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THE INEQUALITIES OF INNOVATION

Colleen V. Chien*

ABSTRACT

Over the last few decades, the United States has become more innovative, but the gains have been distributed unequally. In 2020, over 50% of new U.S. patents went to the top 1% of patentees, and more than 50% of all patents of U.S. origin were generated by just five states, all coastal. Less than 13% of inventors were women. The economic, geographic, and demographic concentration of innovation highlight how the intersections between two traditionally discrete topics—innovation and inequality—have become increasingly relevant. But rather than any single inequality, this Article argues, multiple inequalities—of income, opportunity, and access—have relevance to innovation. Examining the inequalities of innovation, separately and together, exposes the tensions, at times surprising, between notions of equity. When mapped onto patent law, an inequalities framework also reveals how patent law can exacerbate inequality by providing enhanced returns to “invention capital”—the role models, trust, know-how, and networks required to take advantage of inventing. But an inequalities framework also shows how patented innovation can improve conditions for the worst-off, by providing paths to prosperity and hastening the creation and diffusion of innovation across classes, even as it makes the rich richer.

Building on the “inequalities” framework described above, this Article offers a set of legal and administrative proposals grounded in patent law for addressing inequality concerns. To ensure equal opportunities to participate, this Article proposes the creation of an Independent Office of the Small Inventor Advocate, akin to the National Taxpayer Advocate, that would have responsibility for outreaching to and increasing invention capital and know-how among first-time, underrepresented, and under-resourced inventors, and leveling up the inventing playing field, for example through universally

* (c) Professor, Santa Clara University School of Law and Co-Director, High Tech Law Institute, 2013-2015 White House Senior, Innovation and Intellectual Property. Thanks to Jeanne Fromer, Daniel Hemel, Barton Beebe, Peter Lee, Lisa Ouellette, Gregory Day, Michael Shuster, Robert Merges, Lateef Mtima, Carol Rose, Eunice Lee, Mark Lemley, Pam Samuelson, Sonya Katyal, Kali Murray, David Schwartz, Brian Love, Eric Goldman, Tyler Ochoa, Deep Gulasekaram, David Sloss, Jonah Probell, Michael Risch, and audiences at multiple faculty forum and legal colloquium, including at MOSAIC, WIPIP, IP Scholars, NYU School of Law, Santa Clara School of Law, Denver Sturm School of Law, Hastings School of Law, and Arizona Law School for their comments and feedback. Thanks to Erik Perez, Rodney Swartz, Jonathan Collins, Zachary Daly, Stella Collet, and Nicholas Halkowski for excellent research assistance and to the student editors at the Emory Law Journal for their patient and careful editing of the article. Thanks as always to Dirk Calcoen.

accessible patent-quality technology. To expand access to innovation through partnerships and expand public understanding and oversight of the patent system, by other agencies, for example, this Article proposes the introduction of an independent Office of Public Interest and Partnerships in Innovation. Finally, introducing and centering equity metrics, like the number of first-time innovators and gaps in the rates, can support equitable growth in innovation.

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INTRODUCTION

On January 21, 2021, the Centers for Disease Control and Prevention (“CDC”) reported two grim milestones: nearly twenty-five million cases of COVID-19 and over 400,000 deaths in the United States.¹ Days earlier, another federal agency, the U.S. Patent and Trademark Office (“USPTO”), released data showing that, despite a global recession due to the pandemic and record unemployment,² published patent applications had reached an all-time high.³ Increased reliance on vaccines, tests, and technology put intellectual property-intensive industries on the upward-sloping part of the “K-shaped recovery curve,” the divided path of the economic recovery.⁴ While many tech workers were told they could work from home indefinitely,⁵ thousands of small businesses closed permanently.⁶

What is the connection between inequality, innovation, and patents? Distributional questions like this have historically received scant attention, for a few reasons.⁷ First, the purpose of the patent system is, as stated in the U.S.

¹ *COVID Data Tracker*, U.S. CTRS. FOR DISEASE CONTROL & PREVENTION, https://covid.cdc.gov/covid-data-tracker/#trends_totaldeaths_totalcasesper100k (last visited Aug. 16, 2021).

² *Unemployment Rate Rises to Record High 14.7 Percent in April 2020*, U.S. BUREAU OF LAB. STAT. (May 13, 2020), <https://www.bls.gov/opub/ted/2020/unemployment-rate-rises-to-record-high-14-point-7-percent-in-april-2020.htm>.

³ *2020 Trends and Insights*, IFI CLAIMS PAT. SERVS., https://www.ificlaims.com/rankings-trends-2020.htm#title_9 (last visited Feb. 3, 2021) (reporting a slight rise of about 20,000 published applications in 2020 over 2019 and slight decline among grants of 2,000).

⁴ Kariappa Bheemaiah, Mark Esposito & Terence Tse, *Are We Experiencing a K-shaped Recovery from COVID-19?*, WORLD ECON. F. (Dec. 22, 2020), <https://www.weforum.org/agenda/2020/12/k-shaped-covid19-coronavirus-recovery/>.

⁵ Emily Courtney, *25 Companies Switching to Permanent Remote Work*, FLEXJOBS, <https://www.flexjobs.com/blog/post/companies-switching-remote-work-long-term/> (last visited Apr. 27, 2021) (chronicling the early decisions of Twitter, Facebook, and others to offer long-term remote work).

⁶ Anne Sraders & Lance Lambert, *Nearly 100,000 Establishments that Temporarily Shut Down Due to the Pandemic Are Now Out of Business*, FORTUNE (Sept. 28, 2020, 10:25 AM), <https://fortune.com/2020/09/28/covid-buisnesses-shut-down-closed/> (reporting nearly 100,000 business closures).

⁷ Subject to a few notable exceptions, including the scholarship cited in Parts II and III and writings on international access to medicines. See, e.g., Lisa Larrimore Ouellette, *Crowdsourced Bibliography on IP and Distributive Justice*, WRITTEN DESCRIPTION (Jan. 20, 2018),

Constitution, to “promote the Progress of Science and useful Arts.”⁸ As such, the U.S. patent system is “unashamedly utilitarian.”⁹ Second, distributional concerns have traditionally been the domain of public law.¹⁰ Within what Martha McCluskey has called the “maximization first and redistribution second”¹¹ division in law, the role of patent law, it would seem, is simply to encourage maximal innovation. Finally, while the literature regarding the relationship between technology and inequality is vast,¹² little of it has considered the role of the law.¹³

But who gets to benefit from and participate in innovation has increasingly been the subject of heated debate. That an estimated one-third of uninsured Americans do not take their medications as prescribed because of cost¹⁴ has led lawmakers to call for the use of reforms to both “take back” drug patents¹⁵ and reform practices that may be contributing to their unwarranted issuance in the

<https://writtendescription.blogspot.com/2018/01/crowdsourced-bibliography-on-ip-and.html>. For the particular trope of patenting as an important pathway for the American dream, see generally Ryan T. Holthe, *Trolls or Great Inventors: Case Studies of Patent Assertion Entities*, 59 ST. LOUIS U. L.J. 1 (2014). I thank Michael Risch for reminding me of this point.

⁸ U.S. CONST. art. I, § 8, cl. 8.

⁹ Margo A. Bagley, *Patent First, Ask Questions Later: Morality and Biotechnology in Patent Law*, 45 WM. & MARY L. REV. 469, 546 (2003).

¹⁰ See Richard A. Epstein, *Innovation and Inequality: The Separability Thesis*, 39 HARV. J.L. & PUB. POL’Y 1, 10–13 (2016) (arguing for a strict division between promoting innovation and redistributing wealth). But see Jedediah Britton-Purdy, Amy Kapczynski & David Singh Grewal, *Law and Political Economy: Toward a Manifesto*, LAW & POL. ECON. PROJECT (Nov. 6, 2017), <https://lpeblog.org/2017/11/06/law-and-political-economy-toward-a-manifesto> (describing and acknowledging the shortcomings created by the “implicit divide between ‘public’ and ‘private’ fields of law”). In *Oil States Energy Services, LLC v. Greene’s Energy Group, LLC*, the Supreme Court recently confirmed that patents, which confer rights to exclude others from the practice of an invention, are “public franchises” rather than private property. 138 S. Ct. 1365, 1373 (2018).

¹¹ Martha McCluskey, *Against the Economic Pie: How “Redistribution” Limits Political Economic Analysis*, LAW & POL. ECON. PROJECT (Mar. 27, 2019), <https://lpeproject.org/blog/against-the-economic-pie-how-redistribution-limits-political-economic-analysis/>.

¹² See generally Daron Acemoglu, *Technological Change, Inequality, and the Labor Market*, 40 J. ECON. LIT. 7, 12–16 (2002) (providing a literature review on inequality and technological change).

¹³ See KATHARINA PISTOR, *THE CODE OF CAPITAL: HOW THE LAW CREATES WEALTH AND INEQUALITY* 3 (2019).

¹⁴ ROBIN A. COHEN, PETER BOERSMA & ANJEL VAHRATIAN, *STRATEGIES USED BY ADULTS AGED 18–64 TO REDUCE THEIR PRESCRIPTION DRUG COSTS*, 2017 at 3 (2019), <https://stacks.cdc.gov/view/cdc/76621>.

¹⁵ Valerie Bauman, *Democrats Tout Federal Patent Take-Backs for Lowering Drug Costs*, BLOOMBERG L. (Dec. 16, 2019), <https://news.bloomberglaw.com/pharma-and-life-sciences/democrats-tout-federal-patent-take-backs-for-lowering-drug-costs>.

first place.¹⁶ Starkly unequal access to COVID-19 vaccines¹⁷ has led to the unprecedented approval by the World Trade Organization of a partial vaccine patent waiver to combat the COVID-19 pandemic.¹⁸

Those who seek to reduce inequality tend to focus on welfare policies like tax and education. Though patent law may not seem like a natural extension, this Article offers a framework for understanding the intersections between innovation and inequality and suggests how patent policy can help address distributional concerns. Using the patent system as a lever to tackle inequality yields two unique benefits. First, as a form of innovation policy, patent law can spur the development and dissemination of new technologies that raise productivity and real wealth for everyone, thereby avoiding the zero-sum game of redistributing existing wealth. As such, this Article's prescriptions primarily aim to *level up*, and not just *level*, the playing field. Second, an inequalities lens can improve patent law by revealing the mechanisms by which the law both exacerbates and alleviates inequality, in particular through what I call "invention capital"—the trust, resources, know-how, and network of people needed to take advantage of the patent system. This Article calls for more attention to be paid to growing invention capital, in service of spurring innovation that is responsive to the needs of a wider population.

Part I describes a framework for understanding inequality and innovation, centered on the unbraiding of the concept of inequality into three distinct inequalities—economic inequality, inequality of opportunity, and inequality of access. Doing so highlights surprising contrasts: for example, *equality of opportunity* to innovate, but also some amount of *economic inequality*—which supports risk-taking and racing for profits—both foster innovation. Through the lens of three illustrative inventions from 1900 to the present, this Part explores the tensions among and between the inequalities of innovation.

¹⁶ See, e.g., Letter from Patrick Leahy, John Cornyn, Richard Blumenthal, Susan M. Collins, Amy Klobuchar & Mike Braun, U.S. Senators, to Kathi Vidal, Director, U.S. Pat. & Trademark Off. (June 8, 2022) (asking the USPTO to issue a rule of proposed rulemaking or public request for comments regarding the contribution of a patenting practices like "terminal disclaimers" and "continuation patent" filing to poor-quality patents).

¹⁷ Anna Rouw, Jennifer Kates, Adam Wexler & Josh Michaud, *Tracking Global COVID-19 Vaccine Equity: An Update*, KFF (Sept. 22, 2021), <https://www.kff.org/coronavirus-covid-19/issue-brief/tracking-global-covid-19-vaccine-equity-an-update/> (reporting a COVID vaccination rate in Africa of less than 5% versus nearly 70% in richer regions of the world as of September 2021).

¹⁸ See World Trade Organization, Draft Ministerial Decision on the Trips Agreement, WTO Doc. WT/Min(22)/W/15/Rev.2 (2022) (giving express permission to member countries to authorize the use of patents required for the production and supply of COVID-19 vaccines without consultation with the rights holder, subject to limited conditions).

Part II uses the patent system as a case study for understanding how the law intensifies as well as alleviates the inequalities of innovation, contributing to the dynamics identified in Part I. A review of the ways in which patent law intersects with each of the inequalities of innovation underscores the importance of “invention capital”—the role models, trust, know-how, and network needed to take advantage of invention—for ensuring broad opportunity to innovate. However, it also reveals that equality of opportunity and equality of access to innovation are both limited by the system’s opacity, lack of meaningful public oversight and public understanding, and structural factors.

Part III builds upon Part II to suggest ways that the patent system can address the inequalities of innovation. First, to safeguard equal opportunity to participate in invention, it proposes creating an office focused on outreach, the Office of the Small Inventor Advocate—modeled after other such offices in federal agencies—responsible for increasing invention capital and know-how among underrepresented and first-time inventors, and leveling up the playing field—for example, through patent-quality technology. Second, to expand access to innovation, it proposes establishing an Independent Office of the Public Interest and Partnerships focused on advancing public understanding of the patent system, particularly by other public agencies, and fostering technology transactions and partnerships that can expand access to innovation. Third, it proposes the introduction and systematic reporting of innovation equity metrics for measuring and tracking, for example, first-time inventing, to track progress toward narrowing the inequalities of innovation.

I. THE INEQUALITIES OF INNOVATION

Over the last several decades, the United States has become more innovative, but the gains have been distributed unequally. From 1980–2017, the number of yearly U.S.-origin patent grants grew about seven times faster than the population.¹⁹ The wealth of the top one percent of households also grew, from 24% in 1980 to 43% in 2012.²⁰ Less well-known, patent holdings became

¹⁹ *U.S. Patent Statistics Chart: Calendar Years 1963–2020*, U.S. PAT. & TRADEMARK OFF. (May 2021), https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm (showing growth in U.S. yearly patent grants from 37,000 to 150,000, or 300%); see also *United States Population*, WORLDOMETER, <https://www.worldometers.info/world-population/us-population/> (last visited Aug. 16, 2021) (showing growth in U.S. population from 229M to 325M, or 42%).

²⁰ Emmanuel Saez & Gabriel Zucman, *Wealth Inequality in the United States Since 1913: Evidence from Capitalized Income Data*, 131 Q.J. ECON. 519, 553 (2016). But see, e.g., Gerald Auten & David Splinter, *Income Inequality in the United States: Using Tax Data to Measure Long-Term Trends* 1, 2–4 (Feb. 18, 2022), http://davidsplinter.com/AutenSplinter-Tax_Data_and_Inequality.pdf (challenging findings of dramatic inequality growth by Saez and Zucman and, based on taking into account income not reported on tax data and

substantially more concentrated, according to an analysis I performed for this paper—by 2020, more than half of newly granted patents went to the top 1% of patentees, and over three-quarters to the top 10%, up from 39% and 64%, respectively.²¹ Five states, all coastal, captured over 50% of all U.S. patents.²² Women accounted for only 12.8% of inventors on 2019 U.S.-origin patents.²³

But while rising inequality has been called *the* “defining issue of our time,”²⁴ *multiple* inequalities are relevant when it comes to innovation. The idea of distinct equalities is not new. The claim that all “should have the same” begs the questions “of what?” and “among whom?”²⁵ Philosophers have long wrestled with whether fairness requires equality of resources, happiness, or capabilities to do or be what they choose,²⁶ or something else. In the law, civil procedure rules embody formal equality in form (e.g., everyone pays the same fee to file a complaint), but risk substantive inequality in substance (e.g., that everyone pays the same means some will be priced out).²⁷

When it comes to innovation, *at least* three types of inequality matter: (1) *inequality of wealth/income*, regarding the distribution of economic resources; (2) *inequality of opportunity to innovate*, which pertains to the production of innovation; (3) and *inequality of access to innovation*, about the affordability and availability of innovation. Unlike interventions that primarily seek to redistribute existing resources, innovation interventions, because they are about new and better ways of doing things, are generally distinguishable by the way

changes in the marriage rate, finding more modest increases in inequality).

²¹ The precise numbers depend on the data source. See *infra* Appendix Figures 1A, 1B (showing the share of grants going to the top 1% and 10% of U.S. patentees in 2020, using Google Patents and PatentsView data sources, respectively).

²² Analysis is based on 2020 patents by state and population by state. *Patent Counts by Origin and Type Calendar Year 2020*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/web/offices/ac/ido/oeip/taf/st_co_20.htm (last visited Aug. 16, 2021); *US States—Ranked by Population 2021*, WORLD POPULATION REV., <https://worldpopulationreview.com/states> (last visited Aug. 16, 2021). The states with the most patents are California, Texas, New York, Washington, and Massachusetts. *Patent Counts by Origin and Type Calendar Year 2020*, *supra*.

²³ ANDREW A. TOOLE, CHARLES A. W. DEGRAZIA, FRANCESCO LISSONI, MICHELLE J. SAKSENA, KATHERINE P. BLACK, ERNEST MIGUELEZ & GIANLUCA TARASCONI, U.S. PAT. & TRADEMARK OFF., PROGRESS AND POTENTIAL: 2020 UPDATE ON U.S. WOMEN INVENTOR-PATENTEES 1, 2 (2020), <https://www.uspto.gov/sites/default/files/documents/OCE-DH-Progress-Potential-2020.pdf>.

²⁴ Robert L. Borosage, *Inequality is Still the Defining Issue of Our Time*, NATION (Oct. 12, 2016), <https://www.thenation.com/article/archive/inequality-is-still-the-defining-issue-of-our-time/>.

²⁵ Stefan Gosepath, *Equality*, STAN. ENCYC. PHIL., <https://plato.stanford.edu/entries/equality/#EquWel> (Apr. 26, 2021).

²⁶ Norman Daniels, *Equality of What: Welfare, Resources, or Capabilities?*, 50 PHIL. & PHENOMENOLOGICAL RSCH. 273, 273–74 (1990).

²⁷ Paul Stancil, *Substantive Equality and Procedural Justice*, 102 IOWA L. REV. 1633, 1635–37 (2017).

they dynamically extend available resources.²⁸ That is to say: they sound in abundance, not scarcity.

This Part begins with a discussion of each type of inequality and how it intersects with innovation. It then explores the inequalities of innovation through the lens of three innovations, each selected to typify a major era of inventing from the 1900s to the present: a mechanical invention from the early 1900s (steam engine technology); a pharmaceutical invention discovered in the 1960s (naloxone); and a digital invention from the 2010s (database automation). This exploration is not without risk: dissecting “inequality” into multiple inequalities risks decontextualization, promotion of a false moral equivalence, and a failure to holistically consider the causal relationships between types of inequalities. To attempt to avoid such siloing, this Part concludes with a discussion of the inequalities together.

A. *The Three Inequalities of Innovation*

The paragraphs below dissect the concept of “inequality” into the three distinct inequalities—of wealth/income, of opportunity to innovate, and of access to innovation—with relevance to innovation, and discuss some of the more salient dimensions of each.

1. *Inequality of Wealth/Income*

Economic inequality encompasses the gap in income or wealth between rich and poor households,²⁹ and the corresponding differences in the best- and worst-off firms.³⁰ How, if at all, does economic inequality relate to innovation? Though modern accounts stress inequality’s downsides,³¹ inequality has been associated with several potential upsides when it comes to innovation. In *A Theory of Justice*, John Rawls describes how to cultivate a fair and just society.³²

²⁸ Digital goods perhaps exemplify the abundance paradigm best. See Seth G. Benzell & Erik Brynjolfsson, *Digital Abundance and Scarce Genius: Implications for Wages, Interest Rates, and Growth* 5 (Nat’l Bureau of Econ. Rsch., Working Paper No. 25585, 2019), https://www.nber.org/system/files/working_papers/w25585/w25585.pdf (characterizing digital versions of labor and capital as increasing the supply of and reducing the marginal cost of both labor and capital).

²⁹ Saez & Zucman, *supra* note 20, at 520, 573–75.

³⁰ See Jae Song, David J. Price, Faith Guvenen, Nicholas Bloom & Till von Wachter, *Firming Up Inequality*, 134 Q.J. ECON. 1, 3–4 (2019) (tracing income inequality primarily to the differences *between* firms, rather than *within* firms).

³¹ See, e.g., Christopher Ingraham, *How Rising Inequality Hurts Everyone, Even the Rich*, WASH. POST (Feb. 6, 2018), <https://www.washingtonpost.com/news/wonk/wp/2018/02/06/how-rising-inequality-hurts-everyone-even-the-rich/>.

³² JOHN RAWLS, JUSTICE AS FAIRNESS: A RESTATEMENT 42–43 (Erin Kelly ed., Belknap Press 2001)

According to his famous “Difference Principle,” social and economic inequalities should be arranged “to the greatest benefit of the least-advantaged members of society.”³³ That is to say, some level of economic inequality is tolerable, though only when it is “to the greatest benefit” of the worst-off. In the spirit of Winston Churchill’s statement, “[t]he inherent vice of capitalism is the unequal sharing of blessings. The inherent virtue of Socialism is the equal sharing of miseries,”³⁴ innovation may be a blessing whose unequal distribution just may be worth it.

How might income inequality benefit the worst-off vis-à-vis innovation? In “Common Sense of Progress,” Austrian economist Friedrich Hayek explores a few ways.³⁵ First, rich people and firms have rents in excess of others that can be used to underwrite innovations that will eventually benefit all.³⁶ Using prizes, direct funds, and other means, philanthropists have catalyzed breakthroughs in a variety of disease areas, including HIV/AIDS and cystic fibrosis.³⁷ Research firm Bell Labs has led the world in “corporate” Nobel Prizes,³⁸ and pioneered the laser, transistor, and solar cell, among other key inventions.³⁹ Second, the desire for novelties (e.g., space exploration) supports discoveries from which subsequent innovators and the public can learn.⁴⁰ Today’s tech billionaires, many of them self-made, suggest the third, and perhaps most universal, mechanism by which inequality spurs innovation: the promise of riches incentivizes talented people to innovate. When innovative people and firms race

(citing JOHN RAWLS, A THEORY OF JUSTICE §§ 11–14 (Belknap Press 1971)).

³³ *Id.*

³⁴ *Vice of Capitalism*, INT’L CHURCHILL SOC’Y, <https://winstonchurchill.org/resources/quotes/vice-of-capitalism/> (last visited Aug. 16, 2021).

³⁵ See FRIEDRICH A. HAYEK, THE CONSTITUTION OF LIBERTY, CHAPTER 2: THE COMMON SENSE OF PROGRESS 39–53 (1960).

³⁶ *Id.* at 44 (“If today . . . the relatively poor can have a car[,] . . . this was made possible because in the past others with larger incomes were able to spend on what was then a luxury.”).

³⁷ Gabriel Kasper & Justin Marcoux, *The Re-Emerging Art of Funding Innovation*, 12 STAN. SOC. INNOVATION REV. 28, 28, 30–31 (2014); see William J. Broad, *Billionaires with Big Ideas Are Privatizing American Science*, N.Y. TIMES (Mar. 15, 2014), <https://www.nytimes.com/2014/03/16/science/billionaires-with-big-ideas-are-privatizing-american-science.html> (describing donations to disease research based on personal experiences). But see Nicholas Lemann, *Would the World Be Better Off Without Philanthropists?*, NEW YORKER (May 23, 2022), <https://www.newyorker.com/magazine/2022/05/30/would-the-world-be-better-off-without-philanthropists-paul-vallely-emma-saunders-hastings> (summarizing books recounting the familiar critiques of philanthropy as unaccountable, anti-democratic, and inequitable).

³⁸ Karina Cummings, *Nobel Science Prizes in Industry: The Promise and the Challenge of Science in the “Real World”*, <https://www.vanderbilt.edu/AnS/physics/brau/H182/Term%20papers%20'02/Karina.htm> (last visited Aug. 16, 2021). I thank Brian Love for making this point to me.

³⁹ *Awards*, NOKIA BELL LABS, <https://www.bell-labs.com/about/awards/> (last visited Feb. 18, 2022).

⁴⁰ HAYEK, *supra* note 35, at 45 (“[T]he rich, by experimenting with new styles of living . . . perform a necessary service without which the advance of the poor would be very much slower . . .”).

for rents, technological progress, whether patented or not, is accelerated. Incentives are thus a double-edged sword: they motivate innovation, but by giving larger rewards for more innovative ideas, they also imply unequal economic outcomes and contribute to inequality.

In these ways, economic inequality, which is often perceived as the *problem*, seems to be an important part of the *solution* with respect to innovation. The desire to get ahead motivates productive effort and lures talent, creating productive clusters. The resulting innovation, at times underwritten or driven initially by those who *are* ahead, benefits the rich but, the hope is, also everyone else eventually. As explored in Part II, intellectual property intensifies this market-based dynamic by increasing the rewards to certain forms of innovation through exclusion. According to Robert Merges, the inequality that intellectual property contributes to is a “justifiable form of inequality,” because it provides significant benefits to the “least advantaged,” as identified by Rawls.⁴¹ Innovation not only is spurred by inequality, but even without explicitly intending to, it can also make even the worst-off wealthier through abundance. Consistent with the “Difference Principle,” a smaller share of a very large pie in many cases may be preferable to an equal share of a much smaller pie.

But how much inequality is the right amount? If too little inequality is dangerous, too much is even more so because there is little reason to exert effort when the outcomes are already set.⁴² And yet, some advocate for giving innovators that are the furthest ahead even more (intellectual property) protection because doing so will motivate those within striking distance to put more effort in.⁴³

Related to the question of whether economic inequality hastens or stunts innovation is the question of how the gains from innovation are shared between capital and labor. This question is as timely now, during the “fourth” Industrial Revolution, of artificial intelligence and robotics,⁴⁴ as it was during the “first” Industrial Revolution, when mechanized production was first introduced and the

⁴¹ ROBERT MERGES, JUSTIFYING INTELLECTUAL PROPERTY 117–20 (2011).

⁴² See, e.g., Samuel Scheffler, *Is Economic Inequality Really a Problem?*, N.Y. TIMES (July 1, 2020), <https://www.nytimes.com/2020/07/01/opinion/economic-inequality-moral-philosophy.html?auth=login-google>.

⁴³ Daron Acemoglu & Ufuk Akcigit, *State-Dependent Intellectual Property Rights Policy* 34 (Nat’l Bureau of Econ. Rsch., Working Paper No. 12775, 2006) (“Contrary to a naive intuition, we find that the growth-maximizing IPR policy provides greater protection to firms that are further ahead of their rivals than those that are technologically close to their competitors.”).

⁴⁴ Klaus Schwab, *The Fourth Industrial Revolution: What it Means, How to Respond*, WORLD ECON. F. (Jan. 14, 2016), <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/> (describing the fourth Industrial Revolution).

so-called “machinery question” was first posited.⁴⁵ As British economist David Ricardo observed then, machines can make workers more productive, but they can also, over time, replace them and depress wages.⁴⁶ Ricardo’s answer to concerns about the impact of technology on labor was a warning that “the substitution of machinery for human labour [sic] is often very injurious to the interests of the class of labourers [sic].”⁴⁷ But, as described in further detail below, technological innovation often impacts the demand for workers of different skills differently,⁴⁸ with a range of implications for economic inequality.

2. *Inequality of Opportunity to Innovate*

Related to but distinct from economic inequality is the principle of inequality of opportunity.⁴⁹ Equality of opportunity to innovate means giving all a fair chance to participate in and profit from innovation, patented or not. Also known as “starting gate” or “level playing field” equality,⁵⁰ the strong version of equal opportunity demands, Rawls has said, that “offices and positions” be “open to all,” regardless of background.⁵¹ As the Supreme Court has said, the Constitution requires “equal opportunity to aspire, achieve, participate in and contribute to society based on . . . individual talents and capacities.”⁵² Like expanding innovation, boosting equality of opportunity should grow the pie through the development and more productive allocation of talent. Equality of opportunity to innovate has long been an ideal (if not always a reality) of the U.S. patent system⁵³ and related innovation policies.⁵⁴ But if equal opportunity means that everyone in theory *has* an equal chance, it doesn’t necessarily follow that everyone will take that chance. Equal opportunity can still lead to unequal

⁴⁵ DAVID RICARDO, ON THE PRINCIPLES OF POLITICAL ECONOMY AND TAXATION 283 (Batoche Books 2001) (1817).

