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Predictive Analytics

Daryl Lim

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"Predictive Analytics" blends the latest research in behavioral economics with artificial intelligence to address one of the most important legal questions at the heart of intellectual property law and antitrust law – how do courts and agencies make judgments about innovation and competition policies? How can they better predict the consequences of intervention or non-intervention?

The premise of this Article is that we should not continue to build doctrine at the IP-antitrust on theoretical neoclassical assumptions alone but also on the reality of markets using all that AI has to offer us. Behavioral economics and AI do not replace traditional antitrust analysis. Rather, they are complements and imbue antitrust law with continuing durability.

Predicting competitive effects is difficult and we need tools to predict outcomes as precisely and reliably as possible. Until now, antitrust law has only been able to operate before a veil of assumptions and rhetoric. Stakeholders have only been able to think about whether and how to intervene in the exercise of IP rights, particularly patent rights, in the broadest terms since even the smallest perturbations in a complicated set of variables can set off ripples that lead to dramatically divergent outcomes. Facts have always mattered in antitrust law, and a more expansive toolkit can only increase our likelihood of getting it right.

Behavioral economics sheds light on anticompetitive conduct that neoclassical antitrust may regard as irrational and therefore improbable. Once we recognize that it is rational and probable, we need to quantify and value the effects of the conduct. To do this, we need to employ more of the

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analogical reasoning intrinsic in antitrust law. For that, predictive analytics is very good in helping stakeholders with pattern recognition and simulation runs. This brings us closer to being able to ascribe value which human judgment can be brought to bear. In these, AI provides stakeholders with augmented capabilities to confront the computational challenges these tasks require.

INTRODUCTION

We live in the Fourth Industrial Revolution: an age marked by three powerful revolutions that appear at first glance to have little to do with one another. First, artificial intelligence (AI) augments and challenges

how we think about innovation and creativity.[1] Second, behavioral economics unveils the heuristics and biases animating how decisions are made in courtrooms, government agencies, and boardrooms.[2] Third, wireless connectivity has become the fastest scaling technology in history, with mobile device use increasing from zero to eight billion within just a few decades.[3]

These three revolutions converge at the interface between intellectual property (IP), antitrust law, and policy. Like contemporary politics, fault lines obscured by rhetoric and deeply held and equally deeply divided views of the appropriate treatment of IP and use of antitrust policies can make it difficult for courts and agencies to apply laws meant to promote innovation and competition. As more devices become connected to a common platform, the consequences of legal uncertainty, or worse, mistakes in implementation, become amplified.

Take for instance the Internet of Things (IoT), which subsists on standardized patented technology embedded in everyday objects that allow them to send and receive data.[4] Everything from household appliances to automobiles will be connected to mobile standards, such as

1. *See generally* Daryl Lim, *AI & IP: Innovation & Creativity in an Age of Accelerated Change*, 52 AKRON L. REV. 813 (2018) [hereinafter Lim, *AI & IP]*. *See also* Bernard Marr, *What Is Deep Learning AI? A Simple Guide With 8 Practical Examples*, FORBES (Oct. 1, 2018), https://www.forbes.com/sites/bernardmarr/2018/10/01/what-is-deep-learning-ai-a-simple-guide-with-8-practical-examples/ [https://perma.cc/BB84-AA97] ("Since deep-learning algorithms require a ton of data to learn from, this increase in data creation is one reason that deep learning capabilities have grown in recent years.").

2. *See generally* Daryl Lim, *Retooling the Patent-Antitrust Intersection: Insights from Behavioral Economics*, 69 BAYLOR L. REV. 124 (2017); Crawford Hollingworth & Liz Barker, *How Behavioural Economics Is Shaping Our Lives*, BEHAVIORAL ECONOMICS GUIDE 19, 19 (2017), https://www.behavioraleconomics.com/the-be-guide/the-behavioral-economics-guide-2017 [https://perma.cc/ZHY3-K52V] (citation omitted) ("Behavioural insights can no longer be seen as a fashionable short-term foray by public bodies. They have taken root in many ways across many countries around the world."); *id.* at 19 ("Companies using BE include Morningstar, Airbnb, Disney, Walmart, Jawbone, Unilever, Uber, Barclays, Google, eBay, ING, Virgin, Lilly, Financial Times, Swiss Re, Prudential, Boots, AIG, Opower and Tinder—and the list keeps growing. In the public sector, use of behavioural science is also widespread, with multiple governments and institutions applying it in what they do."). *See also* EYAL ZAMIR & DORON TEICHMAN, BEHAVIORAL LAW AND ECONOMICS 361 (2018) (noting how behavioral economics has "already worked [its] way into legislative debates and judicial decisions").

3. Annsley Merelle Ward, *AIPPI Congress Report 1: Standard Essential Patents —Maximizing Value before Enforcement*, THE IPKAT (Sept. 25, 2018), http://ipkitten.blogspot.com/2018/09/aippi-congress-report-1-standard.html [https://perma.cc/SHY5-HK95] ("Wireless connectivity is the fastest scaling technology we have, going from zero to 8 billion devices in a few decades.").

4. Jean-Marc Frangos, *The Internet of Things Will Power the Fourth Industrial Revolution. Here's How*, WORLD ECON. F. (June 24, 2017), https://www.weforum.org/agenda/2017/06/internet-of-things-will-power-the-fourth-industrial-revolution [https://perma.cc/2M7V-6DUD].

5G, in a market worth more than $11 trillion per year by 2025.[5] A 10 percent increase in mobile broadband can increase the nation's gross domestic product between 2–3 percent, as much as the target growth of the United States economy in 2018.[6] As the IoT becomes more pervasive, the stakes involved in making correct determinations at the intersection between IP and antitrust law becomes even more critical. Launching an investigation or litigation addresses the risk of continued competitive harm, but it comes at a cost.

Antitrust law rests on a venerable body of cases dating back at least to 1890.[7] Entrusted by Congress to develop the law, courts have interpreted operative antitrust terms like "monopolization" and "market power" in a way that periodically incorporates changes from law, economics, and

5. Claire Huang, *The Fuss over 5G*, STRAITS TIMES (Dec. 20, 2018) ("[5G] stands for the fifth-generation mobile network technology. It is faster in data transmission and processing, and capacity compared to previous generations of technology. It is said to be at least 10 times faster than 4G. . . . A key feature of 5G is that it reduces network latency—the lag between a signal being sent and received. This can transform the way things operate in any place that taps the technology. The technology can be used in more applications, including ships, planes, pacemakers, incubators, power stations and oil pipelines. . . . [T]he [5G] value chain is made up of device vendors, network infrastructure vendors, software vendors, network operators who also provide services, service providers who use others' networks to reach end users such as WhatsApp and WeChat, regulators and governments."). Bardo Schettini Gherardini & Spiro Dhapi, *Standard Development Organizations And IPR Policies: Their Role In Realizing Future Technologies*, CPI ANTITRUST CHRON., Nov. 2017, at 1, 1, https://www.competitionpolicyinternational.com/standard-development-organizations-and-ipr-policies-their-role-in-realizing-future-technologies [https://perma.cc/F2XG-TTWM] ("Internet of Things . . . technologies are increasingly used to interconnect smart devices, vehicles, household appliances and industrial machines using wireless communication, software or sensors. According to some estimations, IoT systems could represent a market of more than $11 trillion per year by 2025.").

6. Ward, *supra* note 3 ("It is also a technology that directly benefits society: a 10% increase in mobile broadband takeup increases a country's GDP by 2 or 3%."); Jeff Cox, *Why Trump's Goal of 3 Percent Economic Growth Actually Is Achievable and Sustainable*, CNBC (July 27, 2018, 3:38 PM), https://www.cnbc.com/2018/07/27/trump-goal-of-3-percent-economic-growth-is-achievable-and-sustainable.html [https://perma.cc/5VXM-KZ8W].

7. *See* ALBERT H. WALKER, HISTORY OF THE SHERMAN LAW OF THE UNITED STATES OF AMERICA 2 (1910) (explaining the history of the Sherman Act, which was enacted in 1890). Antitrust law has three principal statutory provisions. Section one of the Sherman Act addresses unreasonable restraints of trade among rivals. 15 U.S.C. § 1 (2017). Section two of the Sherman Act addresses monopolization and attempted monopolization by creating or perpetuating a monopoly in a relevant market through obtaining, licensing, or asserting a patent. 15 U.S.C. § 2 (2017). Section seven of the Clayton Act prohibits the acquisition of control over any entity or asset if "the effect of such acquisition may be substantially to lessen competition, or to tend to create a monopoly" in the United States. 15 U.S.C. § 18 (2017). Section five of the FTC Act prohibits "unfair methods of competition," and is rarely applied beyond the relevant provisions of the Sherman and Clayton Acts. 15 U.S.C. § 45 (2017); *see* STATEMENT OF ENFORCEMENT PRINCIPLES REGARDING "UNFAIR METHODS OF COMPETITION" UNDER SECTION 5 OF THE FTC ACT, FTC (Aug. 13, 2015).

other disciplines.[8] It is this ability to adapt that is one of antitrust law's great strengths. For that adaption to continue effectively, however, its intellectual infrastructure must support the regeneration of ideas. Together with this, there must also be a capacity to operationalize those new ideas so stakeholders—those interpreting, enforcing, or advising on antitrust law (judges, government agencies, attorneys, and in-house counsel) can meaningfully use them to guide corporate and judicial decision-making. In recent times, that ability to adapt has ossified.

