June 23, 2011) (statement of Rep. Schiff); *id.* at H4492-93 (statement of Rep. Lofgren); 157 CONG. REC. E1190 (daily ed. June 23, 2011) (statement of Rep. Hirono).

177. H.R. REP. NO. 112-98, pt. 1, at 41 (2011).

178. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 31, 125 Stat. 284, 291-92 (2011).

179. § 28, 125 Stat. at 339.

180. § 32, 125 Stat. at 340.

party may submit a provisional application to establish a priority date for a nonprovisional application submitted within one year.<sup>181</sup> The provisional application is in some sense a “watered-down” patent application. It discloses an invention by describing it and enabling a technical artisan to use it, but it need not include claims, the technical sentences that distinctly claim what the inventor regards as her invention.<sup>182</sup> In essence, the provisional application functions as a placeholder that preserves a priority date for a later, full-blown, nonprovisional application.<sup>183</sup>

On its face, the availability of provisional applications does not seem to favor small firms, and indeed many large entities also submit provisional applications. In practice, however, provisional applications help small, under-resourced entities enter the patent system. Drafting claims is extremely costly,<sup>184</sup> and small entities can instead submit a less expensive provisional application to establish an earlier priority date. In debates over the AIA’s transition to a first-inventor-to-file system, Senator Jon Kyl lauded the benefits for small inventors of provisional applications, which are inexpensive and require no more documentation than standard logbooks and notes to establish a priority date.<sup>185</sup> Furthermore, filing a provisional application gives small entities a year in which to develop and market their technology, raise funds, and determine if it is worthwhile to file a nonprovisional application, which can cost tens of thousands of dollars.<sup>186</sup> Provisional applications allow small entities to establish an earlier priority date and maintain a valuable foothold in the patent system.

#### 4. *Constructive Reduction to Practice*

Another feature of patent law that benefits small entities is constructive reduction to practice. An inventor can only obtain a patent if an invention is “reduced to practice,” which implies some tangible aspect of invention. The most straightforward way of establishing reduction to practice is to physically construct a prototype of the technology.<sup>187</sup> However, the patent system has long allowed inventors to demonstrate “constructive reduction to practice” by filing a patent application that satisfies the disclosure and

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181. 35 U.S.C. § 111; § 119(e).

182. § 111(b)(2).

183. § 119(e).

184. *See supra* note 157 and accompanying text.

185. 157 CONG. REC. S1040-41 (daily ed. Mar. 1, 2011) (statement of Sen. Kyl).

186. *See supra* notes 154–158 and accompanying text.

187. *Cf. Wetmore v. Quick*, 536 F.2d 937, 941 (C.C.P.A. 1976) (holding that to establish actual reduction to practice in an interference, one must show the creation of an invention in a physical or tangible form that shows every element of a count).

enablement requirements of 35 U.S.C. § 112.<sup>188</sup> In other words, an invention may be constructively reduced to practice if a person of ordinary skill in the art can make and use it based on reading the disclosure in a patent application. Interestingly, for a period of time in the nineteenth century, the patent office required many patent applicants to submit small-scale models of their inventions along with their applications.<sup>189</sup> However, this requirement imposed substantial costs on patent applicants and was of little value to patent examiners, and the patent office began to rely more on written documents.<sup>190</sup> Although not necessarily the intention of the patent office, this development benefited small and under-resourced inventors, who do not need to actually build a physical prototype of their invention in order to successfully apply for a patent.

In sum, the patent system promotes patent acquisition by small entities in numerous ways. Small entities, which are disproportionately innovative, pay lower fees. Furthermore, they can take advantage of the grace period provisions of novelty, provisional applications, and constructive reduction to practice to fulfill the requirements of patentability at relatively low cost. As noted, patents are particularly important for small entities, many of which rely on exclusive rights to appropriate returns from innovation, raise capital, and enter markets.<sup>191</sup> It must be acknowledged that these mechanisms assisting small entities operate against a backdrop in which large, well-heeled firms enjoy enormous advantages in obtaining patents. Furthermore, this Part's arguments are based on effect rather than intent: not all of these mechanisms were explicitly intended to aid small entities, but they all have that effect. Whether intentionally or not, these mechanisms accelerate patent acquisition and industry entry for many small, highly innovative entities, thus driving churn.

### *B. Accelerating Back-End Innovation: Dynamic Doctrines to Curb Overreaching and Strategic Behavior by Patentees*

At the front end, the patent system accelerates churn by preferentially facilitating patent acquisition by small entities. Such entities are disproportionately innovative and play an important role in challenging

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188. See USPTO, MANUAL OF PATENT EXAMINING PROCEDURE, § 2138.05 "Reduction to Practice" (9th ed. 2019). For an illuminating history of the origins of the doctrine of constructive reduction to practice, see Warren H. Wilner, *Origin and Development of the Doctrine of Constructive Reduction to Practice*, 36 J. PAT. OFF. SOC'Y. 618 (1954). See also John F. Duffy, *Reviving the Paper Patent Doctrine*, 98 CORNELL L. REV. 1359, 1368–71 (2013).

189. Craig Allen Nard, *Legal Forms and the Common Law of Patents*, 70 B.U. L. REV. 51, 70 n.83 (2010).

190. Duffy, *supra* note 188, at 1370.

191. See *supra* notes 106–124 and accompanying text.

established incumbents. This subpart argues that, at the back end, the patent system also accelerates churn by preventing established patentees from unduly expanding the effective scope of their exclusive rights. Both the patent misuse doctrine and the equitable framework for injunctive relief prevent patentees from asserting their patents in certain overreaching and strategic ways. While such back-end constraints on patent rights could in theory diminish initial incentives to invent, they are intended to eliminate *overreaching* and still leave meaningful avenues for patentees to profit from their inventions.<sup>192</sup> In so doing, these doctrines promote churn by leaving more space for other parties to operate and by intensifying ongoing incentives to innovate for patentees.

### *I. Patent Misuse*

The patent misuse doctrine promotes churn by preventing patentees from leveraging their patents to obtain unwarranted exclusivity. Patent misuse is an equitable doctrine that renders a patent unenforceable if a patentee asserts it in certain anticompetitive ways.<sup>193</sup> The doctrine finds its roots in *Morton Salt v. G. S. Suppiger*,<sup>194</sup> a case in which the patentee (Suppiger) produced patented machines that deposited salt tablets in cans.<sup>195</sup> Suppiger leased these machines to canners on condition that they purchase Suppiger's unpatented salt tablets.<sup>196</sup> The Supreme Court held that such a requirement—which would now be considered a “tying” arrangement—constituted patent misuse because the patentee was restraining competition in the market for the unpatented article.<sup>197</sup> The Court stated that “[e]quity may rightly withhold its assistance from such a use of the patent by declining to entertain a suit for infringement.”<sup>198</sup> Subsequent cases have

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192. See *infra* notes 202 and 221 and accompanying text.

193. Daryl Lim, *Revisiting the Patent Misuse Doctrine: Its Potential Contribution to Maintaining Incentives for Innovation*, in *THE INNOVATION SOCIETY AND INTELLECTUAL PROPERTY* 188, 188 (Joseph Drexel ed., 2019).

194. 314 U.S. 488 (1942), *overruled in part by* *Ill. Tool Works, Inc. v. Indep. Ink, Inc.*, 547 U.S. 28, 42–43 (2006).

195. 547 U.S. at 42 (“After considering the congressional judgment reflected in the 1988 amendment, we conclude that tying arrangements involving patented products should be evaluated under the standards applied in cases like *Fortner II* and *Jefferson Parish* rather than under the per se rule applied in *Morton Salt* and *Loew’s*.”); see also *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 518–19 (1917) (applying the first sale doctrine in a manner that laid the foundations for the patent misuse doctrine); see Cotter, *supra* note 20, at 498–99 (discussing the origins of patent and copyright misuse); Christina Bohannon, *IP Misuse as Foreclosure*, 96 *IOWA L. REV.* 475, 479–86 (2011) (same).

196. *Morton Salt*, 314 U.S. at 490.

197. *Id.* at 494; see also Lim, *supra* note 193, at 188 (“The classic example of misuse is tying, where the patentee forces its licensees to buy patented and nonpatented goods together.”).

198. *Morton Salt*, 314 U.S. at 493.

applied the misuse doctrine in similar tying cases and other instances where the patentee sought to illegitimately expand the scope of a patent.<sup>199</sup>

While several rationales inform the patent misuse doctrine, chief among them is the aim of preventing patentees from “leveraging” their patents to obtain more exclusivity than warranted. In applying the doctrine, the Supreme Court has held that a patentee may not use a patent “to acquire a monopoly not embraced in the patent.”<sup>200</sup> Similarly, the Court of Appeals for the Federal Circuit, which hears all appeals in patent disputes, has stated that “[w]hat patent misuse is about, in short is ‘patent leverage,’ i.e., the use of the patent power to impose overbroad conditions on the use of the patent in suit that are ‘not within the reach of the monopoly granted by the Government.’”<sup>201</sup> In concept, the sweep of the patent misuse doctrine is quite broad. A finding of misuse renders a patent unenforceable until the patentee “purges” that misuse.<sup>202</sup> Additionally, an alleged infringer can assert the defense of misuse against a patentee even if the misuse is directed toward other parties or markets.<sup>203</sup>

Over time, the Federal Circuit and Congress have narrowed the patent misuse doctrine so that it is largely coextensive with antitrust scrutiny.<sup>204</sup> In cases such as *Windsurfing International, Inc. v. AMF, Inc.*, the Federal Circuit held that misuse largely parallels antitrust analysis by prohibiting unlawful restraints on competition in an appropriately defined market.<sup>205</sup>

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199. See, e.g., *Nat'l Lockwasher Co. v. George K. Garrett Co.*, 137 F.2d 255, 256 (3d Cir. 1943) (finding misuse where the patentee used the patent to suppress possible competing goods not covered by the patent); *Berlenbach v. Anderson Thompson Ski Co.*, 329 F.2d 782, 784–85 (9th Cir. 1964) (finding misuse where a patentee prohibited a licensee from selling articles competing with the patented articles); *Brulotte v. Thys Co.*, 379 U.S. 29, 32 (1964) (finding misuse where a patentee conditioned a license on paying royalties after expiration of the patent).