⁴⁶ *Id.*

⁴⁷ *Id.*

⁴⁸ See *infra* Section I.C.3 for a discussion contrasting technologies that are skills-biased (e.g., automation) versus unskilled-biased (e.g., steam power).

⁴⁹ John E. Roemer & Alain Trannoy, *Equality of Opportunity* 1 (Cowles Found., Working Paper No. 1921, 2013) (“[T]he development of egalitarian theory . . . may be characterized as an effort to replace equality of outcomes with equality of opportunities.”).

⁵⁰ *Id.*

⁵¹ RAWLS, JUSTICE AS FAIRNESS, *supra* note 33, at 42 (describing the so-called “offices and positions open to all”).

⁵² *United States v. Virginia*, 518 U.S. 515, 532 (1996).

⁵³ Colleen Chien, *SUCCESS Act Testimony*, SANTA CLARA UNIV. SCH. L. 1, 2 (June 30, 2019), <https://www.uspto.gov/sites/default/files/documents/SUCCESSAct-Chien.pdf> (describing features of the early U.S. patent system that were meant to encourage inclusion).

⁵⁴ See *infra* Section III.A.

outcomes if there are differences in endowments, motivation, or both.

Also, if easy to agree upon in principle, equality of opportunity to innovate is hard to measure in practice.⁵⁵ For example, the extreme underrepresentation of women among inventors⁵⁶ reflects historical and structural factors such as institutional discrimination, limited educational opportunities, and inadequate access to capital.⁵⁷ However, unequal participation in innovation more generally may also be due in part to girls selecting out of STEM classes,⁵⁸ women having stronger comparative advantages in reading and non-STEM fields,⁵⁹ or differences in preferences⁶⁰—factors that are hard to tease apart. Brian May was completing his PhD in astrophysics when he decided to take a break and pursue a musical career with the band Queen,⁶¹ a personal, highly successful choice. But if a woman gets pregnant during her STEM PhD program and “chooses” to take a hiatus to avoid “juggling chainsaws and eating a hamburger while riding a unicycle,” as having a baby while getting a doctorate has been described,⁶² did she really have a choice in the first place? In addition, even if equal opportunity matters more than equal participation, the two are related, since the historic lack of equal opportunity creates structural hurdles to future participation.⁶³

⁵⁵ The difficulty stands in contrast to equality of opportunity in general, which can be approximated by socioeconomic mobility.

⁵⁶ Cf. ANDRE IANCU & LAURA A. PETER, U.S. PAT. & TRADEMARK OFF., REPORT TO CONGRESS PURSUANT TO P.L. 115-273, THE SUCCESS ACT, U.S. PAT. & TRADEMARK OFF. 18–20 (2019) (reporting that women make less than 13% of inventors on U.S. patents); Tara Law, *Women Are Now the Majority of the U.S. Workforce—But Working Women Still Face Serious Challenges*, TIME (Jan. 16, 2020, 4:55 PM), <https://time.com/5766787/women-workforce/> (documenting that women represent just over 50% of the workforce).

⁵⁷ See REPORT TO CONGRESS PURSUANT TO P.L. 115-273, *supra* note 56, at 18–20. Both types of factors are described in Part II, the latter in the context of invention capital.

⁵⁸ CATHERINE HILL, CHRISTIANNE CORBETT & ANDRESSE ST. ROSE, AAUW, WHY SO FEW? WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS 92 (2010), <https://time.com/wp-content/uploads/2015/05/why-so-few-women-in-science-technology-engineering-and-mathematics.pdf>.

⁵⁹ See Gijsbert Stoet & David C. Geary, *The Gender-Equality Paradox in Science, Technology, Engineering, and Mathematics Education*, 29 PSYCH. SCI. 581, 585 (2018).

⁶⁰ See Ronald Dworkin, *What Is Equality? Part 2: Equality of Resources*, 10 PHIL. & PUB. AFFS. 283, 293 (1981) (contrasting “[b]rute luck” with “[o]ption luck,” which involves some element of choice).

⁶¹ *Brian May Biography*, BIOGRAPHY (Apr. 2, 2014), <https://www.biography.com/musician/brian-may>.

⁶² Megan Woolhouse, *Pregnant and Pursuing a PhD, the Ultimate Juggling Act*, BU TODAY (May 15, 2019), <http://www.bu.edu/articles/2019/pregnant-and-phd/>.

⁶³ See Isabel V. Sawhill, *Still the Land of Opportunity?*, BROOKINGS (Mar. 1, 1999), <https://www.brookings.edu/articles/still-the-land-of-opportunity/> (noting that participation is historically limited by multiple factors such as education, social origins, and family background).

3. *Inequality of Access to Innovation: Affordability and Availability*

A final form of inequality with relevance to innovation is *inequality of access*—differences in the ability of the rich and poor, the urban and rural to access innovation. In international health contexts, access has been defined as “the timely use of services according to needs” and includes the dimensions of “geographical and financial accessibility, availability, acceptability and quality.”⁶⁴ This Article specifically distinguishes the *affordability* of an innovation (e.g., is it priced within reach?) from its *availability*—for example, within a particular geography and in a form suitable for the particular needs of diverse consumers (e.g., with respect to a drug innovation, does an appropriate formulation even exist, and is it available to consumers that need them?).⁶⁵ Although related to economic inequality, inequality of access⁶⁶ arguably better measures welfare and happiness, because what one can afford and what solutions are available in the first place matter more than how much money is in one’s bank account.⁶⁷

Along the affordability dimension, whether “equality of access” extends to a particular good depends on its nature as being either essential or nonessential. According to Rawls, essential goods are goods that every rational human is presumed to value, including “rights and liberties, powers and opportunities, income and wealth, and the social bases of self-respect.”⁶⁸ These include essential medicines that “satisfy the priority health care needs of the population.”⁶⁹ Margaret Chon has called for “substantive equality”—equal

⁶⁴ Maryam Bigdeli, Bart Jacobs, Goran Tomson, Richard Laing, Abdul Ghaffar, Bruno Dujardin & Wim Van Damme, *Access to Medicines from a Health System Perspective*, 28 HEALTH POL’Y & PLAN. 692, 693 (2013) (quoting David H. Peters et al., *Poverty and Access to Health Care in Developing Countries*, 1136 ANNALS N.Y. ACAD. SCIS. 161, 162 (2008)).

⁶⁵ Veronika J. Wirtz & Corrina Moucheraud, *Beyond Availability and Affordability: How Access to Medicines Affects Non-Communicable Disease Outcomes*, 2 LANCET PUB. HEALTH 390, 390–91 (2017) (discussing the twin challenges of availability and affordability).

⁶⁶ Inequality of access to innovation could be considered a form of “consumption inequality.” Orazio P. Attanasio & Luigi Pistaferri, *Consumption Inequality*, 30 J. ECON. PERSPS. 3, 3–4 (2016).

⁶⁷ *Id.* at 4 (“[R]esearchers interested in measuring inequality in well-being need to go beyond the fact that consumption is unequally distributed . . .”).

⁶⁸ *Original Position*, in STANFORD ENCYCLOPEDIA OF PHILOSOPHY (rev. Apr. 3, 2019), <https://plato.stanford.edu/archives/sum2019/entries/original-position>; see also Amartya Sen, Drummond Professor of Pol. Econ., Oxford Univ., *The Tanner Lecture on Human Values: Equality of What?*, 213–14 (May 22, 1979) (transcript available at http://www.ophi.org.uk/wp-content/uploads/Sen-1979_Equality-of-What.pdf) (“[Primary social goods] are ‘things that every rational man is presumed to want,’ including ‘rights, liberties and opportunities, income and wealth, and the social bases of self-respect.’”).

⁶⁹ *The WHO Model List of Essential Medicines for Children*, WORLD HEALTH ORG., <https://www.who.int/initiatives/gap-f/our-portfolio/essential-medicines> (last visited June 29, 2021).

access to information, ideas, and goods that serve basic needs.⁷⁰ As she imagines it, such equality would require strict scrutiny of intellectual property grants (as well as interventions that would limit exclusions) that limit access to such goods.⁷¹ But while there is a greater commitment to equal access to lifesaving drugs like vaccines than to nonessential “lifestyle-enhancing” drugs like erectile dysfunction treatment, distinguishing between an innovation want and an innovation can be difficult.⁷²

But despite the dominance of affordability concerns in the public mind when it comes to access to innovation, availability, not just affordability, matters to access. While the often eye-popping prices of pharmaceutical drugs provide a steady diet of headlines,⁷³ the instability of generic supply or the lack of an appropriate formulation or medicine in the first place also present real obstacles.⁷⁴ Companies are reluctant to invest in products for which profit margins are likely to be low. One factor impacting availability, then, depends on the extent to which the market for an innovation is divided. While innovation trickle-down is somewhat suited for “crossover” conditions like COVID-19 and HIV/AIDS, which impact large numbers of patients across many countries, other conditions are split along patient and profitability lines. Neglected diseases like tuberculosis afflict a large but poor swath of people living in developing countries.⁷⁵ Particular geographic and demographic needs—for example, effective COVID-19 vaccines that do not require a cold chain or pediatric formulations for HIV drugs appropriate for infants and children⁷⁶—are also underserved by traditional innovation processes. When an innovation need is

⁷⁰ Margaret Chon, *Intellectual Property and the Development Divide*, 27 CARDOZO L. REV. 2821, 2885, 2894–95 (2006).

⁷¹ *Id.* at 2885.

⁷² While some might even argue access to Viagra is necessary, not just helpful, most would probably agree that high-speed internet access, for example, has already become essential. See Tom Wheeler, *5 Steps to Get the Internet to All Americans*, BROOKINGS (May 27, 2020), <https://www.brookings.edu/research/5-steps-to-get-the-internet-to-all-americans/> (describing high-speed internet access as “no longer ‘nice to have,’ [but] critical”).

⁷³ See, e.g., Ron Wyden, *Let Medicare Negotiate Lower Drug Prices*, BOS. GLOBE (Oct. 25, 2021), <https://www.bostonglobe.com/2021/10/25/opinion/let-medicare-negotiate-lower-drug-prices/> (describing “headline-grabbing drugs at outrageous prices,” such as the \$56,000 per year cost of Alzheimer drug Aduhelm, despite “limited evidence of its effectiveness”).

⁷⁴ Difficulty of access to a child-friendly, palatable, and flexibly dosable (e.g., syrup) form of HIV medicine is one example. Tom Kalil, Deborah M. Birx & Colleen V. Chien, *Accelerating Access to Innovation and Saving Children’s Lives*, WHITE HOUSE (Dec. 5, 2014), <https://obamawhitehouse.archives.gov/blog/2014/12/05/accelerating-access-innovation-and-saving-children-s-lives>.

⁷⁵ *Tuberculosis*, WORLD HEALTH ORG. (Oct. 14, 2021), <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>.

⁷⁶ See Kalil et al., *supra* note 74.

unique to a poor or underrepresented population, there is a greater risk of it going unmet as innovative energy is drawn elsewhere.⁷⁷

Economic inequality can intensify these dynamics. The rise of the rich in the last few decades has caused firms to strategically shift their innovative energies toward rich households⁷⁸ and away from mass markets, where margins are smaller. Although rich consumers are more profitable, intense competition in the premium goods segment has led, somewhat counterintuitively, to *lower* inflation of high-priced goods, like craft beer, relative to lower-priced goods, like mass-market beer.⁷⁹ Income inequality means the innovation needs of the lower class may be overlooked, which, in turn, exacerbates consumption and income inequality. But it also creates consumer choice and hopefully, eventually, higher-quality goods for all.

Taken together, the inequalities of innovation reveal some underappreciated contrasts and surprising insights. *Equality of opportunity* to innovate, among potential inventors, is essential to progress and the achievement of human potential, but some amount of *economic inequality* also supports experimentation, risk-taking, and racing for rents. *Equality of access* to innovation among the masses encompasses not only the affordability but also the availability of innovations to meet the needs of diverse populations. The commitment to *equality of access* to innovation extends to essential or basic goods, but not necessarily to others. The relationship between each of the inequalities of innovation is complex, contested, and non-generalizable across specific contexts. For example, if extreme inequality is a problem, perfect equality of income, access, or opportunity is not necessarily desirable if it means everyone will be worse off. The demand for justice is not necessarily that all incomes or outcomes be equal, or even that every single opportunity be open to all, but that all have the right to not only survive but thrive.

Fig. 1: Dimensions of the Inequalities of Innovation

⁷⁷ See generally Rachel E. Sachs, *Prizing Insurance: Prescription Drug Insurance as Innovation Incentive*, 30 HARV. J.L. & TECH. 153 (2016) (accounting the various policy and quasi-policy mechanisms that have been suggested to correct these imbalances).

⁷⁸ Xavier Jaravel, *The Unequal Gains from Product Innovations*, 134 Q.J. ECON. 715, 717 (2019) (demonstrating how, empirically and theoretically, higher-income households experienced a faster increase in product variety and lower inflation due to firms becoming increasingly attuned to their needs in the face of rising inequality).

⁷⁹ See *id.* at 716, 755–57.

The Inequalities of Innovation	Impacted Population	Example Dimensions
Economic (Wealth and Income) Inequality	All	Top (1%) vs. decile (10%) or “general” inequality; global vs. national inequality
Inequality of Opportunity to Innovate	Potential Inventors	Proxied by innovation-driven economic mobility, robustness of entry; concentration vs. competition in innovation
Inequality of Access to Innovation	Consumers	Availability vs. affordability; essential vs. non-essential innovations; and segmented/neglected vs. crossover conditions and customers

B. Three Patents and a Century of Innovation

But how do the inequalities of wealth, opportunity to innovate, and access to innovation map to particular inventions? The following section explores this question through the lens of three innovations over the last century: a steam engine invention from the 1900s during the golden age of *opportunity to innovate*; a pharmaceutical drug from the 1960s that raises questions about *equality of access to innovation*; and a database automation invention from 2015, the job-replacing nature of which has implications for *equality of income*. Each invention was selected as illustrative of the era in which it arose.⁸⁰

The third invention—database automation—may be the most familiar to contemporary readers. As described below, many of the traits that make that patent similar to others of its era—its multiple ethnically diverse and international inventors, digital nature, and assignment to a large corporation—distinguish it from earlier patents. Over the decades spanned by these three patents, patented innovation has become more corporate, foreign-origin, metropolitan, coastal, and information technology based.

⁸⁰ See *infra* Appendix (showing figures depicting the settings and technologies of invention from the 1900s or 1980s to 2020).

Using inventions to study the relationship between inequality and innovation has several benefits. The “what” of a patent—the problem the disclosed invention solves and how it does so—in many cases has implications for the relationship between labor and capital at the heart of *economic inequality*. The “who” of a patent—the recorded inventors and owner—reveals who has an *opportunity to innovate*. The “how” of a patent—how long it stays in force and how it is kept or traded—influences the availability and accessibility of the invention to consumers, bearing upon *inequality of access to innovation*.

But studying innovations through the patents that cover them has its drawbacks as well. Inventions are downstream; they are the product, rather than the starting point, of many decisions that impact who participates in innovation. In addition, many patents never mature into commercialized innovations and therefore have limited relevance to consumer access or economic inequality. Lastly, many, perhaps most, innovations are never patented. To avoid these pitfalls, care was taken to choose commercially important inventions for which patent records, as well as historical and forensic information, were available.

I. A “Steam Engine” (1905) and the Golden Age of Innovation Opportunity

Over nine million patents and over one hundred years ago, the Patent Office granted patent 782,814 (“’814 patent”) for a “Steam Engine.”⁸¹ The patent covered “new and useful [i]mprovements” in the production of steam engines that simplified their manufacture.⁸² By the time the ’814 patent was granted, nearly 150 years had elapsed since James Watt’s introduction of the steam engine.⁸³

But the patent’s inventorship suggests the broad opportunities to innovate available to (some) Americans during this time, and its content hints at the impact of steam engine technologies on the relationship between labor and (innovation) capital. The ’814 patent was invented by Frank H. Ball,⁸⁴ who, like

⁸¹ U.S. Patent No. 782,814 (filed Jan. 26, 1903).

⁸² *Id.*

⁸³ See Aimee Chin, Chinhui Juhn & Peter Thompson, *Technical Change and the Demand for Skills During the Second Industrial Revolution: Evidence from the Merchant Marine, 1891–1912*, 88 REV. ECON. & STATS. 572, 572 (2006) (outlining the timeline of the steam engine innovation).

⁸⁴ ’814 patent, *supra* note 81.

most inventors at the time,⁸⁵ invented independently.⁸⁶ Ball was from New Jersey, part of the mid-Atlantic region's reign as the most inventive part of the United States.⁸⁷

During the “golden age” of inventing,⁸⁸ inventors devised, patented, and capitalized on their ideas independently, outside of corporations.⁸⁹ Unlike the British patent system on which it was based, the early American patent system encouraged equality of opportunity and broad participation through low fees, merit-based review,⁹⁰ and ways for geographically dispersed inventors to participate.⁹¹ It worked to a degree:⁹² rural patenting was robust and the majority of “great inventors” had little to no formal schooling.⁹³ Less than a quarter of inventors attended college, often relying instead on the ingenuity that led their forebears to immigrate to the United States in the first place.⁹⁴

Steam engine technology itself created demand for unskilled labor. Compared to earlier-generation sailboats,⁹⁵ which required many skilled seamen to move the ropes and position the masts, spars, and sails,⁹⁶ the new steam-

⁸⁵ See Naomi R. Lamoreaux, Kenneth L. Sokoloff & Dhanoos Sutthiphisal, *The Reorganization of Inventive Activity in the United States During the Early Twentieth Century* 46 (Nat'l Bureau of Econ. Rsch., Working Paper No. 15440, 2009) (showing that 70.8% of patents were not assigned in 1890–91); *infra* Appendix Figure 2: Independent Inventors 1900–2020.

⁸⁶ After inventing the steam engine, Ball continued to invent, at times with his son F.A. Ball. See, e.g., Brake, U.S. Patent No. 779,111 (issued Jan. 3, 1905); Friction-Clutch, U.S. Patent No. 808,622 (issued Jan. 2, 1906); Carbureter, U.S. Patent No. 1,391,930 (issued Sept. 27, 1921); see also CARL BREER, *THE BIRTH OF CHRYSLER CORPORATION AND ITS ENGINEERING LEGACY* 44 (1995). This made Ball more prolific than the typical inventor in the 1900s, who had only one or two patents to their name. B. ZORINA KHAN, *THE DEMOCRATIZATION OF INVENTION: PATENTS AND COPYRIGHTS IN AMERICAN ECONOMIC DEVELOPMENT, 1790–1920*, at 112 (2005) (reporting that, in 1850, about 60% of inventors had a single patent to their name and about 18% had two).

⁸⁷ KHAN, *THE DEMOCRATIZATION OF INVENTION*, *supra* note 86, at 189 tbl.7.1.

⁸⁸ MERRITT ROE SMITH ET AL., *HISTORICAL PERSPECTIVE ON INVENTION & CREATIVITY* 18 (2003), <http://web.mit.edu/monicar/Public/old%20stuff/For%20Dava/Grad%20Library.Data/PDF/history-3289136129/history.pdf>.

⁸⁹ *Id.* at 22.

⁹⁰ Petra Moser, *Patents and Innovation: Evidence from Economic History*, 27 J. ECON. PERSPS. 23, 27 (2013) (describing the markedly lower patenting fees charged in the United States compared to Britain).

⁹¹ See *id.* (for example, by permitting patenting by mail).

⁹² Even as it was geographically open, the American patent system was structurally in many ways closed to patenting by foreigners, slaves, and married women as inventors. For a description, see *infra* in Section II.B.2.

⁹³ B. Zorina Khan & Kenneth L. Sokolof, *Institutions and Democratic Invention in 19th-Century America: Evidence from “Great Inventors,” 1790–1930*, 94 AM. ECON. REV. 395, 396–97 (2004).

⁹⁴ *Id.* at 397.

⁹⁵ Chin, *supra* note 83, at 573.

⁹⁶ *Id.*

powered boats were simple to operate.⁹⁷ A lead engineer looked after the machinery and ensured that boilers and other parts functioned properly.⁹⁸ Unskilled workers were also needed to continuously carry and shovel coal into the boiler.⁹⁹ The transition to steam-based travel favored lower-skill workers, making it biased toward the unskilled.

2. “Naloxone” (1966) and Access to Innovation

Decades later, the USPTO granted patent 3,254,088 (“’088 patent”) to a morphine derivative that would come to be known by the trade name “naloxone.”¹⁰⁰ Unlike Ball’s steam engine invention, naloxone’s breakthrough was serendipitous, the product of efforts by inventor Jack Fishman and his collaborators to find a constipation cure.¹⁰¹ But, like the steam engine, naloxone was as typical of its time as it was different from previous generations of inventions.

Perhaps the most dramatic change in the nature of innovation in the twentieth century was the shift in the setting of invention from independent inventing during its golden age as described above¹⁰² to corporate research and development performed in companies and nonprofit labs. Both settings were at play in the development of naloxone: Fishman was a staff member of the Sloan-Kettering Driven Institute for Cancer Research, and also held a part-time position at a private lab.¹⁰³ From 1906, the time of the steam engine, to 1966, the first patent on naloxone, the share of patents to independent inventors shrank dramatically, from about 80% to less than 20%, while the share of patents to corporations soared.¹⁰⁴ As Catherine Fisk has described, the rise of employee invention and associated assignment of patent rights to companies removed the “fuel of interest,” as supplied by a patent, from “the fire of genius.”¹⁰⁵ This

⁹⁷ *Id.*

⁹⁸ *Id.*

⁹⁹ *Id.* at 574.

¹⁰⁰ See Morphine Derivative, U.S. Patent No. 3,254,088 (filed Mar. 14, 1961) (issued May 31, 1966).

¹⁰¹ Nancy D. Campbell, *Just Say Know: A Social History of How Naloxone Came to Matter*, 34 SOC. HIST. ALCOHOL & DRUGS 196, 207–08 (2020).

¹⁰² SMITH ET AL., *supra* note 88, at 18.

¹⁰³ William Yardley, *Jack Fishman Dies at 83; Saved Many from Overdose*, N.Y. TIMES (Dec. 14, 2013), <https://www.nytimes.com/2013/12/15/business/jack-fishman-who-helped-develop-a-drug-to-treat-overdoses-dies-at-83.html>.

¹⁰⁴ See *infra* Appendix Figure 2: Share of Patents to Independent Inventors.

¹⁰⁵ Catherine L. Fisk, *Removing the ‘Fuel of Interest’ From the ‘Fire of Genius’: Law and the Employee Inventor, 1830-1930*, 65 U. CHI. L. REV. 1127, 1129 (1998) (quoting Abraham Lincoln, *Second Lecture on Discoveries and Inventions* (Feb. 11, 1859), in THE ABRAHAM LINCOLN ASSOCIATION, THE COLLECTED WORKS OF ABRAHAM LINCOLN 363 (Roy Basler 3d ed. 1953)).

transition accompanied shifts in the nature of innovation. Early in the 1900s, most patents covered “mechanical engineering” inventions, like the steam engine.¹⁰⁶ But from the 1950s to the 1980s, chemical inventions like naloxone, as well as petrochemicals and plastics, were ascendant,¹⁰⁷ as alluded to by a famous line of the movie *The Graduate*.¹⁰⁸

When the opioid epidemic of the 2010s hit (the third of several),¹⁰⁹ naloxone ended up in the center of a major access-to-innovation controversy. Administration of the drug, by then deemed “essential,”¹¹⁰ was one of the only ways to avoid overdose deaths. Two formulations were introduced: Narcan, a nasal spray,¹¹¹ and Evzio, an applicator designed to be used by third parties following a set of voice prompts.¹¹² The chemical was by now old and cheap, but these delivery mechanisms were new and expensive. The price of Evzio climbed at one point to \$4,500 for a two-pack,¹¹³ placing it far out of reach of most overdose patients.¹¹⁴ Health officials demanded that the new delivery mechanisms be made more affordable and accessible, to “save the lives of people overdosing.”¹¹⁵ Drugmaker Kaléo eventually bowed to public pressure and cut the price.¹¹⁶ Whether or not the firm’s resulting “loss of profit” led to

¹⁰⁶ See *infra* Appendix Figure 4: Technology Trends Among Granted Patents.

¹⁰⁷ See *infra* Appendix Figure 4: Technology Trends Among Granted Patents.

¹⁰⁸ THE GRADUATE (Lawrence Truman Productions 1967). The movie features the famous line: “‘I have one word for you.’ ‘Plastics. There is a great future in plastics.’” Anne M. Fine, *What the Movie “The Graduate” Got Wrong*, THRIVE (Nov. 30, 2016), <https://thriveglobal.com/stories/what-the-movie-the-graduate-got-wrong-2/>.

¹⁰⁹ *Understanding the Epidemic*, CTRS. FOR DISEASE CONTROL & PREVENTION, <https://www.cdc.gov/drugoverdose/epidemic/index.html#three-waves> (last visited Mar. 17, 2021).

¹¹⁰ *Naloxone*, WORLD HEALTH ORG., <https://list.essentialmeds.org/medicines/39> (last visited Aug. 9, 2021) (showing Naloxone to be an essential drug, first added in 1977).

¹¹¹ *What Is Narcan Nasal Spray?*, NARCAN, <https://www.narcan.com/> (last visited Aug. 9, 2021).

¹¹² Underscoring the tragedy of the opioid epidemic, the Evzio applicator is simple enough for an adolescent to use. In a calm yet firm voice, the talking applicator instructs its user to “[p]ull off the [r]ed safety guard,” inject the drug by “[p]ress[ing] firmly . . . for 5 seconds,” “through clothing, if needed,” and “get emergency medical help right away.” *Instructions for Use, EVZIO*, https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=5f8e8d17-a72f-406d-a736-48e61620f9d8&type=display#s_ifu (last visited June 13, 2021).

¹¹³ Letter from Robert Weissman, President, Pub. Citizen, & Leana Wen, Comm’r, Balt. City Health Dep’t, to Kellyanne Conway, Couns. to the President of the United States (May 3, 2018) (<https://www.citizen.org/wp-content/uploads/naloxone-product-government-use-request.pdf>).

¹¹⁴ See Susan Salmond & Virginia Allread, *A Population Health Approach to America’s Opioid Epidemic*, 38 ORTHOPAEDIC NURSING 95, 96 (2019).

¹¹⁵ Weissman & Wen, *supra* note 113.

¹¹⁶ Ned Pagliarulo, *Kaléo, Facing Criticism, Launches Generic Overdose Treatment at Cut Price*, BIOPHARMA DIVE (Dec. 12, 2018), <https://www.biopharmadive.com/news/kaleo-facing-criticism-launches-generic-overdose-treatment-at-cut-price/544237/>.

slowed innovation that could have further extended access to lifesaving drugs among the “worst-off” is both something that a Rawlsian might ask and something that is impossible to answer with certainty.

3. “Database Automation” (2015) and Income Inequality

By the time the Patent Office issued patent 9,201,944, covering database automation techniques to Oracle Corporation,¹¹⁷ “electrical engineering” rather than chemical inventions dominated.¹¹⁸ The first named inventor on the patent was company founder and then-CEO Larry Ellison,¹¹⁹ who, for his contributions, received total compensation that was more than 1,000 times what the average employee earned.¹²⁰ But while the steam engine and naloxone patents named one and two inventors, respectively, the Oracle patent named nine.¹²¹ The majority of Ellison’s co-inventors have Indian surnames, and all appear to reside in the San Francisco Bay Area,¹²² reflecting more recent trends. Using ethnic name registries, Bill Kerr and others have traced the increase of shares of Asian inventors on U.S. patents¹²³ to the point that, by 2018, one in every eleven patents was invented or co-invented by a Chinese or Indian individual residing in the Bay Area.¹²⁴ According to LinkedIn, several of the Oracle inventors came to the United States to attend graduate school before joining the company,¹²⁵ also reflective of a growing trend.¹²⁶

What about the impact of “database automation,” not on Oracle workers, but

¹¹⁷ U.S. Patent No. 9,201,944 B2 (issued Dec. 1, 2015) [hereinafter ‘944 Patent].

¹¹⁸ See *infra* Appendix Figure 4: Technology Trends Among Granted Patents.

¹¹⁹ ‘944 Patent, *supra* note 117.

¹²⁰ Dawn Kawamoto, *Scary: Oracle CEO-Worker Salary Gap*, DICE (Sept. 27, 2013), <https://insights.dice.com/2013/09/27/scary-oracle-ceo-worker-salary-gap-071/>.