Since the 1970s, contemporary antitrust law has run on the rails of neoclassical economics.[9] Informed by neoclassical economics' faith in free markets and distrust of regulatory competence, the Chicago and Harvard Schools of antitrust law (collectively known as "neoclassical antitrust") have steered courts away from antitrust populism toward an effects-based approach using economic analysis of prices and output as targets for intervention.[10] Evidence-based reform was an important step forward in the evolution of antitrust law.

Overlaying IP rights—usually patent rights—can spin antitrust analysis off into the realm of conjecture.[11] Neoclassical antitrust is not

8. State Oil Co. v. Khan, 522 U.S. 3, 20–21 (1997) (citation omitted) ("In the area of antitrust law, there is a competing interest, well represented in this Court's decisions, in recognizing and adapting to changed circumstances and the lessons of accumulated experience. Thus, the general presumption that legislative changes should be left to Congress has less force with respect to the Sherman Act in light of the accepted view that Congress 'expected the courts to give shape to the statute's broad mandate by drawing on common-law tradition.'").

9. Elizabeth M. Bailey, *Behavioral Firms: Does Antitrust Economics Need a Theoretical Update?*, COPI ANTITRUST CHRON., Jan. 2019, at 1, 2, https://www.competitionpolicyinternational.com/wp-content/uploads/2019/01/CPI-Bailey.pdf [https://perma.cc/4VMT-5T23] ("Modern day antitrust is grounded in traditional neoclassical economic theory, which assumes consumers and firms are rational, profit maximizing entities."). *See, e.g.*, Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 595 (1986) ("[A]s presumably rational businesses, petitioners had every incentive *not* to engage . . . .").

10. Herbert Hovenkamp, *Whatever* Did *Happen to the Antitrust Movement?*, 94 NOTRE DAME L. REV. 583, 598–600 (2018) ("Technical antitrust today comes mainly from the Harvard and Chicago schools, which started in different places but began to converge in the late 1960s and 1970s. . . . Speaking very generally, the policy changes that gave rise to current antitrust policy occurred mainly in the late 1970s and 1980s. During that period, antitrust became less interventionist and more responsive to then-current economic theory. . . . The Chicago school has had considerable influence on both antitrust decisionmaking and scholarship. Nevertheless, at the level of specific rulemaking, the course pursued was most generally that proposed by the Harvard school. That remains true to this day."); *see generally* Robert D. Atkinson & David B. Audretsch, *Economic Doctrines and Approaches to Antitrust*, INFO. TECH. & INNOVATION FOUND., Jan. 2011, at 1, 1, http://www.itif.org/files/2011-antitrust.pdf [https://perma.cc/RPK5-SNPA].

11. Douglas H. Ginsburg et al., *Antitrust and Intellectual Property in the United States and The European Union*, *in* THE INTERPLAY BETWEEN COMPETITION LAW AND INTELLECTUAL PROPERTY 99, 100 (Gabriella Muscolo & Marina Tavassi eds., 2019) (discussing how "[m]ost antitrust cases delineating the border between the two concern patents or, occasionally, copyrights;

much help in making forward-looking judgments at the IP-antitrust interface (the "Interface").[12] Whether to do so depends on that cost and, as the law makes clear, antitrust plaintiffs must also prove the counterfactual—that the harm would not have occurred but for the defendant's conduct.[13] The future is hard to predict, and hypothetical counterfactuals even more so. Yet predicting the future is precisely what stakeholders are called to do. Alarmingly, they are without the proper tools to do so. As a result, both the intellectual infrastructure of antitrust law and its operationalization can subsist on little more than conjectures about how innovation and competition interact.[14]

Consider the following example. We all want things cheap, but we are also willing to pay a premium to get from a rotary dial phone to the iPhone. Favoring patentees might benefit upstream innovation, but it may also inadvertently penalize implementers who can offer follow-on improvements or simply disseminate technology to the public more cheaply.[15] At the same time, there is no guarantee that favoring implementers would lead to anything more than larger annual dividends to its own stockholders. If antitrust law was applied broadly, IP rights would be devalued. However, if IP owners could make an end run around antitrust law by labeling a monopoly tax as a royalty, IP would be little

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antitrust cases concerning a trademark or trade secret are relatively rare"); Atkinson & Audretsch, *surpa* note 10, at 1 (observing that neoclassical and populist approaches to antitrust law are "inadequate guides to effective antitrust policy in the twenty-first century, in part because they do not adequately incorporate dynamic factors and innovation").

12. United States v. Microsoft Corp., 253 F.3d 34, 79 (D.C. Cir. 2001) ("[N]either plaintiffs nor the court can confidently reconstruct a product's hypothetical technological development in a world absent the defendant's exclusionary conduct.").

13. Rambus Inc. v. FTC, 522 F.3d 456, 466 (D.C. Cir. 2008).

14. *See* Wolfgang Kerber, *Competition, Innovation, and Competition Law: Dissecting the Interplay*, JOINT DISCUSSION PAPER SERIES ECON. NO. 42-2017, June 10, 2017, at 1, 2, http://www.uni-marburg.de/fb02/makro/forschung/magkspapers [https://perma.cc/N6SY-M5UU] ("There is an increasing concern that traditional concepts in competition law that focus mainly on price effects on existing markets might not be capable of dealing with innovation competition in the digital economy."). *See also* Pedro Caro de Sousa, *The Interface of Competition and Intellectual Law—Taking Stock and Identifying New Challenges*, LIBER AMICORUM FREDERIC JENNY (forthcoming 2019) (manuscript at 2), https://ssrn.com/abstract=3279355 [https://perma.cc/8LKG-9F6F] ("[T]here is still no consensus about the role of competition on innovation.").

15. *See, e.g.*, Jorge Padilla et al., *Antitrust Analysis Involving Intellectual Property and Standards: Implications from Economics*, HARV. J.L. & TECH. (forthcoming 2019) (manuscript at 31), https://ssrn.com/abstract=3119034 [https://perma.cc/4LSX-76CD] ("The risk of placing overly strict limitations upon IPR prices is that the return to innovative behavior is reduced, which means firms will reduce their investment in further innovations, to the detriment of consumers. Compounding the problem, with such limits in place, IPR holders will face significant uncertainty in determining whether their licensing practices violate competition laws, and legal uncertainty is the enemy of financial investment.").

more than a pretext for immunity from antitrust scrutiny.

This inability to anchor policy implementation to more than rhetoric and ideology results in a body of law that has lurched between vilifying the exercise of IP on the one hand, and neglect or indifference on the other. With more than a third of the United States' Gross Domestic Product and thirty million jobs dependent upon IP-intensive industries, that kind of instability and uncertainty is perilous.[16]

This Article provides a fresh manifesto for revitalizing antitrust law's intellectual infrastructure using predictive analytics powered by the latest research on AI and behavioral economics. Predictive analytics, comprising the ability to both generate possible options using AI and judging accurately between them using behavioral economics, can help stakeholders make smarter decisions at the Interface. In practical terms, stakeholders using predictive analytics can correlate complex market variables, estimate the impact of antitrust enforcement on innovation, and use behavioral nudges to achieve dynamically efficient outcomes in a way not previously possible.[17] It must be stressed that neoclassical antitrust remains helpful in framing optimal choices and providing benchmarks for antitrust enforcement.[18] At the same time, with more reliable tools both to predict and judge outcomes, agencies and courts can decide ahead of time and do so with better options. They can also calibrate with greater precision whether and how to act.[19]

Part I observes that bipartisan calls for a revival of populist antitrust are symptoms of a deeper dysfunction that has resulted in a systematic under-enforcement of antitrust law today.[20] Neoclassical antitrust provides stakeholders with neither rudder nor compass to reliably navigate the Interface. This has left antitrust policy vulnerable to dramatic policy swings, most recently exemplified by the Department of Justice's

16. *Why Intellectual Property Matters*, U.S. DEP'T STATE., https://2009-2017.state.gov/e/eb/tpp/ipe/why/index.htm [https://perma.cc/Y5UN-JRZT]; *But see* ZAMIR & TEICHMAN, *supra* note 2, at 384 ("Moreover, a large body of empirical literature has shown that predatory pricing is not, in fact, as rare as dragons, and has documented its occurrence in numerous settings.").

17. *See infra* Parts II, III.

18. *See infra* Part I.

19. *See infra* Parts II, III.

20. Carl Shapiro, *Antitrust in a Time of Populism*, 61 INT'L J. INDUS. ORG. 714, 745 (2018) ("[T]he widespread and bipartisan concern that the deck is stacked in favor of large powerful firms—represent[s] an opportunity, indeed a plea, to strengthen antitrust enforcement."); Nicola Giocoli, *Neither Populist Nor Neoclassical: The Classical Roots of the Competition Principle in American Antitrust*, SSRN (manuscript at 2) (Jun. 20, 2018), https://ssrn.com/abstract=3199703 [https://perma.cc/LF8U-65E7] (quoting Lina M. Khan, Note, *Amazon's Antitrust Paradox*, 126 YALE L.J. 710, 803 (2016)) (citation omitted) ("Though relegated to technocrats for decades, antitrust and competition policy have once again become topics of public concern.").

(DOJ) policy positions on standard essential patents (SEPs).[21] These patents cover inventions necessary to comply with a technical standard such as 3G/4G networking for cellular phones.[22] The smartphone wars are emblematic of fierce debates at this Interface.[23] Patentees wishing to contribute proprietary technology to a standard like Bluetooth or Wi-Fi can self-declare patents to be "essential" to its implementation and undertake to license them on "fair, reasonable, and nondiscriminatory" (FRAND) terms.[24]

On one side are allegations of opportunistic overcharging by patentees, abuse of such patent owners' rights to exclude implementers from standardized technology, and exploitation of their right to choose how to license their technology and to whom.[25] On the other side are allegations of implementers depressing royalty rates due to these patentees.[26] The litigation involving Qualcomm, the world's largest supplier of smartphone chips, and the Federal Trade Commission (FTC) is perhaps the most important modern case embodying these tension-fraught policy debates.[27] The suit both illustrates how key tensions play out in practice and provides important clues to fixing the fault lines at the Interface.