200. *Transparent-Wrap Mach. Corp. v. Stokes & Smith Co.*, 329 U.S. 637, 643 (1947).

201. *Princo Corp. v. Int'l Trade Comm'n*, 616 F.3d 1318, 1331 (Fed. Cir. 2010) (quoting *Zenith Radio Corp. v. Hazeltine Rsch., Inc.*, 395 U.S. 100, 136–38 (1969)); see also *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700 (Fed. Cir. 1992) (holding that the patent misuse doctrine aims to “prevent a patentee from using the patent to obtain market benefit beyond that which inheres in the statutory patent right”); *Windsurfing Int'l, Inc. v. AMF, Inc.*, 782 F.2d 995, 1001 (Fed. Cir. 1986) (describing patent misuse as “impermissibly broaden[ing] the ‘physical or temporal scope’ of the patent grant with anticompetitive effect”).

202. See *Va. Panel Corp. v. MAC Panel Co.*, 133 F.3d 860, 869 (Fed. Cir. 1997); *Morton Salt*, 314 U.S. at 493 (holding that Suppiger’s patent was not enforceable until the effects of its misuse had been “dissipated”).

203. *Motion Picture Patents Co.*, 243 U.S. at 492–94; see *Cotter*, *supra* note 20, at 499.

204. Bohannon, *supra* note 195, at 477; Robert J. Hoerner, *The Decline (And Fall?) of the Patent Misuse Doctrine in the Federal Circuit*, 69 ANTITRUST L.J. 669, 672–82 (2002); Deepa Varadarajan, *The Uses of IP Misuse*, 68 EMORY L.J. 739, 742 (2019) (“In recent decades, patent misuse doctrine has moved closer to antitrust principles, placing competition concerns at the forefront and embracing a ‘rule of reason’ analysis.”); *id.* at 753 (“Patent misuse cases fixate primarily on competitive harms, using antitrust law’s ‘rule of reason’ standard as the lodestar for analysis.”). The roots of this transition lay in even earlier decisions from other courts. See, e.g., *USM Corp. v. SPS Techs., Inc.*, 694 F.2d 505, 511 (7th Cir. 1982) (constraining the patent misuse doctrine by the requirements of antitrust law).

205. 782 F.2d 995, 1001–02 (Fed. Cir. 1986).

Consistent with the Federal Circuit's approach, Congress has also aligned patent misuse with antitrust analysis in the Patent Misuse Reform Act of 1988.<sup>206</sup> Among other provisions, the Act clarified that tying a patent license or patented product to another license or product only constitutes patent misuse if the patentee has market power in the market for the patented item.<sup>207</sup> By insisting on market power before a finding of misuse, the Act adopted a similar approach as antitrust law.<sup>208</sup> The Federal Circuit has interpreted the legislation as narrowing the scope of patent misuse;<sup>209</sup> it has largely limited the doctrine to conduct having an anticompetitive effect as determined by antitrust principles.<sup>210</sup> Empirical evidence reveals that the Federal Circuit's "antitrust-lite" approach appears in 81% of patent misuse cases since 1993.<sup>211</sup>

Recently, the Supreme Court has departed from the Federal Circuit's antitrust-centric approach to the patent misuse doctrine, suggesting a wider scope to the doctrine. In *Kimble v. Marvel Entertainment*, the Supreme Court held that post-term royalty provisions in a patent license are "unlawful per se."<sup>212</sup> In declining to overrule its prior decision in *Brulotte v. Thys Co.*,<sup>213</sup> the Court adopted an approach that deviates from antitrust principles, which would apply a rule of reason analysis insisting on greater proof of market power and anticompetitive effects before finding liability.<sup>214</sup> Although misuse remains a narrow doctrine, the Court's decision suggests greater flexibility to apply patent misuse to curtail patentee behavior that would not qualify as anticompetitive under antitrust analysis.

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206. See 35 U.S.C. § 271(d); Varadarajan, *supra* note 204, at 756 ("Congress also implicitly endorsed this antitrust-influenced model for patent misuse when passing the Patent Misuse Reform Act of 1988.")

207. 35 U.S.C. § 271(d)(5).

208. Bohannon, *supra* note 195, at 501–02.

209. *Princo Corp. v. Int'l Trade Comm'n* 616 F.3d 1318, 1329–30 (Fed. Cir. 2010) ("The 1988 amendment in particular was designed to confine patent misuse, with respect to certain licensing practices, to conduct having anticompetitive effects."); see Camille Barr, Note, *License to Collude: Patent Pools, the Patent Misuse Doctrine, and Princo*, 45 U.C. DAVIS L. REV. 629, 645 (2011) (noting that *Princo* "substantially narrowed the patent misuse defense").

210. *Id.* at 1334; Varadarajan, *supra* note 204, at 755 (arguing that the Federal Circuit "has focused misuse analysis on demonstrable anticompetitive effects, relying primarily on antitrust law's 'rule of reason' to assess challenged practices"); *but see Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1339 (Fed. Cir. 2006) (stating that patent misuse is a "broader wrong" than an antitrust violation); *C.R. Bard, Inc. v. M3 Sys., Inc.*, 157 F.3d 1340, 1372 (Fed. Cir. 1998); *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700, 704 (Fed. Cir. 1992).

211. Daryl Lim, *Patent Misuse and Antitrust: Rebirth or False Dawn?*, 20 MICH. TELECOMM. & TECH. L. REV. 299, 326 (2014).

212. *Kimble v. Marvel Ent., LLC*, 576 U.S. 446, 464 (2015).

213. 379 U.S. 29, 32 (1964).

214. Varadarajan, *supra* note 204, at 757.

Although its contours are shifting, the patent misuse doctrine plays an important role in accelerating churn. As noted, the twin processes driving churn are robust entry of new competitors and ongoing competitive challenges against established incumbents. To the extent that incumbents can misuse patents to stifle competition and obtain more economic reward than their contributions merit,<sup>215</sup> they can undermine churn. To be sure, misuse is a limited doctrine, particularly under the Federal Circuit's jurisprudence. Nonetheless, it performs an important function and illustrates that patent law both confers exclusive rights and guards against overreaching by patentees. In so doing, the patent misuse doctrine helps maintain competitive pressure on patentees and provides them with an ongoing incentive to keep innovating or risk economic harm.

## 2. *The Equitable Standard for Injunctive Relief*

Another back-end mechanism for disciplining overreaching by patentees—and thereby promoting churn—is the equitable standard for granting injunctive relief. Historically, the Federal Circuit applied a rule of virtually automatically granting injunctions to patentees who won their infringement suits.<sup>216</sup> This rule conferred significant power to patentees, since they could almost certainly rely on getting an injunction to stop infringing activity. This landscape changed with the Supreme Court's 2006 decision in *eBay v. MercExchange*.<sup>217</sup> In *eBay*, the Court repudiated the Federal Circuit's approach and adopted a four-factor equitable test to determine the grant of an injunction after a finding of patent infringement.<sup>218</sup> Within this equitable framework, a plaintiff must establish:

- (1) that it has suffered an irreparable injury;
- (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury;
- (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and
- (4) that the public interest would not be disserved by a permanent injunction.<sup>219</sup>

Compared to the Federal Circuit's longstanding approach, *eBay* creates greater flexibility to deny injunctions to prevailing patentees in infringement suits. Among other implications, denying an injunction prevents patentees from leveraging the right to exclude to obtain greater

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215. Bohannon, *supra* note 195, at 476 (characterizing misuse as “the one doctrine explicitly concerned with limiting IP overreaching”); Varadarajan, *supra* note 204, at 742.

216. *MercExchange, L.L.C. v. eBay, Inc.*, 401 F.3d 1323, 1339 (Fed. Cir. 2005).

217. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006).

218. *Id.* at 391

219. *Id.*

economic reward than warranted for their technological contributions.<sup>220</sup> It is important to note that even if a prevailing patentee does not receive an injunction, it may still receive damages, which can include ongoing royalties based on the defendant's continued infringement.<sup>221</sup>

Denying an injunction has important implications for enhancing innovation. Such denials can increase static efficiency, as they enhance access to an already-created technology. More relevant to churn, denying an injunction can also enhance dynamic efficiency and promote cumulative innovation. Denying an injunction allows users greater access to a patented technology, either directly because unauthorized use is not enjoined or indirectly through providing users with greater leverage in licensing negotiations with patentees.<sup>222</sup> Furthermore, denying an injunction can increase the patentee's own ongoing incentives to innovate both by eliminating windfalls arising from undue leveraging of patents and increasing competitive pressures on such patentees.

While this Article has characterized the equitable framework for injunctive relief as a back-end factor because it can curb overreaching by established patentees, it also has important implications for front-end entry by new entities. On the one hand, a legal framework in which courts are less likely to grant injunctions lowers risks for new entrants that might infringe other parties' patents. On the other hand, such a landscape decreases the value of any patents wielded by new entrants themselves. As we have seen, patents are important for new entrants,<sup>223</sup> and the ability to get an injunction can help small entities secure financing and establish a foothold in an industry.<sup>224</sup> As such, the lower probability of obtaining an injunction following *eBay* can hurt potential new entrants.<sup>225</sup>

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220. *Id.* at 395 (Kennedy, J., concurring).

221. *See, e.g., Paice LLC v. Toyota Motor Corp.*, 504 F.3d 1293, 1314 (Fed. Cir. 2007) (“Under some circumstances, awarding an ongoing royalty for patent infringement in lieu of an injunction may be appropriate.”).

222. It is important to note that even if a prevailing patentee does not get an injunction, the prospect of high damages awards can serve many of the same functions, such as providing substantial leverage to patentees in negotiations and significantly discouraging infringement. Notably, alongside the decreased probability of granting injunctions, there has also been a movement to decrease and rationalize damages awards. *See, e.g., Lucent Tech., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1324 (Fed. Cir. 2009) (rejecting the jury's award of a substantial royalty as “based mainly on speculation or guesswork”).

223. *See supra* Part II.A.