¹²¹ ‘944 Patent, *supra* note 117.

¹²² *Id.* (listing inventors Amit Ganesh, Vineet Marwah, Anindya C. Patthak, Shasank K. Chavan, and Manosiz Bhattacharyya).

¹²³ William R. Kerr, *U.S. High-Skilled Immigration, Innovation and Entrepreneurship: Empirical Approaches and Evidence* 5 (Nat’l Bureau of Econ. Rsch., Working Paper No. 19377, 2013) (showing the increase in shares of Indian and Chinese inventors from 1975 to 2004, from under 2% to 6% and 9%, respectively); accord Katie Puckett, *World in Motion*, KATIE PUCKETT’S WRITING (Sept. 15, 2019), <https://katiepuckett.com/2019/09/15/world-in-motion/>.

¹²⁴ WILLIAM R. KERR, *THE GIFT OF GLOBAL TALENT* 50, 59 (2019) (relying on analysis of surnames that reflect ethnic heritage).

¹²⁵ See, e.g., Amit Ganesh, LINKEDIN, <https://www.linkedin.com/in/amit-ganesh-a5692a/> (last visited June 30, 2020) (reporting also that Ganesh started a PhD at Stanford but left after one year); Vineet Marwah, LINKEDIN, <https://www.linkedin.com/in/vineetmarwah/> (last visited June 30, 2020).

¹²⁶ JOSH TRAPANI & KATHERINE HALE, NAT’L SCI. BD., *HIGHER EDUCATION IN SCIENCE AND ENGINEERING* 43 (2019), <https://nces.nsf.gov/pubs/nsb20197/assets/nsb20197.pdf> (showing that temporary visa holders earned 56% of U.S. doctoral degrees in computer science in 2017).

the employees of Oracle's corporate customers? Although more work is required to enter information into a database and set up its continual capture, subsequent uses require a lot less manual data entry and processing, reducing headcount. Across Oracle's extensive enterprise database customer base, skilled workers have become more efficient, databases have taken over the tasks previously performed by low-skilled workers, and new opportunities have been created.¹²⁷ Similar stories of automation leading to job loss and rising inequality can be told across the economy.¹²⁸

C. Tensions Within and Among Inequalities

Considered separately, each of the inventions described above tells its own story about the inequalities of innovation, reflecting who gets to participate and profit from innovation, who gets access to innovation, and who wins and who loses economically from the resulting innovation. Analyzing them together reinforces the tensions between notions of equity and innovation, as explored below.

¹²⁷ ORACLE, IMPROVE PRODUCTIVITY & EFFICIENCY WITH SELF-SERVICE PORTALS 10–11 (2013), <https://www.oracle.com/technetwork/middleware/webcenter/portal/overview/webcenter-portal-customers-2016644.pdf>.

¹²⁸ Harry Holzer, *Understanding the Impact of Automation on Workers, Jobs, and Wages*, BROOKINGS (Jan. 19, 2022), <https://www.brookings.edu/blog/up-front/2022/01/19/understanding-the-impact-of-automation-on-workers-jobs-and-wages/> (describing those who are directly displaced by machines, including many clerical and production workers, as among those who “lose out,” adding to labor market inequality).

Fig. 2: Tensions Within and Among the Inequalities of Innovation

Inequalities of Innovation	Examples / Tensions
Economic Inequality	“Unskilled-unbiased” (steam engine) vs. “Skilled-biased” (database automation) technological change
Inequality of Opportunity to Innovate	Domestic equality of opportunity (steam engine) vs. global equality of opportunity (database automation)
Inequality of Access to Innovation	Competition (generic naloxone) vs. consumer availability (Evzio applicator) vs. consumer affordability (Evzio pricing)

1. Income Inequality: Independent Versus Corporate Inventors, Skilled Versus Unskilled Bias

Who benefits from innovation on the production (as opposed to consumption) side? The vignettes above highlight two issues concerning how the spoils of innovation are shared by the innovator and her employer, and, more generally, how innovation impacts workers.

Though patent rights have always vested initially in inventors, the rise of corporate- or lab-based invention under assignment and associated equitable doctrines¹²⁹ means that, in the United States, the firm, not the inventor, owns the invention. Unlike in a number of major European jurisdictions, there are limited expectations of remuneration by the employer other than the employee’s salary.¹³⁰ The progression from the “solo” inventor of the steam engine patent

¹²⁹ Including the “shop right” and “hired to invent” doctrines, the latter which operates on the theory that the inventor hired to solve a particular problem has already been rewarded through her compensation. *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 187 (1933).

¹³⁰ Morag Peberdy & Alain Strowel, *Employee’s Rights to Compensation for Inventions—A European Perspective*, LIFE SCIS. 64 (Mar. 5, 2010), <https://www.cov.com/~media/files/corporate/publications/2010/01/employees-rights-to-compensation-for-inventions—a-european-perspective.ashx> (describing policies in France and Germany).

to the nine Oracle employees named on the database patent suggests that the gains from innovation are presently more likely to flow to *investors* than inventors. However, the distinction may be less important than it seems. While independent inventors, similar to Ball, have captured a diminishing share of overall patents, investment in technological innovation and entrepreneurship is at an all-time high.¹³¹ In addition, individuals benefit, both from being named as inventors, even on corporate patents, and from the valuable knowledge they acquire through invention, which, in many cases, can be taken to other firms. Non-competes are illegal in California, and it appears that at least one of the Oracle inventors has gone on to become a successful tech executive at a competing firm, drawing upon his knowledge of databases.¹³²

A second set of issues is centered around Ricardo's "machinery question:" will technology take the jobs?¹³³ The steam engine and database automation inventions provide conflicting answers underscoring that innovation does not impact the demand for jobs consistently. Steam engine technology is what Clayton Christensen calls an "empowering" innovation—one that so fundamentally changes how things are done that it creates new jobs for those who build, distribute, and provide products and services *newly made possible*.¹³⁴ Steamboat technology created demand for coal carriers and a whole generation of workers while reducing the need for highly skilled sailors, making it *unskilled-biased*. "Efficiency" inventions, on the other hand, reduce the cost of making and distributing *existing* products and services, in theory freeing them up for investments in empowering innovations.¹³⁵ By reducing the need for repetitive, manual tasks like data entry, database automation innovations have reduced the number of clerical and accounting tasks for which human workers are needed.¹³⁶

Artificial intelligence is predicted to lead to substantial job losses across the economy,¹³⁷ but not uniformly. Among the jobs most likely to be impacted by

¹³¹ Sam Shear, *Venture Capitalists Invested More Money than Ever into Start-Ups Last Year*, CNBC (Jan. 13, 2022, 9:31 AM), <https://www.cnbc.com/2022/01/13/vcs-invested-more-money-than-ever-into-start-ups-last-year.html>. ("Venture capitalists invested more than \$675 billion in start-ups worldwide in 2021, doubling 2020's previous all-time high.")

¹³² See Amit Ganesh, LINKEDIN, *supra* note 125 (indicating that Ganesh now runs Google Cloud's database portfolio of products as a VP of Engineering).

¹³³ See RICARDO, *supra* note 45, at 283.

¹³⁴ Clayton M. Christensen, *A Capitalist's Dilemma, Whoever Wins on Tuesday*, N.Y. TIMES (Nov. 3, 2012), <https://www.nytimes.com/2012/11/04/business/a-capitalists-dilemma-whoever-becomes-president.html>.

¹³⁵ *Id.*

¹³⁶ Though it is also true that database technologies have opened up new ways of doing business, taking on some characteristics of empowering innovations.

¹³⁷ Susan Lund, James Manyika, Liz Hilton Segel, André Dua, Bryan Hancock, Scott Rutherford & Brent

advances in artificial intelligence is *high-skill* radiology, because computers are proving to be better at spotting patterns in scans than trained doctors.¹³⁸ Likewise, numerous automotive and mechanic jobs that do not require a college degree are among those *least* likely to be replaced by robots, because they require in-home service or on-site individualized problem-solving.¹³⁹

These examples illustrate the distinct, and often unpredictable, ways that the introduction of technology can impact the distribution of work and wages. The interface between patented innovation and labor is both innovation-specific and job-specific. The regulatory and social context also matters. Technology is not destiny.

2. *Equality of Opportunity to Innovate: Global Versus Domestic*

A closely related question to who benefits from innovation is who is poised to participate in innovation, which relates to equality of opportunity to innovate. In one sense, the solo, independent invention of Ball's steam engine would seem to have little in common with the collaborative, immigrant-driven invention of the Oracle database. In another sense, though, the two represent bookends in the American equality-of-opportunity story, in which a person's ingenuity, hard work, and determination, regardless of her background, will be rewarded. But whether recent trends are cause for celebration or concern depends on who you ask.

To optimists, one of the greatest virtues of America's tech sector is that it has brought talent from around the world to contribute to growing the American economy. Immigrants have founded some 40% of Fortune 500 companies¹⁴⁰ and started the majority of "unicorn" startups.¹⁴¹ Silicon Valley owes much to global

Macon, *The Future of Work in America: People and Places, Today and Tomorrow*, MCKINSEY & CO. (July 11, 2019), <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-in-america-people-and-places-today-and-tomorrow#> ("[W]ithin 60 percent of jobs, at least 30 percent of activities could be automated . . . [with] currently demonstrated technologies.").

¹³⁸ Sara Reardon, *Rise of Robot Radiologists*, NATURE (Dec. 18, 2019), <https://www.nature.com/articles/d41586-019-03847-z>.

¹³⁹ See Sarah Gonser, *Ten Jobs that Are Safe from Robots*, HECHINGER REP. (Sept. 18, 2018), <https://hechingerreport.org/ten-jobs-that-are-safe-from-robots/> (arguing that automotive and mechanic jobs are robot-proof jobs because they require "technical knowledge plus problem-solving and customer service skills").

¹⁴⁰ Alice Gast, *A Magic Pony and America's Unicorns: How Immigrants Spark Innovation*, WORLD ECON. F. (Jan. 17, 2017), <https://www.weforum.org/agenda/2017/01/a-magic-pony-and-americas-unicorns-why-we-need-immigrants-to-spark-innovation-in-business-and-science/>.

¹⁴¹ STUART ANDERSON, NAT'L FOUND. FOR AMER. POL'Y, IMMIGRANTS AND BILLION DOLLAR STARTUPS 4 (2016), <https://www.immigrationresearch.org/system/files/Immigrants-and-Billion-Dollar-Startups.NFAP-Policy-Brief.March-2016.pdf>. Unicorn startups are those valued at \$1 billion or more. *Id.*

talent: in 2016, more than half of computer science doctoral degree earners were immigrants.¹⁴² Their success, it would seem, proves that the United States offers an equal opportunity for the most talented individuals, regardless of origin, to succeed.

Yet, these trends also support a more pessimistic view centered on the failure of the United States to cultivate domestic STEM capacity to fill local needs. An accounting of the costs and benefits of high-skill immigration reveals why: when a firm employs a highly skilled worker, both the immigrant and the firm benefit. The immigrant gains expanded opportunities and wages, and the firm taps into a greater supply of talents and skills.¹⁴³ But, at the same time, some domestic workers lose, faced with increased competition for high-skilled jobs. When the tech industry blames a skills gap for needing to look abroad but does not raise wages,¹⁴⁴ they appear to be putting their own self-interests and the desire to access talent from a broad range of people above the interests of citizens. So does the tech lobby's interest in high-skilled immigration but more muted presence in policy discussions about improving domestic STEM education.¹⁴⁵ Leveling opportunities globally, it would seem, reduces the need to insist on shoring up equality of opportunity domestically.

Loosely applying a version of Rawls's "Difference Principle"—that inequalities that improve the worst-off are tolerable—does high-skilled immigration benefit all, including those with the least? Studies have found that a 1% increase in immigrant college graduates resulted in 9–18% more patents per capita, benefiting the whole economy.¹⁴⁶ Rather than being displaced, native patenting actually increases when H-1B workers innovate,¹⁴⁷ which implies that

¹⁴² *Science & Engineering Doctorates, Which Fields Attract Students?*, NAT'L SCI. FOUND. (Dec. 2017), <https://www.nsf.gov/statistics/2018/nsf18304/report/which-fields-attract-students/temporary-visa-holders.cfm>.

¹⁴³ See C. Fritz Foley & William R. Kerr, *Ethnic Innovation and U.S. Multinational Firm Activity*, 59 MGMT. SCI. 1529, 1529 (2013).

¹⁴⁴ See, e.g., Peter Cappelli, *Skill Gaps, Skill Shortages and Skill Mismatches: Evidence for the U.S.* 3, 37 (Nat'l Bureau of Econ. Rsch., Working Paper No. 20382, 2014) (questioning the idea of a "skills gap" and positing that over-education is a more pressing problem than under-education).

¹⁴⁵ See Pawel Popiel, *The Tech Lobby: Tracing the Contours of New Media Elite Lobbying Power*, 11 COMMUN CULTURE & CRITIQUE 566, 572, 578 (2018) (showing that, according to an analysis of House lobbying disclosures from 2005–2016, immigration, but not STEM education, is one of the top priorities of the tech lobby); Pawel Popiel, *The Tech Lobby: Tracing the Contours of New Media Elite Lobbying Power* 1, app. at 20 tab.2 (2018), https://www.researchgate.net/publication/331049004_The_Tech_Lobby_Tracing_the_Contours_of_New_Media_Elite_Lobbying_Power.

¹⁴⁶ Jennifer Hunt & Marjolaine Gauthier-Loiselle, *How Much Does Immigration Boost Innovation?* 5 (Inst. for the Study of Lab., Working Paper No. 3921, 2009).

¹⁴⁷ *Id.* at 3.

immigration grows the innovation pie. However, given regional differences, whether these trends put “the worst-off” in the United States on better footing is harder to discern. Even the idea that expanding immigration gives rise to global “equality of opportunity,” upon scrutiny, may deserve qualification. Two out of the three immigrant Oracle inventors¹⁴⁸ attended India Institute of Technology (IIT) colleges, which some view as bastions of privilege.¹⁴⁹ Even for a concept as universally accepted as equality of opportunity, competing considerations may come into play.

3. *Equality of Access to Innovation: Availability Versus Affordability*

Among the inequalities of innovation, conflicts may arise not only along dimensions of a particular ideal (i.e., global vs. domestic equality of opportunity) but *between* egalitarian goals. What happened after the invention of naloxone shows how the goal of equality of access to innovation, in terms of availability *and* affordability, was not necessarily served initially by the expiration of the initial patent that made generic entry possible.

Several years after naloxone was first patented, it was approved for use in emergency treatment of opioid overdose via injection into a muscle or vein by a professional.¹⁵⁰ The patent expired in 1985,¹⁵¹ and, from 1985–86, four new injectable formulations were approved.¹⁵² However, despite the new availability of the drug, use did not grow.¹⁵³ The waning of the heroin epidemic played some part.¹⁵⁴ But so did the waning of the patent. According to accounts, as profits disappeared with the expiration of the naloxone patent, “there was no longer

¹⁴⁸ See *supra* note 125 and accompanying text.

¹⁴⁹ Eldho Matthews, *Who Gets Into India's IITs?*, INSIDE HIGHER ED. (Apr. 14, 2015), <https://www.insidehighered.com/blogs/world-view/who-gets-india;s-iits> (describing a “clear pattern of stratification in terms of access” to IITs, with admission correlated with secondary school type, place of origin of candidates, and family background).

¹⁵⁰ U.S. FOOD & DRUG ADMIN., JOINT MEETING OF THE ANESTHETIC AND ANALGESIC DRUG PRODUCTS ADVISORY COMMITTEE AND THE DRUG SAFETY AND RISK MANAGEMENT ADVISORY COMMITTEE 9 (2018), <https://www.fda.gov/media/121182/download> (describing naloxone as being initially approved in 1971, ten years after the naloxone patent was first applied for); see U.S. Patent No. 3,254,088A, *supra* note 100.

¹⁵¹ Michael Hufford & Donald S. Burke, *The Costs of Heroin and Naloxone: A Tragic Snapshot of the Opioid Crisis*, STAT (Nov. 8, 2018), <https://www.statnews.com/2018/11/08/costs-heroin-naloxone-tragic-snapshot-opioid-crisis/>.

¹⁵² U.S. FOOD & DRUG ADMIN., *supra* note 150, at 16 tbl.1.

¹⁵³ Eliza Wheeler, T. Stephen Jones, Michael K. Gilbert & Peter J. Davidson, *Opioid Overdose Prevention Programs Providing Naloxone to Laypersons*, CTRS. FOR DISEASE CONTROL & PREVENTION tbl.1 (June 19, 2015), <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6423a2.htm> (reporting minimal growth in the use of naloxone from 1996 to 2010).

¹⁵⁴ Keith Humphreys, *An Overdose Antidote Goes Mainstream*, 34 HEALTH AFFS. 1624, 1624 (2015).

much incentive to market it extensively.”¹⁵⁵ Under these circumstances, improving conditions for generic entry did not necessarily translate into improved access for consumers.

When the opioid epidemic hit a few decades later, demand increased but so did problems with a lack of availability of appropriate versions of the drug. The approved delivery path was through a prescription obtained from a doctor.¹⁵⁶ However, as the number of opioid overdoses increased, so did the need for third parties, like first responders, to administer the drug. But such administration was limited, in part because of the risk of injury to the patient during injection.¹⁵⁷ Although relabeling the drug provided a path forward, a lack of patents on the drug meant that no single firm was willing to invest the millions of dollars required to educate the market.¹⁵⁸ That the U.S. healthcare system relies on private firms to do this work arguably contributes to a high risk, high reward dynamic in which patents play an integral role.

The introduction of the easier-to-use and highly patented devices described earlier, in Section I.B.2., boosted access by expanding *availability* of the drug in different forms. The company’s pricing strategy also drastically limited the *affordability* of the drug in its lifesaving form, as discussed earlier.¹⁵⁹ But at the end of the day, it was likely the promise of exclusivity and the ability to price *freely*, not the greater opportunity to compete alone, that created the incentives needed to induce innovation in the administration of the drug.

When the inequalities of innovation are considered in view of several key inventions, the result is a textured story. Economic inequality is a big part of the problem, but it may also be part of the solution when it comes to stimulating advances that will eventually meet the needs of the worst-off. Changes in the nature of innovation, as well as the balance of rights under employment and immigration law, influence the distribution of the gains from innovation. Recent shifts in innovation have arguably been accompanied both by an expansion of global equality of opportunity, *and* unequal domestic opportunities to participate in innovation. Access to innovation has at least two dimensions: price and availability. Price competition, through broad opportunity to participate, may

¹⁵⁵ *Id.*

¹⁵⁶ *Id.* at 1625.

¹⁵⁷ *Id.*

¹⁵⁸ Daniel Kim, Kevin S. Irwin & Kaveh Khoshnood, *Expanded Access to Naloxone: Options for Critical Response to the Epidemic of Opioid Overdose Mortality*, 99 AM. J. PUB. HEALTH 402, 406 (2009).

¹⁵⁹ *See supra* Section I.A.3.

drive down prices, increasing the *affordability* of existing innovations. But more will be needed to foster the new innovations necessary to meet the unique needs of underserved populations and reduce disparities in the *availability* of relevant innovation.

If inequality in innovation is easy to spot, then the dynamics discussed above¹⁶⁰ may explain, in part, why it is hard to solve. First, there are multiple egalitarian goals when it comes to innovation. Second, they are often in tension, and rarely can be generalized. Finally, the impact of inequality of innovation is often unpredictable and dependent not only on the nature of the technology, but also the social, legal, and regulatory context. The next Part turns to the role that innovation law and policy, in particular patent law, play in determining the inequalities of innovation.

II. HOW PATENT LAW ALLEVIATES AND INTENSIFIES THE INEQUALITIES OF INNOVATION

The previous Part examined three inequalities—of wealth/income, opportunity, and access—with relevance to innovation. As the case studies described above show, technological and market factors have shaped who makes, profits from, and accesses innovation, and on what terms. But so have law and policy. For example, labor law dictates what happens when jobs are automated away, and immigration policies have enabled the rise in immigrant inventorship in the United States.

Feeding into a larger conversation about the law as a central, not peripheral, actor in the creation and perpetuation of economic inequality,¹⁶¹ this Part explores the role of patent law and its administration in shaping the inequalities of innovation. Just as the growth in economic inequality is attributable to enhanced returns to capital as compared to economic growth, below, this Article argues that by providing enhanced returns to “invention capital,” the patent system rewards firms and individuals with such capital relative to those without it, potentially widening the inequalities of innovation. This Article uses the term “invention capital”¹⁶² to refer to the financial and human capital, including

¹⁶⁰ A full accounting of these dynamics is beyond the scope of this paper. For example, inequality of opportunity (e.g., due to unequal access to education) reflects, in part, economic inequality. Additionally, unequal access to lifesaving medicines, for example, can also contribute to economic inequality.

¹⁶¹ See, e.g., PISTOR, *supra* note 13, at 3 (arguing that, though largely overlooked, the law creates wealth inequality by selectively “coding” and protecting certain assets, entrenching and concentrating wealth through undemocratic and largely unaccountable processes).

¹⁶² Cf. Jeff Dyer, Nathan Furr & Mike Hendron, *Innovation Capital: The Secret Ingredient Behind the World's Most Innovative Leaders*, FORBES (Sept. 4, 2018),

money, educational resources, skills, experience, and ideas, but also the “social capital”¹⁶³—who you know and can call on—that supports inventing and innovation.

To be sure, the impact of patent policy on the distribution of income, opportunity, and access in many cases will be less direct than that of, for example, education policy (on equality of opportunity), tax policy (on economic inequality), or competition policy (on equality of access). Further, patent policy is only one of many forms of innovation policy,¹⁶⁴ and patented innovation is only one type of innovation. Care must be taken not to overemphasize the importance of patent incentives relative to other innovation.¹⁶⁵ A final objection to this exercise might be that if we do not maximize innovation, then there will be less to redistribute.¹⁶⁶

Notwithstanding these arguments, applying an inequalities lens to patent law is worthwhile for at least a few reasons. The uneven distribution of “invention capital” bears upon the opportunity to participate in innovation. The “public franchise” nature of patents, which “take from the public rights of immense value, and bestow them upon the patentee,” as the Supreme Court has said,¹⁶⁷ makes the system accountable to public interests. Patents also *intersect* with public law doctrines, like tax and competition law. The extent to which the patent bargain is being used to extend, not suppress, opportunity to innovate and access innovation directly shapes the system’s ability to support equitable economic growth.

Building on the tensions highlighted in Part I, this Part explores the ways in which patents can both alleviate and exacerbate the inequalities of innovation.

<https://www.forbes.com/sites/nathanfurrjeffdyer/2018/09/04/innovation-capital-the-secret-ingredient-behind-the-worlds-most-innovative-leaders/?sh=6a0d6315fdf3> (using the term “innovation capital” differently to refer to intangible personal resources that “help[] you win resources to commercialize novel ideas”).

¹⁶³ Michael Woolcock, *The Place of Social Capital in Understanding Social and Economics Outcomes*, ISUMA 11, 12 (2001) (discussing social capital as it pertains to economic development).

¹⁶⁴ See Daniel J. Hemel & Lisa Larrimore Ouellette, *Innovation Policy Pluralism*, 128 YALE L.J. 544, 549–50 (2019) (accounting IP and non-IP innovation policies).

¹⁶⁵ For a parallel argument in the constitutional law sphere, see generally ADRIAN VERMEULE, *THE SYSTEM OF THE CONSTITUTION* 4 (2011) (arguing that, when analyzed in isolation, parts of the Constitution may not seem democratic, but taken together, it works).

¹⁶⁶ This point is reinforced by recent research that suggests that tax policy explains less of the difference in inequality in the United States as compared to Europe than does pre-tax, or “pre-distribution” factors. See generally Thomas Blanchet, Lucas Chancel & Amory Gethin, *Why is Europe More Equal than the United States?* 4 (World Inequality Lab, Working Paper No. 2020/19, 2021), <https://wid.world/document/why-is-europe-more-equal-than-the-united-states-world-inequality-lab-wp-2020-19/>.

¹⁶⁷ *Oil States Energy Servs., LLC v. Greene’s Energy Grp., LLC*, 138 S. Ct. 1365, 1373 (2018) (quoting *United States v. Am. Bell Tel. Co.*, 128 U.S. 315, 370 (1888)).

Invention-driven entrepreneurship, a particular strain of the American rags-to-riches story,¹⁶⁸ can create wealth and economic mobility. The system's inclusive nature enables applicants to gain the validation of a patent, fostering equality of opportunity. The development and diffusion of innovation, through licensing and differential pricing during the patent and generic production after the patent's expiry, support access to innovation. But several mechanisms cut in the opposite direction. The cost and complexity of the patent system tilt the playing field toward firms and people with "invention capital" and away from those without it. This complexity has also posed a challenge to the work of regulators responsible for promoting equality of access and opportunity to innovate.

A. How Patents Alleviate the Inequalities of Innovation

This section outlines ways in which patents alleviate the inequalities of: (1) wealth and income; (2) opportunity to participate in innovation; and (3) access to innovation. Though by no means exhaustive, it draws upon legal, literary, economic, and empirical accounts of the patent system to consider the intersections of patent law and the various inequalities.

¹⁶⁸ As embodied by "Horatio Alger" heroes. Ryan T. Holte, *Trolls or Great Inventors: Case Studies of Patent Assertion Entities*, 59 ST. LOUIS U. L.J. 1, 5 n.5 (2014).

Fig. 3: Patent Mechanisms that Alleviate the Inequalities of Innovation

The Inequalities of Innovation	Patent Mechanisms that Alleviate Inequality
Economic Inequality	Patent Validation and Capital Creation
Inequality of Opportunity to Innovate	Inclusion, Exclusion, and Licensing
Inequality of Access to Innovation	Commercialization and Diffusion Incentives, Price Discrimination, and Spillovers

1. Reducing Economic Inequality Through Validation and “Invention Capital” Creation

One way in which patented innovation reduces economic inequality is by helping those with less gain more over their lifetimes. The inventors and inventions of the previous Part hint at these paths to prosperity. Frank Ball’s patents served as the basis for the Ball Engine Co., the company he co-founded with his partner.¹⁶⁹ Before he was known as “Jack Fishman,” the inventor of naloxone, Jacob Fiszman fled Nazi occupation in Poland with his parents.¹⁷⁰ One of the inventors on the Oracle patent, who immigrated to the United States for schooling, has gone on to become a Silicon Valley executive.¹⁷¹

But patents can also help those with much gain even more. Larry Ellison was one of the richest people in the world by the time he was issued the ’944

¹⁶⁹ KENNETH L. COPE, *AMERICAN STEAM ENGINE BUILDERS: 1800–1900*, at 24 (2006).

¹⁷⁰ Yardley, *supra* note 103.

¹⁷¹ See Amit Ganesh, LINKEDIN, <https://www.linkedin.com/in/amit-ganesh-a5692a/> (last visited July 1, 2021) (indicating that Ganesh went from being an Oracle employee to a VP at Google).

patent.¹⁷² His company has ranked among the top fifty patentees¹⁷³ and has used its patents to sue other large companies.¹⁷⁴ Is patented innovation actually helping to lift incomes at the bottom relative to the top, or making the rich, and the dominant firms they work for, richer? Both, the empirical research suggests.

Philippe Aghion and his coauthors have analyzed the relationship between changes in patenting and changes in income inequality from 1980 to 2015.¹⁷⁵ When the researchers looked at entities that had increased their patenting intensity in general, they did not find an increase in economic mobility. In fact, they found the opposite: increases in the intensity of patenting were correlated with increases in “top income inequality.”¹⁷⁶ The accumulation of patents made the very rich (top 1%) richer, consistent with what we might call the “Larry Ellison effect.”¹⁷⁷

However, when the analysis was limited to patenting by first-time patentees (or “new entrants”), the opposite was true: first-time patenting was positively associated with both increasing economic mobility and decreasing general inequality.¹⁷⁸ Collectively, these facts implicate a Rawlsian tradeoff: the growth in patented innovation has made the rich richer but also the poor richer. California illustrates how both can be true. There, the very rich owe much to innovation: 29% of the increase in the top 1%’s income share over the past decades is due to innovation.¹⁷⁹ But, economic mobility is also high—“much higher than those in the least innovative state”—thanks, at least in part, to patented innovation.¹⁸⁰

But are patents doing the work of innovation-driven economic

¹⁷² Chase Peterson-Withorn, *2015 Forbes 400: Full List of America’s Richest People*, FORBES (Sept. 29, 2015), <https://www.forbes.com/sites/chasewithorn/2015/09/29/2015-forbes-400-full-list-of-americas-richest-people/?sh=5f4c29b73c64>.