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21. *See* Caro de Sousa, *supra* note 14 (manuscript at 17) ("The largest and most immediate commercial and antitrust concern regarding SEPs is that the owners of SEPs will command very substantial market power once the standard in question becomes widely adopted.").

22. Kirti Gupta & Mark Snyder, *Smart Phone Litigation and Standard Essential Patents*, 12–13 (Stanford U. Hoover Inst. Working Group on Intell. Prop., Innovation, and Prosperity, Working Paper Series No. 14006), https://ssrn.com/abstract=2492331.

23. Michael A. Carrier, *DOJ Giving Cover to Monopolizing Firms that Breach Antitrust Rules*, HILL (Oct. 11, 2018, 2:00 PM), https://thehill.com/opinion/finance/410958-doj-giving-cover-to-monopolizing-firms-breaching-antitrust-rules [https://perma.cc/4VFG-2LHG] ("Standards present vital issues lying at the intersection of patent and antitrust law.") [hereinafter Carrier, *DOJ Giving Cover*]; Timothy J. Muris, *Bipartisan Patent Reform and Competition Policy*, GEO. MASON U. L. AND ECON. RES. PAPER SERIES, no. 18-46, 2017, at 1, 1, https://ssrn.com/abstract=3292476 [https://perma.cc/RT96-J8GQ] ("More than 250,000 patents may be used in a smartphone, including many of questionable quality that users of the standards cannot avoid. The result has been endless intellectual property (IP) litigation, the 'smartphone wars' as dubbed in the press."). *See also* Daryl Lim, *Standard Essential Patents, Trolls, and the Smartphone Wars: Triangulating the End Game*, 119 PENN ST. L. REV. 1, 7 (2014) [hereinafter Lim, *Triangulating the End Game*].

24. Lim, *surpa* note 23, at 4.

25. Rana Foroohar, *Let the 5G Battles Begin*, FIN. TIMES (Nov. 26, 2017), https://www.ft.com/content/d8d615ae-cf9c-11e7-b781-794ce08b24dc [https://perma.cc/J4Y9-UB4J] ("The result, according to one recent survey, is that roughly three-quarters of wireless tech IP holders are refusing to provide assurances that they'll license their latest technologies in certain circumstances, something that could start to undermine connectivity.").

26. *See infra* Part I.

27. Rhett Jones, *What's at Stake in Qualcomm's Blockbuster FTC Antitrust Trial*, GIZMODO (Jan. 10, 2019, 2:15 PM), https://gizmodo.com/whats-at-stake-in-qualcomms-blockbuster-ftc-antitrust-t-1831469771 [https://perma.cc/LZG8-DKA9] ("The FTC's case is seen as a decisive moment . . . .").

Part II discusses the heuristics and biases responsible for the Interface's endemic instability.[28] Just as Newtonian physics opened the door to deeper truths we now call quantum theory and relativity, incorporating behavioral economics into antitrust analysis will account for implicit deviations from assumed rational actor behavior in antitrust jurisprudence.[29] Behavioral economics is gaining recognition in a few antitrust court and agency decisions.[30] Specifically, antitrust driven by behavioral economics requires clear proof based on objective criteria, but leaves the door open to plausible theories of harm.[31]

Part II illustrates how heuristics and biases apply in three ways at the Interface: (1) overestimating innovation incentives while underestimating consumer harm, (2) crafting smarter remedies, and (3) explaining the importance of establishing regulatory sandboxes and safe harbors.

Part III explains how stakeholders can harness AI advances to make better predictions and judgments at the Interface. Predictive analytics is the lifeblood of the intelligence community, whose experience provides an important blueprint to improving antitrust analysis. [32] When stakeholders assess evidence and identify antitrust issues, they are looking for abnormalities much in the same way that oncologists look at a CT scan for cancerous tumors. Predictive analytics can lower the incidence of false positives. Part III shows how AI can draw upon a multitude of data sources to estimate the impact on innovation while behavioral economics ameliorates biases when stakeholders decide between the options presented. As AI tools enabling prediction become cheaper and more widespread, the premium on stakeholders' abilities to predict innovation outcomes will fall while the importance of their

28. Bailey, *supra* note 9, at 5 ("Understanding how consumers and firms make decisions is fundamental to antitrust because the assumptions made are central to predicting competitive dynamics post-transaction.").

29. Indeed, as one commentator noted, "[a]ntitrust is the most natural application of behavioral law and economics because the field is the most completely dependent on economic analysis of all of the major fields of law." Max Huffman, *A Look at Behavioral Antitrust From 2018*, CPI ANTITRUST CHRON., Jan. 2019, at 1, 3.

30. Bailey, *supra* note 9, at 4 ("There are a limited, but slowly growing, number of antitrust precedents for the reliance on behavioral assumptions.").

31. LEONARD MLODINOW, SUBLIMINAL: HOW YOUR UNCONSCIOUS MIND RULES YOUR BEHAVIOR 3 (1st ed. 2012) ("These subliminal aspects of everything that happens to us may seem to play very little part in our daily lives. But they are the almost invisible roots of our conscious thoughts.").

32. PHILIP E. TETLOCK & DAN GARDNER, SUPERFORECASTING: THE ART AND SCIENCE OF PREDICTION 17 (2015) ("And a big part of what American intelligence does is forecast global political and economic trends.").

judgment will rise.[33] Part III concludes by suggesting a readily applicable framework for how stakeholders can apply predictive analytics at the Interface, as well as highlighting its limitations.

Part IV concludes with suggestions for future research.

I. THE INTELLECTUAL PROPERTY-ANTITRUST DIVIDE

IP law and antitrust law both seek to promote vibrant marketplace competition today while incentivizing tomorrow's innovation.[34] Antitrust law generally respects IP rights and only in exceptional circumstances interferes with how IP owners choose to exercise those rights.[35] IP owners cannot be punished simply because they make life miserable for their rivals.[36] Accordingly, courts and antitrust agencies such as the FTC and the DOJ exercise considerable self-restraint in finding for antitrust plaintiffs in cases involving IP.[37] Besides strict thresholds, plaintiffs are held to at each stage of the litigation process,

33. AJAY AGRAWAL ET AL., PREDICTION MACHINES: THE SIMPLE ECONOMICS OF ARTIFICIAL INTELLIGENCE 19–20 (2018) ("The drop in the cost of prediction will impact the value of other things, increasing the value of complements (data, judgment, and action) and diminishing the value of substitutes (human prediction).").

34. *See* ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY § 1.0, U.S. DEP'T JUST. & FED. TRADE COMM'N (Jan. 12, 2017), www.justice.gov/atr/IPguidelines/download [https://perma.cc/N3XT-Y4L5] ("The intellectual property laws and the antitrust laws share the common purpose of promoting innovation and enhancing consumer welfare. The intellectual property laws provide incentives for innovation and its dissemination and commercialization by establishing enforceable property rights for the creators of new and useful products, more efficient processes, and original works of expression. . . . The antitrust laws promote innovation and consumer welfare by prohibiting certain actions that may harm competition with respect to either existing or new ways of serving consumers."). *See also* Alison Jones & Renato Nazzini, *The Effect of Competition Law on Patent Remedies*, PATENT REMEDIES & COMPLEX PRODUCTS: TOWARD A GLOBAL CONSENSUS (Cambridge Univ. Press, forthcoming 2019) (manuscript at 372), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3248905 [https://perma.cc/4AU4-4W46] (noting that "[i]t is often said that patent law (and intellectual property (IP) law more broadly) and competition law 'constitute complementary components of a modern industrial policy' which aim to improve innovation and consumer welfare"). Atari Games Corp. v. Nintendo of Am., Inc., 897 F.2d 1572, 1576 (Fed. Cir. 1990) (noting antitrust and IP law "are actually complementary, as both are aimed at encouraging innovation, industry and competition.").

35. Jessica K. Delbaum and David Higbee, *IP & Antitrust Know-How 2018*, MONDAQ (Oct. 31, 2018), http://www.mondaq.com/unitedstates/x/750422/Patent/IP+Antitrust+KnowHow+2018 [https://perma.cc/C7HZ-A9XJ] ("Absent exceptional circumstances, an IP owner, even one with monopoly power, has no duty to license to others and a unilateral refusal to license generally will not be a basis for an antitrust violation.").

36. *See* Brown Shoe Co. v. United States, 370 U.S. 294, 320 (1962) ("Taken as a whole, the legislative history illuminates congressional concern with the protection of *competition*, not *competitors*.").