224. *See* Steve Brachman, *Senate Hearing on STRONGER Patents Act Highlights Sharp Split on Injunctive Relief, IPR Fixes*, IPWATCHDOG (Sept. 12, 2019), <https://www.ipwatchdog.com/2019/09/12/senate-hearing-stronger-patents-act-highlights-sharp-split-injunctive-relief-ipr-fixes/id=113241/> [<https://perma.cc/8G3J-3XDM>].

225. To ameliorate this dynamic, I argue below for applying the *eBay* framework in a manner in which, all things being equal, small patentees would be more likely to get injunctions than large patentees. *See infra* notes 320–322 and accompanying text.

More broadly, for all patentees, the *eBay* framework plays an important role in preventing overreaching by patentees by directing courts to consider the equities of granting injunctions rather than simply automatically granting such relief. This subpart explores two types of patented technologies for which denying injunctions against infringers promises significant innovation gains: components contributing to broader products and technological standards.

First, denials of injunctions can enhance innovation where a patented technology is but one component of a broader product. Many products, particularly in the information technology sector, incorporate hundreds if not thousands of patented components.<sup>226</sup> If the manufacturer of, say, a smartphone incorporates one infringing component into its product, then granting an injunction to the patentee provides significant leverage for that patentee to enjoin distribution of the entire smartphone.<sup>227</sup> In his *eBay* concurrence, Justice Kennedy cautioned that granting an injunction in such situations provides the patentee with undue leverage to hold up products or processes of much greater value than the patented component itself.<sup>228</sup> While in theory an infringer could redesign its product to eliminate a patented component, in reality that is often infeasible because of irreversible investments in a particular design.<sup>229</sup> District courts seem to be applying Justice Kennedy's guidance in applying *eBay*. Empirical research on the first seven and a half years following the Supreme Court's decision finds a statistically significant incidence of denying injunctions where "a patent claims a 'small component' of an infringing product."<sup>230</sup> The Federal Circuit has also embraced this principle, holding that to establish irreparable harm, a patentee must demonstrate a "causal nexus" between the defendant's infringement and the patentee's harm.<sup>231</sup> Denying an injunction allows greater innovation by parties utilizing the patented component while still enabling the patentee to obtain reasonable compensation. By removing

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226. See Mark A. Lemley, *Ten Things to Do About Patent Holdup of Standards (And One Not To)*, 48 B.C. L. REV. 149, 150 (2007) ("[I]n the IT industries, there are usually multiple patents—sometimes hundreds or even thousands—on each new product.") [hereinafter Lemley, *Ten Things*].

227. See *id.* at 153.

228. *eBay*, 547 U.S. at 396–97 (Kennedy, J., concurring) ("When the patented invention is but a small component of the product the companies seek to produce and the threat of an injunction is employed simply for undue leverage in negotiations, legal damages may well be sufficient to compensate for the infringement and an injunction may not serve the public interest.")

229. Lemley, *Ten Things*, *supra* note 226, at 153–54.

230. Christopher B. Seaman, *Permanent Injunctions in Patent Litigation after eBay: An Empirical Study*, 101 IOWA L. REV. 1949, 1998 (2016).

231. *Apple Inc. v. Samsung Elecs. Co., Ltd.*, 809 F.3d 633, 639 (Fed. Cir. 2015) (citing *Apple Inc. v. Samsung Elecs. Co.*, 695 F.3d 1370, 1374 (Fed. Cir. 2012)). This framework for irreparable harm weighs against granting an injunction where "the patentee seeks to leverage its patent for competitive gain beyond that which the inventive contribution and value of the patent warrant." *Apple*, 695 F.3d at 1375.

the windfall of holdup value, denying an injunction also rationalizes economic rewards for patentees and spurs them to continue innovating to sustain their existence.

Second, denials of injunctions can enhance innovation where a defendant infringes a patent on a standard. Technological standards facilitate interoperability among different components and systems and are highly valuable. Notable examples include the JPEG standard for compressing photographs<sup>232</sup> and standards governing the design of memory chips.<sup>233</sup> Such technological standards give rise to network effects in which the value of the standard increases as more people use it.<sup>234</sup> While standard-setting processes enable valuable interoperability and can facilitate firm entry, abuses of such processes can hamper innovation.<sup>235</sup> The ability of standards to hamper innovation is particularly acute when those standards—or key components of them—are patented.<sup>236</sup> Patents on dominant standards can depress innovation by parties needing access to those standards as well as by the patentee itself. Constrained access to a patented standard or exorbitant licensing demands (backed by the threat of injunction) prevent parties from developing new products that interoperate with existing technologies. Additionally, because owners of patented standards can extract a holdup windfall from asserting exclusive rights,<sup>237</sup> they may be overcompensated for their technological contribution and have less incentive to keep innovating.

Denying injunctions to owners of patented standards can ameliorate these concerns. To be sure, private ordering can also address holdup from patented standards, such as commitments on the part of standard-setting

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232. See Michael Kannellos, *Forgent Settles JPEG Patent Cases*, CNET NEWS.COM (Nov. 1, 2006 7:53 PM) [http://www.news.com/Forgent-settles-JPEG-patent-cases/2100-1014\\_3-6131574.html?tag=item](http://www.news.com/Forgent-settles-JPEG-patent-cases/2100-1014_3-6131574.html?tag=item) [<https://perma.cc/NTX9-GMZ6>].

233. See *In re Rambus Inc.*, No. 9302, Opinion of the Commission (F.T.C. Aug. 2, 2006); Pamela A. MacLean, *'Rambus' Ruling is a Standards Landmark*, NAT'L L.J. (Oct. 23, 2006); Mark A. Lemley & Philip J. Weiser, *Should Property Rules or Liability Rules Govern Information?*, 85 TEX. L. REV. 783, 837–38 (2007).

234. See COUNCIL OF ECONOMIC ADVISERS, BENEFITS OF COMPETITION AND INDICATORS OF MARKET POWER 3 (2016); Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. ECON. PERSPS. 93, 94 (1994). Network effects are also referred to as demand-side economies of scale. Hal R. Varian, *High-Technology Industries and Market Structure*, FED. RES. BANK KAN. CITY, at 81 (2001); see Michael E. Porter, *The Five Competitive Forces That Shape Strategy*, HARV. BUS. REV., Jan. 2008, at 27.

235. Wu, *Taking Innovation Seriously*, *supra* note 35, at 321–23; cf. Robert Pitofsky, *Challenges of the New Economy: Issues at the Intersection of Antitrust and Intellectual Property*, 68 ANTITRUST L.J. 913, 923 (2001) (noting that dominance can become a formidable barrier to entry).

236. *Apple, Inc. v. Motorola, Inc.*, 869 F. Supp. 2d 901, 913 (N.D. Ill. 2012) (citing *Broadcom Corp. v. Qualcomm Inc.*, 501 F.3d 297, 313–14 (3d Cir. 2007) (“But once a patent becomes essential to a standard, the patentee’s bargaining power surges because a prospective licensee has no alternative to licensing the patent; he is at the patentee’s mercy.”)).

237. Cotter, *supra* note 20, at 530.

organizations and individual patentees to license standards on fair, reasonable, and non-discriminatory (FRAND) terms.<sup>238</sup> However, enforcing these commitments can be difficult, and patent law can act as well. *eBay* opens the door for courts to deny injunctions when a party infringes a patent on a standard, thus lessening the holdup leverage such patents would normally confer.<sup>239</sup> Denying injunctions allows parties greater access to patented standards, which facilitates innovation in components and systems that interoperate with prevailing technological platforms. Patentees can still receive compensation for their inventions, but lessening holdup leverage and attendant windfalls also intensifies ongoing incentives to innovate in the next round of innovation. While one option is for such patentees to simply accept some erosion of their market dominance, another option is for them to continue innovating, perhaps by producing better standards. In both ways, the denial of injunction relief can promote churn.

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In sum, patents are more dynamic than they appear at first glance. Various aspects of the patent system accelerate both the front-end and back-end processes that drive churn. At the front end, the patent system facilitates patent acquisition by small entities by charging them lower patent fees and adopting several features, such as the grace period provisions of the novelty requirement, provisional applications, and constructive reduction to practice, that enhance their ability to obtain patents. Small entities tend to be disproportionately innovative, and their entry in technological markets helps maximize competitive pressures against incumbents. At the back end, the patent system possesses doctrines that discipline overreaching and strategic behavior on the part of established patentees. The patent misuse doctrine renders patents unenforceable when patentees assert them in anticompetitive ways, thereby encouraging innovation by all entities. And courts can deny injunctions to patentees when holdup leverage inflates the value of exclusive rights, further promoting innovation. By favoring the

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238. See Lemley, *Ten Things*, *supra* note 226, at 155–61; *Apple*, 869 F. Supp. 2d at 913 (citing *Broadcom Corp. v. Qualcomm Inc.*, 501 F.3d 297, 313–14 (3d Cir. 2007) (“The purpose of the FRAND requirements . . . is to confine the patentee’s royalty demand to the value conferred by the patent itself as distinct from the additional value—the hold-up value—conferred by the patent’s being designated as standard-essential.”); see also Jorge Contreras, *A Market Reliance Theory for FRAND Commitments and Other Patent Pledges*, 2015 UTAH L. REV. 479, 485 (arguing for rendering patent pledges enforceable under a “market reliance” theory that blends aspects of promissory estoppel and the “fraud-on-the-market” theory from federal securities laws).

239. Lemley, *Ten Things*, *supra* note 226, at 167; Peter Lee, *The Evolution of Intellectual Infrastructure*, 83 WASH. L. REV. 39, 106–09 (2008). See also Robert P. Merges & Jeffrey M. Kuhn, *An Estoppel Doctrine for Patented Standards*, 97 CALIF. L. REV. 1 (2009) (advocating an estoppel doctrine to prevent strategic assertion of patents on standards); Marshall Leaffer, *Patent Misuse and Innovation*, 10 J. HIGH TECH. L. 142, 167 (2010) (arguing that while Merges and Kuhn distinguish their proposal from patent misuse, it operates substantively like a patent misuse doctrine).

entry of highly innovative small entities and withdrawing strict exclusivity when patentees unduly leverage their patents, the patent system accelerates churn.