¹⁷³ Samuel Stebbins, *The World’s 50 Most Innovative Companies*, USA TODAY (Jan. 12, 2018), <https://www.usatoday.com/story/money/business/2018/01/12/worlds-50-most-innovative-companies/1023095001/>.

¹⁷⁴ Namely Google, in the early stages of the *Oracle v. Google* suit currently pending before the Supreme Court. See generally Sue Gee, *10 Years On: Oracle V Google Still Ongoing*, I PROGRAMMER (Aug. 16, 2020), <https://www.i-programmer.info/news/82-heritage/13925-10-years-on-oracle-v-google.html>.

¹⁷⁵ See Philippe Aghion, Ufuk Akcigit, Antonin Bergeaud, Richard Blundell & David Hemous, *Innovation and Top Income Inequality*, 86 REV. ECON. STUD. 1, 2 (2019).

¹⁷⁶ *Id.*

¹⁷⁷ *Id.*

¹⁷⁸ *Id.* at 5.

¹⁷⁹ *Id.* at 32.

¹⁸⁰ Philippe Aghion, Ufuk Akcigit, Antonin Bergeaud, Richard Blundell & David Hemous, *Innovation, Income Inequality, and Social Mobility*, VOXEU (July 28, 2015), <https://voxeu.org/article/innovation-income-inequality-and-social-mobility>.

empowerment, or are just along for the ride? It is important to acknowledge that the question is irrelevant for the many innovative firms that do not patent. In addition, the answer is likely to be unique for each firm, based on the relative importance of the patent to non-patent assets and comparative advantages. However, relevant research, which has tracked startups that do and do not succeed on their patent applications,¹⁸¹ finds that getting a first patent acts as a catalyst on the path to success.¹⁸² Companies that win the patent “lottery” “create more jobs, enjoy faster sales growth, and are more innovative,”¹⁸³ though these gains may be at the expense of other startups. Just as startups appear to be more responsive to gaining patents, they also seem to be more sensitive to losing them. Galasso and Schankerman have found, in their study of patent invalidations, that the loss of patent rights by small firms significantly increases the likelihood of an exit from patenting.¹⁸⁴

2. *Expanding Equality of Opportunity Through the Currency of Invention*¹⁸⁵

Why might the impacts of entrant patents be so distinct when compared to the impacts of general patenting?¹⁸⁶ For all patent owners, a patent validates an idea’s originality and offers some level of protection. But when an entrepreneur lacks a proven track record, revenue stream, or vetted model, a patent can set her business apart from others. Open to all that apply, the patent system’s *inclusiveness* offers one way for a newcomer to increase her odds of success, through the “certification” of a patent.¹⁸⁷ Having a patent not only serves as a

¹⁸¹ See Joan Farre-Mensa, Deepak Hedge & Alexander Ljungqvist, *What Is a Patent Worth? Evidence from the U.S. Patent “Lottery”*, 75 J. FIN. 639, 640 (2020).

¹⁸² *Id.* at 641; see Natarajan Balasubramanian & Jagadeesh Sivadasan, *What Happens When Firms Patent? New Evidence from U.S. Economic Census Data*, 93 REV. ECON. & STAT. 126, 144 (2011) (finding that increases in patent stock are associated with increases in firm size, scope, and skill and capital intensity, including among first-time patentees).

¹⁸³ Farre-Mensa et al., *supra* note 181, at 641, 677.

¹⁸⁴ Alberto Galasso & Mark Schankerman, *Patent Rights, Innovation, and Firm Exit*, 49 RAND J. ECON. 64, 66 (2018).

¹⁸⁵ For a discussion of software patents as a “currency,” see Colleen V. Chien, *Software Patents as a Currency, Not Tax, on Innovation*, 31 BERKELEY TECH. L.J. 1669, 1679–80 (2016).

¹⁸⁶ See generally Peter Lee, *Reconceptualizing the Role of Intellectual Property Rights in Shaping Industry Structure*, 72 VAND. L. REV. 1197, 1205–11 (2019) (reviewing the literature on how patents facilitate entry and discussing the role of patents at distinct points in a firm’s life).

¹⁸⁷ Indeed, patents have been argued to be “worth little in isolation; financially benefiting from patents depends on institutions such as corporate rent-sharing and venture capital.” JONATHAN S. MASUR & LISA LARRIMORE OUELLETTE, *PATENT LAW: CASES, PROBLEMS, AND MATERIALS* 37 (2021). For a discussion of the disproportional importance of IP rights for entrants and small companies, see generally JONATHAN M. BARNETT, *INNOVATORS, FIRMS, AND MARKETS: THE ORGANIZATIONAL LOGIC OF INTELLECTUAL PROPERTY* (2021).

signal in the market, but it also provides inventors with the confidence to share about and publicize their inventions without fear of being ripped off, thereby resolving the “Arrow information paradox.”¹⁸⁸ Disclosures about an invention outside of (but *made possible* by) a patent to potential investors, customers, members of the scientific and technical community, and the public are potentially just as important as disclosures within the four corners of the patent, to the inventor, and to society.¹⁸⁹

When an entrepreneur lacks the wealth, status, funding, or connections to commercialize an idea, a patent can provide an economic asset that can be borrowed upon, traded, or licensed. This is what happened with naloxone. Jack Fishman’s small firm may not have had the commercialization capabilities available to competitors, but his patent made it easier to sell the technology to a much larger company, Dow DuPont,¹⁹⁰ that did. The ways in which patents flexibly empower have further been illustrated in film, fiction, and fact.

The movie *Joy*, in part, tells the real-life story of a divorced single mother and serial inventor and entrepreneur, Joy Mangano.¹⁹¹ Her first experience ended with the novel flea collar she devised being sold by a manufacturer before she could get to market.¹⁹² Vowing to never lose out like that again, Mangano went on to obtain one hundred patents covering household inventions, like the Miracle Mop and Huggable Hangers.¹⁹³ Her patents prevented her from being ripped off and gave her time, as an outsider in the domestic cleaning industry, to develop the profile and products on which she built a multimillion dollar household goods empire.¹⁹⁴ Patenting allowed Mangano to leverage not only her ingenuity, but also her unique purview as a working mother. As she has explained, “I’m a mom, I work, I have a house to clean, things to organize. We all have certain similar needs, and I address them.”¹⁹⁵

¹⁸⁸ 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, 615 (1962).

¹⁸⁹ Colleen V. Chien, *Contextualizing Patent Disclosure*, 69 *VAND. L. REV.* 1849, 1852–53 (2016).

¹⁹⁰ U.S. Patent No. 3,391,157 (assigned from Endo Labs. to E.I. Du Pont de Nemours and Co. Nov. 10, 1982), <https://assignment.uspto.gov/patent/index.html#/patent/search/resultFilterresultAbstract?searchInput=3254088&id=3391157&type=patNum> (showing the sale of Fishman’s naloxone patent to Dow DuPont).

¹⁹¹ Eliza Berman, *The True Story Behind the Movie Joy*, *TIME* (Dec. 27, 2015), <https://time.com/4161779/joy-movie-accuracy-fact-check/>.

¹⁹² *Id.*

¹⁹³ *Id.* (describing Huggable Hangers, one of Mangano’s many patented products, as “HSN’s best-selling product of all time”).

¹⁹⁴ *Id.*

¹⁹⁵ Susan Konig, *Cleaning Up in Business, With a Mop*, *N.Y. TIMES*, Feb. 11, 2001, at 14.

Inventing products that served the unique needs of women, particularly black women, played a similar role in the meteoric rise in the early 1900s of Madam C.J. Walker, America's first self-made black female millionaire.¹⁹⁶ Walker's business was based on the patented hair-care products¹⁹⁷ she devised to address her own hair loss issues and sold through an army of 40,000 agents who went to churches and door-to-door.¹⁹⁸ But her business was also a response to segregationist policies and lack of knowledge and responsiveness of white businesses to the needs of the black community.¹⁹⁹ Hers is a prime example of how patented inventions can expand opportunity to innovate as well as broaden access to innovation.

For those with good ideas but without the entrepreneurial drive or talent²⁰⁰ of a Joy Mangano or Madame Walker, the sale or license of a patent, rather than its commercialization, offers an alternative path to prosperity. The best-selling novel, *An American Marriage*, features one Franklin Davenport, who goes from being “a barefoot boy from Sunflower, Alabama,” to a millionaire based on an invention he devises at home in his spare time and sells to a company.²⁰¹ The life of fictional Davenport shares some parallels with the real life of Lonnie Johnson. Though Johnson had worked for years as an engineer, he was consistently underestimated as an African-American in a field in which he was often “the only person of color in the room.”²⁰² Developing a pressurized water gun in his spare time,²⁰³ Johnson patented and licensed his invention, the “super soaker,” to a company that would eventually be acquired by toymaker Hasbro, creating one of the best-selling toys of all time.²⁰⁴

In the early patent system, the sale of one's patent was a key way an inventor

¹⁹⁶ Henry Louis Gates, Jr., *Madam Walker, the First Black American Woman to Be a Self-Made Millionaire*, PBS, <https://www.pbs.org/wnet/african-americans-many-rivers-to-cross/history/100-amazing-facts/madam-walker-the-first-black-american-woman-to-be-a-self-made-millionaire/> (last visited Oct. 12, 2020).

¹⁹⁷ See, e.g., U.S. Patent No. 1,716,173 (filed May 16, 1928).

¹⁹⁸ Gates, *supra* note 196.

¹⁹⁹ *Id.*

²⁰⁰ For a discussion of how poverty interferes with invention and creativity, see Stephanie Plamondon Bair, *Impoverished IP*, 81 OHIO ST. L.J. 523, 539–46 (2020) (arguing that poverty interferes with the conditions necessary for creativity and inventing, including time, mental space, and a long-term perspective).

²⁰¹ TAYARI JONES, *AN AMERICAN MARRIAGE* 114 (2018).

²⁰² Pagan Kennedy, *Who Made That Super Soaker?*, N.Y. TIMES (Aug. 2, 2013), https://www.nytimes.com/2013/08/04/magazine/who-made-that-super-soaker.html?_r=1&.

²⁰³ *Lonnie Johnson*, BIOGRAPHY.COM (Dec. 2, 2015), <https://www.biography.com/inventor/lonnie-johnson>.

²⁰⁴ *Id.* (describing Johnson's licensing of his product to Larami Corp., which was later acquired by Hasbro).

got paid. As Daron Acemoglu and James Robinson have written, “[i]f you were poor with a good idea, it was one thing to take out a patent, which was not so expensive, after all. It was another thing entirely to use that patent to make money. One way, of course, was to sell the patent to someone else.”²⁰⁵ The Patent Office played a key role in supporting markets for technology, not only in issuing assets that could be traded, but also in providing information about inventions for sale.²⁰⁶ Eventually finding its way to publications like *Scientific American*, patent information supported a vibrant secondary market in technology in which inventors and firms exchanged information, patents, and innovation.²⁰⁷ Entities that cannot themselves commercialize the technologies they develop rely on licensing to develop and disseminate products, to the benefit of society, the licensee, and the licensor. Indeed, licenses from universities and other research entities have seeded many therapeutic and drug innovations developed by the biotechnology industry.²⁰⁸

3. *Expanding Access to Innovation Through Diffusion via Incentives for Follow-On Innovation and Commercialization, Price Discrimination, and Spillovers*

Although innovation initially enriches those at the top, its social impact, at least as to broadly consumed crossover goods, comes from its broader diffusion. As Austrian political economist Joseph Schumpeter said, “[t]he capitalist achievement does not typically consist in providing more silk stockings for queens but in bringing them within the reach of factory girls in return for steadily decreasing amounts of effort. . . . [This] progressively raises the standard of life of the masses.”²⁰⁹ As described below, patents support broad-based access to innovation in several ways, including by encouraging follow-on invention and commercialization, geographic diffusion, differential pricing, and spillovers, both during and after the term of a patent. These mechanisms, in turn, operate on both dimensions of access to innovation highlighted above: availability and affordability.

²⁰⁵ DARON ACEMOGLU & JAMES A. ROBINSON, *WHY NATIONS FAIL: THE ORIGINS OF POWER, PROSPERITY, AND POVERTY* 33 (2012).

²⁰⁶ See Naomi R. Lamoreaux & Kenneth L. Sokoloff, *Inventors, Firms, and the Market for Technology in the Late Nineteenth and Early Twentieth Centuries*, in *LEARNING BY DOING IN MARKETS, FIRMS, AND COUNTRIES* 19, 22 (1999).

²⁰⁷ See *id.* at 22–23.

²⁰⁸ See Vicki Loise & Ashley J. Stevens, *The Bayh-Dole Act Turns 30*, 45 *LES NOUVELLES* 185, 188–89 (2010) (showing one estimate that puts this prevalence at 76%).

²⁰⁹ JOSEPH A. SCHUMPETER, *CAPITALISM, SOCIALISM & DEMOCRACY* 67–68 (5th ed. 2003) (1976).

a. Incentives to Commercialize and Diffuse, Enhancing Availability

When an innovation is initially devised, it is generally motivated by a particular use case, situated within a particular community, within a particular geography, together comprising the innovation's initial target market. But the potential market may be much broader. In the absence of tradable rights, innovative ideas and know-how are fiercely guarded as trade secrets,²¹⁰ and limited in their diffusion by the capacity and desire of their owners. Patents can accelerate commercialization by making it safer and easier for innovators, working alone or with their licensees, to attract investment and partners in order to commercialize the invention and reach additional markets. Studying the growth of patent systems internationally, Petra Moser has considered how patenting chemical inventions has impacted their reach. She found that as patenting became more prevalent, inventive activity spread, leading the industry to become significantly more geographically widespread.²¹¹ Licensing partnerships are particularly important when the costs of entering a market outweigh the benefits for the originator firm, and vice versa for a local or partner firm.²¹²

The ability to obtain patents, including on an ongoing basis, can also enhance access to relevant inventions and formulations. It is axiomatic that without the right to exclude, the pharmaceutical industry would not exist in its present form because patents enable the recapture of the enormous costs of drug development through a period of exclusivity. As the naloxone vignette illustrates, however, the ability to seek patents on different formulations, methods of administration, or other incremental inventions also drives investment in follow-on improvements tailored to custom markets by the original innovator or a licensee. The ability to patent incremental advances does raise other problems, as described in the next subpart; however, the rents created by patents can be used to support the further development of and, ultimately, wider diffusion of the innovation.

b. By Enabling Price Discrimination, Boosting Affordability

Price discrimination—charging different prices for the same good or

²¹⁰ Petra Moser, *Do Patents Weaken the Localization of Innovations? Evidence from World's Fairs*, 71 J. ECON. HIST. 363, 363 (2011).

²¹¹ *Id.* at 365.

²¹² See, e.g., Arianna Martinelli, Andrea Mina & Elena Romito, *Collective Licensing and Asymmetric Information: The Double Effect of the Medicine Patent Pool on Generic Drug Markets* 1, 24 (Jan. 31, 2020), https://www.law.northwestern.edu/research-faculty/clbe/events/innovation/documents/mina_martinelli.pdf. (“[L]icensing—either voluntary or compulsory—is the most effective way to improve access to drugs.”).

service—can further boost access to the worst-off. When a product is patented in different jurisdictions and the original owner's intellectual property rights are not "exhausted" by the sale, the patentee can charge different prices in different markets without worrying about resales of low-priced goods undercutting profits in the high-priced market. The presence of patent rights in both jurisdictions supports lower prices in the secondary market, allowing more low-priced consumers to get access than if the price was the same across all markets.²¹³

A study of the timing of new drugs launched between 1983 and 2002 demonstrates how stronger patent rights can encourage diffusion.²¹⁴ It found that while price regulation delayed entry into certain countries, stronger patent rights accelerated entry.²¹⁵ It is not necessarily surprising that patent rights drive entry by patent owners, insofar as they are associated with a lower risk of competition and a higher chance of profitability. In addition, rights-owner-controlled dissemination of a product will not necessarily be as rapid or broad as compared to, for example, dissemination through generic competition. However, these findings underscore the ways in which exclusion can drive diffusion by supporting cross-subsidization across market segments.

c. By Supporting Spillovers and Generic Entry, Enhancing Access to Knowledge and Innovation

Another set of broad-based benefits comes not from *patenting*, but from *patents*. Patents contain detailed technical descriptions and drawings through which privately created knowledge "spills over" to the public. Unlike trade shows, paid publications, and industry conferences, no entrance or membership fees are required to access patents, which are stored on government websites. Improvements to the public patent record, as with investments in public knowledge generally, particularly benefit those who otherwise do not have access to information. A study by Jeff Furman and his colleagues examined the opening of patent libraries across the United States.²¹⁶ They found that after a patent library opened, the number of patents increased relative to control regions and that the response was especially significant among young companies,²¹⁷

²¹³ See generally Keith E. Maskus, *Parallel Imports*, 23 WORLD ECON. 1269, 1269–71 (2000) (providing an overview of parallel trade).

²¹⁴ Iain M. Cockburn, Jean O. Lanjouw & Mark Schankerman, *Patents and the Global Diffusion of New Drugs*, 106 AM. ECON. REV. 136, 162 (2016).

²¹⁵ *Id.* at 150, 152, 162.

²¹⁶ Jeffrey L. Furman, Markus Nagler & Martin Watzinger, *Disclosure and Subsequent Innovation: Evidence from the Patent Depository Library Program* 1–2 (Nat'l Bureau Econ. Rsch., Working Paper No. 24660, 2018).

²¹⁷ *Id.* at 3.

leading to an increase in local business formation and job creation.²¹⁸ Though that study considered the role of patents in facilitating information flows in the pre-internet era, Jinhwan Kim and Kristen Valentine studied a more recent rule change under which previously private patent applications started to release publicly.²¹⁹ The earlier availability of information increased research and development (“R&D”) among firms whose rivals revealed more information,²²⁰ but reduced it among the revealers.²²¹

When a patent expires, the invention enters the public domain and becomes available for use by all, which typically lowers prices. The FDA has reported that when the expiration of drug patents is followed by the introduction of six or more competitors, the price of the product drops on average by 95%, although the price decrease is less than half of that when there is only one competitor.²²²

Across these stories of individuals, upstarts, and outsiders, each of whom have found success through invention, patents have played a few roles. A patent can validate the originality of an underlying idea. The exclusive rights of a patent also provide space to newcomers to develop their inventions with less fear of being ripped off, encouraging investments in commercialization and market expansion. The knowledge within patents spills over, and, when embodied in product form, expands access to innovation. Once the patent has expired, the invention can be used generically. Yet, the mere existence of these positive mechanisms does not mean that they are meaningfully available. For new innovators to gain from patenting, they must have the knowledge, wherewithal, resources, and connections to file for patents and succeed in their applications. To be able to learn from patents or benefit from their sale or licensing requires the ability to find the appropriate patents and to locate parties with which to transact. Benefiting from the patent system depends on having “invention capital,” discussed further in the next section.

²¹⁸ *Id.* at 4.

²¹⁹ Jinhwan Kim & Kristen Valentine, *The Innovation Consequences of Mandatory Patent Disclosures*, 71 J. ACCT. & ECON. 1, 4 (2021) (studying the adoption of the “18-month” rule, according to which all patent applications are published eighteen months after the earliest filing date rather than only upon patent grant, pursuant to the American Inventor Protection Act of 1999).

²²⁰ *Id.* at 17.

²²¹ *Id.*

²²² RYAN CONRAD & RANDALL LUTTER, *GENERIC COMPETITION AND DRUG PRICES: NEW EVIDENCE LINKING GREATER GENERIC COMPETITION AND LOWER GENERIC DRUG PRICES* 2–3 (2019) (explaining how the expiration of drug patents, when followed by the introduction of six or more competitors, results in an average price drop of 95%, and less than half of that when there is only one competitor).

B. How Patents Intensify the Inequalities of Innovation

Just as patents can alleviate the inequalities of innovation, however, so too can they intensify them. To understand how, it is useful to revisit a formulation that is commonly used to explain economic inequality: when the value of capital—property, stocks, or other holdings—rises faster than the economy at large, the gap between those with and without capital widens.²²³ As described below, enhanced returns to “invention capital” play a similar role in intensifying the inequalities of innovation.

²²³ THOMAS PIKETTY, CAPITAL IN THE TWENTY-FIRST CENTURY 34 (Arthur Goldhammer trans.) (2017).

Fig. 4: Patent Mechanisms that Alleviate the Inequalities of Innovation

Inequalities of Innovation	Patent Mechanisms that Exacerbate Inequality—Firm Level	Patent Mechanisms that Exacerbate Inequality—Individual Level
Economic Inequality	Enhanced returns to invention capital, patent-based tax avoidance	Lack of access to invention capital (the exposure, trust, resources, know-how, and network) required to benefit from invention and innovation
Inequality of Opportunity to Innovate	High costs of enforcement and defense, to the disadvantage of small plaintiffs and defendants	High social and financial costs, raising barriers to participation
Inequality of Access to Innovation	Extended terms and scope leading to suppression of competition, access, and oversight	

At the firm level, patent lobbyists and lawyers have helped successful companies employ various strategies to extend their rights and avoid oversight, limiting tax payments, opportunity, and access. On an individual level, a lack of role models, positive associations with patents, and networks of legal counsel have limited opportunities to participate in innovation. These dynamics have tilted the patent system in favor of those with *invention capital* and away from those without it.

1. *Increasing Economic Inequality Through Lobbying, Tax Avoidance, and the Importance of Invention Capital*

How might the patent system exacerbate economic inequality? The subsections below describe a few mechanisms. Sophisticated firms have used lobbying and intellectual-property-based tax practices to affect the upward redistribution of rents. At the individual level, a lack of several forms of invention capital—including knowledge of patenting and innovation career paths, geographically proximate role models, and trust in and positive associations with patenting—as well as the corporatization of invention, limit broad-based sharing of the gains from invention.

a. *At the Firm Level: Lobbying*

Success in the patent system requires not only good ideas (*what* you know), but also good connections (*who* you know) and money. Many of these connections are paid for. Every year, patent-intensive firms pour resources into lobbying; in 2020, the pharma and tech sectors together spent close to \$1 million per member of Congress.²²⁴ A number of studies have found lobbying to be correlated with lower levels of economic mobility and entry.²²⁵

Pharmaceutical lobbying has been blamed for making drug prices the highest in the world domestically and suppressing access to drug innovation internationally. In the realm of international intellectual property, the perceived undue influence of pharmaceutical lobbyists has elicited countermovements in favor of greater flexibilities and substantive equality in trade laws.²²⁶ Right behind them, in terms of lobbying spending, are tech companies. While somewhat less developed than “left-wing” populist critiques of the pharmaceutical lobby, “right-wing” populist views²²⁷ decry the influence of an

²²⁴ *Industries*, OPENSECRETS, <https://www.opensecrets.org/federal-lobbying/industries> (last visited Feb. 18, 2021) (showing that in 2020, those two industries spent approximately \$473 million to lobby 535 members—an average of \$884,100 per member).

²²⁵ *See, e.g.*, Aghion et al., *Innovation and Top Income Inequality*, *supra* note 175, at 4 (discussing how lobbying activities typically help incumbents prevent new entry and thus, in locations with higher lobbying intensity, innovativeness has a lower effect on social mobility).

²²⁶ *See, e.g.*, Chon, *supra* note 70, at 2823 (proposing a “substantive equality” principle for warding off intellectual property incursions on basic goods).

²²⁷ *See generally* JOHN B. JUDIS, *THE POPULIST EXPLOSION: HOW THE GREAT RECESSION TRANSFORMED AMERICAN AND EUROPEAN POLITICS* 12–17 (2016) (distinguishing between several forms of populism, including right-wing populism—which is triadic because it pits the people against left-wing elites and the groups that they have, from the perspective of right-wing populists, artificially propped up—and left-wing populism—which is more binary because it is the people versus the elite establishment).

industry that has prioritized, in various years, privacy, antitrust,²²⁸ and intellectual property issues.²²⁹ According to “right-wing” populist views, large tech companies have worked to weaken the patent system in order to engage in the “efficient infringement”²³⁰ of others’ rights, to such an extent and at such scale that the benefits of infringing outweigh the risks of getting caught.²³¹

b. At the Firm Level: Patent “Rent Keeping”²³² to Avoid Taxes

For large companies with multiple locations, patents have been used not only to capture and shield rents, but also to hold on to them. Multinationals have sheltered trillions of dollars by transferring patents and other forms of intellectual property to hard-to-track subsidiaries or affiliates located in lower tax jurisdictions.²³³ The affiliate then provides licenses for use of the intellectual property in exchange for royalty revenue.²³⁴ The revenue is taxed at the lower rate and the avoided taxes remain in the firm rather than being returned to the government.²³⁵

While all firms seek to reduce their tax burdens, intellectual property assets are more portable than assets like factories or plants, which require physical

²²⁸ AJ Dellinger, *How the Biggest Tech Companies Spent Half a Billion Dollars Lobbying Congress*, FORBES (Apr. 30, 2019, 8:01 PM), <https://www.forbes.com/sites/ajdellinger/2019/04/30/how-the-biggest-tech-companies-spent-half-a-billion-dollars-lobbying-congress/#270aa8d657c9> (describing privacy as tech companies’ highest priority topic in 2018, and competition policy being one of Google’s priorities during that same year).

²²⁹ See, e.g., *Policy Position: Patents*, INTERNET ASS’N, <https://internetassociation.org/positions/patent-reform/> (last visited Mar. 1, 2020); *Policy Position: Copyright*, INTERNET ASS’N, <https://internetassociation.org/positions/copyright/> (last visited Mar. 1, 2020).

²³⁰ See, e.g., Pat Choate, *Patent Theft as a Business Strategy*, HUFFPOST: THE BLOG (May 23, 2010, 5:12 AM), http://www.huffingtonpost.com/pat-choate/patent-theft-as-a-business_b_508780.html (describing systemic infringement by the largest tech companies, including Cisco, Intel, IBM, Microsoft, and HP, resulting in patent owners suing fifteen of the top tech companies over 740 times between 1996 and 2008, and patent owners winning over \$4 billion in damages).

²³¹ *Id.*

²³² In contrast with “rent seeking,” which describes the seeking out of wealth, generally using legal means, without any reciprocal contribution of productivity, “rent keeping” refers to acting in order to avoid losing rents, for example through tax avoidance schemes. See CFI Team, *Rent-seeking*, CORP. FIN. INST. (Feb. 9, 2021), <https://corporatefinanceinstitute.com/resources/knowledge/economics/rent-seeking/>.

²³³ Reuven Avi-Yonah, *A Decisive Tax Defeat for the Multinationals?*, AM. PROSPECT (June 29, 2020), <https://prospect.org/economy/decisive-tax-defeat-for-the-multinationals/> (describing transfer pricing as the “most common and flagrant way big companies avoid taxes,” and identifying the tax revenue at stake as “at least \$2 billion and could be much more” on the basis of shifting \$3 trillion in income generated by intangibles to low-tax jurisdictions).

²³⁴ Andrew Blair-Stanek, *Intellectual Property Law Solutions to Tax Avoidance*, 62 UCLA L. REV. 2, 27 (2015).

²³⁵ *Id.* at 5.

proximity to skilled labor or markets.²³⁶ The uniqueness of each individual patent makes it difficult to value: the nature of innovation and the patents filed is such that the distribution of patent values is highly skewed, ranging from “0 to several billion.”²³⁷ These features make patents “ideal for avoiding tax.”²³⁸ By transferring a patent from a high-tax jurisdiction to a low- or no-tax jurisdiction for an artificially low price, the tax on the transfer is limited. If the patent later turns out to be valuable, the royalties associated with the patent are now safely in the low-tax jurisdiction, escaping taxation.²³⁹ The perfectly legal tax avoidance strategies of firms, also known as “base erosion and profit shifting” (“BEPS”) practices, have contributed to an estimated \$100–240 billion in avoided taxes annually.²⁴⁰ The divisions between tax and patent law, just like the divisions between patent and antitrust law imposed by the *Noerr-Pennington* doctrine, described below, have historically contributed to a lack of effective public law oversight, increasing firm-level inequality.²⁴¹

c. At the Individual Level: A Lack of Knowledge, Role Models, Hostility, and Cultural Factors

But just as some have used patents to prevent income redistribution at the

²³⁶ See Herman Mark Schwartz, *Wealth and Secular Stagnation: The Role of Industrial Organization and Intellectual Property Rights*, 2 RSF: RUSSELL SAGE FOUND. J. SOC. SCIS. 226, 239 (2016) (“This kind of tax evasion and avoidance could not be done as easily if firms were physically producing goods in facilities that were integrated with IP production. Most tax authorities use a substantial presence test that would attach taxation to the value created in that factory . . .”).