37. Andreas Mundt, *CPI Talks . . .*, CPI ANTITRUST CHRON. Apr. 2018, at 1, 2, https://www.competitionpolicyinternational.com/cpi-talks-3/ [https://perma.cc/VJP6-ATAM] ("This is why it is so difficult in the digital economy to determine when an agency should intervene.").

this restraint may also stem in part from a lack of confidence in deciphering what would be the correct remedy even if an abuse is found.[38] There is also concern that antitrust defendants would be ensnared in a web of private litigation, which forms the bulk of antitrust litigation in the United States.[39] The consequences are severe. Violators face compensatory and treble damages as well as behavioral remedies.[40] Antitrust remedies may circumscribe rights conferred under patent law, including providing injunctive relief, licensing of the patented technology, or varying the terms of the license.[41]

While IP owners are not particularly suspect, neither are they immune from antitrust scrutiny in the absence of an express statutory exception.[42]

38. Jones & Nazzini, *supra* note 34, at 424 ("[A]ppropriate terms of dealing (especially pricing) as well as the realistic prospects for monitoring of that behavior in the future."). The lack of enforcement may also be due to the increased use of consent decrees against patentees, particularly in the standard-setting area. *Id.* at 426. ("This procedure has also been relied upon quite frequently by the U.S. authorities in enforcement actions involving the anticompetitive licensing or exploitation of patents, particularly (in recent years) within the context of technical standard-setting."). *See, e.g.*, Jorge L. Contreras, *A Brief History of FRAND: Analyzing Current Debates in Standard Setting and Antitrust Through a Historical Lens*, 80 ANTITRUST L.J. 41 (2015) (discussing and collecting these decrees). *See generally*, Renata Hesse & Frances Marshall., *U.S. Antitrust Aspects of FRAND Disputes*, *in* THE CAMBRIDGE HANDBOOK OF TECHNICAL STANDARDIZATION LAW: COMPETITION, ANTITRUST, AND PATENTS 263–89 (Jorge L. Contreras ed., 2017); *In re* Dell Computer Corp. 121 F.T.C. 616, 619–23 (1996) (failure to disclose to a standard-setting organization, thereby exploiting an unfair method of competition in violation of Section 5 of the FTC Act); *In re* Robert Bosch GmbH, F.T.C. File No. 121-0081, Decision and Order (Apr. 23, 2013); *In re* Motorola Mobility LLC and Google Inc., F.T.C. File No. 121-0120, Decision and Order (July 23, 2013) (seeking injunctive relief against unlicensed implementers of a technical standard as to which they had made FRAND commitments). A consent decree is endorsed by the court that makes the judgment and has the legal force of an adjudicated decision, and a breach of the consent decree by the defendant attracts contempt of court. United States v. Swift & Co., 286 U.S. 106, 112 (1932) (actionable contempt).

39. *See* Organization for Economic Co-operation and Development [OECD], *Relationship Between Public and Private Antitrust Enforcement*, at 8, DAF/COMP/WP3/WD (June 15, 2015), https://www.justice.gov/atr/file/823166/download [https://perma.cc/7LT5-JBRG] ("While these cases are important examples of civil non-merger enforcement actions brought by federal and state enforcement agencies, most civil non-merger antitrust cases are brought by private enforcers."); Spencer Weber Waller, *The Omega Man or The Isolation of U.S. Antitrust Law* (forthcoming 2019) (manuscript at 49), https://ssrn.com/abstract=3295988 ("[T]he Supreme Court has restricted the substance of antitrust rules for fear of overenforcement, almost always in the context of a private treble damages case.").

40. *See, e.g.*, Clayton Act, 15 U.S.C. § 15(a) (1964).

41. Northern Sec. Co. v. United States, 193 U.S. 197, 346 (1904) (explaining that the broad scope of antitrust injunctive relief will "bring about the dissolution or suppression of" the illegal conduct).

42. United States v. Microsoft Corp., 253 F.3d 34, 63 (D.C. Cir. 2001) (quoting *In re* Indep. Serv. Orgs. Antitrust Litig., 203 F.3d 1322, 1325 (Fed. Cir. 2000)) ("Intellectual property rights do not confer a privilege to violate the antitrust laws."); *see* Ill. Tool Works Inc. v. Indep. Ink, Inc., 547 U.S. 28, 45–46 (2006) (holding that a plaintiff may not rely solely upon a patent to establish that a manufacturer of ink containers has market power); *see, e.g.*, Patent Act, 35 U.S.C. § 271(d)

As the Supreme Court recently observed, "patent and antitrust policies are both relevant in determining the 'scope of the patent monopoly'—and consequently antitrust law immunity—that is conferred by a patent."[43] The rejection of immunity from antitrust scrutiny is sound as a matter of doctrine and policy. As a practical matter, however, this begs the question as to when and how antitrust law should be operationalized.

One way to do this is to look at antitrust policy goals. Antitrust law values and safeguards contestability to create room for mavericks to grow by preventing IP owners from squashing them through collusion, mergers, and acquisitions, or through IP owners' market dominance.[44] Courts generally assess competitive effects under a "rule of reason," in which "the factfinder weighs all of the circumstances of a case in deciding whether a restrictive practice should be prohibited as imposing an unreasonable restraint on competition."[45] The rule of reason is apt in IP cases because it can be difficult to detect market power and distinguish legitimate exclusion from illegitimate abuse.[46] Courts have used industry-specific heuristics as evidence of anticompetitive conduct; such as the size of a reverse payment from a brand pharmaceutical to a potential generic challenger, the presence of pretextual justifications in refusing to license patented technology, and the exclusion of nascent competition by leveraging on a dominant operation served as evidence of

(2010) (providing that a unilateral refusal to license cannot be either patent misuse or an antitrust violation, or that tying of patented goods is unlawful only in the presence of tying market power).

43. F.T.C. v. Actavis, Inc., 570 U.S. 136, 148 (2013); Simpson v. Union Oil Co. of Cal., 377 U.S. 13, 24 (1964) (concluding that the IP laws "are in *pari materia* with the antitrust laws and modify them *pro tanto*"); Ginsburg et al., *supra* note 11, at 100 ("Neither regime is subordinate to the other; rather, the antitrust and IP laws relate to the same general subject and must be applied in a manner that harmonizes them.").

44. Richard Blumenthal & Tim Wu, *What the Microsoft Antitrust Case Taught Us*, N.Y. TIMES (May 18, 2018), [https://perma.cc/WUS9-F664] ("Microsoft was itself, in the early 1980s, the beneficiary of another antitrust case, against IBM, the computing colossus of its time."); *see, e.g.*, United States v. U.S. Gypsum Co., 333 U.S. 364, 400–402 (1948) (finding horizontal price-fixing agreement involving patent royalties illegal under antitrust law); New York *ex rel.* Schneiderman v. Actavis PLC, 787 F.3d 638, 659 (2d Cir. 2015) (finding product hopping illegal); *In re* Robert Bosch GmbH, F.T.C. File No. 121-0081, Decision and Order (Apr. 23, 2013) (entering a consent order for acquisition requiring the SEP owner to license some patents on a royalty-free basis).

45. Cont'l Television, Inc. v. GTE Sylvania Inc., 433 U.S. 36, 49 (1977); *see also* Nat'l Soc'y of Prof'l Eng'rs v. United States, 435 U.S. 679, 689 (1978) (applying the rule of reason when a restraint of trade is "ancillary to a legitimate transaction," including a patent license).

46. Padilla et al., *supra* note 15 (manuscript at 20) ("[It] is particularly important in IP matters where it is often more difficult to determine monopoly power because IP holders must necessarily charge more than marginal costs in order to recoup their investment, and there are substantial risks involved in seeking to create and commercialize IP. . . . The risk here is in inferring monopoly power from shares of a defined market, an approach that is fraught with error, particularly in high-tech business models involving IP.").

anticompetitive conduct.[47] Eventually when the courts "have had considerable experience" with "conduct that would always or almost always tend to restrict competition and decrease output," such as price-fixing or market division, then the restraint is condemned as per se unlawful.[48]

Antitrust law today faces pressure for it to be employed in pursuit of populist goals. In particular, the rise of income inequality and expansion of the Internet economy has prompted calls to enforce antitrust law more vigorously against big companies.[49] For instance, in *Amazon's Antitrust Paradox*, Professor Lina Khan warned that Amazon's entrenched position confers market power over retailers, delivery companies, and consumers, and she points to antitrust law's "hostility to false positives" for its impotence in dealing with the unassailable durability of tech companies.[50] This movement consists of many voices and has been called many things—"populist antitrust, neo-Brandeisian antitrust, or hipster antitrust."[51] In particular, "hipster antitrust" is "animated more by concerns about the political power of large corporations than by concerns about their economic power" and is attempting to remold antitrust law for the Fourth Industrial Revolution.[52]

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47. *See, e.g.*, *Actavis*, 570 U.S. at 158; Eastman Kodak Co. v. Image Tech. Servs., Inc., 504 U.S. 451, 461 (1992) (stating that a plaintiff may rebut an asserted business justification by demonstrating either that the justification does not legitimately promote competition or that the justification is pretextual); *Microsoft*, 253 F.3d at 79 ("We may infer causation when exclusionary conduct is aimed at producers of nascent competitive technologies as well as when it is aimed at producers of established substitutes.").

48. United States v. Kemp & Assocs., Inc., 907 F.3d 1264, 1272 (10th Cir. 2018) (citations omitted) ("The per se rule is not a different cause of action than the rule of reason, but rather only an evidentiary shortcut through the rule of reason morass. It reflects the recognition that some practices will nearly always invite condemnation under the rule of reason, and in those cases the per se rule is appropriate because "for the sake of business certainty and litigation efficiency we . . . tolerate[] the invalidation of some agreements that a full-blown inquiry might have proved to be reasonable.").

49. Giocoli, *supra* note 20, at 2 ("Triggered by the aftermaths of the great financial crisis, the alleged rise of inequality in the American economy and the expansion of the web economy, a lively debate has recently started (actually, re-started) in the US about antitrust law. . . . '[C]ompetition is now on the front pages, as concerns over rising concentration, extraordinary profits accruing to the top slice of corporations, slowing innovation, and widening income and wealth inequality have galvanized attention.'").

50. Khan, *supra* note 20, at 738; *see also* Robert Pitofsky, *The Political Content of Antitrust*, 127 U. PA. L. REV. 1051, 1051 (1979) ("It is bad history, bad policy, and bad law to exclude certain political values in interpreting the antitrust laws.").