#### IV. IMPLICATIONS OF CHURN FOR PATENT LAW

This Article reveals the underappreciated contribution of patents to evolutionary economic change. The availability of an exclusive, time-limited right to technology promotes a baseline level of churn. However, patents accelerate churn through subsidizing patent acquisition by small entities and by disciplining overreaching and strategic behavior by existing patentees. The role of patents in promoting churn, moreover, sheds new light on both patents themselves and their relationship to competition.

##### *A. A New Dynamism in Patent Law*

Patents are conventionally understood as providing what could be called “unitary” exclusive rights. Within this unitary view, patent law does not discriminate based on the identity of a patent applicant or the nature of the technology to be patented.<sup>240</sup> At least in a formal sense, exclusive rights are equally available to all who satisfy the requirements of patentability.<sup>241</sup> This unitary view accords with a conception of patents as property rights,<sup>242</sup> in which they confer a consistent and strict right to exclude that lasts for twenty years from the date of filing.<sup>243</sup>

Scholars have already challenged the unitary view of patent law by revealing the subtle ways in which patent law operates differently in different technological fields. In particular, Professors Dan Burk and Mark Lemley note that courts manipulate various patent-law “policy levers” and thereby tailor patent doctrines to the different innovation dynamics in, say, information technology versus biopharmaceuticals.<sup>244</sup>

Patent law’s contributions to churn reveal other ways in which patent rights deviate from the unitary model. First, the patent system formally

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240. Lemley, *Ten Things*, *supra* note 226, at 150. International treaty obligations shore up this unitary principle. See TRIPS art. 27.1, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 (“[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.”).

241. Of course, it takes only a modest dose of legal realism to realize that intellectual property rights are *not* equally available to all parties. As in many areas of life, well-resourced entities have distinct advantages. Patent filing fees and prosecution can run into the tens of thousands of dollars.

242. See, e.g., F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 703 (2001).

243. 35 U.S.C. § 154(a)(2).

244. Dan. L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1641–58 (2003).

discriminates based on the identity of a party seeking patent rights. In the “policy levers” model, courts subtly manipulate patent doctrine to fit various industries, but the overarching doctrine remains formally the same. However, this Article reveals that patent law explicitly discriminates in favor of some parties rather than others, as evidenced in the lower fees that small and micro entities pay to obtain and maintain patents. Furthermore, the interests of one class of patentees—small entities—fundamentally informed general rules of patentability, as revealed in the grace period provisions of the AIA. As a descriptive matter, patent law simply does not treat all patentees the same. Such flexibility, moreover, creates opportunities for more explicitly differentiating among patentees to advance innovation policy objectives.<sup>245</sup>

Second, patent law’s contribution to churn reveals that the nature of patents changes based on an individual patentee’s behavior and circumstances. In the unitary model, patents confer a right to exclude that lasts for twenty years from the date of filing. However, patent law possesses dynamic doctrines that eliminate or weaken patent rights when asserted in overreaching or strategic ways. The patent misuse doctrine renders patents unenforceable if parties assert them in certain anticompetitive manners. Courts can deny injunctions based on equitable principles, for instance when the holdup value of an injunction far exceeds a patentee’s actual technological contribution. Rather than conferring unitary rights fixed over the course of their lifetime, patent law features underappreciated flexibility. Fittingly, exclusive rights aimed at fostering technological dynamism also exhibit dynamism themselves.

### *B. Rethinking Patent Law’s Relationship with Competition*

Patents’ contribution to churn also sheds new light on patent law’s relationship with competition. By its very design, patent law inhibits competition by conferring exclusive rights on a novel technology. Indeed, in articulating the theory of creative destruction, Schumpeter lauded the competition-suppressing function of patents, which give patentees breathing room to engage in long-term planning and invest in innovation.<sup>246</sup> By inhibiting competition, patent law appears to raise tensions with antitrust law.<sup>247</sup> While, at a high level, both bodies of law seek to enhance welfare, their perspectives and mechanisms seem to diverge. Patent law focuses on enhancing dynamic efficiency by maintaining incentives to invent, while

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245. See *infra* Part VI.A.

246. SCHUMPETER, CAPITALISM, *supra* note 1, at 96.

247. See, e.g., Carrier, *supra* note 20, at 762–63 (recognizing this conflict and describing ways that courts have sought to resolve patent and antitrust law).

antitrust focuses on static efficiency by reallocating the existing supply of resources.<sup>248</sup> Courts have struggled for years to resolve apparent conflicts between these bodies of law.<sup>249</sup>

Scholars have fruitfully attempted to resolve this perceived tension by arguing that patent law and antitrust share the objective of promoting innovation.<sup>250</sup> Professor Michael Carrier has argued for a rebuttable presumption in favor of patentees when their use of patents draws antitrust scrutiny.<sup>251</sup> However, he argues that antitrust analysis should consider industry dynamics and the centrality of patents to innovation in particular fields. Carrier's proposal is emblematic of a more nuanced approach that seeks to apply the levers of patent and antitrust law differently depending on the varying innovation dynamics of different industries.<sup>252</sup> In similar fashion, Professor Robert Pitofsky has also sought to harmonize intellectual property and antitrust law through the lens of efficiencies. He argues that antitrust authorities should be less inclined to intervene in the accumulation of market power when it serves efficiencies related to innovation.<sup>253</sup>

This Article reveals more direct mechanisms by which patents promote competition and thus work in concert with antitrust law. At the front end, by selectively favoring patent acquisition by small entities (which tend to be disproportionately innovative), the patent system can help ensure a steady stream of competitors against established industry players. In this manner, the patent system affirmatively reduces barriers to entry for small and under-resourced entities. Antitrust law, on the other hand, operates in a reactive manner to penalize parties who unlawfully erect barriers to entry or attempt to engage in mergers and acquisitions with the effect of lessening competition. Antitrust law does not directly subsidize new entry in the way that patent law does.

Second, at the back end, patent law also promotes competition by not only granting exclusive rights but also taking them away. As noted, impending patent expiration creates an incentive for patentees to continue innovating if they seek to maintain market relevance.<sup>254</sup> Furthermore,

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248. *Id.* at 770–71. This is, of course, a high-level schematic. See Mark A. Lemley, *Industry-Specific Antitrust Policy for Innovation*, 2011 COLUM. BUS. L. REV. 637, 638 (2011 Milton Handler Lecture) (questioning the simple association of intellectual property law with dynamic efficiency and antitrust with static welfare).

249. Carrier, *supra* note 20, at 788–800.

250. See, e.g., Pitofsky, *supra* note 235, at 919 (“[T]he history of the last 110 years has treated antitrust and intellectual property as complementary regimes, both designed to encourage innovation within appropriate limits.”).

251. Carrier, *supra* note 20, at 816.

252. See, e.g., Rai, *supra* note 61, at 838 (advocating a narrow scope for upstream biotech patents to prevent a situation where “a single firm has broad power over upstream research with uncertain and potentially numerous applications”).

253. Pitofsky, *supra* note 235, at 917.

254. See *supra* Part II.B.

dynamic doctrines such as patent misuse and the equitable standard of injunctive relief curtail overreaching and strategic behavior by patentees.<sup>255</sup> These doctrines promote competition both by curbing overly expansive exclusive rights and by shoring up incentives for patentees to continue innovating.<sup>256</sup>

Of course, while patent law possesses some surprisingly pro-competitive features, one should not discount the role of patents in inhibiting competition.<sup>257</sup> As noted, broad patent thickets can raise barriers to entry and stifle competition. Empirical research in the software industry has shown that a 10% increase in the number of patents is associated with a 3–8% decline in the number of entrants.<sup>258</sup> Ironically, sometimes it is the prevalence of patents in an industry that renders patents so important to entry. That same empirical research revealed that the negative impact of patents on industry entry is mitigated when entrants have their own patents.<sup>259</sup> Additionally, at the back end, patentees engage in increasingly creative strategies to enhance, expand, and extend patent-based exclusivity and thus hamper competition.<sup>260</sup> The essential point, however, is that patents can promote competition in powerful and underappreciated ways.

## V. NORMATIVE ANALYSIS OF CHURN

Having explored how patents contribute to churn, this Part turns to a normative evaluation of churn and patent law's role in promoting it. It first considers the value of churn as an objective of innovation policy. While churn is subject to critique as wasteful, this Part ultimately argues in favor of the constant incentives for innovation at its core. This Part then evaluates the role of patent law in promoting churn. Here, it distinguishes between patents' front-end and back-end contributions. Regarding front-end measures, it argues in favor of orienting the patent system toward promoting entry by small entities, which tend to be disproportionately innovative. However, patent subsidies would benefit from greater granularity given that patents are not equally helpful to promoting entry in all technological industries. Furthermore, in industries where subsidizing patent fees for

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255. See *supra* Part III.B.

256. See, e.g., Herbert Hovenkamp, *Antitrust and Innovation: Where We Are and Where We Should Be Going*, 77 ANTITRUST L.J. 749, 751 (2011) ("In this area, intellectual property and antitrust pull in the same direction. Both are served by condemning restraints that limit the likelihood or range of innovations unreasonably.").

257. See, e.g., Pitofsky, *supra* note 235, at 916 ("The systems designed to encourage and protect innovation—patents and copyrights—can be, and often are, used to barricade a market against entry by new rivals.").

258. Cockburn & MacGarvie, *supra* note 126, at 915.

259. *Id.* at 915–16.

260. See *supra* notes 138–140 and accompanying text.

small entities is justified, the patent system can do more to reduce other financial barriers to obtaining patents. Regarding back-end measures, it argues in favor of greater sensitivity to churn and robust doctrines to discipline overreaching and strategic behavior by existing patentees.

#### *A. The Normative Value of Churn*

This Article argues that the constant innovation at the heart of churn renders it a worthwhile objective of innovation policy. In so doing, it acknowledges that churn has several deficiencies. First, it is highly wasteful. In an evolutionary process in which many startups enter industries to challenge incumbents, the vast majority of those startups will fail. Silicon Valley is littered with the detritus of thousands of failed startups, all yearning to be the next Amazon, Facebook, or Netflix but dying in obscurity. The mechanics of venture capital financing, in which startups sustain enormous losses over long periods in the hopes of ultimately prevailing in winner-take-all markets, further increases waste.<sup>261</sup>

Furthermore, within industrial churn, if established incumbents do not continue innovating, they face displacement by the new generation of insurgent firms. Failure of leading firms also entails significant waste, an unfortunate consequence that Schumpeter recognized in analogous processes of creative destruction.<sup>262</sup> The failure of startups and dismantling of large firms is not simply an economic abstraction but involves the financial and psychological toll of laying off employees, closing facilities (in some cases, some that had served as the bedrock of local communities), and selling off distressed assets at steep discounts. There is no getting around the fact that churn entails significant waste.