²³⁷ DIETMAR HARHOFF, INNO-TEC16, MEASURING AND ESTIMATING PATENT VALUE: WIPO-OECD WORKSHOP ON STATISTICS IN THE PATENT FIELD 16 (2003), <http://www.oecd.org/science/inno/33882355.pdf>.

²³⁸ Blair-Stanek, *supra* note 234, at 5.

²³⁹ *Id.*

²⁴⁰ *Understanding Tax Avoidance*, OECD, <https://www.oecd.org/tax/beps/> (last visited June 23, 2021).

²⁴¹ Reforms initiated by the Organization for Economic Co-operation and Development (“OECD”) would address corporate tax avoidance using transparency and coordination through so-called “country-by-country reporting” that requires multinationals to disclose the global allocation of the income, profit, taxes paid, and economic activity among the jurisdictions in which they operate. *Action 13 Country-by-Country Reporting*, OECD, <https://www.oecd.org/tax/beps/beps-actions/action13/> (last visited June 23, 2022) (“[T]he second set of aggregated . . . data from CbCRs was . . . released in July 2021[.] . . provid[ing] information on the global tax and economic activities of nearly 6,000 multinational enterprise groups . . . operating across more than 100 jurisdictions worldwide.”). The Biden Administration has also introduced a tax plan to “stop[] unfair and wasteful profit shifting to tax havens” by increasing the global minimum tax on income from intangible assets (“Global Intangible Low-Taxed Income,” or “GILTI” for short) earned by foreign affiliates of U.S. companies from 10.5% to 21%, and eliminating an exemption on the first 10% of return on assets in foreign countries. *FACT SHEET: The American Jobs Plan*, WHITE HOUSE (Mar. 31, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>; see also Annmarie Conboy-DePasquale, Reese Goldsmith, Lori Harju, Charlie Iovino, Timothy Jackson, Gregory Janssen, Michael Marn, Radha Mohan & Russ Sullivan, Brownstein Hyatt Farber Schreck, *American Jobs Plan Analysis*, JDSUPRA (Apr. 1, 2021), <https://www.jdsupra.com/legalnews/american-jobs-plan-analysis-7875465/>.

firm level, a number of mechanisms have also operated to prevent uptake of the benefits of invention at the individual level. For individuals who successfully commercialize their own inventions, the act of patenting turns labor into capital, providing an asset from which personal wealth can be built and passed down. But even assuming a sufficient educational background, the “invention capital” needed to independently pursue an innovation career and patent successfully is not necessarily distributed equally across society.

If you take a group of high-achieving third graders and follow them for decades, what will you find? Raj Chetty and his colleagues recently carried out this exercise, tracking kids in the top 10% of their respective standardized math tests scores throughout their careers.²⁴² They found that when they compared kids of equal intelligence, the wealthiest kids were ten times more likely to become inventors than kids from families with below-median incomes.²⁴³ Talented female, Hispanic, and black students were also much less likely to invent than their white and Asian male counterparts.²⁴⁴ But rather than pointing to factors like financial incentives or STEM education, the study identified differences in “exposure to innovation during childhood” as the key source of variation.²⁴⁵ A lack of mentors and role models, particularly of demographic similarity (e.g., female inventors for females), “explain[ed] why talented children in low-income families, minorities, and women are significantly less likely to become inventors.”²⁴⁶ Their findings support the idea that one’s zip code, exposure to patenting, role models, and social connections play an important role in determining who does and does not invent.²⁴⁷ For many talented individuals, whether in rural, disadvantaged, or underrepresented neighborhoods, knowledge of innovation and invention pathways is simply lacking.

The finding that inventing appears to favor the rich and innovation savvy is challenging to those who believe that the patent system operates as a meritocracy. However, in context, it is nothing new. Like other professions passed down between generations, a culture of inventing and patenting is a form of knowledge capital that functions as an inheritance.²⁴⁸ The inventor-successors

²⁴² Alex Bell, Raj Chetty, Xavier Jaravel, Neviana Petkova & John Van Reenen, *Who Becomes an Inventor in America? The Importance of Exposure to Innovation*, 134 Q.J. ECON. 647, 650, 674 n.18 (2019).

²⁴³ *Id.* at 649.

²⁴⁴ *Id.* at 666–67, 672–73.

²⁴⁵ *Id.* at 709.

²⁴⁶ *Id.*

²⁴⁷ *Id.* at 709–10.

²⁴⁸ See, e.g., Aghion et al., *Innovation and Top Income Inequality*, *supra* note 175, at 3 (finding, based on data from 1880 to 1940, a positive correlation between a father’s education and the likelihood of patenting).

of Franklin Ball, the steam engine inventor, included his son, Frederick, grandson, Tom, and eventually his great-grandson, Jeremy,²⁴⁹ who continued inventing in similar areas.²⁵⁰

But where does a lack of knowledge, role models, and trusted connections, all forms of invention capital, by women and underrepresented minorities come from? In the antebellum South, although enslaved people faced restrictions that prevented them from patenting their inventions,²⁵¹ white slave masters were not stopped from “tak[ing] undue credit” or attempting to patent the machines and other inventions of slaves as their own.²⁵² Accounts of men taking credit for the inventions of women cover technologies that range from the paper bag, to wireless communication, to light pulses, to the structure of DNA.²⁵³ The rules of patent ownership historically have meant that the inventions of women and slaves flowed to white, land-owning men, not necessarily the true inventors or their heirs.²⁵⁴ There are now no restrictions on who can be named an inventor. However, it remains that in many cases, the gains to inventors from inventing are limited. That is because, as discussed in Part I, the vast majority of inventing happens within corporations where patent rights are ceded to the company. Even

²⁴⁹ See ply33 Comment to carbking, *Penberthy (Ball & Ball) Carburetor Information Wanted*, ANTIQUE AUTO. CLUB AM. (Apr. 13, 2018), <https://forums.aaca.org/topic/307916-penberthy-ball-ball-carburetor-information-wanted/>.

²⁵⁰ *Id.* (explaining that, by this time, Franklin Ball’s grandson invented automotive rather than steam engines).

²⁵¹ See Brian L. Frye, *Invention of a Slave*, 68 SYRACUSE L. REV. 181, 183 (2018) (explaining the antebellum Patent Act, which “effectively precluded” slaves from patenting inventions).

²⁵² Shontavia Jackson Johnson, *The Colorblind Patent System and Black Inventors*, LANDSLIDE VOL. II NO. 4 (2019), https://www.americanbar.org/groups/intellectual_property_law/publications/landslide/2018-19/march-april/colorblind-patent-system-black-inventors/.

²⁵³ Leslie Regan Shade, *Book Reviews*, 13 CANADIAN WOMAN STUD. 112, 114 (1993) (reviewing DAVID F. NOBLE, *A WORLD WITHOUT WOMEN: THE CHRISTIAN CLERICAL CULTURE OF WESTERN SCIENCE* (1992); JUDY WAJCMAN, *FEMINIST CONFRONTS TECHNOLOGY* (1991); GILL KIRKUP & LAURIE SMITH KELLER, *INVENTING WOMEN: SCIENCE, TECHNOLOGY, AND GENDER* (1992); ANNE L. MACDONALD, *FEMININE INGENUITY: WOMEN AND INVENTION IN AMERICA* (1992)) (recounting, for example, the fight over the invention of the paper bag by Margaret Knight); see also Krystyna Chávez, *19 Groundbreaking Discoveries by Women that Were Credited to Men*, MARIE CLAIRE (Feb. 28, 2019), <https://www.marieclaire.com/culture/g5026/female-discoveries-credited-to-men/> (describing inventions and discoveries made by women—ranging from wireless communication by Hedy Lamarr to radio pulses by Jocelyn Bell Burnell—for which men claimed the credit); Joanna Rothkopf, *How One Man Tried to Write Women out of CRISPR, the Biggest Biotech Innovation in Decades*, JEZEBEL (Jan. 20, 2016, 11:45 AM), <https://jezebel.com/how-one-man-tried-to-write-women-out-of-crispr-the-big-1753996281> (describing the exclusion of Rosalind Franklin from credit for the structure of DNA in favor of her colleagues James Watson and Francis Crick, as well as the “significant[] minimiz[ation]” of the role Jennifer Doudna’s lab had in advancing the technology).

²⁵⁴ Johnson, *supra* note 252; see also Kara W. Swanson, *Race and Selective Legal Memory: Reflections on Invention of a Slave*, 120 COLUM. L. REV. 1077, 1080 (2020) (recounting the complicated history of slave owners attempting to patent the inventions of their slaves).

in the absence of agreements, equitable doctrines tend to favor employers.²⁵⁵

Cultural factors in combination with employment law may be deterring certain groups from participating in inventing. A report by the Smithsonian Center's Lemelson Center for the Study of Invention and Innovation recently found:

Traditional definitions of invention and innovation are too narrow. Conventional understandings of these terms, steeped in Western capitalistic outlooks, prioritize profitability, efficiency, autonomy, newness, and ownership. A Black view of invention and innovation, however, includes an emphasis on aiding the community, advancing artistic expression, repurposing existing resources, and promoting cooperation.²⁵⁶

Lateef Mtima has made a similar critique of intellectual property—that it should not solely be viewed as an engine for the economy, but that, under the broader rubric of intellectual property social justice theory, it should instead be thought of as “providing material inducements toward the achievement of broader social utility and social justice goals.”²⁵⁷

That diverse inventors may not see themselves or their interests advanced within this scheme is reinforced by a recent guide to “best practices in diversity” in invention geared at company in-house counsel.²⁵⁸ According to the guide, “[t]he term ‘inventor’ may be unrelatable to diverse inventors, in part because the celebrated historical inventors from U.S. history tend to be non-diverse.”²⁵⁹ The guide advises companies to reframe “inventorship” as problem-solving.²⁶⁰ However, to the extent that innovation workers see corporate invention processes—which typically assign all rights to the employer according to the hired to invent doctrine²⁶¹—as primarily extractive in nature, similar to the

²⁵⁵ See *supra* Section I.C.1. (discussing the hired to invent and shop right doctrines.)

²⁵⁶ TAHIRA REID SMITH, MONICA SMITH & TYRONE GRANDISON, THE LEMELSON CTR. FOR THE STUDY OF INVENTION & INNOVATION, BLACK INVENTORS & INNOVATORS: NEW PERSPECTIVES 7 (2020), <https://invention.si.edu/node/29159/p/739-executive-summary>.

²⁵⁷ Lateef Mtima, *IP Social Justice Theory: Access, Inclusion, and Empowerment*, 55 GONZ. L. REV. 401, 418 (2019).

²⁵⁸ LAURA NORRIS, MARY FULLER, JOY PEACOCK & SYDNEY YAZZOLINO, DIVERSITY IN INNOVATION BEST PRACTICES GUIDE 3 (2021), <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=1992&context=facpubs>.

²⁵⁹ *Id.* at 6.

²⁶⁰ *Id.*

²⁶¹ See Fisk, *supra* note 105, at 1132; see also Catherine L. Fisk, *The Story of Ingersoll-Rand v. Ciavatta: Employee Inventors in Corporate Research & Development—Reconciling Innovation with Entrepreneurship*,

historical appropriation of ideas, the issue may be more about the alignment of interests and values than semantics. As such, a number of factors may explain why patenting-based pathways to prosperity are narrower than is desirable.

Downright hostility and racial violence have also historically suppressed invention.²⁶² Professor and Federal Reserve Board of Governors member Lisa Cook has documented how riots, lynchings, and the passage of segregation laws have historically been followed by an exodus of black inventors from patenting.²⁶³ Treating the rise in mass violence between 1870 and 1940 as a historical experiment, she finds that the Tulsa massacre in 1921 and similar violent acts contributed to a loss of more than 1,100 patents, with only 726 actual patents among black inventors over this period.²⁶⁴ A culture of hostility has also been responsible for qualified individuals leaving, rather than staying and patenting in, their chosen STEM careers and roles. In their report on women inventors and patents, the Institute for Women's Policy Research found "[s]exism and gender discrimination in the workplace, particularly in STEM fields, along with a lack of family friendly workplace policies," reduced opportunities for collaboration and drove women out of STEM occupations.²⁶⁵ The Kapur Center's "Tech Leavers Study" examined why people, particularly black, Latinx, and women, left their jobs in tech. The top reason for leaving, even more than a better opportunity, was "unfair treatment," including stereotyping, bullying, public humiliation, and embarrassment.²⁶⁶ Respondents specifically cited microaggressions, unwanted sexual attention, isolation, and persistent biases as reasons for departing.²⁶⁷

2. *Increasing Inequality of Opportunity Through Unequal Access to Patenting and High Costs*

To participate and benefit from invention and innovation requires navigating the legal process of getting a patent, typically with the help of a trusted lawyer or agent. Bringing or defending against a patent assertion also requires the help

DUKE SCI., TECH. & INNOVATION SERIES 5–6 (2006).

²⁶² See, e.g., Lisa D. Cook, *Violence and Economic Activity: Evidence from African American Patents, 1870–1940*, 19 J. ECON. GROWTH 221, 242–44 (2014).

²⁶³ See *id.* at 242.

²⁶⁴ *Id.* at 222, 224 n.3.

²⁶⁵ JESSICA MILLI, EMMA WILLIAMS-BARON, MEIKA BERLAN, JENNY XIA & BARBARA GAULT, EQUITY IN INNOVATION: WOMEN INVENTORS AND PATENTS 2 (2016), <https://iwpr.org/wp-content/uploads/2020/12/C448-Equity-in-Innovation.pdf>.

²⁶⁶ See ALLISON SCOTT, FREADA KAPOR KLEIN & URIRIDIAKOGHENE ONOVAKPURI, TECH LEAVERS STUDY (2017), <https://www.kaporcenter.org/wp-content/uploads/2017/08/TechLeavers2017.pdf>.

²⁶⁷ *Id.*

of legal counsel. But differences in access to and ability to pay counsel have translated into differences in opportunity to participate in and gain from innovation and invention.

a. At the Firm Level: Strategic Lawyering to Extend Patent Term and Scope

The crux of the patent bargain is that patent rights are bounded along at least the dimensions of time and scope. Patent rights expire twenty years from the date of filing, after which time the invention enters the public domain.²⁶⁸ Even when a patent is in force, the exclusive right is not endless, but, as with real property, is defined by the “boundaries” of the invention.²⁶⁹ But through strategic lawyering, patent applicants have been able to stretch these limits of time and scope. For example, attempting to extend the life of one’s patent²⁷⁰ beyond what others get is an old game. For centuries, patent owners have lobbied Congress to get the duration of their patents extended.²⁷¹ In 1996, the pharmaceutical firm G.D. Searle got its patent on the drug Daypro extended when a provision was “quietly inserted” into an emergency budget bill that was passed to avert a government shutdown.²⁷² In 2020, a bill was proposed that would extend the term of COVID-19 drug patents by ten years.²⁷³ It did not advance.²⁷⁴ A more reliable way of extending scope and term has been to

²⁶⁸ 35 U.S.C. § 154 (stating that a patent may expire sooner than twenty years after the date of its filing if its owner fails to pay the requisite maintenance fees).

²⁶⁹ Tun-Jen Chiang, *Fixing Patent Boundaries*, 108 MICH. L. REV. 523, 524–26 (2010) (likening patent to real property “boundaries”).

²⁷⁰ The same is true of copyrights. See Lawrence Lessig, *Congress’ Latest Move to Extend Copyright Protections Is Misguided*, WIRED (May 18, 2018, 8:00 AM), <https://www.wired.com/story/congress-latest-move-to-extend-copyright-protection-is-misguided/> (describing the Sonny Bono Copyright Term Extension Act as the “11th extension in the prior 40 years”).

²⁷¹ See Richard M. Cooper, *Legislative Patent Extensions*, 48 FOOD & DRUG L.J. 59, 60–62 (1993) (describing patent extensions from the early 1800s to the 1980s).

²⁷² Adriel Bettelheim, *Drugmakers Under Siege*, 9 CQ RESEARCHER 753, 766 (Sept. 3, 1999), <https://library.cqpress.com/cqresearcher/#!/document.php?id=cqresrre1999090300>; The Pink Sheet, *Searle Daypro Patent Extension Bill Introduced by Sen. Simon, Co-sponsored by Sen. Hatch*, SCRIP (Jan. 8, 1996), <https://scrip.pharmaintelligence.informa.com/PS027467/Searle-Daypro-patent-extension-bill-introduced-by-Sen-Simon-cosponsored-by-Sen-Hatch> (citing the long delays in regulatory approvals as leading to the need for the bill).

²⁷³ Celeste Alvarez, James Mullen III & Desmond O’Sullivan, *Bill Proposes 10 Additional Years for COVID-19 Inventions*, JDSUPRA (July 29, 2020), <https://www.jdsupra.com/legalnews/bill-proposes-10-additional-years-for-43324/>.

²⁷⁴ See *S.3630—Facilitating Innovation to Fight Coronavirus Act*, CONGRESS.GOV, <https://www.congress.gov/bills/116/congress/senate/bills/3630/text?r=1&s=1> (last visited Aug. 16, 2021) (showing the bill as not getting out of Committee).

navigate the complex cluster of rules and doctrines that permit patentees to file for successive “continuation” applications. Such applications allow inventors to get the benefit of an earlier filed application, based on the same specifications but claiming different subject matter.²⁷⁵ From a single patent specification, the patent owner can get multiple patents, though their subject matter must be supported by the original application.²⁷⁶

As described in Part I, naloxone was first introduced in 1961. But while the basic chemistry has been known for decades, the creators of the Evzio applicator have secured additional patent protections reportedly until 2034,²⁷⁷ over sixty years after discovery of the drug. Although the average number of patents covering a drug is less than four,²⁷⁸ manufacturer Kaléo has boasted having over twenty patents just on the Evzio applicator.²⁷⁹ A closer look reveals that not only are the patents overlapping, rather than distinct, but that nine of the inventions have the exact same name and are part of the same patent “family,”²⁸⁰ covering modified versions of the same invention with slightly different dates of expiration.²⁸¹ The ability to get patents over incremental improvements, as described in Part I, was important for stimulating development of the new applicator. But the piling-on of patent filings suggest more may be going on. While developing a new drug is estimated to cost at least between \$1–2.8 billion,²⁸² Kaléo’s public filings suggest that it only spent a small fraction of that amount to develop a novel applicator.²⁸³ Though in the absence of a counterfactual it is hard to be sure that fewer lives were saved than would have

²⁷⁵ This is authorized by 35 U.S.C. § 120, which entitles later-filed applications to the benefits of the earlier-filed application on which it depends if certain conditions are met. 35 U.S.C. § 120.

²⁷⁶ Cesare Righi & Timothy Simcoe, *Patent Examiner Specialization 4–5* (Nat’l Bureau of Econ. Rsch., Working Paper No. 23913, 2017).

²⁷⁷ Weissman & Wen, *supra* note 113.

²⁷⁸ Lisa Larrimore Ouellette, *How Many Patents Does It Take to Make a Drug? Follow-On Pharmaceutical Patents and University Licensing*, 17 MICH. TELECOMMS. & TECH. L. REV. 299, 300 (2010).

²⁷⁹ *Kaléo Announces the Award of its 100th Patent*, KALÉO (Jan. 25, 2016), <https://kaleo.com/press-release/kaleo-announces-the-award-of-its-100th-patent/>.

²⁸⁰ See Medicament Delivery Device Having an Electronic Circuit System, U.S. Patent No. 9,238,108 B2; US-9238108-B2 (issued Jan. 19, 2016) (showing nine patent publications to Kaléo, including the “Medicament Delivery Device Having an Electronic Circuit System”).

²⁸¹ *Id.* (showing expiration dates that include 2027 (for U.S. Patent No. 9,238,108) and 2026 (for U.S. Patent No. 10,076,611)).

²⁸² Jonathan Gardner, *New Estimate Puts Cost to Develop a New Drug at \$1B, Adding to Long-Running Debate*, BIOPHARMA DIVE (Mar. 3, 2020), <https://www.biopharmadive.com/news/new-drug-cost-research-development-market-jama-study/573381/> (describing competing studies).

²⁸³ Alex Wang & Aaron S. Kesselheim, *Government Patent Use to Address the Rising Cost of Naloxone: 28 U.S.C. § 1498 and Evzio*, 46 J.L. MED. & ETHICS 472, 476 (2018) (contrasting Kaléo’s claim that it has spent “more than \$100 million in the research, development and commercialization of Evzio” with public filings that show far smaller sums being spent on research and development).

been saved under different conditions, the company's dramatic price reductions under public pressure suggest high margins.²⁸⁴

The strategy of applying for large numbers of patents to raise barriers to competitors is called “thicketing,” because it requires others to cut through a “thicket” of patents, which are often hard to track, before they can enter the market.²⁸⁵ The patents may not be novel or even valid. Robin Feldman has found that 78% of drug patents are not for new drugs, but rather cover existing ones.²⁸⁶ When so-called “secondary” patents are challenged, they are only upheld 32% of the time, while active-ingredient patents are upheld 92% of the time.²⁸⁷

The stakes can be considerable. For example, in the case of the blockbuster arthritis drug Humira, the most successful (remuneratively) drug of all-time,²⁸⁸ a major reason prices have remained high is, in the words of a district court, “Humira-related patents (more than a hundred) make it difficult (if not impossible) to sell competing drugs.”²⁸⁹ Although patents are supposed to cover only new-to-the-world (novel) inventions, 90% of the 132 patents drugmaker AbbVie received for Humira were issued twelve years after the drug was first marketed.²⁹⁰ They covered not only AbbVie's drug, but also “ingredients and formulations that AbbVie anticipated its competition might seek to employ.”²⁹¹ It is notable that to get patents over these variants, AbbVie was not required to have actually made them—the sanctioning of “prophetic examples” by the Patent Office means that companies can disclose “made-up experiments and fictional data in patents” and have it “treated as equivalent to factual data,” according to Janet Freilich, who has studied the practice in depth.²⁹² The ability to pursue continuation patents was a cornerstone of AbbVie's strategy: in an independent analysis performed for this paper of the patents covering Humira disclosed by AbbVie in the litigation, the vast majority were found to be continuations.²⁹³ As noted by the Northern District of Illinois, a single patent

²⁸⁴ See *supra* Section I.B.2.

²⁸⁵ See, e.g., Gregory R. Day & Michael Schuster, *Patent Inequality*, 71 ALA. L. REV. 115, 127 (2019).

²⁸⁶ Robin Feldman, *May Your Drug Price Be Evergreen*, 5 J.L. & BIOSCIENCES 590, 597 (2018).

²⁸⁷ C. Scott Hemphill & Bhaven Sampat, *Drug Patents at the Supreme Court*, 339 SCI. 1386, 1387 (2013).

²⁸⁸ Sally Turner, *Humira: The Highs and Lows of the World's Most Successful Drug*, PHARMA, https://pharma.nridigital.com/pharma_sep18/humira_the_highs_and_lows_of_the_world_s_most_successful_drug (last visited June 14, 2021).

²⁸⁹ *In re Humira (Adalimumab) Antitrust Litig.*, 465 F. Supp. 3d 811, 819 (N.D. Ill. 2020), *aff'd sub nom. Mayor & City Council of Balt. v. AbbVie Inc.*, 42 F.4th 709 (7th Cir. 2022).

²⁹⁰ See *id.* at 822.

²⁹¹ *Id.*

²⁹² Janet Freilich, *Prophetic Patents*, 53 U.C. DAVIS L. REV. 663, 666 (2019).

²⁹³ Author's analysis, to be posted to Dataverse (showing that of seventy-nine patents listed in *Humira*, 465 F. Supp. 3d at 819, sixty-one were continuation, continuation in part, or divisional patents; fifty-two were

application covering Humira “serve[d] as the basis for twenty-two continuation applications, all of which would have been barred by prior art but-for their ability to relate back.”²⁹⁴ As the court also found, “AbbVie’s 100-plus Humira-related patents can be traced back to twenty root patents, forming twenty patent [family] trees.”²⁹⁵

The firm’s strategy has been to extend and, to some degree, obscure: in the words of the company CFO, as revealed during an antitrust lawsuit currently pending in the Seventh Circuit, the firm was “‘obviously not very specific about what’ it was putting into its ‘very robust collection of IP’ because ‘with a product as important and as attractive as Humira, you do everything you can on the IP front to ensure that you’ve protected it to the best you can.’”²⁹⁶ AbbVie’s strategy was “to ‘make it more difficult for a biosimilar to follow behind.’”²⁹⁷ The strategy has worked—though a number of AbbVie’s patents have proven to be invalid, each challenge is costly.²⁹⁸ Rather than try to cut through the thicket, competitors have, in some cases, settled with AbbVie, translating into delayed dates of generic entry.²⁹⁹ Humira is a uniquely valuable drug, and it is no surprise that AbbVie took the steps that it did to protect its rights. However, the use of continuations to extend the value of patents is not unique: a paper by Mark Lemley and Judge Kimberly Moore found that 43% of biotechnology and organic chemistry patents were continuation patents, rather than covering new molecules.³⁰⁰ In an independent analysis of utility patents litigated in 2019, I found 51% were found to be continuation patents.³⁰¹

Filing for successive patents has translated into extended exclusivity, the

continuation or continuation in part; and nine were divisional patents).

²⁹⁴ *Humira*, 465 F. Supp. 3d at 823 (referring to U.S. Patent Application 10/22.140).

²⁹⁵ *Id.*

²⁹⁶ *Id.* at 824 (citations omitted).

²⁹⁷ *Id.* (citations omitted).

²⁹⁸ *See id.* at 826 (“[Competitors felt] that they had to enter into the settlement agreements because their only other choice[] [was] years of expensive litigation over an impossible patent thicket . . .”).

²⁹⁹ *See* Noah Higgins-Dunn, *AbbVie Repeatedly Hiked Humira, Imbruvica Prices and Abused Patents to Keep Competitors at Bay: Report*, FIERCE PHARMA (May 18, 2021, 12:00 PM), <https://www.fiercepharma.com/pharma/abbvie-repeatedly-raised-prices-for-humira-imbruvica-and-abused-u-s-patent-system-to-extend> (describing Congressional probe into AbbVie’s actions to delay generic entry for Humira, including settling with competitors challenging AbbVie’s patents).

³⁰⁰ Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 86 tbl.2 (2004) (showing a table of Continuation Filing by Technology Centers, at “TC1600: Biotechnology and Organic Chemistry”).

³⁰¹ *See* Colleen Chien, *2019 Litigated Patents and Continuity Claims*, GOOGLEDOCS, <https://docs.google.com/spreadsheets/d/16jy7bk9Rjx9PvVFC5pozXUMqoJy8O5XDZuFhigPdchQ/edit?usp=s> haring.h (last visited Aug. 19, 2021).

extension of patent life through “evergreening.”³⁰² Filing for many continuation patents in order to cover the products of competitors has created “impassable” patent thickets for competitors.³⁰³ These tactics, perfectly legal under patent law, have helped pharmaceutical firms reap large profits,³⁰⁴ while also arguably supporting product innovation. They have also been used by holders of patents covering technical standards. Tim Simcoe and Cesare Righi have found the use of continuation procedures to opportunistically pursue “new patents that are infringed by already-published standards” to be “widespread.”³⁰⁵

Do such tactics, even though allowed under patent law, amount to anti-competitive behavior? The allegation in *Humira* was that AbbVie’s patent actions to box out competition violated Sections 1 and 2 of the Sherman Act and state laws.³⁰⁶ But the scope of antitrust oversight of patenting behavior has been limited by the *Noerr-Pennington* doctrine, which immunizes behavior that is legal under patent law from antitrust liability unless it constitutes “a pattern of baseless, repetitive claims.”³⁰⁷ In the dismissal of antitrust claims against AbbVie concerning Humira, the court found that though AbbVie had failed in a large share of its applications and asserted patents, it succeeded in a majority of them,³⁰⁸ undercutting the finding of such a pattern. But it is unclear whether this interpretation actually captures the anti-competitive harms that are associated with continuation patents. This is in part because the intended purpose of continuation patents in the scheme of the patent system—and also how far AbbVie has departed from it—are not well-appreciated due to low public understanding of these administrative options.

b. At the Individual Level: Knowledge of Patenting and Access to Trusted, Trustworthy, and High-Quality Patent Attorneys

That the system tends to favor those with the best lawyers and patent portfolios, not necessarily those with the best ideas or most talent, applies not only to firms, but to individuals as well. While some features of the patent

³⁰² Feldman, *supra* note 286, at 596.