51. Joshua N. Holian et al., *FTC Opens Doors and Minds to New Approaches for Competition and Consumer Protection in the 21st Century*, LATHAM & WATKINS CLIENT ALERT COMMENT. (Sept. 17, 2018), https://www.lw.com/thoughtLeadership/lw-ftc-doors-minds-competition-consumer-protection-21st-century [https://perma.cc/NZ3B-RX9B].

52. Shapiro, *supra* note 20, at 28.

A. "Hipster" Antitrust: What was Old is New Again

Populist sentiments animated antitrust law at its genesis, condemning companies more due to their size rather than any actual harm they inflicted on the competitive process or consumer welfare.[53] From the 1970s onward, however, neoclassical economics tethered antitrust law to consumer welfare.[54] Over the years, antitrust law continued its evolution toward an evidence-based approach.[55] Maximizing consumer welfare would mean "enable[ing] markets to produce the highest output of the highest quality goods and services consistent with competition."[56] As part of the DOJ and FTC's commitment to evidence-based economic analysis, they employ a sizeable force of about 130 Ph.D. economists.[57]

Beginning around 2016, however, bipartisan undercurrents began to criticize antitrust law's inability to address vast concentrations of the market and political power.[58] They point to how antitrust enforcement

53. *Id.* ("Antitrust was born and then fortified during a period of populism in the United States in the late 19th and early 20th centuries."); *see* Richard M. Steuer, *Incipiency*, 31 LOY. CONSUMER L. REV. 155, 157 (2019) ("When the first antitrust laws were adopted at the end of the Nineteenth Century, supporters of the new legislation were motivated by a desire not only to protect consumers, but to limit the power of big business and preserve small businesses."); Knowledge@Wharton & Herbert Hovenkamp, *How to Build a Better Antitrust Policy*, KNOWLEDGE@WHARTON (Dec 14, 2017), https://knowledge.wharton.upenn.edu/article/anti-trust/ [https://perma.cc/7PXT-3XMA] ("The original progressive movement in the early 20th century had that motive, and the result was very significant expansion of the antitrust laws.").

54. *See generally* ROBERT H. BORK, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF (1978); *See* Steuer, *supra* note 53, at 158 ("Professor Bork advocated that consumer welfare—low prices, high output, good quality, and maximum efficiency—is the only legitimate goal of antitrust, and that no other objectives should be recognized."); *id*. ("In the ensuing years, courts interpreting the antitrust laws increasing have come to adopt the consumer welfare standard as the sole standard for judging alleged antitrust violations. Enforcement agencies likewise have come to rely on the consumer welfare standard as the only standard for assessing mergers and acquisitions, and deciding whether to challenge allegedly anticompetitive conduct in court.").

55. BORK, *supra* note 54, at 51 (stating that "[t]he only legitimate goal of American antitrust law is the maximization of consumer welfare."); Thomas J. Horton, *Rediscovering Antitrust's Lost Values*, 16 U.N.H. L. REV. 179, 190 (2018) ("Indeed, neoconservative scholars have been outspoken in proclaiming that Congress was necessarily focused on increasing economic efficiency."); *id.* at 181 ("Such heady proclamations are based on the rapid ascendance over the last 40 years of neoclassical economics, which largely rule American antitrust today."); *id*. at 182 ("Discussions of modern antitrust often emphasize its evolution, over the last several decades, into a rigorous economic discipline that is largely technocratic and apolitical."); Hovenkamp, *supra* note 10, at 611 ("[T]he rule of reason was a joint enterprise of the Chicago and Harvard schools. Bork's scholarship [building on Taft's work] developed the argument for the rule's domain by arguing for fewer applications of the per se rule. Subsequent Harvard school scholarship fashioned the rule of reason's modern, burden-shifting process of proof.").

56. Hovenkamp, *supra* note 10, at 620.

57. Marcel Boyer et al., *The Rise of Economics in Competition Policy: A Canadian Perspective*, CIRANO, at 2 (Dec. 2017).

58. Lina Khan, *The Supreme Court Just Quietly Gutted Antitrust Law*, VOX (July 3, 2018, 9:40

has been reduced to a trickle,[59] and how antitrust law has become "totally inadequate" in reining in abuses by tech giants such as Google, Apple, Facebook, and Amazon, and the threat they pose to "American democracy."[60] One reason for this apparent lack of antitrust activity is that neoclassical antitrust assumes that market inefficiencies tend to correct themselves. [61] Further, as Professor Herbert Hovenkamp observed, neoclassical antitrust "often appears to be under-deterrent because of its insistence on due process and rationality, administrability and clear proof."[62]

The slow antitrust litigation process is another reason for the increasing irrelevance of antitrust law in industries where business cycles are measured in months rather than years.[63] Regardless of whether a private party or government enforcer brings a case, litigation may take too long

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AM), https://www.vox.com/the-big-idea/2018/7/3/17530320/antitrust-american-express-amazon-uber-tech-monopoly-monopsony [https://perma.cc/ZG3Z-V5NQ] (describing this as a time "when politicians, journalists, and members of the public increasingly recognize that America has a major market power problem and that we must revitalize our antitrust tradition. When companies have too much market power, they can depress wages and salaries, raise prices, block entrepreneurship, stunt investment, and exert undue political power."); Shapiro, *supra* note 20, at 2 ("[I]n July 2017 Congressional Democrats unveiled 'A Better Deal: Cracking Down on Corporate Monopolies and the Abuse of Economic and Political Power.'").

59. *See, e.g.*, Horton, *supra* note 55, at 186 ("[E]conomics and empiricism do not provide answers to all questions arising in antitrust law."); Marina Lao, *Ideology Matters in the Antitrust Debate*, 79 ANTITRUST L.J. 649, 649–50 (2014) (observing that "some antitrust scholars would preserve a limited role for other values [while] others challenge the central role of economics more frontally"); Eleanor M. Fox, *The Politics of Law and Economics in Judicial Decision Making: Antitrust as a Window*, 61 N.Y.U. L. REV. 554, 584 (1986) ("If pressed to take account of harms beyond output restraint . . . jurists may find that they *can* advance values of antitrust law—diversity, opportunity, fair process, choice, and fairer distribution—without also raising the costs of goods and services to consumers."); Blumenthal & Wu, *supra* note 44 ("Between 1970 and 1999, the United States brought about 15 monopoly cases each year; between 2000 and 2014 that number went down to just three.").

60. *See* Horton, *supra* note 55, at 193.

61. *See* Jonathan B. Baker, *Taking the Error Out of "Error Cost" Analysis: What's Wrong with Antitrust's Right*, 80 ANTITRUST L.J. 1, 30 (2015) ("[T]he oddly selective conservative skepticism about the competence of courts to make factual assessments appears to reflect a reflexive hostility to exclusion cases, rather than a sober response to limits on the courts' institutional competence.").

62. Hovenkamp, *supra* note 10, at 594.

63. Jean Tirole, *Taming the Tech Monopolies*, STRAITS TIMES (Dec. 28, 2018), https://www.straitstimes.com/opinion/taming-the-tech-monopolies [https://perma.cc/UZ5Z-JSMS] ("With rapidly changing technologies and globalisation, traditional regulatory tools have become less effective, causing competition policy to lag."); Timothy Cowen & Stephen Dnes, *The Good, Bad & Ugly in Competition Law Enforcement: Observations From The Technology Sector*, CPI ANTITRUST CHRON. 1, 5 (2017) (observing "that the current antitrust and regulatory system doesn't work well in promptly addressing established issues. In short, it is simply too slow."); *see also id.* ("Microsoft, Intel and Google, affect many other sectors and involve huge factors of production; and yet the Microsoft investigation took 10 years, and the Google investigation continues, 10 years on.").

to meaningfully benefit the innovative process. Currently, this is a necessary evil because agency and court decisions need to stand up to scrutiny on appeal.[64]

Other commentators point to neoclassical antirust law's convoluted rules, which are "so complicated that it is no longer understandable to many, including not only the electorate and juries, but also judges armed with solely general legal sophistication." [65] As Professor Elhauge explained:

> [T]he fact that modern technocratic antitrust stresses open-ended case-by-case all-things-considered analysis of whether welfare is enhanced or harmed by any specific conduct. That makes it incomprehensible to most judges and juries, so they can be bamboozled with bad arguments like the claim that anticompetitively creating monopsony power upstream should be permitted because it does not harm consumer welfare.[66]

Advocates of "hipster" antitrust call for nothing less than "a radical redefinition of its main goal and, consequently, the abandonment of the [neoclassical] view."[67] They say that the root of the problem may lie in antitrust law's focus on short-term effects such as price and output, which "fails to capture the architecture of market power in the twenty-first century marketplace."[68] Their solution is to encompass non-price effects that facilitate income redistribution.[69]

The "hipster" movement highlights neoclassical antitrust's inadequacy in the Fourth Industrial Revolution. [70] Neoclassical antitrust analysis focuses on static factors and has no tools to deal with questions pertaining to political economy, behavioral biases and institutional complexities. Ideologically, neoclassical antitrust, with its belief in little or no government intervention, has been criticized as "generally promoted by

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64. Mundt, *supra* note 37, at 3 ("So we have to find the right balance between procedural efficiency and thoroughness.").

65. Interview by John Briggs with Einer Elhauge, Professor, Harvard Law School (transcript available at https://eventbrowse.com/city/na/event/6th-bill-kovacic-antitrust-salon-an-interview-with-einer-elhauge/ [https://perma.cc/L372-K556]) [hereinafter Elhauge Interview].

66. *Id*.