Second and relatedly, a relentless focus on encouraging entry may encourage over-entry of startups with relatively little social benefit. Within churn, too many startups may be forming, and their efforts to distinguish themselves from existing firms may result in redundant or low-value innovation.<sup>263</sup> In analogous fashion, drawing from the theory of demand diversion, Professor Michael Abramowicz argues in the copyright context that “once a number of choices exist in a particular genre, further expansion of choice adds relatively little social value.”<sup>264</sup> Put succinctly, does society

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261. Kenney & Zysman, *supra* note 124, at 44–45.

262. SCHUMPETER, *CAPITALISM*, *supra* note 1, at 90 (“[T]here is certainly no point in trying to conserve obsolescent industries indefinitely; but there is a point in trying to avoid their coming down with a crash and in attempting to turn a rout, which may become a center of cumulative depressive effects, into orderly retreat.”).

263. Holmstrom, *supra* note 76, at 306.

264. Michael Abramowicz, *An Industrial Organization Approach to Copyright Law*, 46 WM. & MARY L. REV. 33, 39 (2004).

really need another cookbook? As applied to the technological sphere, one could question the social value of multitudes of new innovations that arise every year that offer incremental benefits (or none at all) relative to the state of the art.<sup>265</sup>

While the costs of churn are formidable, voluminous evidence suggests that innovation is central to economic growth and increases in standards of living.<sup>266</sup> The constant innovation and considerable waste inherent in churn may simply be the price to be paid for the occasional breakthroughs that drive technological progress. Natural selection operates on vast populations to reveal the occasional mutation that offers an adaptive advantage. Churn embodies a similar numbers game in which many trivial technologies necessarily arise on the way to finding the few inventions that drive evolutionary advancement.<sup>267</sup> And in both the biological and economic contexts, dinosaurs that cannot adapt to their environment face extinction.

Churn also reflects the value of decentralization. Recently, concern over industry concentration and the dominance of megacompanies has prompted antitrust actions against large technology incumbents such as Facebook and Google.<sup>268</sup> Churn provides a mechanism for dissipating such centralized economic power by encouraging large numbers of small entities to challenge, and perhaps even displace, those incumbents. Churn promises not only significant economic and political gains from challenging oligopolists and decentralizing decision making but also substantial innovation gains.<sup>269</sup> Churn helps push economic systems away from hierarchical to polyarchical arrangements.<sup>270</sup> Hierarchies make fewer mistakes but may filter out good ideas, while polyarchies may choose bad projects but also develop more innovative ideas.<sup>271</sup> By encouraging robust market entry by numerous small firms, churn provides fertile ground for identifying and cultivating the most significant innovations.

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265. This critique may be most relevant to information technology startups, and it does not apply equally to all industries. Importantly, evidence suggests that in one technologically important industry—biopharmaceuticals—the number of startups had declined significantly, which imperils future innovation. Michael S. Kinch, Zachary Kraft & Tyler Schwartz, *Sources of Innovation for New Medicines: Questions of Sustainability*, 26 *DRUG DISCOVERY TODAY* 240, 243 (2021).

266. See, e.g., Hovenkamp, *supra* note 256, at 751 (“[T]here seems to be broad consensus that the gains to be had from innovation are larger than the gains from simple production and trading under constant technology.”).

267. Cf. Wu, *Taking Innovation Seriously*, *supra* note 35, at 316 (arguing that antitrust enforcement policy should “encourage small-firm, decentralized innovation that proceeds in an evolutionary rather than planned fashion”).

268. See *supra* note 10.

269. Tim Wu, *Intellectual Property, Innovation, and Decentralized Decisions*, 92 *VA. L. REV.* 123, 126 (2006) [hereinafter Wu, *Decentralized*].

270. Raaj Kumar Sah & Joseph E. Stiglitz, *The Architecture of Economic Systems: Hierarchies and Polyarchies*, 76 *AM. ECON. REV.* 716 (1986).

271. Wu, *Decentralized*, *supra* note 269, at 127.

Relatedly, there is a valuable distributive element to churn. Unlike the large oligopolists of Schumpeter's later writings on creative destruction, small firms take center stage in churn. As Professors Spencer and Kirchoff observe, "by creating the technologies that dethrone the large corporations, [new technology-based firms] keep wealth cycling through the economy, thus interrupting the cycles of wealth concentration that so worried Schumpeter."<sup>272</sup> Of course, these small firms and their financiers often occupy elite economic strata themselves. Nonetheless, a robust startup sector prevents even greater wealth concentration by large incumbents. Perhaps more importantly, small businesses are the primary drivers of employment growth,<sup>273</sup> and an industrial policy that favors such entities promises meaningful distributive benefits.

#### *B. Normative Assessment of Patent Law's Contributions to Churn*

While churn represents a worthwhile policy objective, the role of patent law in promoting that objective is more complicated. This Article draws a distinction between patent law's front-end contributions to new entry and its back-end role in disciplining overreaching patentees. It argues broadly for orienting the patent system toward promoting entry by small entities. However, it also argues for a granular, contextual approach given that patents are not equally helpful to promoting entry in all fields and that in some cases, they may exacerbate innovation-dampening patent thickets. Furthermore, where patents do play an important role in promoting entry by small entities, current subsidies for patent acquisition may be inadequate. Regarding back-end measures, this Article argues for greater attentiveness to churn and robust mechanisms to discipline overreaching and strategic behavior by patentees.

##### *1. Promoting Patenting by Small Entities*

Given the disproportionately innovative nature of small firms, orienting the patent system toward promoting the industry entry of such firms is a worthwhile policy objective. Promoting such entry advances both the patent system's objective of technological progress and the broader goal of fostering industrial churn. In most cases, subsidizing patent acquisition will advance the goal of promoting entry by small technology firms. The justification for doing so is even more acute given that the patent system has undergone a significant shift toward patent ownership by large versus small entities. In 1885, only 12% of patents were issued to corporations; by 1998,

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272. Spencer & Kirchoff, *supra* note 6, at 153–54.

273. *Id.* at 147.

only 12.5% of patents were issued to independent inventors.<sup>274</sup> Currently, small and micro entities obtain 20% and 2.5%, respectively, of all U.S. patents.<sup>275</sup>

While in general increasing patent acquisition by small entities will promote industry entry, it is important to calibrate subsidies based on industry differences.<sup>276</sup> On the one hand, patents are most important to fostering entry in industries where technologies are costly to develop and exclusive rights are necessary to capture a significant share of the value of an invention. Such attributes, for instance, largely characterize the biopharmaceutical industry. On the other hand, patents are less necessary for entering industries featuring low development costs and where alternative appropriation mechanisms, such as first-mover advantage, are significant. Such attributes largely describe the software industry.<sup>277</sup> Additionally, the wide availability of venture capital and significant demand for software also suggest that opportunities for entry in the software industry are relatively robust, even in the absence of patents.<sup>278</sup> Empirical surveys reveal that patents are less useful to small firms in software and Internet fields than in biopharmaceuticals.<sup>279</sup>

Going further, subsidizing patent acquisition by small entities may even harm innovation in some fields. As a general matter, the greatest concerns about the patent system are based not on there being too few patents, but too many of them. A voluminous literature has focused on the emergence of patent thickets and anticommons, particularly in information technology (IT) fields where a single product, such as a smartphone, can read on hundreds or thousands of patents.<sup>280</sup> Such proliferation of patents raise entry costs for new firms.<sup>281</sup> It is important to note that the entry-inhibiting effects of patent thickets are mitigated when a new entrant is armed with its own

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274. Robert P. Merges, *One Hundred Years of Solicitude: Intellectual Property Law, 1900–2000*, 88 CALIF. L. REV. 2187, 2215–17 (2000); ZORINA KHAN, *THE DEMOCRATIZATION OF INVENTION: PATENTS AND COPYRIGHTS IN AMERICAN ECONOMIC DEVELOPMENT, 1790–1920* (2005) (describing the highly democratic nature of the early U.S. patent system, which featured low barriers to entry).

275. See USPTO, *supra* note 169, at 206 tbl.11.

276. See *supra* notes 118–129 and accompanying text; cf. Rai, *supra* note 61, at 837 (noting that patents play significantly different roles in promoting innovation in different industries).

277. See Maureen K. Ohlhausen, *Patent Rights in a Climate of Intellectual Property Rights Skepticism*, 30 HARV. J.L. & TECH. 103, 140 (2016) (“Patents are not always well suited to driving software innovation.”).

278. John R. Allison, Abe Dunn & Ronald J. Mann, *Software Patents, Incumbents, and Entry*, 85 TEX. L. REV. 1579, 1579–80 (2007); see Mann, *supra* note 119, at 970.

279. Graham et al., *supra* note 106, at 1295 (“[O]ur chief finding is that, outside of the software and Internet sector, patenting plays a substantial role in helping early-stage technology companies compete.”).

280. See Shapiro, *supra* note 21; Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. 698 (1998).

281. See Cockburn & MacGarvie, *supra* note 126.

patents.<sup>282</sup> While this suggests that subsidizing patent acquisition by small entities remains good policy, such subsidies ultimately exacerbate the proliferation of patents that raises entry costs for everyone. This puts more pressure on all parties to obtain more patents, creating a prisoner's dilemma in which all parties would be better off with fewer patents but feel compelled to obtain more.<sup>283</sup> In some industries, while subsidizing patent acquisition may be good for the goose, it may be bad for the gander.