³⁰³ *Humira*, 465 F. Supp. 3d at 845.

³⁰⁴ See generally U.S. GOV’T ACCOUNTABILITY OFF., DRUG INDUSTRY: PROFITS, RESEARCH AND DEVELOPMENT SPENDING, AND MERGER AND ACQUISITION DEALS (2017), <https://www.gao.gov/assets/gao-18-40.pdf> (finding that from 2006 to 2015, large drug company “margin[s] fluctuated between 15 and 20 percent” versus margins across large non-drug companies of only four and nine percent).

³⁰⁵ Righi & Simcoe, *supra* note 276, at 3.

³⁰⁶ See *Humira*, 465 F. Supp. 3d at 826.

³⁰⁷ Cal. Motor Transp. Co. v. Trucking Unlimited, 404 U.S. 508, 513 (1972).

³⁰⁸ See *Humira*, 465 F. Supp. 3d at 824–28, *aff’d sub nom.* Mayor & City Council of Balt. v. AbbVie Inc., 42 F.4th 709 (7th Cir. 2022).

system are designed to promote broad participation by all, other features, this subsection argues, cut the other way. As has been discussed at length elsewhere,³⁰⁹ patenting is expensive, putting it out of reach of some.³¹⁰ In addition, the “corporatization” of R&D means that firms, rather than individuals, are applying for most of the patents.³¹¹ But for innovators or entrepreneurs—even within firms³¹²—to even know to apply for a patent in the first place takes knowledge that patenting is possible, a sense that it is worthwhile, and a belief that one will get a fair shot during the patenting process. It also requires a relationship with a patent agent or lawyer who can vet an invention for its patentability (or lack thereof), and, as appropriate, file the patent and pursue it to completion.

Applying for a patent takes a certain level of awareness that, in many cases, is lacking. But even to be able to apply for a patent, conditional upon having a patentable idea and the organization to pursue it, an applicant must work with a bar-qualified patent agent or attorney, or the applicant must file *pro se*. At various points in history, segregationist laws have restricted access to patent lawyers³¹³ and removed black examiners from the civil service.³¹⁴ While no rules currently explicitly bar women, African-Americans, or others from becoming patent attorneys, the patent bar remains overwhelmingly male³¹⁵ and, until recently, the patent examination corps included few black examiners.³¹⁶ This is

³⁰⁹ MILLI ET AL., *supra* note 265, at 18–20.

³¹⁰ However, these barriers do not necessarily impede innovation, insofar as startups and midsize technology firms can select other, cheaper forms of intellectual property protection (trade secrecy, copyright, and trademarks) to serve as imperfect “substitutes” to patenting. *See* Clark D. Asay, *Patenting Elasticities*, 91 S. CAL. L. REV. 1, 26 (2017) (quoting ARLEEN J. HOAG & JOHN H. HOAG, *INTRODUCTORY ECONOMICS* 65 (4th ed. 2006)).

³¹¹ *See id.* at 15 (“[R]esource-constrained parties are likely to patent less than those with greater resources . . . [because of] [t]he high costs of patenting . . .”).

³¹² For example, women in the STEM workforce only patent at a fraction of the rate that their male counterparts do, due to factors including a lack of awareness. *See generally* NORRIS ET AL., *supra* note 258, at 7–9 (finding that awareness was a key reason why female inventors did not engage in the invention process).

³¹³ Cook, *supra* note 262, at 226.

³¹⁴ *Id.* at 237 n.41.

³¹⁵ La’Cee Conley, *USPTO Responds to Patent Bar Gender Gap Inquiry, Mulls Changes to Registration Process*, IPWATCHDOG (Jan. 25, 2021), <https://www.ipwatchdog.com/2021/01/25/uspto-responds-patent-bar-gender-gap-inquiry-mulls-changes-registration-process/id=129373/> (reporting that almost 30% of 2019 new patent agents were women); *see* Saurabh Vishnubhakat, *Gender Diversity in the Patent Bar*, 14 J. MARSHALL REV. INTELL. PROP. L. 67, 80 tbl.2 (2014) (reporting that, among agents and attorneys with identifiable gender, about 20% were women).

³¹⁶ Davetta Goins, *Spotlight on Commerce: Davetta Goins, Supervisory Patent Examiner*, USPTO (Feb. 26, 2020), <https://www.uspto.gov/blog/director/entry/spotlight-on-commerce-davetta-goins> (describing the growth at the USPTO of African-American employees from “a few” per Tech Center in the early 2000s to approximately 20% of employees in 2020, whereby employee counts include both patent examiners and

in part because to be eligible to even sit for the patent bar generally requires a science, technology, or engineering degree.³¹⁷ Because of their underrepresentation among STEM, engineering, and computer science graduates, women and minorities are disproportionately excluded from sitting for the patent bar, a number of commentators have noted.³¹⁸ When Sara Blakely, the founder of the billion-dollar women's undergarment empire Spanx, got her start, she could not find "a single female patent attorney . . . in the whole state of Georgia" to file a patent application.³¹⁹ Research by Abhay Aneja and his colleagues suggests that the lack of access to high-quality patent attorneys contributes to the "gender patent granting gap"—the lower success rates of comparable patent applications submitted by women to the US Patent Office.³²⁰ Though patent applications by women are abandoned to a higher degree than applications by men in response to early-stage rejections, the difference is reduced when "women-led applications have either the backing of firms or high-quality legal representation, consistent with a potential role for institutional support in mitigating gender disparities."³²¹ Uneven access to quality legal counsel may also explain in part why, as explored in the next Part, independent inventors and small firms are considerably less likely to succeed on their applications than large firms.

When independent and small inventors do not have trusted connections that can help them navigate the patenting process, they are more vulnerable to unscrupulous patent lawyers and scammers. Although only a small fraction of patents become valuable products, the enthusiasm of inventors makes them susceptible to unrealistic marketing claims or expectations, at times with ruinous results.³²² In *East of Eden*, John Steinbeck describes the main character:

[Samuel] developed a very bad patent habit, a disease many men suffer from. He invented [] part of a [] machine The patent

administrative staff).

³¹⁷ Letter from Eric Goldman, Professor, Santa Clara Univ. Sch. L., Jess Miers, Student, Santa Clara Univ. Sch. L., et al., to U.S. Pat. & Trademark Off. (June 30, 2019) (on file at <https://www.uspto.gov/sites/default/files/documents/SUCCESSAct-Goldman-et-al.pdf>).

³¹⁸ *Id.*

³¹⁹ Inc. Staff, *How Spanx Got Started*, INC. (Jan. 20, 2012), <https://www.inc.com/sara-blakely/how-sara-blakely-started-spanx.html>.

³²⁰ Abhay Aneja, Oren Reshef & Gauri Subramani, *Try, Try, Try Again? Differential Responses to Rejection & The Gender Innovation Gap* 1, 11 (May 2021), http://sites.bu.edu/tpri/files/2021/06/Try_try_try_May21.pdf.

³²¹ *Id.* at 1.

³²² *See Invention Promotion Scams*, FED. TRADE COMM'N CONSUMER ADVICE (Dec. 2021), <https://consumer.ftc.gov/articles/invention-promotion-scams>.

attorney ate up his little profit . . . [and the money] was drained off in patents. The Hamilton children went barefoot, . . . and food was sometimes scarce³²³

In recent years, so-called “invention promotion firms” that promise to evaluate, patent, and market inventions in exchange for substantial sums of money upfront have flourished. In 2017, the Federal Trade Commission (“FTC”) initiated a suit against “World Patent Marketing,” a company in Florida it said had “bilked thousands of consumers out of millions of dollars.”³²⁴ The company promised inventors lucrative licensing or manufacturing agreements but “fail[ed] to fulfill almost every promise [made].”³²⁵ In 2011, the FTC set up a consumer awareness site and hotline to warn independent innovators of “dishonest invention promoters [who] lie about the profit potential of your invention to get you to pay for expensive, but often useless, services.”³²⁶ Poor access to quality patent attorneys exacerbates inequalities in opportunities to innovate and invent.

c. At the Firm and Individual Level: By Leveraging High Litigation Costs and Large Patent Portfolios

Well-resourced companies enjoy advantages not only when they file for individual patents, but also when they strategically acquire and enforce or defend against patent assertions. As defendants, small firms have vulnerabilities that their larger rivals do not—they are often fighting for survival, less experienced, and less likely to have staff dedicated to legal matters, much less patent legal matters.³²⁷ This makes them an easy target for certain types of “patent assertion entities,” known more colloquially as “trolls”—special purpose firms that strategically use their patents to sue and support litigation rather than the development or commercialization of products.³²⁸ Although trolls target firms of all sizes, the impact of threatened litigation on young or small firms that are on the rise, especially when they are strategically timed, for example on the eve

³²³ JOHN STEINBECK, *EAST OF EDEN* 41 (1952).

³²⁴ Complaint for Permanent Injunction & Other Equitable Relief at 1, Fed. Trade Comm’n v. World Patent Mktg., Inc., No. 17-CV-20848-DPG (S.D. Fla. Mar. 6, 2017).

³²⁵ *Id.* at 2.

³²⁶ See *Invention Promotion Scams*, FED. TRADE COMM’N CONSUMER ADVICE (Dec. 2021), <https://consumer.ftc.gov/articles/invention-promotion-scams>.

³²⁷ See Colleen V. Chien, *Startups and Patent Trolls*, 17 STAN. TECH. L. REV. 461, 476 (2014) (recognizing that for some under-resourced small companies, the “legal system is [the] enemy”).

³²⁸ See Colleen V. Chien, *From Arms Race to Marketplace: The Complex Patent Ecosystem and Its Implications for the Patent System*, 62 HASTINGS L.J. 297, 313 (2010).

of an initial public offering, can be more devastating.³²⁹ This makes settlements an attractive option.

Suits by large companies, or “bullies,” against smaller rivals can be just as, if not more, damaging because the interests transcend obtaining a financial settlement. In response to a survey conducted among venture capitalists about patent litigation against startups, for example, respondents cited, “[b]ig company scorched earth tactics . . . [meant to] scare a smaller company and make it hard to raise funding,” to “drain the start-up of cash to remove a competitor,” “to squash a thinly funded competitor,” or “to shut [the] company down.”³³⁰

Such “bully” suits name small companies as *defendants*, but the high cost of litigation is bad for small innovators as patent *plaintiffs* as well. This is because when large firms copy but “hold out” and refuse to negotiate with patentholders, engaging in “efficient infringement,”³³¹ it is difficult for smaller firms to get their day in court due to the cost of assertion, the high risk of countersuit based on one of the many patents in a larger competitor’s portfolio, and the demise of automatic injunctions to prevailing patentees.³³² Patent plaintiffs must put at risk not only the legal cost of the assertion, but also the patent, which is susceptible to validity challenges in court as well as at the USPTO, through post-grant administrative challenges.³³³ Serial defensive challenges, in which single or multiple parties file successive challenges to the same patent, wearing down and draining the patentee of resources,³³⁴ also smack of abuse. They highlight the

³²⁹ See Chien, *Startups and Patent Trolls*, *supra* note 327, at 475 (reporting survey evidence suggesting that the smaller the target company, the more likely it was to make an operational change, like pivoting away from a product or product line, or shutting down).

³³⁰ COLLEEN V. CHIEN, PATENT ASSERTION AND STARTUP INNOVATION 23 (Sept. 2013), <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=1858&context=facpubs>; see also Ted Sichelman, *The Vonage Trilogy: A Case Study in “Patent Bullying”*, 90 NOTRE DAME L. REV. 543 (2014), <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=1858&context=facpubs> (discussing patent bullying and predation).

³³¹ See, e.g., *Online Platforms and Market Power, Part 5: Competitors in the Digital Economy*, Hearing Before the Subcomm. on Antitrust, Commercial and Admin. Law, 116th Cong. 8 (Jan. 17, 2020) (documenting claims by Sonos that Google copied its technology).

³³² Colleen V. Chien & Mark A. Lemley, *Patent Holdup, the ITC, and the Public Interest*, 98 CORNELL L. REV. 1, 3, 16 (2012) (describing the decline in injunction rates following the *eBay v. Mercexchange* decision, particularly among non-practicing entities who primarily earn their revenues through licensing fees).

³³³ Principally, a post-grant challenge is through a procedure called inter partes review. See *Inter Partes Review*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/patents/ptab/trials/inter-partes-review> (Sept. 4, 2020, 01:09 PM).

³³⁴ Steven Carlson & Ryan Schultz, *Tallying Repetitive Inter Partes Review Challenges*, LAW360 (Sept. 14, 2018, 5:09 PM), <https://www.robinskaplan.com/~media/pdfs/tallying%20repetitive%20inter%20partes%20review%20challenges.pdf?la=en> (finding that over half of petitions filed by Apple were duplicative, attacking the same claims, and

tensions, as discussed in Part I, between the interests of consumers who stand to benefit from broader access to inventions covered by patents that are invalidated, and the interests of small or upstart patent holding firms.

Even in the absence of lawsuits, large patent portfolios may have a deterrent effect on small firms. Studying patent portfolio accumulation, George Day and Michael Schuster have found that startup inventors reduce their research and development expenditures when faced with growing numbers of patents in a field.³³⁵ In a related paper, Bronwyn Hall and her coauthors have reached similar conclusions about the deterrent impact of patent thickets on entry and investment based on an analysis of data from U.K. firms, but also find that the answer depends on the nature of the technology.³³⁶ Reduced investment and entry are not necessarily welfare-reducing in areas of growing complexity, where entry can be excessive and lead to “business stealing” when a new firm merely shifts, rather than increases, customer demand.³³⁷ But when patent thickets discourage entry in new technology areas, there is a greater risk that original, “outside the box” ideas will be lost.³³⁸ In these ways, sophisticated parties have exploited the high cost of litigation, as well as their ability to amass large portfolios of patents, to dampen opportunity as well as access to the innovations of new firms.

3. Decreasing Access by Avoiding Government Oversight

Another way in which firms limit oversight and downstream access to innovation is through sharp practices with respect to government-funded innovation. Although patentees are generally free to do what they want with their inventions, taxpayer-funded inventions are different and subject to special contractual and statutory safeguards. In the case of the COVID-19 vaccine, for example, the U.S. Biomedical Advanced Research and Development Authority (“BARDA”) struck a deal with Moderna to reimburse it up to \$1 billion in research and development costs³³⁹ and, in exchange, get priority for the purchase of the vaccine at a lower price.³⁴⁰ The federal government also has the statutory

documenting a similar pattern for other leading filers).

³³⁵ Day & Schuster, *supra* note 285, at 154.

³³⁶ Bronwyn H. Hall, Christian Helmers & Georg von Graevenitz, *Technology Entry in the Presence of Patent Thickets* 20 (Nat’l Bureau of Econ. Rsch., Working Paper No. 21455, 2015), https://www.nber.org/system/files/working_papers/w21455/w21455.pdf.

³³⁷ *Id.*

³³⁸ *Id.* at 21.

³³⁹ *U.S. Government Exercise 1st Option for Additional 100 Million Doses of Moderna’s COVID-19 Vaccine Candidate*, MODERNA (Dec. 11, 2020), <https://investors.modernatx.com/news-releases/news-release-details/us-government-exercises-1st-option-additional-100-million-doses>.

³⁴⁰ Sissi Cao, *COVID-19 Vaccine Prices Revealed from Pfizer, Moderna, and AstraZeneca*, OBSERVER

right, under certain circumstances, to take steps to expand access to the fruits of government-funded research.³⁴¹ As was referred to at the beginning of this Article, the Bayh-Dole Act authorizes the exercise of so-called “[m]arch-in” rights according to which, under certain limited circumstances, the government can provide licenses to third parties to make the invention more widely available.³⁴² Even if rarely exercised, the presence of this powerful tool serves as an accountability check on government-funded inventions.

But for the mechanism of government oversight to actually broaden access to “government inventions,” such inventions must be identifiable in the first place. Unfortunately, compliance with government interest disclosures and co-inventorship is often less than robust.³⁴³ For example, in the case of Moderna’s COVID-19 vaccine, two separate government agencies, the Defense Advanced Research Project Agency (“DARPA”) and the National Institutes of Health (“NIH”), initiated investigations based on the potential nondisclosure of government ownership interests in Moderna patents.³⁴⁴ Following this heightened scrutiny, Moderna pledged to not enforce its COVID-19 patents.³⁴⁵ At the time of this writing, Moderna and the NIH remained engaged in a bitter inventorship dispute over government-funded mRNA patents.³⁴⁶ While prompt correction of the record would be an appropriate remedy for a good-faith omission of a government inventor, deliberately leaving off an inventor would result in the patent being held unenforceable under the doctrine of inequitable conduct.³⁴⁷ But even when government ownership information is disclosed, it is often strategically delayed or poorly integrated into the patent record.³⁴⁸

(Nov. 23, 2020, 4:26 PM), <https://observer.com/2020/11/covid19-vaccine-price-pfizer-moderna-astrazeneca-oxford/>.

³⁴¹ 35 U.S.C. § 203(a).

³⁴² *Id.* (specifying the conditions under which the federal government can “[m]arch-in” on IP rights covering federally funded research and use it without the permission of the rightsholder).

³⁴³ Arti K. Rai & Bhaven N. Sampat, *Accountability in Patenting of Federally Funded Research*, 30 NATURE BIOTECHNOLOGY 953, 954 (2012).

³⁴⁴ See Jorge L. Contreras, *Deconstructing Moderna’s COVID-19 Patent Pledge*, BILL OF HEALTH: EXAMINING INTERSECTION OF HEALTH, TECH. & BIOETHICS (Oct. 21, 2020), <https://blog.petrieflom.law.harvard.edu/2020/10/21/moderna-covid19-patent-pledge/>.

³⁴⁵ *Id.*

³⁴⁶ Heidi Ledford, *What the Moderna-NIH COVID Vaccine Patent Fight Means for Research*, NATURE (Nov. 30, 2021), <https://www.nature.com/articles/d41586-021-03535-x>.

³⁴⁷ See, e.g., *Advanced Magnetic Closures, Inc. v. Rome Fasteners Corp.*, 607 F.3d 817, 828 (Fed. Cir. 2010).

³⁴⁸ See Maya M. Durvasula, Lisa Larrimore Ouellette & Heidi L. Williams, *Private and Public Investments in Biomedical Research* 8 (Nat’l Bureau of Econ. Rsch., Working Paper No. 28349, 2021), <https://www.nber.org/papers/w28349#:~:text=Recent%20policy%20attention%20has%20focused,of%20government%20support%20for%20research> (finding disclosures are often made late and “certificates of correction

Although far from comprehensive, the foregoing describes some of the tactics firms have used to capture advantage in and through the patent system. Though the patent system is supposed to balance the interests of rights holders and implementers, the complexity and cost of the system advantage those with the resources and wherewithal to use the system strategically relative to others, regardless of which side they are on. As firms with invention capital use it to enrich themselves, the inequalities of innovation are intensified. Though “gaming the system” to gain advantage is not illegal, nor particularly new,³⁴⁹ nor unique to patents,³⁵⁰ it does suppress competition and therefore certain kinds of opportunity and access.

This Part has described the mechanisms by which the patent system can both alleviate and extend the inequalities of innovation. Viewing them together underscores the inherent tensions, like those identified in the previous Part, between a number of patent doctrines, each of which may plausibly advance egalitarian interests. As described earlier, increasing access to an invention through its diffusion, for example to a different country, is supported by the ability of the innovator firm to price discriminate, which in turn depends on “first sale” or exhaustion policies. While a policy of limited or “national” exhaustion permits price discrimination and encourages innovator companies to make investments to enter new markets with the security that offering lower prices there will not cannibalize sales in the original market, a policy of expansive or “international” exhaustion favors consumers in the original market who can in theory avail themselves of the lower prices now offered in the other market (e.g., U.S. consumers benefiting from lower Canadian drug prices). Similarly, the ability to file continuation patents can boost the value of an individual patent, may lead to greater intellectual property “empowerment” for its owner, and can result in even greater availability of the invention but, ultimately, produce higher-priced access for some consumers. Giving more rights or requiring remuneration to employee-inventors, as many countries in Europe do, would shift the balance of the benefits of invention toward labor and away from capital, but also introduce significant transaction costs to be passed on to consumers,

are not integrated into the standard patent data sets”).

³⁴⁹ See, e.g., *supra* Section II.B. (describing the history of lobbying for patent extensions).

³⁵⁰ See, e.g., Tyler T. Ochoa, *Patent and Copyright Term Extension and the Constitution: A Historical Perspective*, 49 J. COPYRIGHT SOC’Y U.S.A. 19, 39–46, 49–50 (2002) (describing numerous copyright extensions in the twentieth century including through the 1909 Act, nine temporary extensions provided in anticipation of the 1976 Act, the 1976 Act, the 1998 Act, and one private extension).

limiting access. Adjustments to the law in the face of such tradeoffs must be finely calibrated and carefully weighted.

III. PATENT REFORMS TO EXPAND INNOVATION AND EQUITY

This Part discusses several ideas for narrowing the inequalities of innovation through patent law and policy. In so doing, it is worth emphasizing that these ideas serve as a complement to, not a substitute for, laws and policies³⁵¹ that may more directly address each of the inequalities of innovation. As to economic inequality, for example, even if all people patented at the rate of children from wealthy white families, mechanically speaking, the number of inventors annually would still be a tiny fraction of the number of Americans whose income would be impacted by an increase in the minimum wage.³⁵² Similarly, the number of people that could potentially take advantage of improved STEM education is much greater than, for example, the fraction of innovators that would benefit from tweaks to patent filing protocols. In addition, not everyone can or will choose to respond to patent incentives,³⁵³ no matter how expanded the opportunity. At base, the notion that intellectual property rights should serve to advance distributive justice should not detract from the “actual” tools of redistribution like taxation, labor, or other welfare policies.

What patent law *is* good for, however, is stimulating innovation, at least certain kinds,³⁵⁴ and spurring the diffusion of that innovation, potentially enriching innovators along the way. What it can also offer are ideas that are grounded in the generative nature of innovation: in many cases, the hard part is coming up with the innovation (e.g., a drug or new algorithm), but copies are

³⁵¹ Research suggests that the highest impact inequality policies are in the areas of health and education, and target youth. See Nathaniel Hendren & Ben Sprung-Keyser, *A Unified Welfare Analysis of Government Policies*, 135 Q.J. ECON. 1209, 1213 (2020).

³⁵² According to the USPTO, there were approximately 393,000 inventors with U.S. residences in 2015. See *U.S. Resident Inventors and Their Utility Patents Breakout by State Regional Component*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/web/offices/ac/ido/oeip/taf/inv_countyall/usa_invcounty_gd.htm (May 16, 2021, 4:10 PM). If that number is quadrupled, commensurate with the statement that “there would be four times as many inventors” if women and children from poor families patented at the same level as children from wealthy white families (not accounting for people that fall into multiple categories), then the total would be 1.6 million inventors. Bell et al., *supra* note 242, at 710. Over 80 million Americans are paid hourly. *Characteristics of Minimum Wage Workers, 2017*, U.S. BUREAU OF LAB. STAT., BLS REPS. (Mar. 2018), <https://www.bls.gov/opub/reports/minimum-wage/2017/>.

³⁵³ See Bair, *supra* note 200, at 544, 547 (arguing that poverty interferes with the conditions necessary for creativity and inventing, including time, mental space, and long-term perspective).

³⁵⁴ Amy Kapczynski & Tahla Syed, *The Continuum of Excludability and the Limits of Patents*, 122 YALE L.J. 1900, 1904, 1906 (2013) (warning that intellectual property systems may over-incentivize innovations where excludability is high and under-incentivize contributions where excludability is implausible).

cheap and virtually non-rivalrous. The law and administration of patents can support licensing and ability to price discriminate freely, supporting abundant access. Patents are also public franchises, not private rights, and the patent system directly interfaces with public interest laws and doctrines focused on improving the lot of the worst-off. Taking advantage of these features of patent law and policy, below this Article discusses ideas for leveling *up*, and not just leveling the playing field with respect to opportunity and access to innovation through institutional and administrative interventions in patents.

Before discussing a few proposals, it is worth returning to the normative and practical question of whether ensuring absolute equality in innovation, as compared to improving conditions of the worst-off, should be the primary goal. As previously discussed, in a primarily market-based innovation system based on incentives, some level of inequality is unavoidable. While alternative means for encouraging innovation, such as prizes and grants, exist, and indeed coexist, with the patent system, as a recent comprehensive review of the literature found, “no system is ideal.”³⁵⁵ Even in contexts when theoretical comparisons of the strengths or weaknesses of each policy tool are possible, the lack of a true counterfactual makes conclusions hard to draw.

The goal of optimizing conditions for the “worst-off” has its own challenges, principally that it requires empirical estimations that are unavailable in many cases. For example, how might one trade off the short- and long-term welfare impacts associated with international vs. domestic exhaustion? Likewise, comparing the interests of the “worst-off” consumers and the “worst-off” inventors, in a Pareto-optimal context, where improving things for one group comes at the cost of the other,³⁵⁶ is not exactly straightforward.

This Part seeks to avoid some of these difficult questions by focusing on “win-win” or, at least, “win-no-lose” interventions, aimed at expanding opportunity and access. Equality still has a role to play when deciding how to allocate limited resources among competing priorities. In the face of disparities in inventing and access, the narrowing of gaps represents a guidepost for developing and evaluating reforms and advancing equality.

³⁵⁵ Michael Abramowicz, *Prize and Reward Alternatives to Intellectual Property*, in RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW 350, 373 (Ben Depoorter & Peter S. Menell eds., 2019) (including, among the challenges of administering prize or grant systems: administration costs and risks, difficulties in accurately specifying or valuing desired innovations, and the risk of under-commercialization).

³⁵⁶ *Pareto Optimality*, SCIENCE DIRECT, <https://www.sciencedirect.com/topics/engineering/pareto-optimality> (last visited Aug. 16, 2021) (“Pareto optimality is the state at which resources in a given system are optimized in a way that one dimension cannot improve without a second worsening.”).

One limitation of the discussion below is that it does not recommend changes to patent law, even as the previous Part acknowledged, the relevance of doctrines like exhaustion, inventor remuneration, and inequitable conduct, to how the benefits of innovation are distributed. One reason is that inequality is ruthlessly practical—having to do less with legal rights on the books and more to do with the gains to welfare as experienced in real life.³⁵⁷ Another reason is that the types of innovation for which patents arguably matter the most, pharmaceuticals, benefit from systemic certainty, rather than the case-by-case determinations offered by equity. Perhaps for this reason, laws that require the evaluation of a number of factors before suspending patents—for example, through the exercise of march-in rights or compulsory licenses—have been used sparingly. A final reason is that while agreeing on expanding equity and access in principle is easy, working out the specifics of legal and administrative reforms requires detailed, considered analysis beyond the scope of this Article.

For all of these reasons, this Article focuses below on the creation of the institutional and administrative structures for increasing opportunity and access in the patent system, leaving to them the more fulsome consideration of changes to the law that would do the same. Specifically, this Article recommends: (1) to increase opportunity to invent, creating an Independent Office of the Small Inventor Advocate within the USPTO that would be responsible for increasing invention capital and know-how among underrepresented and underserved innovators, leveling up the inventing playing field, for example through patent quality technology and rigorously evaluating policy suggestions such as the creation of a patent small claims court; (2) to increase access, establishing an Independent Office of the Public Interest and Partnerships to enhance public understanding of the patent system and support partnerships to advance access; and (3) to track progress in narrowing the inequalities of innovation, introducing invention equity metrics.

A. Expanding Opportunity to Innovate by Leveling Up the Patenting Playing Field

The discussion below explores a few ideas for “leveling up” the patenting playing field. These suggestions include, in the acquisition of patents, universal access to patent quality technology, and in their enforcement, exploring a small

³⁵⁷ In the COVID-19 context, for example, schemes that waive rights, to many, are less meaningful than schemes that actually accomplish the delivery of medicines.

claims option, as well as working to build invention capital, and to carry out these reforms, establishing an Independent Office of the Small Inventor Advocate.