67. Giocoli, *supra* note 20, at 2.

68. Khan, *supra* note 20, at 716.

69. Samuel Himel & Robert Seamans, *Artificial Intelligence, Incentives to Innovate, and Competition Policy*, CPI ANTITRUST CHRON. 1, 5 (2017), https://www.competitionpolicyinternational.com/wp-content/uploads/2017/12/CPI-Himel-Seamans.pdf [https://perma.cc/33VV-9KG7].

70. Elhauge Interview, *supra* note 65 ("I think Antitrust Populism has brought great new energy to the field by correctly stressing that our current approach has produced a system-wide underenforcement of antitrust law and by making non-technocratic arguments that are understandable to the general public.").

right-wing think tanks funded by rich libertarians who want to pay less tax."[71] In particular, neoclassical antitrust tends to make simplifying assumptions such as a single "equilibrium" for the economy and "rational expectations" among a homogeneous pool of economic actors.[72]

At the same time, "hipster" antitrust is both ideologically and structurally unsound. It rides on a simplistic and long-discarded notion that "big is bad," which courts and commentators have long rejected.[73] A retrograde retreat to an age when successful competitors are penalized simply for winning the market would be a mistake.[74] Wielding antitrust against victorious commercial Goliaths would chill vigorous competition and undermine economic growth.[75] While antitrust law should be retooled, it should not be wielded as a populist pitchfork. Antitrust law was not designed to fix political problems and in any case populism rides on outsized expectations about what it can accomplish.[76]

Compared to the lobotomizing of economic policy from antitrust, incremental retooling is the better option. As Professor Jonathan Baker observed, "[s]o long as competition policy remains the product of a political understanding aimed at capturing economic efficiencies, as it should, economic analysis will remain the essence of antitrust policy, enforcement, and litigation."[77] While the ambit of "economic efficiencies" is not crystal clear, departing from the consumer welfare standard risks prioritizing rivals over the process of competition itself and causing marketplace inefficiency. How then can neoclassical antitrust evolve to remain relevant in this technological age?

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71. Ben Chu, *The Economics Profession Does Not Need a 'Reformation'*, INDEPENDENT (Dec. 26, 2017, 12:00 PM), https://www.independent.co.uk/voices/economics-heterodox-reform-supply-demand-politics-a8128606.html [https://perma.cc/75C6-5KDK].

72. *Id*.

73. Shapiro, *supra* note 20, at 26.

74. William A. Galston & Clara Hendrickson, *What the Future of U.S. Antitrust Should Look Like*, HARV. BUS. Rev. (Jan. 9, 2018) ("[A] radical revision of the current framework would mean transforming antitrust into an arena of political contention without clear standards to guide administrators and judges, ultimately weakening the antitrust regime.").

75. Shapiro, *supra* note 20, at 28 ("Economic growth will be undermined if firms are discouraged from competing vigorously for fear that they will be found to have violated the antitrust laws, or for fear they will be broken up if they are too successful.").

76. E. R.R. Presidents Conference v. Noerr Motor Freight, Inc., 365 U.S. 127, 140–41 (1961) ("Insofar as that [Sherman] Act sets up a code of ethics at all, it is a code that condemns trade restraints, not political activity . . . . The proscriptions of the Act, tailored as they are for the business world, are not at all appropriate for application in the political arena.").

77. Horton, *supra* note 55, at 191 (2018); Pitofsky, *supra* note 50, at 1051 (agreeing that economic concerns should "remain paramount," and that "[t]he issue among most serious people has never been whether non-economic considerations should outweigh significant long-term economies of scale" in interpretations of the antitrust laws and concrete antitrust analyses").

1. The Neoclassical Antitrust Paradox

Antitrust drifts on a foundation of broadly-worded statutes.[78] This was not an oversight by Congress. Antitrust law governs a vast array of corporate behavior in diverse industries. It would not be possible to prospectively legislate the rules of competition to cover all industries in any meaningful way for all time. Congress therefore strategically delegated to courts and agencies the responsibility of developing antitrust law.[79]

Congress's decision means the law developed erratically.[80] As early as 1898, less than a decade after Congress enacted the Sherman Act, courts were already concerned with "[t]he manifest danger in the administration of justice according to so shifting, vague, and indeterminate a standard," and attempted to establish a framework of "reasonableness" that would serve as a doctrinal anchor.[81] To balance anticompetitive and procompetitive effects, they applied the rule of reason.[82] It insisted "that theories of both competitive harm and offsetting explanations be well developed, and that fact findings be both sufficient and justified."[83] If a practice was "reasonable," it survived antitrust scrutiny.[84] However, that balancing was more illusory than real. Empirical studies show courts

78. Eriq Gardner, *Trump, Time Warner, AT&T and How to Win the Antitrust Trial of the Century*, HOLLYWOOD REP. (Mar. 8, 2018, 6:00 AM), https://www.hollywoodreporter.com/features/trump-time-warner-at-t-how-win-antitrust-trial-century-1092542 [https://perma.cc/CVN8-FAPQ] ("But the laws have vague language, so regulators and courts must spell out the rules of competition."); Hovenkamp, *supra* note 10, at 597–98 (criticising the Sherman Act, which condemns restraints on trade or monopolization without further elaboration, and the Clayton Act, which addresses price discrimination, "tying and exclusive dealing, and mergers," because operative terms such as "substantially lessen competition" or "tend to create a monopoly," are "so general that it can mean practically anything.").

79. Kimble v. Marvel Entm't, LLC, 135 S. Ct. 2401, 2418 (2015) (citation omitted) ("[*S*]*tare decisis* has 'less-than-usual force in cases involving the Sherman Act.' . . . But this distinction is unwarranted. We have been more willing to reexamine antitrust precedents because they have attributes of common-law decisions.").

80. Hovenkamp, *supra* note 10, at 597 ("Much of the discrepancy between movement antitrust and technical antitrust results from the very broad and sparse language of the principal antitrust laws.").

81. United States v. Addyston Pipe & Steel Co., 85 F. 271, 283–84 (6th Cir. 1898).

82. Michael A. Carrier, *The Rule of Reason in The Post-Actavis World*, COLUM. BUS. L. REV. 25, 29 (2018) [hereinafter Carrier, *The Rule of Reason*] ("[The Court in] *Continental T.V. v. GTE Sylvania* replaced a formalistic analysis centering on whether title to an article had passed with an economic approach analyzing competitive effects.").

83. Hovenkamp, *supra* note 10, at 600–01.

84. *See* PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION ¶ 1501 (4th ed. 2017) ("The court held that agreements in restraint of trade are enforceable if they are reasonably ancillary to a lawful principal transaction . . . if the restraint is reasonable . . . and so framed and so guarded as to afford adequate protection . . . without injuring the public.'").

instead rely on a burden-shifting approach in about 97 percent of cases.[85]

Over time, courts developed heuristics to simplify the analysis, including higher prices or lower output, a market power requirement, and the notion of "antitrust injury" for private litigants.[86] Even so, the rule of reason was regarded as "unduly cumbersome," "costly to litigate," and "unwieldy."[87] With per se offenses, things are easier. Market power generally need not be proven, and anticompetitive effects are largely inferred from the conduct itself.[88] However, the varieties of cases amenable to the per se rule shrink, leaving most cases subject to analysis under the rule of reason.[89]

A robust antitrust regime can coexist with robust IP rights. As former United States Patent and Trade Office (USPTO) Director David Kappos observed, there is "no doctrinal or philosophical reason why strong IPRs cannot be reconciled with antitrust law."[90] He explained that the "differences in perspective and time scale between the two bodies of law

85. Carrier, *The Rule of Reason*, *supra* note 82, at 30 ("First, the plaintiff must show a significant anticompetitive effect, either an actual effect (such as a price increase or output reduction) or potential effect (such as market power). Second, if the plaintiff can make such a showing, the burden shifts to the defendant to show a legitimate procompetitive justification for the restraint. Third, if the defendant can offer a justification, the plaintiff can show that the restraint is not reasonably necessary to achieve the defendant's objectives or that the objectives could be achieved by alternatives 'less restrictive' of competition. And fourth, courts balance anticompetitive and procompetitive effects."); *id.* at 29 ("This view, however, is not accurate. In two empirical studies covering all Rule-of-Reason cases from 1977 to 1999 and 1999 to 2009, I found that courts engaged in a burden-shifting approach."); *id.* at 30–31 ("Finally, in 4% and 2% of cases, the court balances anticompetitive and procompetitive effects."); *id.* at 38 ("With ninety-seven percent of cases today dismissed at the first stage due to plaintiffs' failure to show an anticompetitive effect, the *Actavis* shortcuts are significant.").

86. *See generally* Viamedia, Inc. v. Comcast Corp., 335 F. Supp. 3d 1036, 1066–68 (N.D. Ill. 2018).

87. Hovenkamp, *supra* note 10, at 601 ("The Harvard school's approach to the rule of reason has the advantage that it takes evidence of both harm and offsetting justifications more seriously. It has the disadvantage that the rule of reason has become unduly cumbersome and costly to litigate."); *See also* Robert H. Bork & Ward S. Bowman, Jr., *The Crisis in Antitrust*, 65 COLUM. L. REV. 363, 363–64 (bemoaning how antitrust "vacillated between the policy of preserving competition and the policy of preserving competitors from their more energetic and efficient rivals").

88. *See, e.g.*, Newman v. Universal Pictures, 813 F.2d 1519, 1522–23 (9th Cir. 1987) ("[The] per se rule relieves plaintiff of the burden of demonstrating an anticompetitive effect, which is assumed . . . ."); *see* Kimble v. Marvel Entm't, LLC, 135 S. Ct. 2401, 2407 (2015) (demanding royalties on a patent that has expired is per se unlawful).