Among other effects, subsidizing patent acquisition by small entities may ultimately redound to the benefit of patent aggregators and large incumbents.<sup>284</sup> If small entities obtain patents and have limited avenues for commercializing their technologies, they may simply sell their patents to patent assertion entities. Such patent aggregators amass large patent portfolios, do not manufacture any technologies, and rely on licensing and the threat of litigation to obtain revenues.<sup>285</sup> These so-called patent trolls are widely regarded as taxes on innovation and can frustrate new entry. One nonrandom study found that 79 of 223 surveyed technology startups had received at least one demand from a patent assertion entity.<sup>286</sup> In addition to nonpracticing entities, large incumbents may also ultimately benefit from subsidies intended for small entities. In the software industry, for instance, large players often amass large defensive patent portfolios (in part by buying patents from small entities) to wield against potential litigants suing them for infringement.<sup>287</sup> In a more direct fashion, large incumbents often simply acquire small entities, thus benefiting from any patents those small entities obtained on a subsidized basis. In sum, subsidies for patent acquisition by small entities may have the unintended consequence of benefitting large patent holders.

Although the patent system's subsidies for small entities may be unnecessary and even counterproductive in some industries, in other industries where such subsidies are helpful for promoting entry, they may be insufficient. Empirical research confirms that the cost of prosecuting and enforcing patents represents a significant barrier to accessing the patent

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282. *Id.* at 915–16.

283. See Christopher A. Cotropia & James Gibson, *The Upside of Intellectual Property's Downside*, 57 UCLA L. REV. 921, 972–73 (2010).

284. Hall, *supra* note 109, at 668 (summarizing literature suggesting that non-practicing entities buy patents primarily for licensing revenue and incumbents buy patents for defensive reasons).

285. Colleen V. Chien, *Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents*, 87 N.C. L. REV. 1571 (2009).

286. Colleen V. Chien, *Startups and Patent Trolls*, 17 STAN. TECH. L. REV. 464 (2014).

287. Colleen V. Chien, *Opening the Patent System: Diffusionary Levers in Patent Law*, 89 S. CAL. L. REV. 793, 821 (2016); see *Oracle Corporation - Patent Policy*, ORACLE, <https://groups.csail.mit.edu/mac/projects/lpf/Patents/testimony/statements/oracle.statement.html> [<https://perma.cc/5XGL-GF9C>] (“Unfortunately, as a defensive strategy, Oracle has been forced to protect itself by selectively applying for patents which will present the best opportunities for cross-licensing between Oracle and other companies who may allege patent infringement.”).

system for technology entrepreneurs.<sup>288</sup> As noted, reduced patent fees can save small and micro entities thousands of dollars, which is a significant sum. However, fees for a patent attorney or agent to prosecute a patent range in the tens of thousands of dollars and represent a higher barrier to patent acquisition.<sup>289</sup> Accordingly, in industries for which the patent system should legitimately subsidize patent acquisition by small entities, such as biopharmaceuticals, the current approach of simply reducing patent fees may be inadequate.

## 2. *Promoting Back-End Competition and Innovation*

While patent law's subsidies for patent acquisition by small entities would benefit from greater granularity, the case for promoting back-end innovation by curtailing exclusive rights is more categorically defensible. This Article argues that patent expiration, the patent misuse doctrine, and the denial of injunctions based on equitable principles all play valuable roles in promoting churn. Patent law promotes incentives to invent not only by granting exclusive rights but also by taking them away. It is widely recognized that curtailing exclusive rights enriches the public domain, fosters innovation by competitors, and enhances static efficiency.<sup>290</sup> Less appreciated, expiration and curtailment of exclusive rights can—within certain limits—also shore up ongoing incentives to invent for patentees. More broadly, this Article calls for greater use of the flexibility inherent in equitable doctrines such as misuse and the framework for injunctive relief to modulate exclusive rights to promote churn.

Critics may question why patent law needs dynamic mechanisms to curtail exclusive rights based on patentee behavior given that patents expire in twenty years anyway. However, overreaching and strategic behavior by patentees can produce significant mischief even during the twenty-year patent term. For example, major computer manufacturer Dell participated in a standard-setting process in which it certified that it had no intellectual property rights in the standard.<sup>291</sup> However, Dell later asserted relevant patents and demanded royalties from adopters of the standard.<sup>292</sup> Similarly, memory-chip maker Rambus participated in a standard-setting process without disclosing that it had relevant patents, then asserted those patents

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288. Graham et al., *supra* note 106, at 1262.

289. *Id.* at 1311.

290. As the Supreme Court has stated, the “right to copy” is a background norm to which patents are a statutorily created exception. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 164–68 (1989).

291. Robert Pitofsky, *Antitrust and Intellectual Property: Unresolved Issues at the Heart of the New Economy*, 16 BERKELEY TECH. L.J. 535, 551 (2001).

292. *Id.*

after widespread adoption of the standard.<sup>293</sup> These behaviors raised innovation costs for other parties and depressed incentives to invent for patentees enjoying holdup leverage over others. Particularly in fast-moving industries, the innovation and welfare losses from such behavior warrant intervention before twenty years pass.

Regarding the patent misuse doctrine, a related question is why patent law should promote competition when another body of law—antitrust—ostensibly exists precisely for that purpose. However, IP scholars examining the misuse doctrine have cogently argued that patent law has an independent interest in promoting competition relative to antitrust.<sup>294</sup> From a substantive perspective, patent law can pursue pro-competitive policies that fall outside the ambit of antitrust law.<sup>295</sup> As Professor Christina Bohannon argues, patent misuse can directly address concerns, such as foreclosure of innovation or the public domain, that extend beyond antitrust law’s narrow focus on competition.<sup>296</sup> From a procedural perspective, patent law can address competition deficits that do not meet evidentiary thresholds for antitrust enforcement, for example in situations where precise market definitions are not available.<sup>297</sup> In short, a robust patent misuse doctrine—aimed at advancing patent law’s interest in competition—has an important role to play in driving churn.

## VI. PRESCRIPTIONS FOR ENHANCING PATENT LAW’S CONTRIBUTIONS TO CHURN

While pursuing churn is a worthwhile objective, the previous normative analysis reveals room for improvement in how patent law contributes to processes of evolutionary economic change. This Part advances prescriptions for enhancing patent law’s contributions to churn. While doing so, it acknowledges that promoting churn requires a multiprong approach spanning several elements of industrial policy.<sup>298</sup> Focusing on the role of

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293. See Richard Dagen, Rambus, *Innovation Efficiency, and Section 5 of the FTC Act*, 90 B.U. L. REV. 1479, 1486–87 (2010) (describing Rambus’s participation in the JEDEC standard-setting process).

294. Bohannon, *supra* note 195, at 499 (“IP law’s role as the engine of innovation also gives it an independent interest in enhancing competition.”); Cotter, *supra* note 20, at 490.

295. Bohannon, *supra* note 195, at 497; Cotter, *supra* note 20, at 490 (“IP law, on occasion, may increase social welfare by promoting competition in ways that antitrust law does not address, and may do so based on evidence that would be insufficient in an antitrust context.”).

296. Bohannon, *supra* note 195, at 505.

297. Cotter, *supra* note 20, at 490.

298. For example, antitrust law plays an important role in promoting churn. More aggressive merger enforcement can prevent incumbents from short-circuiting churn by simply acquiring challengers rather than out-innovating them. See Lee, *Innovation Consolidation*, *supra* note 141, at 1048–51 (exploring reforms to antitrust to enhance innovation); Wu, *Taking Innovation Seriously*, *supra*

patents in this process, this Part proposes two sets of prescriptions. First, it advocates calibrating patent fees to promote the entry of small technology firms in a manner that takes into account the varying innovation dynamics of different industries. Second, it proposes greater consideration of churn in back-end doctrines like patent misuse and the equitable framework for injunctive relief, particularly to curb overreaching by patentees.

#### *A. Rationalizing Subsidies for Patent Acquisition*

Promoting industry entry by small entities is critical to churn given the disproportionately innovative nature of such entities. As explained above, however, patents play different roles in promoting (or even inhibiting) entry in various industries. As such, the current framework for subsidizing patent acquisition by small entities would benefit from greater granularity based on the innovation dynamics of specific fields.<sup>299</sup> This Article proposes a framework for modifying patent fees comprised of two elements: raising patent fees for large entities and subsidizing patent acquisition by small entities based on the dynamics of particular industries. This granular approach would maintain the current (discounted) patent fees for small entities in fields like software where subsidizing patent acquisition has both positive and negative effects. However, it would vastly increase subsidies (including, in some cases, covering fees for patent lawyers or agents) in fields like biopharmaceuticals where patent acquisition by small entities more unambiguously promotes entry.

First, this Article proposes increasing general (non-discounted) patent fees (including fees for filing, search, and other functions) by some meaningful but not excessive amount, say 10%. Raising patent fees would serve several purposes. It would deter, at the margin, the acquisition and maintenance of patents of relatively little commercial value.<sup>300</sup> Faced with

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note 35, at 319 (advocating “merger policies that prevent larger firms from acquiring highly innovative small firms in order to either capture or shut down their innovation efforts”); *cf.* Waller & Sag, *supra* note 13, at 2228 (“Taking Schumpeter seriously means designing a legal and regulatory system which maximizes the incentives and opportunities for innovation by challengers to displace incumbents while minimizing the incentives and opportunities for incumbents to engage in exclusionary conduct that degrades the opportunities and incentives for future challengers.”). Antitrust authorities must focus on preserving competition in not only product markets but also innovation markets. *See* Rai, *supra* note 61, at 820. Additionally, robust venture capital markets are necessary to provide adequate financing for new entrants so that they can compete effectively against incumbents. *See* Peter Lee, Enhancing the Innovative Capacity of Venture Capital: Empirical Evidence from Northern California (unpublished manuscript) (on file with author). Legal reforms are needed to prevent incumbents from unduly acquiring VC-backed startups. *See* Mark A. Lemley & Andrew McCreary, *Exit Strategy*, 101 B.U. L. REV. 1, 72–101 (2021) (enumerating several “reentry strategies” for VC-backed startups).

299. *See supra* Part II.A.

300. Gaétan de Rassenfosse & Adam B. Jaffe, *Are Patent Fees Effective at Weeding Out Low-Quality Patents?*, 27 J. ECON. MGMT. STRAT. 134, 135 (2018).

higher fees, potential patent applicants that do not qualify for a subsidy (typically, large entities) would file for and maintain fewer patents. This reduction in patents would help alleviate patent thickets that currently shore up barriers to entry in some industries.