1. By Reducing the Success Gap in Patenting Through Patent-Quality Technology

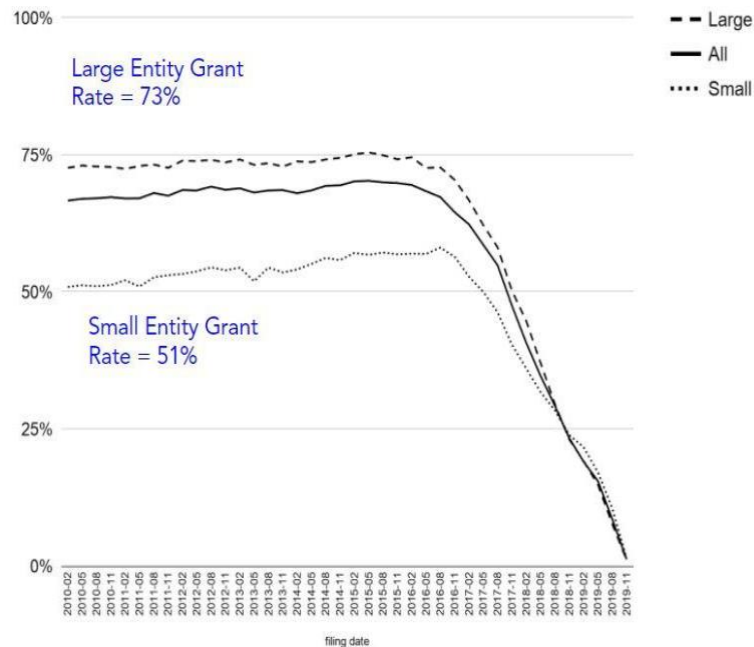
As described previously, first-time patenting is associated with increasing economic mobility and other positive outcomes.³⁵⁸ For at least these reasons, it is important to pay attention not only to who is applying for patents, but also to what happens when they do. The rate at which firms “succeed” on their patent applications is estimated to be around 71% on average,³⁵⁹ but how are firms that are first-time applicants faring? Using data obtained from Google patents, I previously traced patent applications by the size of the filer from the initial application through its eventual resolution.³⁶⁰ I found, consistent with other analyses,³⁶¹ that among applications filed ten years ago, 73% of large entity applications had matured into patents but only 51% of small or micro-entity applications had.

³⁵⁸ See Farre-Mensa, *supra* note 181, at 642–43. See generally Aghion et al., *Innovation and Top Income Inequality*, *supra* note 175.

³⁵⁹ Michael Carley, Deepak Hegde & Alan Marco, *What is the Probability of Receiving a U.S. Patent?*, 17 YALE J.L. & TECH. 203, 213 fig.3 (2015) (distinguishing between “family” and “progenitor” allowance rates of 56% and 71%, respectively). Note that the 71% figure is an average of percentages of six different industries. *Id.*

³⁶⁰ Colleen V. Chien, Jonathan Collins, Zachary J. Daly & Rodney Swartz, *Guest Post: Advancing Inclusive Innovation and Entrepreneurship Through the Patent System*, PATENTLYO (Nov. 4, 2020) (reporting on an analysis performed in October 2020 of Patent Examination Data System (PEDS) data of a random sample of patent applications filed in 2010); *Patent Examination Data System*, USPTO, <https://ped.uspto.gov/peds/#/> (Aug. 15, 2021). It uses entity size at filing as the source of entity size data. See *Office Action Research Dataset for Patents*, USPTO (last visited June 20, 2022), <https://www.uspto.gov/ip-policy/economic-research/research-datasets/office-action-research-dataset-patents>.

³⁶¹ Kate Gaudry & Sarah C. Brock, *Patent Prosecution Statistics: Large Versus Small Entities*, INTELL. PROP. TODAY (Oct. 2014), https://www.kilpatricktownsend.com/~media/Files/articles/2014/Gaudry_OCT14%20V3.ashx (“[S]mall entities’ patent applications were 58% more likely to be abandoned than [those of] large entities.”); see also Carley et al., *supra* note 359, at 214 (2015) (showing that small entity patent filers had lower rates of allowance than large entity filers).

Fig. 5: Patent Grant Rates by Entity Size

This means that in almost half of the cases, the applications submitted by small entities do not actually turn into patents by the ten-year mark. Given the importance of entrant applicant success, the USPTO should further investigate the causes of this high failure rate, for example, through survey or other forensic work. Small inventor attrition may be due to any of a variety of factors, such as a higher firm failure or pivot rate, differences in the types of patents sought, the merits of the underlying inventions, or less cash on hand.³⁶² It may also stem from the differences in the application experience alluded to in Part II leading to low quality among applications submitted.³⁶³ A previous analysis has shown that discounted (“small” and “micro”) entity applications are much more likely to experience rejections under 35 U.S.C. § 112, which requires that an invention be adequately disclosed and precisely claimed.³⁶⁴ Small entity and independent

³⁶² See Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 EMORY L.J. 181, 193 (2008).

³⁶³ See *supra* Part II.

³⁶⁴ 35 U.S.C. § 112; see also Colleen V. Chien, *Rigorous Policy Pilots the USPTO Could Try*, 104 IOWA L. REV. ONLINE 1, 21 (2019).

inventor patents are also less likely to survive post-grant challenges.³⁶⁵ Because a patent specification cannot be supplemented with additional information once it has been filed, the failure to sufficiently disclose and describe the invention can be fatal to the application. But for new entrants, it is not always easy to tell what level of disclosure will pass statutory muster. In surveys, patent examiners have identified mismatches between the claims, the “inventive concept,” and the specification to pose the biggest problems.³⁶⁶

One way to level up the application playing field would be to ensure that access to high quality patent tools are accessible to entrants and incumbents.³⁶⁷ As described in previous work, technological tools are now available to help to detect errors, point out weaknesses in applications, and even to draft patents.³⁶⁸ But under-resourced and less sophisticated patent applicants are among the least likely to have access to fee-based tools, particularly when they represent themselves pro se.

To support independent inventors, small entities, and first-time filers, the USPTO could work to make these tools available to all applicants. One model is provided by the “IRS Free File program,” which provides low-income and military families³⁶⁹ with free access to tax return filing software.³⁷⁰ If technology firms agreed to extend the “small” or “micro” discounts available at the USPTO of 50% and 75% to clients, or to provide the tools to applicants that qualify for USPTO pro bono assistance, then tool adoption, equity, and applicant readiness would all be boosted. Advanced market commitments, or other means of coordinating, or aggregating demand would reduce uncertainty in the market.

³⁶⁵ Brian J. Love, Shawn P. Miller & Shawn Ambwani, *Determinants of Patent Quality: Evidence from Inter Partes Review Proceedings*, 90 U. COLO. L. REV. 67, 119 & n.217 (2019) (finding patents obtained by small entities and independent inventors to be “significantly less likely to pass muster” in post-grant challenge contexts and citing supporting prior research).

³⁶⁶ JIM DWYER & MARTY RATER, U.S. PAT. & TRADEMARK OFF., EXAMINERS PROVIDE THEIR VIEWS ON PREPARED APPLICATIONS: APPLICATION READINESS SURVEY 16 (2017), https://www.uspto.gov/sites/default/files/documents/QChat_Oct_12_2017.pdf (reporting on a survey of examiners that asked about deficits in patent specifications). The survey rated “[h]aving claims that are solely directed to the inventive concept” as having the largest gap among claims, while “[h]aving the inventive concept clearly set forth” had the largest gap among specifications. *Id.*

³⁶⁷ See Chien, *Rigorous Policy Pilots the USPTO Could Try*, supra note 364, at 22–24.

³⁶⁸ *Id.*

³⁶⁹ *IRS Free File Program Delivered by TurboTax*, TURBOTAX, <https://freefile.intuit.com/> (last visited Feb. 26, 2021).

³⁷⁰ Though, in a way that takes into account problems in the administration of the Intuit FreeFile program. See Justin Elliott & Lucas Waldron, *Here’s How TurboTax Just Tricked You into Paying to File Your Taxes*, PROPUBLICA (Mar. 24, 2021), <https://www.propublica.org/article/turbotax-just-tricked-you-into-paying-to-file-your-taxes> (describing efforts by TurboTax to misleadingly direct taxpayers to the paid rather than free version of its software).

The same economic models that allow AARP, bar associations, and other loyalty membership associations to provide these services to their members could be used here. “Means-testing” could be accomplished through declarations made to the USPTO of an applicant’s or patentee’s size that risk a finding of inequitable conduct rendering the patent unenforceable if found to be false later.³⁷¹

2. *By Reducing the Enforcement and Defense Gaps Through a Patent Small Claims Court?*

Though the foregoing paragraphs focus on making it easier for small entities and independent inventors to obtain patents, a similar approach could be applied to make it easier for small entities to both enforce their patents and protect themselves against claims of infringement. One way of doing so could be through a “small claims” patent court that is designed to reduce the burden on both small plaintiffs and defendants. For plaintiffs, the high cost of litigation and the possibility of countersuits currently puts all but the best-resourced patentholders at a disadvantage. For small defendants, the high cost of defense³⁷² can also create a lose-lose situation, since:

[n]o matter what, a company that successfully defends against a patent suit is left in a worse position than when it started. If it has not spent money on damages, then it has spent money on legal fees, making the objective to get out of the suit as cheaply as possible.³⁷³

While the obvious upside of such a forum is, of course, that it could curb opportunistic infringement by making it more likely that small plaintiffs will get their day in court, there is a risk that the forum itself will result in opportunistic assertion, resulting in a proliferation of cases against small defendants. The adoption of possible features like capping costs based on the estimated value of a case, requiring both parties to opt in, and enabling the pre-specification of agreed-upon, arbitration-type remedies, may make it more likely that the appropriate balance between under-enforcement and over-enforcement will be struck.³⁷⁴ The use of some version of these features in the copyright system’s emerging small claims court under the Copyright Alternative in Small-Claims

³⁷¹ 37 C.F.R. § 1.28(d).

³⁷² Collen V. Chien & Michael J. Guo, *Does the U.S. Patent System Need a Patent Small Claims Proceeding?* 2 (Santa Clara Univ. Legal Stud. Rsch. Paper Series, Working Paper No. 10–13, 2013), <https://ssrn.com/abstract=2249896>.

³⁷³ *Id.* at 5.

³⁷⁴ *See id.*

Enforcement (“CASE”) Act,³⁷⁵ as well as private sector experiments like Amazon’s Utility Patent Neutral Evaluation Procedure,³⁷⁶ both of which aim to limit the cost of adjudicating patent claims, are likely to be instructive. In early 2022, the Administrative Conference of the United States (“ACUS”), an independent governmental agency, announced that it had been engaged by the USPTO to conduct an independent study of issues associated with, and options for designing, a small claims patent court, for ultimate submission to Congress.³⁷⁷ But rather than trying to perfect a program on the first try, the USPTO could build on its tradition of testing out promising programs by “piloting” them temporarily³⁷⁸ to try to test the impact of a small claims court, under the ambit of an Independent Office of the Small Inventor Advocate, as described below.

3. *By Increasing Invention Capital*

But to even have a patent to enforce in the first place, or an innovation that is worth fighting over, requires more than just good ideas—it also requires exposure to relevant networks of support. With its rich administrative data, the USPTO can help to build invention capital among invention outsiders and traditionally underrepresented groups. For example, as the holder of information on patent bar qualified agents and attorneys, the USPTO can make it easier to find trusted and qualified legal help. Already, the USPTO maintains a public listing of registered attorneys and agents for disciplinary purposes,³⁷⁹ but this could be supplemented with the fields of information provided on an opt-in basis by practitioners including the last prosecuted patent, relevant technologies and client types, and relevant affinity and professional groups. As businesses seek to

³⁷⁵ This operates as an opt-in forum. See Corit Henris, *Oof! Nice Try Congress—The Downfalls CASE Act and Why We Should be Looking to our Cousins Across the Pond for Guidance in Updating our New Small Claims Intellectual Property Court*, 29 U. GA. J. INTELL. PROP. L. 175, 196–97 (2021). The CASE Act of 2020 established an alternative to federal court for parties seeking resolution of low-value copyright disputes; it is scheduled to begin operation in 2022. See generally Copyright Alternative in Small-Claims Enforcement Act of 2019, 17 U.S.C. § 1502(a) (stating that elements of the CASE Act serve as an alternative to federal court).

³⁷⁶ Also an opt-in system, under Amazon’s program, each party pays \$4,000 for a neutral, Amazon-appointed patent attorney to determine whether a product likely infringes a valid patent. The winning party gets its money back, and the losing party’s money goes to the evaluator. If the evaluator finds infringement—or if the alleged infringer does not participate—the product listing is removed and will only be reinstated after a court order. Kaity Y. Emerson, *From Amazon’s Domination of E-Commerce to its Foray into Patent Litigation: Will Amazon Succeed as “The District of Amazon Federal Court”?*, 21 N.C. J.L. & TECH. 71, 89–92 (2019).

³⁷⁷ ADMINISTRATIVE CONFERENCE OF THE UNITED STATES, REQUEST FOR PROPOSALS—FEBRUARY 3, 2022, U.S. PATENT SMALL CLAIMS COURT (2022), <https://www.acus.gov/sites/default/files/documents/USPTO%20RFP%202022.02.03.pdf>.

³⁷⁸ See Chien, *Rigorous Policy Pilots the USPTO Could Try*, *supra* note 364, at 2.

³⁷⁹ Vishnubhakat, *supra* note 315, at 73.

diversify the attorneys they hire, for example demographically or geographically, such information can help facilitate connections.

An existing literature suggests that “the gender gap in patenting, entrepreneurial activities, and commercialization of inventions could be mitigated by the intervention of mentors and role models.”³⁸⁰ As the holder of information on patent applicants and holders, the USPTO can also facilitate targeted connections through affinity or other inventor groups,³⁸¹ building, for example, on its coordination work certifying intellectual property clinics at law schools across the country. As of June 2021, the USPTO had certified 60 programs,³⁸² servicing inventors across the country. The Office could play a similar “coordination” or certification role in supporting additional pro bono law or mentoring connections, for example, between intellectual property attorney groups, like the American Intellectual Property Law Association (“AIPLA”) or Intellectual Property Owner (“IPO”), and affinity groups, like the National Society of Black Engineers (“NSBE”). The USPTO could also facilitate connections to other innovation resources offered by the government, such as grants, innovation facilities, or other support. Finally, the Office may be able to play an indirect role in boosting inclusion in commercial events, such as conferences and workshops, where critical content and connections are often made. For example, it could encourage conference providers to offer “small” or “micro-entity” discounts or remote tracks, certifiable through filing status, for reaching and including a larger set of people.³⁸³

The Office can also improve how it provides access to patenting know-how and information. The USPTO already provides numerous resources on its website to help members of the public learn about patents and patenting.³⁸⁴ But it remains difficult to navigate the site and find answers to basic questions about how to get patents, find an attorney, and connect with help.³⁸⁵ A concerted effort to build a front end to first-time and small inventors, for example, through a

³⁸⁰ *Report to Congress Pursuant to P.L. 115-273, The SUCCESS Act*, *supra* note 56, at 19.

³⁸¹ Lisa Cook has recommended that the federal government facilitate remote mentorships through federal labs. LISA D. COOK, POLICIES TO BROADEN PARTICIPATION IN THE INNOVATION PROCESS 15 (2020), https://www.brookings.edu/wp-content/uploads/2020/08/Cook_PP_LO_8.13.pdf.

³⁸² *USPTO to Expand Law School Clinic Certification Program*, U.S. PAT. & TRADEMARK OFF. (June 1, 2021), <https://www.uspto.gov/about-us/news-updates/uspto-expand-law-school-clinic-certification-program-1>.

³⁸³ See Colleen Chien & Ernest Fok, *Comments to the National Strategy for Expanding American Innovation*, SANTA CLARA L. 1, 61 (2021), <http://digitalcommons.law.scu.edu/facpubs/986/> (presenting comments on boosting innovation through conference partnerships by Dalton Chasser).

³⁸⁴ See *Learning and Resources*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/learning-resources> (last visited May 28, 2021).

³⁸⁵ See Chien & Fok, *Comments to the National Strategy for Expanding American Innovation*, *supra* note 383, at 18 (describing the difficulty of finding information on the USPTO website).

dedicated website presence, like www.uspto.gov/inventor or inventor.gov, could go a long way. The USPTO's regional staff can further help to provide a "human face" and connection to those seeking invention education, invention services, and training about the patent system, and it would be worth quantifying and scaling their impact—for example, leveraging the legions of patent examiners that work remotely across the country. To house all of these "invention capital"-building activities, this Article proposes an Independent Office of the Small Inventor Advocate, discussed next.

4. *Through an Independent Office of the Small Inventor Advocate*

Many of the ideas above should not be controversial and, in fact, are not completely new. Under Section 28 of the America Invents Act ("AIA"), Congress created a Patent Ombudsman Program for small business concerns.³⁸⁶ But the ambit of the Program, which lacks independent funding, is narrow, limited to providing support services relating to patent filings to small business concerns and independent inventors.³⁸⁷ In practice, this means facilitating complaint handling when applications become stalled in the examination process, tracking complaints to ensure each is handled within ten business days, and using inquiry trends to assess training needs for USPTO staff. The Ombudsman Program so far has primarily worked in a ministerial capacity.³⁸⁸ A broader role—for example, overseeing the ideas described above—would not necessarily fall into the responsibilities of the Program.

This Article proposes a different and more muscular model for supporting small and underrepresented inventors—the creation of an Independent Office of the Small Inventor Advocate. This Office would house the wide variety of programs that the USPTO already has (such as its recently constituted Council for Inclusive Innovation and Patent Pro Bono programs), administer new programs for expanding invention capital, and engage in research and advocacy on behalf of small inventors and innovators. Such an Office could be modeled after existing Offices within the executive branch that are tasked with safeguarding the interests of particular populations. One example is provided by the Taxpayer Advocate Service ("TAS") of the IRS, led by the National

³⁸⁶ Leahy-Smith America Invents Act, Pub. L. No. 112–29 (Sept. 16, 2011).

³⁸⁷ *Id.*

³⁸⁸ See Anthony Knight, *Patents Ombudsman Program*, U.S. PAT. & TRADEMARK OFF. 5 (available at https://drive.google.com/file/d/1DYRU_OHCcJoYL8W01EfVDMcMmwpbErtI/view) (last visited June 20, 2022) (identifying the top five inquiries by those using the program as (1) status inquiries, (2) filings, (3) case prosecution concerns, (4) petitions, and (5) general questions).

Taxpayer Advocate as appointed by the Secretary of Treasury.³⁸⁹ The TAS was created to help taxpayers resolve problems with the IRS, protect taxpayer rights, reduce taxpayer burden, and encourage overall service improvement at the IRS.³⁹⁰ But it started in a way that resembles the USPTO's Ombudsperson Program,³⁹¹ when, "[i]n 1976[,] the IRS created . . . the problem resolution program (PRP)[,] . . . endowing specially designated and more experienced revenue agents and [Revenue Officers] with the discretion and independence to help taxpayers"³⁹² The program then expanded in 1979 to include a senior management position, or the taxpayer ombudsman, to perform systemic advocacy for taxpayers.³⁹³ In 1988, Congress codified the function of the taxpayer ombudsman in "section 7811, in the Taxpayer Bill of Rights."³⁹⁴ Then, in 1998, Congress amended IRC section 7803(c), creating the National Taxpayer Advocate ("NTA") of today.³⁹⁵ To help ensure this independence, the NTA reports only to the IRS commissioner.³⁹⁶

An important role of the NTA is to advocate for small taxpayers. A tribute to long-standing NTA Nina Olson, who held the position for eighteen years, credited her efforts—including annual reports and testimony to Congress, public outreach, and professional engagement—all of which "advanced low-income taxpayers' rights," "helped improve systemic rights and access to justice for all federal taxpayers," and "establish[ed] and strengthen[ed] state and local taxpayer advocate and ombuds offices."³⁹⁷ The TAS helps more than 200,000³⁹⁸ taxpayers per year³⁹⁹ and in fiscal year 2020, had an operating budget of over \$200 million.⁴⁰⁰

³⁸⁹ 26 U.S.C. § 7803I(1)(B)(i)–(ii).

³⁹⁰ Internal Revenue Service Restructuring and Reform Act of 1998, Pub. L. No. 105-206, 112 Stat. 699(2)(A)(i)–(iv) (codified as amended in scattered sections of 26 U.S.C.).

³⁹¹ Bryan T. Camp, *What Good Is the National Taxpayer Advocate?*, 126 TAX NOTES 1243, 1247 (Mar. 8, 2010).

³⁹² *Id.*

³⁹³ *Id.*

³⁹⁴ *Id.*

³⁹⁵ 26 U.S.C. § 7803(c).

³⁹⁶ *Id.* at §7803(c)(1)(B)(i).

³⁹⁷ Danshera Wetherington Cords, *Tribute to National Taxpayer Advocate Nina Olson*, 18 PITT. TAX REV. 1, 7 (2020).

³⁹⁸ Roughly 240 million federal tax returns were filed in the 2020 fiscal year. *See Returns Filed, Taxes Collected & Refunds Issued*, IRS, <https://www.irs.gov/statistics/returns-filed-taxes-collected-and-refunds-issued> (last visited May 22, 2022).

³⁹⁹ Louis DeNicola, *What is the Taxpayer Advocate Service and What Does It Do?*, CREDITKARMA (Dec. 21, 2020), <https://www.creditkarma.com/tax/i/taxpayer-advocate-service>.

⁴⁰⁰ UNITED STATES GOVERNMENT ACCOUNTABILITY OFFICE, TAXPAYER ADVOCATE SERVICE: OPPORTUNITIES EXIST TO IMPROVE REPORTS TO CONGRESS (2021), <https://www.gao.gov/assets/gao-21-217.pdf>.

Another administrative model is offered by the Office of Advocacy of the Small Business Association (“OASBA”), whose mission it is to be the “independent voice” for small business within the federal government,⁴⁰¹ by intervening in regulatory processes, producing research to inform policy, and “fostering a two-way communication between federal agencies and the small business community.”⁴⁰² The OASBA has reported that its rules have resulted in first-year regulatory cost savings for small businesses of \$3.2 billion in the 2021 fiscal year.⁴⁰³ Borrowing from these models, a few key ingredients of a new Independent Office of the Small Inventor Advocate would be autonomy and independence, an advocacy and research role, a clearly defined mission and set of performance metrics, and dedicated funding and resources. Besides working to close each of the patent grant, enforcement, and defense gaps, bolstering invention capital, and coordinating pro bono support, such an Office could also work closely with the inventor community to test and socialize upcoming developments—like regulatory changes, changes to the Manual of Patent Examination and Procedure (“MPEP”), and website revisions—and make suggestions to Congress and the USPTO on matters accordingly.

B. Increasing Access and Accountability Through an Independent Office of the Public Interest and Partnerships

To advance access to innovation through the patent system, this subsection proposes the establishment of an Independent Office of the Public Interest and Partnerships, to make the patent system more accountable to public interests and to foster partnerships covering patented inventions. As described in Part II, while the purpose of the patent system is to promote innovation, a broader set of legal tools ranging from the oversight provisions of Bayh-Dole to antitrust law are invested in increasing access to patented innovation along both the dimensions of affordability and availability. In addition, as described, partnerships can dramatically increase access to patented innovation by supporting both follow-on innovation, to adapt an innovation to a different use case or set of consumers, and expanded innovation to new markets.

But the information costs associated with both exercising oversight and finding out basic information about patents—for example, its projected expiration date, who owns it, and whether someone is willing to license it—are

⁴⁰¹ *About—SBA’s Office of Advocacy*, U.S. SBA OFF. ADVOC., <https://advocacy.sba.gov/about/> (last visited May 22, 2022).

⁴⁰² ROBERT JAY DILGER, CONG. RSCH. SERV., SBA OFFICE OF ADVOCACY: OVERVIEW, HISTORY, AND CURRENT ISSUES 1 (2022), <https://sgp.fas.org/crs/misc/R43625.pdf>; *see also* 15 U.S.C. § 634.

⁴⁰³ DILGER, *supra* note 402, at 11.

high. The ability of generalists or members of the public to discern the status of a particular patent application requires in-depth knowledge of patent procedure and law to decipher what practices (e.g., prophetic examples) or options (e.g., continuations) have been taken in pursuit of a patent.⁴⁰⁴

The Executive Order on Competition issued by President Biden early in his administration hints at both the broad interests in patents and a way around the opacity and density of patent records.⁴⁰⁵ The Order directs agencies to take action involving standards-setting processes that implicate the rights of patent holders and implementers,⁴⁰⁶ and also to advance a broad set of public interests in the use and potential misuse of patent law, with respect to seed and farm inputs, generic drugs and biosimilars,⁴⁰⁷ and federally funded inventions.⁴⁰⁸ It directs not only the USPTO, but also the National Institute of Standards and Technology (“NIST”), Department of Health and Human Services (“HHS”), Food and Drug Administration (“FDA”), and Department of Agriculture (“USDA”) to take action on various patent issues.

The collaboration between agencies contemplated in the Order highlights the important role the USPTO can play in clarifying the patent record in a way that advances the broader public interest. As it stands, the USPTO has been a model in terms of “open data,” providing extensive data releases that have seeded a rich body of empirical research and hundreds of patent open data companies.⁴⁰⁹ But the complexity of the system also limits robust public debate and oversight, especially in light of the silos between legal regimes that exist.

An Independent Office of Public Interest and Partnerships, similar to the

⁴⁰⁴ See Jorge L. Contreras, *Shepardizing Patents*, PATENTLY-O (June 16, 2021), <https://patentlyo.com/patent/2021/06/contreras-shepardizing-patents.html> (discussing the difficulty of finding critical information about patents based on public records).

⁴⁰⁵ *FACT SHEET: Executive Order on Promoting Competition in the American Economy*, THE WHITE HOUSE (July 9, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/07/09/fact-sheet-executive-order-on-promoting-competition-in-the-american-economy/>.

⁴⁰⁶ Exec. Order No. 14036, 86 Fed. Reg. 36,987, 36,991 (July 14, 2021); see also U.S. PAT. & TRADEMARK OFF. NAT’L INST. OF STANDARDS & TECH. & U.S. DEP’T OF JUST., POLICY STATEMENT ON REMEDIES FOR STANDARDS—ESSENTIAL PATENTS SUBJECT TO VOLUNTARY F/RAND COMMITMENTS 7 (2019), <https://www.justice.gov/atr/page/file/1228016/download> (describing the negotiation dynamic between patent owners and implementers).

⁴⁰⁷ Exec. Order No. 14036, 86 Fed. Reg. at 36,987–89, 36,993–94 & 36,997.

⁴⁰⁸ *Id.* at 36,998.

⁴⁰⁹ Letter from Colleen V. Chien, Assoc. Professor L. & Brian J. Love, Assistant Professor L., to The Hon. Michelle L. Lee, Under Sec. of Commerce (Feb. 12, 2016) (on file with author); Colleen V. Chien & Reuben Bauer, *Patent Open Data Companies Working List*, GOOGLE DOCS, <https://docs.google.com/spreadsheets/d/1qNtPr4P3PPLwbeHy4SuVHwnqoH23zORxjnEZost5law/edit#gid=0> (last visited Aug. 18, 2021).

Independent Office of the Small Inventor Advocate, could be tasked with improving public understanding of the patent record. Such an Office could support meaningful exchange with public agencies, public interest groups, and others with interests in patents. Like statutory inspectors general (“IGs”), such an Office could represent an independent, nonpartisan official within the federal government.⁴¹⁰ But unlike IGs, who have the broad mandate of preventing and detecting waste, fraud, abuse, and mismanagement within federal departments and agencies,⁴¹¹ the ambit of the ombudsperson could be narrow—to advance public interests within the patent system by ensuring that the patent record is accessible and accurately interpreted, to conduct research, and to recommend improvements to both increase the comprehensibility of patent practices and the patent record, as well as bolster partnerships and commercialization efforts more broadly. The Office could potentially be housed within the Department of Commerce, the departmental home of the USPTO, or potentially within the USPTO, but, like the Independent Office of the Small Inventor Advocate, remain independent from the USPTO.