89. Herbert Hovenkamp, *The Rule of Reason*, 70 FLA. L. REV. 81, 83 (2018) [hereinafter Hovenkamp, *The Rule of Reason*] ("Today it extends to 'naked' price fixing and market division agreements, a small subset of boycotts, or concerted refusals to deal, and—by a very thin thread—some tying arrangements.").

90. David J. Kappos, *The Antitrust Assault on Intellectual Property*, 31 HARV. J.L. & TECH. 665, 672 (2018).

can obscure their common ground."[91] Antitrust law, he noted, focuses on the "immediate effects, particularly on prices and market outcomes."[92] In contrast, "as drivers of innovation [IP rights] work dynamically and gradually to create an entirely different world, one containing new products, businesses, or even industries, as well as to facilitate technologies that improve the operation of existing markets."[93]

In other words, while consumers benefit from lower prices and higher outputs in the short run, innovation gives the single greatest boost to consumer welfare in the long run.[94] Firms may innovate to reduce costs or launch new products and services.[95] Constitutionally enshrined IP rights encourage this sort of innovation.[96] Owners rely on them to appropriate the rewards of innovation through sales and licenses that might otherwise be misappropriated by free-riders.[97] In turn, the rewards spur future innovation by providing an income stream and driving rivals to invent around patented technology.[98] IP rights thus "protect the competitive process in innovation, which also benefits consumers."[99] In the long run, consumers benefit when the price of technology drops. When Thomas Edison patented the incandescent lamp in the early 1800s, artificial light cost about 400 times what it does today.[100] Its cheap

91. *Id.*

92. *Id.*

93. *Id*.

94. Caro de Sousa, *supra* note 14 (manuscript at 1) ("It is widely accepted that innovation and technological progress are the single most important determinant of economic growth."); Padilla et al., *supra* note 15 (manuscript at 2, 4) (While consumers gain from increases in static efficiency in the short run, economics teaches us that dynamic efficiency, including societal gains from innovation, are an even greater driver of consumer welfare. . . . [T]he social value of process and product innovation is very large.").

95. Padilla et al., *supra* note 15 (manuscript at 2) ("Product innovation may lead to better products (*vertical product innovation*) or products that are different from the existing ones without being superior (*horizontal product innovation*). It may also lead to entirely new products or ways of doing things (often referred to as *drastic* or *leapfrog innovation*). Process and product innovation are extremely valuable to social welfare.").

96. U.S. CONST. art. I, § 8 (empowering Congress "[t]o promote the progress of science and useful arts, by securing, for limited times, to authors and inventors, the exclusive right to their respective writings and discoveries"); Padilla et al., *supra* note 15 (manuscript at 5) ("IPRs exist to stimulate innovation by increasing the return on costly investments in research and development ('R&D').").

97. Kappos, *supra* note 90, at 667 ("IPRs encourage innovation by assuring that the rewards of innovation go to the innovator, whether the innovator chooses to sell the innovation or license it to others.").

98. *Id.*

99. *Id.* at 671.

100. *See* William D. Nordhaus, *Two Centuries of Productivity Growth in Computing*, 67 J. ECON. HIST. 128 (2007) (noting that in the early 1800s it would have cost four hundred times what for the same amount of light).

abundance lit up the world and transformed how we lived and worked. The same might be said of the ubiquity of computing in photography, autonomous vehicles, and city planning.[101] This means IP deference needs to balance between protecting the initial innovator's rights and fostering follow-on or cumulative developments.[102] It also means that inapt intervention "has the capability to destroy incentives to innovate and economies of scale."[103]

An important takeaway here then is that where competitive problems may have their roots in the IP system itself, antitrust should not use it as a compensatory tool. The better solution is endogenous, not exogenous.[104] The answer is to focus on specific defects in the acquisition and exercise of IP rights.[105] Further, IP law has endogenous policy levers to curb opportunism by patentees such as patent misuse, the first sale doctrine, and patent-post grant review.[106]

That conclusion, however, does not address when the inflection point of dynamic gains is reached. The focus should be on static efficiency. Every antitrust case involving IP requires some consideration of two "but for" worlds, one in which intervention takes place and one in which it does not.[107] Whether IP-deference yields greater innovation is difficult to prove.[108] There is some consensus that IP and innovation exist on an

101. AGRAWAL ET AL., *supra* note 33, at 12 ("The advent and commercialization of computers made arithmetic cheap.").

102. Caro de Sousa, *supra* note 14 (manuscript at 2) ("All IP rights seek to promote innovation and creativity by striking a balance between protecting the initial creator's rights and fostering follow-on or cumulative developments."); *id.* (manuscript at 4) ("An important consequence of the inverted U-shape relationship between market concentration and innovation is that, in general, moderate amounts of competition enforcement create a market environment that is more conducive to innovation.").

103. Mundt, *supra* note 37, at 2.

104. *See* Caro de Sousa, *supra* note 14 (manuscript at 10) ("[I]t would be inappropriate to use competition law for the purpose of remedying the defects of IP regimes."); *See also* William E. Kovacic & Andreas P. Reindl, *An Interdisciplinary Approach to Improving Competition Policy and Intellectual Property Policy*, 28 FORDHAM INT'L L.J.1062, 1067–68. (noting that using antitrust to expand access to IP rights is a crude, second-best solution to cure weaknesses that reside in the rights granting process).

105. Daryl Lim, *Patent Misuse and Antitrust: Rebirth or False Dawn?*, 20 MICH. TELECOMM. & TECH. L. REV. 299, 304–05 (2014) [hereinafter Lim, *Patent Misuse*].

106. *Id.* at 385 (suggesting judges can help by finding patent misuse when appropriate); *see, e.g.*, Daryl Lim, *Misconduct in Standard Setting: The Case for Patent Misuse*, 51 IDEA 559, 560, 590 (2011) (noting the various sources of relief for misuse and monopolization by patentees).

107. Padilla et al., *supra* note 15 [manuscript at 19] ("In order to protect an IPR holder's core right to exclude, when considering whether specific conduct has anticompetitive effects, the analysis will include a determination of what would have happened in the absence of a license (the 'but for world') . . . .").

108. Koren W. Wong-Ervin & Georgios Effraimidis, *Recommendations Following the FTC's October 2018 Hearings on IP and Innovation*, CPI 2 (Oct. 2018),

inverted U-shaped curve—that too much or too little protection harms innovation.[109]

The stakes involved and costs of mistaken intervention provide a clue as to why courts are normally reluctant to grant fiats against patentees unless the theory of anticompetitive harm has been clearly made.[110] As one dissenting opinion from the Supreme Court recently noted, "because the relevant question is a comparison between reality and a hypothetical state of affairs, to require actual proof of reduced output is often to require the impossible—tantamount to saying that the Sherman Act does not apply at all."[111]

The open-ended nature of antitrust law has resulted in untethered swings in its approach to IP rights. For instance, the early 1900s, IP rights were immune from antitrust scrutiny.[112] By the 1940s, antitrust law severely limited the restrictions patentees could impose on their licensees.[113] This anti-patent sentiment reached a high-water mark in the 1970s when the DOJ's treated numerous licensing practices as per se violations.[114] In 1988, the DOJ shifted to a rule of reason approach to

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https://www.competitionpolicyinternational.com/recommendations-following-the-ftcs-october-2018-hearings-on-ip-and-innovation/ [https://perma.cc/HXX4-4JS6] ("Professor Michael Frakes explained that any attempt to approach empirically the question of whether the patent system incentivizes and/or results in innovation encounters notable obstacles, perhaps the most difficult of which is the construction of the necessary counterfactual.").

109. *Id.* ("[T]he economics literature taken as a whole suggests that the relationship between IP and innovation is an inverted-U shape, i.e., either too little or too much IP protection lowers innovation.").

110. Novell, Inc. v. Microsoft Corp., 731 F.3d 1064, 1073–80 (10th Cir. 2013).

111. Ohio v. Am. Express Co., 138 S. Ct. 2274, 2302 (2018).

112. Bennett v. Nat'l Harrow Co., 186 U.S. 70, 91 (1902) (noting "absolute freedom in the use or sale of rights under the patent laws . . . . The very object of these laws is monopoly . . . .").

113. *See, e.g.*, Ethyl Gasoline Corp. v. United States, 309 U.S. 436, 456–58 (1940) (rejecting restrictions using patents when the interests can be protected in other ways which do not implicate monopolized practices); Carbice Corp. of Am. v. Am. Patents Dev. Corp., 283 U.S. 27, 34 n.4 (1931) (noting that an attempt to use a patent to unreasonably restrain commerce is both beyond the scope of the patent and a direct violation of the antitrust laws); *see also* United States v. Masonite Corp., 316 U.S. 265, 282 (1942) (holding that the power to hold a patent and price fix is an "injury which the Sherman Act condemns [which] renders it illegal per se"); Morton Salt Co. v. G. S. Suppiger Co., 314 U.S. 488 (1942), *abrogated by* Ill. Tool Works Inc. v. Independ. Ink, Inc., 547 U.S. 28, 37 (2006); Mercoid Corp. v. Mid-Continent Inv. Co., 320 U.S. 661 (1944); Int'l. Salt Co. v. United States, 332 U.S. 392 (1947), *abrogated by Ill. Tool Works Inc*., 547 U.S. at 37.