Additionally, raising general patent fees while maintaining or increasing subsidies for small entities (discussed further below) would increase the share of patents issued to small entities, which tend to be disproportionately innovative. This is particularly likely given that large companies are far more probable than small entities to amass large patent portfolios, thus bearing the cost of higher fees over a much greater number of patents.<sup>301</sup> Raising fees for large entities would help counteract the longstanding shift in patent ownership from small to large entities.<sup>302</sup> Finally, increasing non-discounted fees would generate funds to subsidize patent acquisition by small entities.

Some might question whether a 10% increase in patent fees would dissuade multi-billion-dollar companies from applying for patents. At the other end of the spectrum, others might worry that fee increases would deter large firms from obtaining much-needed patents on valuable innovations. Here, the differing patent dynamics of various industries help achieve the objectives of this proposal. The financial toll of increased fees would obviously be greater in industries where firms apply for large numbers of patents—which also tend to be the industries most at risk of developing innovation-dampening patent thickets. Information technology companies overwhelmingly obtain the most patents per firm; in 2020, the companies with the most U.S. patents granted were IBM (9,130), Samsung (6,415), Canon (3,225), Microsoft (2,905), and Intel (2,867).<sup>303</sup> For such firms, a 10% increase in patent fees on thousands of patents could meaningfully decrease patenting activity, which is precisely the objective given the threat of patent thickets in these industries. Empirical analysis of (more substantial) patent fee increases from 1982 revealed that such increases led to a “significant trimming of low-quality patents.”<sup>304</sup> On the other hand, for industries where patent protection is critical for innovation, such as biopharmaceuticals, a 10% increase in patent fees would not prevent large,

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301. John R. Allison, *Patent Value*, in 2 RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW 47, 54 (Ben Depoorter et al. eds., 2019).

302. See *supra* notes 274–275 and accompanying text. As noted, to effectively shift the balance of patent ownership toward small entities, changes to patent fees would need to be coupled with antitrust protections to prevent undue acquisitions of small entities (and their patents) by large entities. See *supra* note 298.

303. Companies with the Most U.S. Patents Granted to Them in 2020, STATISTA (2021), <https://www.statista.com/statistics/274825/companies-with-the-most-assigned-patents/> [<https://perma.cc/F5TE-YC6Z>].

304. De Rassenfosse & Jaffe, *supra* note 300, at 135.

well-heeled incumbents from patenting truly innovative technologies. Such firms would not be deterred from patenting both because they tend to apply for much fewer patents and because patents on core technologies are essential to their business model. Tellingly, no biopharmaceutical firm is among the top fifty recipients of U.S. patents in 2020.<sup>305</sup> As such, a 10% increase in patent fees is not likely to meaningfully deter patenting of key biopharmaceutical assets.

Second, these general patent fee increases would be coupled with a new system for subsidizing patent acquisition by small entities that is sensitive to differing innovation dynamics in different fields. A central administrative unit with economic expertise, such as the USPTO's Office of the Chief Economist, would set different patent subsidies for different technological areas.<sup>306</sup>

For patent applicants in the software and Internet sector, the USPTO should set subsidies so that small and micro entities pay what they currently do under the present system. (Given an across-the-board increase in patent fees, maintaining current charges would represent a greater discount for small entities.) For small entities in these industries,<sup>307</sup> offsetting policy considerations regarding subsidizing patent acquisition suggests simply maintaining the status quo. On the one hand, empirical research suggests that patents are not as critical for entry in these fields as other ones. Furthermore, subsidizing patent acquisition by small software and Internet firms could exacerbate patent thickets, which are especially problematic in these industries. Additionally, a nontrivial proportion of any subsidies would ultimately benefit patent aggregators and large incumbents due to their acquisition of small-entity patents and startups themselves. On the other hand, patents are still helpful for small entities in these fields, particularly later-stage startups seeking to commercialize their technologies. Furthermore, as noted, the entry-inhibiting effects of patent thickets are mitigated for startups wielding their own patents.<sup>308</sup> As a rough calculation, the pros and cons of subsidizing patent acquisition by small entities in software and Internet fields roughly negate each other, suggesting keeping their fees consistent with the status quo.

In industries with different innovation dynamics, however, more substantial patent subsidies would be available for small entities. For fields

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305. Statista, *supra* note 303.

306. In cases of "borderline" technologies that span more than one industry, the Office of the Chief Economist could make case-by-case determinations of an appropriate subsidy or, to maximize administrative convenience, simply average the subsidies from the industries spanned.

307. In general, this proposal would maintain steeper discounts for micro entities, as in the current framework. For linguistic economy, this section refers to "small entities" to refer to both small and micro entities, but it will distinguish between them when appropriate.

308. Cockburn & MacGarvie, *supra* note 126, at 915–16.

in which patents are crucial to entry and in which patent thickets have not materialized, the USPTO should liberally discount patent fees for small entities. Thus, for instance, the USPTO should provide more generous discounts, perhaps even entirely waiving patent fees, for promising biotech startups for which patent protection is critical to industry entry. Importantly, for small firms in such industries, the USPTO should subsidize not only patent fees, but also the cost of hiring a patent attorney or agent to prosecute a patent. Empirical research shows that prosecution costs are a substantial barrier for technology entrepreneurs seeking to access the patent system,<sup>309</sup> and fees for legal counsel represent the majority of prosecution costs. If the patent system is to meaningfully subsidize patent acquisition and entry by small, under-resourced firms, it should go further than discounting the fees it charges and subsidize outside legal fees as well. Again, revenues from increases in general patent fees would provide funds for these extra subsidies.

This system of raising across-the-board patent fees and then selectively subsidizing patent acquisition by small entities offers several benefits in driving churn. First, it helps focus large entities' patent acquisition and maintenance strategies on technologies of higher value, thus winnowing out lower-value technologies for which patents offer little benefit and significant costs. Second and relatedly, it mitigates patent thickets that inhibit entry and innovation in some industries. Third, this proposal allows the USPTO to tailor subsidies to the unique innovation dynamics of particular industries. Fourth, for small entities deserving of subsidy, this proposal provides meaningful access to the patent system by covering not only official USPTO fees, but also the much higher fees of patent counsel. By decreasing patenting by large entities and increasing patenting by small entities where needed, this proposal helps reduce barriers to entry for entities likely to be highly innovative.

### *B. Curtailing Overreaching by Patentees*

In addition to reforming patent fees and subsidies to promote entry by small firms, this Article argues for shoring up back-end mechanisms to promote churn. It advocates more expansive application of the patent misuse doctrine and the equitable framework for injunctive relief to promote ongoing competition and incentives to innovate.

First, this Article proposes more expansive application of the patent misuse doctrine. As described above, Congress and the Federal Circuit have largely narrowed this doctrine to be coextensive with antitrust analysis.<sup>310</sup>

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309. Graham et al., *supra* note 106, at 1262.

310. See *supra* notes 204–211 and accompanying text.

But as numerous scholars have argued, the patent misuse doctrine can and should address innovation-dampening behavior that falls beyond antitrust analysis.<sup>311</sup> Doing so would actually return patent misuse doctrine to its roots in Supreme Court precedents.<sup>312</sup> Among other considerations, patent misuse should be available to sanction behavior without the traditional antitrust requirements of defining antitrust markets or establishing market power, which can be very difficult to demonstrate.<sup>313</sup> As Professor Bohannon argues, while misuse should continue to redress antitrust violations, it should also address a wider set of unlawful conduct including foreclosure of competition, future innovation, and access to the public domain.<sup>314</sup> Notably, the Supreme Court has signaled at least partial support for a more patent-centric and less antitrust-based patent misuse doctrine.<sup>315</sup>

This Article argues for reorienting the patent misuse doctrine toward effectuating patent policy and promoting innovation, not just competition. A broader conception of patent misuse would allow this doctrine to curtail a wider range of patentee overreaching, thus accelerating churn. The doctrine should redress restrictive behavior that is too speculative to create cognizable competitive harms under antitrust analysis but that nonetheless undermines innovation.

Take, for example, *Princo v. ITC*.<sup>316</sup> In this case, Philips and Sony entered into a joint venture to develop a standard for recordable and rewritable CDs. They jointly licensed a package of patents, including a Sony patent that covered an alternate technology, only for use with this standard. When sued for infringement, Princo argued that Philips had engaged in patent misuse by colluding with Sony to not license Sony's patent to develop a competing technology. The Federal Circuit rejected this claim on

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311. Bohannon, *supra* note 195, at 476 (arguing that misuse has become “less faithful to the core IP values of promoting innovation and protecting access to the public domain”); Robin C. Feldman, *The Insufficiency of Antitrust Analysis for Patent Misuse*, 55 HASTINGS L.J. 399, 400 (2003); Leaffer, *supra* note 239, at 148 (arguing that patent misuse should transcend antitrust concerns and focus on patent policy and the effects of patents on innovation); *cf.* Pitofsky, *supra* note 235, at 924 (“An approach that starts from the point that a patent holder does not have to sell or license to anyone, and proceeds from that unchallenged assumption to the rule that it therefore can condition its sales or licenses in any way it sees fit (with tie-in sales as the sole antitrust exception), would be an unwise and unfortunate departure from the traditional approach in this area.”).

312. Barr, *supra* note 209, at 650; Hoerner, *supra* note 204, at 685.

313. Robert P. Merges, *Reflections on Current Legislation Affecting Patent Misuse*, 70 J. PAT. & TRADEMARK OFF. SOC'Y 793, 793 (1988) (discussing the difficulty of applying antitrust market definitions to markets for patented technologies); Feldman, *supra* note 311, at 400–01 (observing that problematic patents do not always confer market power); Leaffer, *supra* note 239, at 153 (noting the difficulty of establishing market power).

314. Bohannon, *supra* note 195, at 478.

315. *Kimble v. Marvel*, 576 U.S. 446, 463 (2015) (“That patent (not antitrust) policy gave rise to the Court's conclusion that post-patent royalty contracts are unenforceable—utterly ‘regardless of a demonstrable effect on competition.’”) (citation omitted).