Besides advancing public interests, the Independent Office of the Public Interest and Partnerships could also address and support technology commercialization, through voluntary patent partnerships as well as open-source based models, for example, based on pledges and the identification of technology whitespaces. One need not look any further than COVID-19 to appreciate the importance of these alternative models for expanding access to innovation. Merck and Pfizer have licensed patents over small molecule lifesaving COVID-19 drug treatments through the Medicines Patent Pool (“MPP”).⁴¹² The UN-backed MPP negotiates with patentholders for licenses and then offers these licenses to qualified generic suppliers for providing products to resource-poor nations.⁴¹³ This scheme removes the risk for both buyers and sellers of technology. Patentholders and product developers gain an effective way of sharing their innovative products through voluntary licensing agreements that provide them with the option of receiving a fair royalty and the peace of mind that the licensee will produce quality generic versions of originator

⁴¹⁰ See generally KATHRYN A. FRANCIS, CONG. RSCH. SERV., STATUTORY INSPECTORS GENERAL IN THE FEDERAL GOVERNMENT: A PRIMER (2022), <https://crsreports.congress.gov/product/pdf/R/R45450> (providing an overview of statutory Inspector General).

⁴¹¹ *Id.* at 1.

⁴¹² James Love, *KEI Comments on the Pfizer MPP License for PF-07321332 + Ritonavir (Sold by Pfizer under the brand name Paxlovid)*, KNOWLEDGE ECOLOGY INT’L (Nov. 16, 2021), <https://www.keionline.org/36960>.

⁴¹³ *Medicines Patent Pool—Frequently Asked Questions*, MEDS. PAT. POOL, <https://medicinespatentpool.org/uploads/2018/04/MPP-FAQ-EN.2018.06.06.pdf> (June 1, 2018).

products.⁴¹⁴ Generic suppliers benefit from data exclusivity waivers and technology transfers to help accelerate generic product registration, and avoid the need to hold separate negotiations with multiple parties by bundling the rights needed.⁴¹⁵

Another promising development has been the deliberate development of a patent-free COVID-19 vaccine by researchers in Texas in order to boost widespread access to vaccines.⁴¹⁶ An Independent Office of Public Interests and Partnerships could work to ensure that technology “whitespaces” created by the expiration of patents or pledge of patent rights are easily ascertainable and visible to all, potentially working to create freedom of action through better information about patent expiry and coverage. Such an office could also study and make recommendations about how to improve patent notice through the collection and dissemination of patent marking information, and more generally supporting further commercialization through commercial transactions and other forms of collaboration.

The suggestion to strengthen public interests and public access through an Independent Office of Public Interests and Partnerships may seem rather modest in light of the strong rhetoric on patents as tools of inequality.⁴¹⁷ However, public debate on many of the topics of controversy, including term and scope extension through continuations practice and their costs and benefits, have been limited by a lack of public understanding of the pros and cons, which could be more thoroughly vetted by an independent office. Further, while the USPTO’s mission is focused on serving the public’s interest in the quality examination of patents and trademarks, it is currently no single agency’s responsibility to ensure that the public interest in access to innovation is also served.

C. Measuring and Tracking Equity in Invention Through Invention Equity Metrics

A final proposal for enhancing equity in innovation is through the

⁴¹⁴ *Id.*

⁴¹⁵ *Id.*

⁴¹⁶ See Karen Brooks Harper, *From Obscurity to a Nobel Prize Nomination: Houston Scientists Acclaimed for Their Patent-Free COVID-19 Vaccine*, TEX. TRIB. (Feb. 10, 2022), <https://www.texastribune.org/2022/02/10/corbevax-texas-coronavirus-vaccine/> (describing the Corbevax vaccine).

⁴¹⁷ See, e.g., Joseph E. Stiglitz, *How Intellectual Property Reinforces Inequality*, N.Y. TIMES (July 14, 2013, 9:04 PM), <https://opinionator.blogs.nytimes.com/2013/07/14/how-intellectual-property-reinforces-inequality/> (arguing that the United States’ intellectual property regime is a key contributor to societal inequality).

introduction of “innovation equity metrics,” a compilation of patent and other data metrics that reflect equity in innovation. Systematic reporting of metrics that reflect demographic (e.g., race, ethnicity, and gender), economic (e.g., large vs. small entity vs. first-time), and geographic (e.g., rural, urban, suburban, international) diversity can help to promote awareness of gaps and efforts to narrow them, which are priorities of the Biden Administration.⁴¹⁸

To date, reporting on patents has tended to focus on the top 1% of patentors. For example, for almost three decades, IBM has been awarded more patents than any other entity.⁴¹⁹ However, top and aggregate statistics leave many important questions unanswered. Has patenting followed a “K-shaped recovery curve,” with large companies doing well and small businesses languishing? Has female patenting slowed disproportionately, matching the job losses⁴²⁰ and reduction in publication output⁴²¹ women have suffered? How concentrated are new grants? An effort to collect and report trends that address the distribution of invention could address these questions and reveal the impact of innovation in light of new policy. Introducing invention equity metrics like these can help in setting general policy direction and in evaluating innovation-specific policy efforts.

While the idea of tracking and reporting on the distribution of patenting and patents may seem unrelated to the task of granting patents, it has strong statutory and historical support.⁴²² The second enumerated duty of the USPTO, after the

⁴¹⁸ Alondra Nelson & Clarence Wardell III, *An Update from the Equitable Data Working Group*, THE WHITE HOUSE (July 27, 2021) (quoting Exec. Order No. 13985, 86 Fed. Reg. 7,009), <https://www.whitehouse.gov/briefing-room/blog/2021/07/27/an-update-from-the-equitable-data-working-group/> (describing the work of the White House Equitable Data Working Group whose charge is to “gather the data necessary” to advance equity, including through the development, curation, and dissemination of equity metrics across realms).

⁴¹⁹ Press Release, Hugh Collins, IBM Tops U.S. Patent List for 28th Consecutive Year with Innovations in Artificial Intelligence, Hybrid Cloud, Quantum Computing, and Cyber-Security, IBM (Jan. 12, 2021), <https://newsroom.ibm.com/2021-01-12-IBM-Tops-U-S-Patent-List-for-28th-Consecutive-Year-with-Innovations-in-Artificial-Intelligence-Hybrid-Cloud-Quantum-Computing-and-Cyber-Security>. IBM was also first in 2022, but only by a few dozen patents. See Press Release, Harrity & Harrity, Harrity Analytics Releases 2022 Patent 300® List (Jan. 6, 2022), <https://harrityllp.com/harrity-analytics-releases-2022-patent-300-list/>.

⁴²⁰ Megan DiTrolio, *The U.S. Economy Lost 140,000 Jobs in December. All Were Held by Women*, MARIE CLAIRE (Jan. 9, 2021), <https://www.marieclaire.com/career-advice/a35167076/job-loss-december-2020-women/> (documenting disparities in job losses in December 2020 and citing losses to female-dominant fields, like education).

⁴²¹ Colleen Flaherty, *Women Are Falling Behind*, INSIDE HIGHER ED (Oct. 20, 2020), <https://www.insidehighered.com/news/2020/10/20/large-scale-study-backs-other-research-showing-relative-declines-womens-research> (summarizing small- and large-scale studies that show relative declines in women’s research productivity during the pandemic).

⁴²² See 35 U.S.C. § 2(a)(1) (describing, under its “Power and Duties,” the USPTO’s “responsib[ility] for the granting and issuing of patents and the registration of trademarks”).

examination of patents and trademarks, is “disseminating to the public information with respect to patents and trademarks.”⁴²³ Embracing this role as part of the open data movement in government, the agency has released numerous administrative datasets in flexible formats.⁴²⁴

The USPTO could follow the precedent established by other federal agencies in using data metrics to address disparities.⁴²⁵ For example, HHS has described data collection and monitoring as key facilitators in their work to reduce racial and ethnic health disparities.⁴²⁶ Since 2011, the CDC has highlighted public health reports that reduced disparities and inequalities.⁴²⁷ The paragraphs below discuss how such approaches can be mapped to invention equity metrics and the strengths and limitations of currently available data.

1. Does Patenting Reflect Innovation Entry or Increasing Firms’ Dominance? (Investing in Identity Efforts)

Based on the insight that firm and job churn are key drivers of productivity and economic growth, a rich set of metrics has been developed to track “business dynamism” and entry.⁴²⁸ The concern, backed by evidence, is that dominant firms are crowding out new entrants and startup formation has slowed, in turn slowing productivity growth while growing inequality.⁴²⁹ As described in Part II, a startup’s first-ever patent and a large firm’s 1000th patent have different implications for social welfare.⁴³⁰ While patenting by entrants supports

⁴²³ *Id.* at § 2(a)(2).

⁴²⁴ *See, e.g., USPTO APIs*, U.S. PAT. & TRADEMARK OFF., <https://developer.uspto.gov/api-catalog> (last visited Feb. 27, 2021).

⁴²⁵ Rashida Dorsey, Dana M. Petersen & Lisa Schottenfeld, *The Department of Health and Human Services Action Plan to Reduce Racial and Ethnic Health Disparities: A Commentary on Data Needs to Monitor Progress Toward Health Equity*, 3 HEALTH SYS. & POL’Y RSCH. 1, 1 (2016) (quoting DEP’T OF HEALTH & HUMAN SERVS., ACTION PLAN TO REDUCE RACIAL AND ETHNIC HEALTH DISPARITIES (2011) (setting an agency goal in 2011 for “a nation free of disparities in health and health care” by tracking data pertaining to various equity metrics).

⁴²⁶ *See id.*

⁴²⁷ *Health Disparities and Strategies Reports*, CTRS. DISEASE CONTROL & PREVENTION (July 17, 2018), <https://www.cdc.gov/minorityhealth/chdir/index.html>.

⁴²⁸ Ian Hathaway & Robert E. Litan, *Declining Business Dynamism in the United States: A Look at States and Metros*, BROOKINGS (May 5, 2014), <https://www.brookings.edu/research/declining-business-dynamism-in-the-united-states-a-look-at-states-and-metros/> (explaining the concept of “business dynamism”).

⁴²⁹ JAY SHAMBAUGH, RYAN NUNN, AUDREY BREITWIESER & PATRICK LIU, THE HAMILTON PROJ., THE STATE OF COMPETITION AND DYNAMISM: FACTS ABOUT CONCENTRATION, START-UPS, AND RELATED POLICIES 1, 3, 19 (2018), https://www.brookings.edu/wp-content/uploads/2018/06/ES_THP_20180611_CompetitionFacts_20180611.pdf.

⁴³⁰ *See supra* Part II.

economic mobility, patenting by incumbents risks suppressing competition.⁴³¹ Using USPTO data, I generated the share of patents granted each year to first-time patentees. As shown in Appendix Figure 5, this data suggests that the share of patent grants to entrants has dropped from 13% in 1990 to 7% in 2019, a potentially worrisome trend.⁴³²

An analysis by Akcigit and Ates reported a similar general decline of over 50% in entrants' share of patents over the period of reporting,⁴³³ but the details were different—the earlier analysis found a different base share of around 8%, down to less than 4% in 2012.⁴³⁴ What explains the difference? The analysis reported in this paper is based on the USPTO's data, which reflects extensive but imperfect name disambiguation efforts, while the Akcigit-Ates analysis adds additional cleaning approaches. As a result, while both analyses show the same general (downwards) trend in entry shares, the Akcigit-Ates view shows continuous, year-over-year declines from 2010 to 2018, whereas my analysis reflects that the decline has largely subsided in the post-2010 period. The quality of the data matters and is worthy of greater priority and investment, in both the characterization of past patenting and the collection of data for future tracking.

Improving the quality of existing data is a challenging but important task. For determining whether an inventor is considered a “first-time patentee,” for example, the USPTO could make this a category of small entity discount, with applicants checking all the categories that apply. The USPTO could also ask a voluntary question: “Is this the applicant's first patent application?” The IDEA Act introduced in the 116th Congress provides another model for data collection.⁴³⁵ It directs the USPTO to collect demographic information, including gender, ethnicity, national origin, sexual identity, veteran status, disability, education, and income levels, which are currently not reported.⁴³⁶ In order to avoid any prejudice to the patentholder, the information would be kept confidential and separate. The collection would be voluntary, raising selection

⁴³¹ Aghion et al., *Innovation and Top Income Inequality*, *supra* note 175, at 3–4 & fig.3, 39–41 (describing the correlation of innovation and social mobility).

⁴³² See *Patent View*, USPTO, www.patentsview.org (last visited July 3, 2021) (providing a database dating back to 1976 so the earlier shares reflect newness based on shorter history of patenting) (replication code on file with the author).

⁴³³ Ufuk Akcigit & Sina T. Ates, *What Happened to U.S. Business Dynamism?* 45 fig.9b (Nat'l Bureau Econ. Rsch., Working Paper No. 25756, 2019), https://www.nber.org/system/files/working_papers/w25756/w25756.pdf.

⁴³⁴ *Id.*

⁴³⁵ Inventor Diversity for Economic Advancement Act of 2019, § 124, H.R. 4075 (codified as amended at 35 U.S.C. 11).

⁴³⁶ *Id.*

issues that would need to be addressed.

Another way in which these innovation metrics can further equity is in the evaluation and formulation of patent policy. For example, for a forthcoming article, I track US and Canadian independent inventor activity in the period before and after the AIA was passed, to test whether or not the AIA's introduction of a "first to file" regime to the United States led to a measurable decline in participation by independent inventors, as was feared.⁴³⁷ Taking seriously policies meant to bolster equity means not only passing, but rigorously evaluating such policies after they are enacted.

D. Enriching and Collecting Data to Track Inclusion

While the adoption of fee discounts is one example of an "inclusive innovation" policy change, there are numerous others, both within the patent system⁴³⁸ and outside of it, at the local, state, and federal and private-sector levels.⁴³⁹ But it is often difficult to connect a policy to its target audience or outcome, and therefore to evaluate its effectiveness. For example, in the case of the Small Business Innovation Research ("SBIR") program of the Small Business Administration, although grantees are encouraged to patent, patent activity is not reported.⁴⁴⁰ This is a missed opportunity to track the inventive impact of funding on their targeted federal contractors: woman-owned businesses and socially and economically disadvantaged businesses, including businesses in historically underutilized business (HUBZones) districts⁴⁴¹—and, more importantly, to improve SBIR programs with this information. Likewise, there has been little independent effort to analyze the downstream impact of the AIA's pro bono efforts in part because the USPTO has a policy of not disclosing what applications have benefited from them.⁴⁴² Shoring up the connections as

⁴³⁷ Colleen Chien, *Redefining Progress as Diversity in Innovation and Inventorship* 5, 11–12 (July 31, 2022) (unpublished manuscript) (on file with author).

⁴³⁸ See, e.g., Peter Lee, *Toward a Distributive Agenda for U.S. Patent Law*, 55 HOUS. L. REV. 321, 347–50, 352 (2017).

⁴³⁹ See, e.g., *New Cities Initiative to Increase Women in Tech Across the U.S.*, PIVOTAL VENTURES (Jan. 28, 2020), <https://www.pivotalventures.org/newsroom/get-cities-city-based-initiative-increase-women-tech-united-states-chicago-launch>.

⁴⁴⁰ See *Reports*, SMALL BUS. INNOVATION RSCH., <https://www.sbir.gov/reports> (last visited Feb. 26, 2021) (including patenting advice but not reporting patenting activity).

⁴⁴¹ For an overview of the types of contractors targeted by the Small Business Administration, see *Contracting Assistance Programs*, U.S. SMALL BUS. ADMIN., <https://www.sba.gov/federal-contracting/contracting-assistance-programs> (last visited Aug. 16, 2021). Some survey work on the patenting behavior of SBIR applicants has been done. See, e.g., Reynold V. Galope, *What Types of Start-ups Receive Funding from the Small Business Innovation Research (SBIR) Program? Evidence from the Kauffman Firm Survey*, 9 J. TECH. MGMT. & INNOVATION 17, 18 (2014).

⁴⁴² Letter from U.S. Pat. & Trademark Off. to Colleen V. Chien (Nov. 26, 2019) (responding to FOIA

well as the quality, consistency, and availability of data by collecting data on first-time patenting and demographic fields, as discussed above, could go a long way.⁴⁴³ So could efforts to release anonymized or aggregated information as applications are being filed, rather than with the customary eighteen-month lag, and⁴⁴⁴ the USPTO's reporting of female invention in fulfillment of its responsibilities under the Study of Underrepresented Classes Chasing Engineering and Science ("SUCCESS") Act⁴⁴⁵—as well as earlier related reporting on the geographic and demographic qualities of inventors⁴⁴⁶—demonstrate what is possible with a focus on equity.

CONCLUSION

In the summer of 2021, Jeff Bezos, the richest man in the world, flew into space on a rocket that he personally funded.⁴⁴⁷ Shortly after returning from space, he committed to giving \$200 million to changemakers tackling topics like tech equity.⁴⁴⁸ Bezos's net worth at the time, \$188 billion,⁴⁴⁹ was bolstered by a reported tax rate of only 0.98% from 2014 to 2018.⁴⁵⁰

The questions of who participates in, profits from, and can access the fruits of innovation are not only central to the issue of shared prosperity, but also the

Request F-20-00025) (on file with author).

⁴⁴³ See *supra* Section III.C.

⁴⁴⁴ 35 U.S.C. § 122(b) (specifying default publication eighteen months after a patent application, which can be abbreviated by applicant request).

⁴⁴⁵ U.S. PAT. & TRADEMARK OFF., *supra* note 55, at 7–10 figs.1, 2, 3 & 4.

⁴⁴⁶ Until 2015, the Patent Technology Monitoring Team ("PTMT") reported on filings and grants by geographic origin and independent inventor status, but the reports have not been kept up to date. See *Calendar Year Patent Statistics (January 1 to December 31)*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/web/offices/ac/ido/oeip/taf/reports.htm> (last visited May 5, 2021) (showing chart of bibliographic patent data current through 2015).

⁴⁴⁷ Eric Berger, *Despite Tuesday's Flight, Jeff Bezos is Running Out of Time to Save Blue Origin*, ARS TECHNICA (July 21, 2021), <https://arstechnica.com/science/2021/07/despite-tuesdays-flight-jeff-bezos-is-running-out-of-time-to-save-blue-origin/>.

⁴⁴⁸ One of Bezos's recipients was Van Jones, whose coding nonprofit, YesWeCode, aims to "cultivat[e] future leaders and entrepreneurs from underrepresented backgrounds." *Donate Now*, DREAM CORPS, <https://act.thedreamcorps.org/signup/future-dreamers-interest-form/?source=facebook> (last visited Aug. 20, 2021).

⁴⁴⁹ Ben Gilbert, *How Billionaires Like Jeff Bezos and Elon Musk Avoid Paying Federal Income Tax While Increasing Their Net Worth by Billions*, BUS. INSIDER (June 13, 2021, 8:23 AM), <https://www.businessinsider.com/how-billionaires-avoid-paying-federal-income-tax-2021-6>.

⁴⁵⁰ Sarah Hansen, *Richest Americans—Including Bezos, Musk and Buffett—Paid Federal Income Taxes Equaling Just 3.4% of \$401 Billion in New Wealth, Bombshell Report Shows*, FORBES (June 8, 2021, 10:39 AM), <https://www.forbes.com/sites/sarahhansen/2021/06/08/richest-americans-including-bezos-musk-and-buffett-paid-federal-income-taxes-equaling-just-34-of-401-billion-in-new-wealth-bombshell-report-shows/?sh=71de90967fe1>.

diversity of problems that receive attention and solutions that get elevated. In a market economy, the market decides, but law and policy shape the market. This Article has divided the concept of inequality into three distinct subtypes with relevance to innovation—inequality of wealth, inequality of opportunity to innovate, and inequality of access to innovation. It eschews more one-dimensional accounts that tend to portray patents simply as tools of inequality or prosperity—they can be both, and the context and the institutional details matter. An inequalities framework provides a way to talk about the different dynamics and tensions at stake, but also the distinct regulatory levers that are available to shift the balance towards greater equity in innovation. Application of such an approach to other types of intellectual property may have similar benefits.

At bottom, patent law's fundamental role remains to “promote the progress,” stimulating the creation of wealth and innovation that all can benefit from. It can do that in an equitable way, as discussed in Part III, by prioritizing the development of “invention capital”—including the social capital of who you know and can call on—among underrepresented groups, stimulating greater participation in inventing and entrepreneurship. It can also ensure that opportunities to get patents are equal, by investing in patent education and quality tools and attending to the needs of small inventors. It can support equity in innovation more broadly by centering and measuring equity and entry, as well as enhancing public interests in patent law by improving public understanding of the patent system and promoting partnerships.

APPENDIX

Fig. 1A: U.S. Patent Inequality (1900-2020) (Data Source: Google Patents)

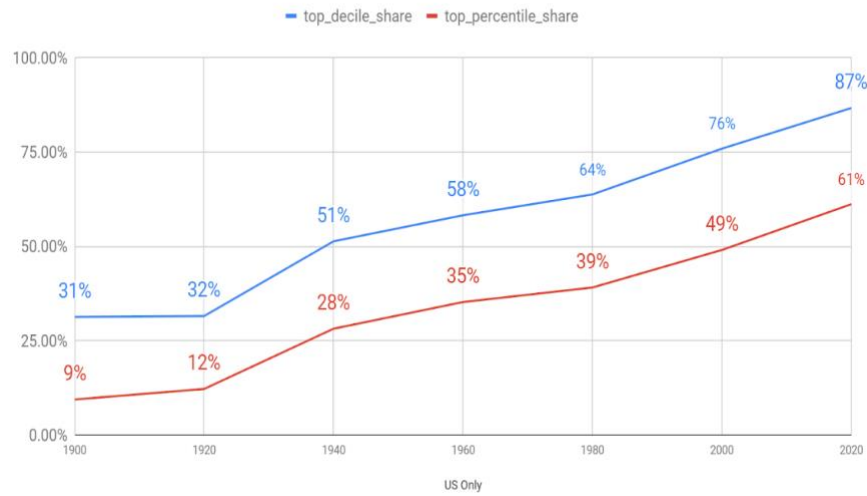


Fig. 1B: U.S. Patent Inequality (1980-2020) (Data Source: PatentsView)

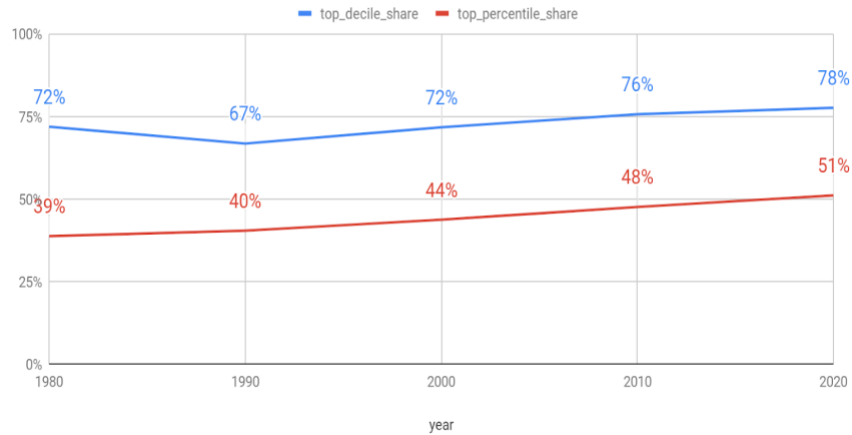


Fig. 2: Share of Patents Named to Independent Inventors from 1906-2020 (Data Sources: Innography, USPTO)

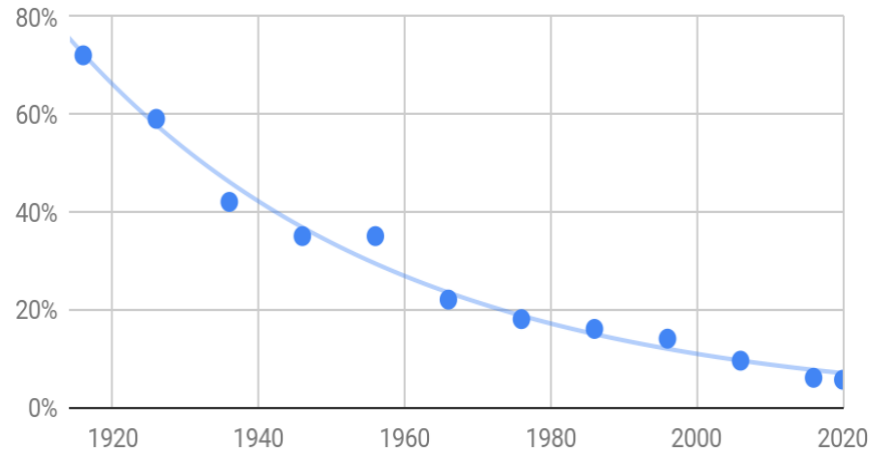


Fig. 3: Patent Owner Shares by Decade (Datasource: Patents View)

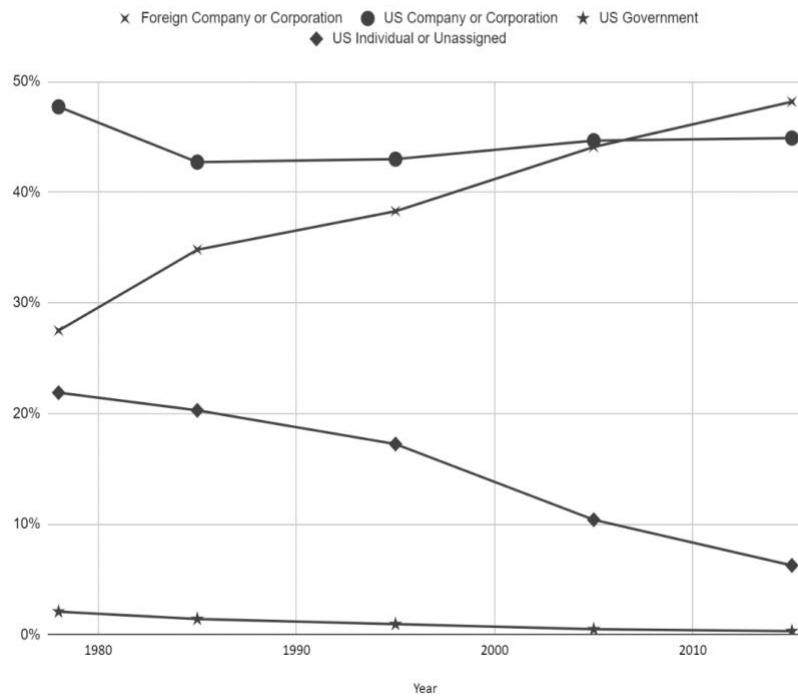
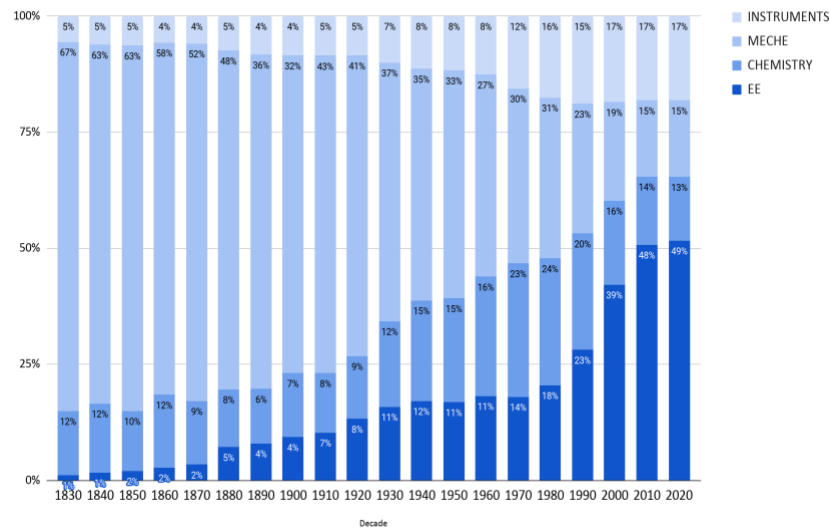


Fig. 4: Technology Trends Among Granted Patents (Datasource: Google Patents)



Classes calculated based on matching the first IPC/CPC to technology sectors as shown based on the following source: Ulrich Schmoch, *Concept of a Technology Classification for Country Comparisons: Final Report to the World Intellectual Property Organization*, WIPO, 9 tbl.2 (2008)).

Fig. 5: Share of New Patents to Entrants (Datasource: PatentsView)