316. 616 F.3d 1318 (Fed. Cir. 2010).

several grounds, including that Sony's patented technology showed little promise as a competitor to the Philips-Sony standard.<sup>317</sup> Following antitrust analysis, the Federal Circuit noted that Princo had to demonstrate a "reasonable probability" that Sony's technology could mature into a "competitive force" in the relevant market.<sup>318</sup> However, from an innovation perspective, this may be too high of a burden for Princo to demonstrate. As Professor Bohannon cogently argues, patent misuse doctrine, grounded in patent and not antitrust policy, should look beyond competitive harms to redress foreclosure of innovation.<sup>319</sup> Here, a finding of patent misuse would have encouraged the licensing of Sony's patent, which may have hastened the development of a new technology.

Second, this Article argues for incorporating considerations of churn in the *eBay v. MercExchange* framework governing the grant of injunctions to prevailing patentees. To begin, it contends that courts should consider the relative size and market position of the patentee and infringer in the third *eBay* factor dealing with the balance of hardships.<sup>320</sup> This factor "assesses the relative effect of granting or denying an injunction on the parties,"<sup>321</sup> thus rendering the size and strength of the parties relevant considerations. Take, for example, the case of a large patentee suing a small infringer. There, considerations such as the limited nature of the defendant's infringement, the peripheral nature of the infringed patent(s) within the large patentee's portfolio, and the enterprise-threatening impact of an injunction on the small infringer may help tip the balance of hardships in favor of the small infringer. All else being equal, this *eBay* factor would then weigh against granting an injunction to the large patentee. Of course, much depends on particular facts, as even a large patentee could rely significantly on a single crucial patent, in which case the balance of hardships may favor granting an injunction. Notably, for a small patentee suing a large infringer, opposing considerations may tip the balance of hardships to favor the small patentee. This would particularly be the case if the patent protected the small entity's core technology and an injunction would not unduly harm the large infringer.<sup>322</sup> In such cases, the *eBay* calculus would weigh in favor of granting an injunction to the small patentee, which may help it achieve industry entry.

More generally, this Article argues that courts should consider the objective of promoting churn in the fourth factor of the *eBay* test, which

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317. *Id.* at 1337.

318. *Id.* at 1338.

319. Bohannon, *supra* note 195, at 514.

320. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006).

321. *i4i Ltd. P'ship v. Microsoft Corp.*, 598 F.3d 831, 862 (Fed. Cir. 2010).

322. This analysis assumes that the small patentee is an operating entity and not, for instance, a patent assertion entity.

focuses on the public interest.<sup>323</sup> The aim of promoting churn weighs in favor of denying injunctions—to all patentees, both small and large—in two scenarios: where the infringing technology is but one component of a larger integrated product<sup>324</sup> and where the infringing technology is part of a standard.

Denying injunctions in these scenarios would have two important sets of benefits. First, it would enhance access to a patented technology by firms other than the patentee. Allowing a firm to incorporate a patented component in its product or adopt a patented standard while facing only damages rather than an injunction would facilitate cumulative innovation to the extent that a patented component or standard was an input into generating new technologies. Second, denials of injunctions in these circumstances would also enhance ongoing incentives to innovate for patentees. This approach would rationalize economic rewards for patentees by reducing holdup windfall, thus creating greater incentive to innovate on an ongoing basis. These reforms would help effectuate Schumpeter's own teaching that "a monopoly position is in general no cushion to sleep on. As it can be gained, so it can be retained only by alertness and energy."<sup>325</sup>

Promoting churn suggests other patent reforms as well. In general, it counsels against strategic uses of patents to shore up or extend exclusivity without continued innovation. In the biopharmaceutical industry, patentees engage in "evergreening" to extend exclusivity over a drug by patenting relatively minor variations of it.<sup>326</sup> Evergreening has attracted significant criticism for diminishing competition, thus increasing drug prices and decreasing access. To these critiques, the perspective of churn also adds the criticism that evergreening undermines the incentive of established patentees to continue innovating. To address evergreening, more robust standards of patentable subject matter or nonobviousness can ensure that

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323. *eBay*, 547 U.S. at 391.

324. Under current doctrine, courts consider whether an infringing component is only one part of a broader product in the first factor of the *eBay* test, which concerns irreparable harm. *See Apple Inc. v. Samsung Elecs. Co., Ltd.*, 809 F.3d 633, 639 (Fed. Cir. 2015) (recognizing that a patentee must demonstrate a "causal nexus" between the defendant's infringement and the patentee's harm to establish irreparable harm). This factor tends to weigh against granting an injunction when a patentee tries to leverage exclusivity "beyond that which the inventive contribution and value of the patent warrant." *Apple Inc. v. Samsung Elecs. Co., Ltd.*, 695 F.3d 1370, 1375 (Fed. Cir. 2012). This Article argues for continuing to consider whether an infringing component is part of a larger product in the first factor, but it also argues that such considerations are relevant to the fourth factor, which deals with the public interest. There, the emphasis is not so much on the degree of harm to the patentee, but the macroscopic innovation benefits from allowing infringers to continue to utilize a patented component.

325. SCHUMPETER, *CAPITALISM*, *supra* note 1, at 102.

326. Eisenberg, *supra* note 139, at 354.

trivial modifications of existing inventions are not patentable.<sup>327</sup> In addition to evergreening, patentees in the biopharmaceutical sector have sought to extend their exclusivity by exploiting the Hatch-Waxman regime, which in theory provides an incentive for generic companies to challenge the patents of brand companies.<sup>328</sup> Brand companies have exploited the law to pay generic manufacturers to settle patent challenges, thereby avoiding patent invalidations and delaying generic entry.<sup>329</sup> The Supreme Court has recently clarified that such behavior is not per se legal and is subject to antitrust law's rule of reason.<sup>330</sup> Greater antitrust scrutiny of such deals would ensure that patentees cannot simply rest on their past achievements and must continue innovating to maintain their market position.

At this point, it is helpful to address a potential objection. This Article has argued that curtailing patent exclusivity (via the patent misuse doctrine or denying injunctions) will enhance ongoing incentives to invent for patentees facing such curtailment. One could surmise, however, that instead of enhancing back-end incentives to invent, the knowledge that patent rights might be curtailed would simply diminish front-end incentives to invent. Such an outcome would depress the aims of the patent system and the process of churn overall. However, there is good reason to believe that this objection is overstated. Unlike, for example, an across-the-board reduction in the patent term, a patentee cannot be sure that a court sometime in the future will render any of its patents unenforceable or refuse to grant an injunction after a finding of infringement. Thus, the chilling effect of these measures must be discounted by the probability that they may never apply.<sup>331</sup> Empirical analysis of another case-by-case mechanism to curtail patent rights—compulsory licenses—reveals that such licenses only depress initial incentives to invent in limited circumstances.<sup>332</sup> Furthermore, behavioral research indicating that owners of intellectual property routinely overestimate its value suggests that initial incentives to invent will remain

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327. See, e.g., *Novartis AG v. Union of India*, AIR 2013 SC 24759 (India) (upholding the Indian Patent Office's rejection of Novartis AG's patent application on Glivec as nonpatentable subject matter) [<https://perma.cc/53RA-2LDX>].

328. See *supra* note 140 and accompanying text.

329. See, e.g., *FTC v. Actavis Inc.*, 570 U.S. 136, 147 (2013) (holding that such agreements are subject to antitrust challenges under the rule of reason); Feldman & Frondorf, *supra* note 140, at 503 (noting Hatch-Waxman has created opportunities for pharmaceutical companies to hold off generic competition).

330. *Actavis*, 570 U.S. at 147.

331. For example, one empirical study from 2016 found that courts granted permanent injunctions 72.5% of the time in cases from May 2006 to December 2013. Seaman, *supra* note 230, at 1983. However, grant rates varied considerably by context. When patent assertion entities were removed from consideration, the injunction grant rate for all other patentees was 80%. *Id.* at 1988.

332. Colleen V. Chien, *Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?*, 18 BERKELEY TECH. L.J. 853, 880–81 (2003).

high.<sup>333</sup> It bears emphasizing that patentees subject to the patent misuse doctrine can “cure” the unenforceability of their patent by ending their misuse. Furthermore, patentees that do not get an injunction under the *eBay* framework may still receive damages. In both contexts, properly constrained assertion of patents still allows patentees to receive compensation, thus shoring up incentives to invent.

Of course, curtailing exclusive rights will contribute to some patentees simply failing. Unfortunately, such failures create significant economic loss. However, the theory of churn holds that constant competitive pressure—including the threat of extinction—provides the most powerful incentive for innovation. If an incumbent cannot or will not innovate, then the rewards of the market will flow to the next generation of innovators, and the cycle will begin again.

#### CONCLUSION

This Article has looked beyond patent law’s impact on individual invention to explore its contributions to industrial churn. Drawing on evolutionary theories of economic change, churn represents an iterative process in which new innovations and entities challenge existing incumbents, which must continually innovate or face displacement. This Article has argued that patent law promotes churn in surprising and underappreciated ways. It contends that the mere availability of an exclusive, time-limited right to technology facilitates a baseline level of churn. Exclusive rights can assist startups with market entry (where they can challenge incumbents), and expiration of patents ensures that technology incumbents must continue innovating or face their demise. However, this Article argues that patents do more to accelerate churn. At the front end, patents maximize competitive pressures against incumbents by subsidizing patent acquisition by small entities, which tend to be disproportionately innovative. At the back end, doctrines such as patent misuse and the equitable standard for injunctive relief discipline overreaching patentees and increase their incentive to keep innovating.

Patent law’s contributions to churn shed new light on the nature of patents and their relationship to competition. While patent rights are often characterized as unitary and fixed across all contexts, this Article shows that they possess significant flexibility. Patent law discriminates in favor of small entities, and it selectively curtails rights based on patentee behavior. Additionally, while patents are often characterized as an exception to competition, they also promote competition by fostering new entry and

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333. Christopher Buccafusco & Christopher Sprigman, *Valuing Intellectual Property: An Experiment*, 96 CORNELL L. REV. 1, 5 (2010).

disciplining overreaching patentees. While churn is a worthwhile objective of industrial policy, this Article suggests reforms to the way in which the patent system promotes it. It recommends increasing general patent fees while calibrating subsidies for patent acquisition by small entities based on individual industry dynamics. It further advocates greater consideration of churn in back-end doctrines and shoring up their ability to curtail exclusive rights to prevent overreaching by patentees. In this manner, the patent system can better contribute to evolutionary economic change.