114. Bruce Wilson, *Dep't of Justice Luncheon Speech, Law on Licensing Practices: Myth or Reality?*, APLA BULL. 54, 58–59 (Jan.–Feb. 1975) (remarking that the "nine no-no's" include prohibitions on (1) tying; (2) grantbacks; (3) resale; (4) covenants covering non-patented products or services; (5) restricting licenses by licensor; (6) package licensing; (7) metered royalties; (8) restricting the resale of products made by a patented process; and (9) minimum resale price maintenance).

patent licensing.[115] In 1995, the DOJ and FTC jointly issued the *Guidelines for the Licensing of Intellectual Property* and endorsed a rule of reason approach to patent licensing.[116] By the 2000s, a "scope of the patent" approach had developed, whereby everything falling within the patent claims or duration of the patent is immune to antitrust scrutiny, thus all but coming a full circle.[117] And as mentioned at the beginning of Part I, the current approach directs courts to find their way through the rule of reason using heuristics.[118]

Stakeholders do not know tomorrow's impact on today's intervention. For that matter, they do not know if non-intervention is better than intervention. Either side may be accused of making "claims that are impossible to deliver, or adopt[ing] speculative, unprovable theories about competitive harm."[119] This makes the quest for dynamic efficiency—which is inherently focused on the long run—an elusive one. Those seeking more patent deference and those seeking less seem like blind men arguing over the colors of the rainbow.

2. Like Blind Men Arguing Over the Color of a Rainbow

It would be overly simplistic to say that the tension between IP and antitrust comes about because IP law confers exclusive rights while antitrust seeks to correct anticompetitive market outcomes. The modern view acknowledges that both antitrust and IP laws accommodate each other—a "yin-yang" approach which defines IP scope by both IP and antitrust policies—but agencies and courts face the task of accounting for innovation incentives.[120] Antitrust law's merger analysis offers a clue about the difficulty in prophylactic intervention. Merger analysis is structured to be forward-looking, mandated by statute to curb incipient

115. U.S. DEP'T OF JUSTICE, ANTITRUST ENFORCEMENT GUIDELINES FOR INT'L OPERATIONS, 64, 68 (Nov. 10, 1988).

116. U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY § 3.4 (Apr. 6, 1995), *available at* https://www.justice.gov/sites/default/files/atr/legacy/2006/04/27/0558.pdf [https://perma.cc/RQL5-7BET] (announcing the intention to evaluate patent licensing practices under a balancing test); *id.* ("In the vast majority of cases, restraints in intellectual property licensing arrangements are evaluated under the rule of reason.").

117. *In re* Indep. Service Orgs. Antitrust Litig., 203 F.3d 1322, 1329 (Fed. Cir. 2000) (holding that Xerox's refusal to license was "squarely within the rights granted by Congress to the copyright holder and did not constitute a violation of the antitrust laws" in the absence of definitive rebuttal evidence).

118. FTC v. Actavis, Inc., 570 U.S. 136, 148 (2013).

119. Hovenkamp, *supra* note 10, at 594 (explaining how movement antitrust differs from technical antitrust).

120. *Actavis*, 570 U.S. at 148.

harm.[121] However, even merger analysis has increasingly focused on price effects rather than non-price effects such as innovation.[122]

Schumpeterians offer one vision of innovation, betting it comes from rewarding the IP owners.[123] Monopolies are temporary and rapidly displaced by new monopolies through the process of creative destruction.[124] Clamping down on innovators may chill entrepreneurship, ward off investors, and prevent society from ascending the inverted U-shaped innovation curve. Arrovians, on the other hand, believe that competition creates better and cheaper products, with innovation based on the need to outperform competitors.[125] If a newcomer has a better product than the incumbent, it might want to block the entrant from gaining even a partial foothold in the market. Ignore exploitative and exclusionary conduct, and innovators may wrest control over the vital arteries needed for the creation and dissemination of technology. Insulation from competition thus results in reduced "firm dynamism, increased firm age, decreased labor mobility and lower total factor productivity growth."[126] In such situations, "by addressing and eliminating anticompetitive restraints imposed by private firms in innovation-focused markets, competition authorities create space and opportunities for innovation and growth."[127] The key then is to keep the market contestable.[128]

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121. Steuer, *supra* note 53, at 160 ("The Clayton Act was adopted in 1914 to fill gaps that had appeared in the coverage of the Sherman Act. Troubling mergers and acquisitions were escaping the reach of the Sherman Act, and exclusive dealing and tying persisted in closing off competition. The Clayton Act did not purport to change the goals of the antitrust laws. Instead, it amplified those laws by changing the time horizon for analysis in adopting what would become known as the 'incipiency' doctrine.").

122. Himel & Seamans, *supra* note 69, at 5 ("[T]owards assessing what is measurable.").

123. *See generally* JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY (2d ed. 1942) (recognizing that patent-based innovation produces the best results for the economy, in a process he called "creative destruction").

124. Kappos, *supra* note 90, at 672 ("Crucially, the negative effects of weakening IPRs are neither immediate nor apparent: when we weaken incentives to innovate, we cannot know what innovations we have preempted and how much better off those innovations would have made us.").

125. Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITIES: ECONOMIC AND SOCIAL FACTORS 609, 626 (R. Nelson ed., 1962); *see also* Caro de Sousa, *supra* note 14 (manuscript at 3–4) ("The proponents of Arrow and, to some extent, of Aghion et al., see an important role for antitrust agencies in supporting innovation because they understand competition to be an important the driver of innovation.").

126. Himel & Seamans, *supra* note 69, at 4.

127. Caro de Sousa, *supra* note 14 (manuscript at 4).

128. Tirole, *supra* note 63 ("A new enterprise that is more efficient or more innovative than an established monopoly must be permitted to enter the market; or, in the economic jargon, the market in question must be 'contestable.'").

Hindsight sometimes supports intervention, such as the government's indictment of Microsoft in the 1990s. Despite Microsoft's popularity among consumers, courts found it used its triple monopoly in its operating system, applications, and Internet browser markets to exclude rivals and perpetuate its market power.[129] Microsoft's supporters warned that interfering with its business practices would harm innovation and chill the nation's economic lifeblood.[130] History makes at least a plausible case that cracking down on Microsoft allowed innovation to surge in newly opened markets such as Internet search and, e-commerce.[131] Google, the tiny start-up, might not have prevailed against Internet Explorer which was so snugly integrated into Windows. Similarly, Myspace would have been the default social network instead of Facebook. Netflix and Amazon may never have come to be. The enduring lesson Microsoft taught then is that keeping markets contestable requires decisive action from courts and agencies even when products and producers are popular.[132] Ironically, many of these once fledgling startups have since become embroiled in their own antitrust controversies.[133]

The debate over patented standards vividly captures the diametric narratives between those who seek access to the technology and those who seek control. Standards provide a common platform for information and communications technology covering myriad technologies. On the surface, the goal of both camps is similar—to incentivize the development of technologies and standards by preserving a fair and adequate return for patented technology, while ensuring widespread dissemination of standardized technologies based on fair access conditions. However, both sides see the other as the source of opportunistic profiteering.

The nature and scope of both "holdups" and "holdouts" remain

129. *See generally* United States v. Microsoft Corp., 253 F.3d 34 (D.C. Cir. 2001).

130. *See, e.g.*, Daniel F. Spulber, *Unlocking Technology: Antitrust and Innovation*, 4 J. COMP. L. & ECON. 915, 962 (2008) (explaining how innovation will be stifled if antitrust authorities require standardization).

131. Blumenthal & Wu, *supra* note 44 ("But what we do know is that the remedy pushed Microsoft to act with more caution, creating an essential opening for a new generation of firms.").

132. *Id.* ("The enduring lesson of the Microsoft case was that keeping markets open can require a trustbuster's courage to take decisive action against even a very popular monopolist.").

133. *Id.* ("Some limitations were placed on Microsoft's behavior, such as a requirement that it share certain programming information with third-party companies. The appropriateness of that remedy is still debated."); *see, e.g.*, William Robinson, *Antitrust Scrutiny of Technology Companies Continues to Expand*, NAT'L L. REV. (July 24, 2019), https://www.natlawreview.com/article/antitrust-scrutiny-technology-companies-continues-to-expand [https://perma.cc/XS86-QYH8] (noting various antitrust disputes including those against tech giants like Apple and Qualcomm).

controversial. Holdups generally refer to a patentee's refusal to grant a license on FRAND terms to extract higher fees unconnected to technical contribution to the standard or exclude an implementer from the market. Holdouts generally refers to an implementer's refusal to take a license offered on FRAND terms in order to opportunistically depress fees or extract additional concessions holdups and holdouts result from technology-specific investments, since neither can completely specify the terms before committing themselves.

FRAND obligations mitigate holdup.[134] For this reason, courts have found that SEP owners unconstrained by FRAND commitments pose an anticompetitive threat by monopolizing technology markets. [135] However, like the antitrust statutes, FRAND obligations governing SEP industries are vaguely worded and the terms provide no mechanism on how to determine what those obligations mean in practice. [136]

134. *See, e.g.*, CSIRO v. Cisco Sys. Inc., 809 F.3d 1295, 1305 (Fed. Cir. 2015) (citations omitted) ("This value—the value of the technology—is distinct from any value that artificially accrues to the patent due to the standard's adoption. Without this rule, patentees would receive all the benefit created by standardization—benefit that would otherwise flow to consumers and businesses practicing the standard."); Ericsson v. D-Link Sys., 773 F.3d 1201, 1232–33 (Fed. Cir. 2014) ("In other words, a royalty award for a SEP must be apportioned to the value of the patented invention . . . , not the value of the standard as a whole."); *see also* Microsoft Corp. v. Motorola, Inc., No. C10-1823JLR, 2013 WL 2111217, at *12 (W.D. Wash. April 25, 2013) (citations omitted) ("A RAND royalty should be set at a level consistent with the SSOs' goal of promoting widespread adoption of their standards. . . . In the context of a dispute concerning whether or not a given royalty is RAND, a proper methodology used to determine a RAND royalty should therefore recognize and seek to mitigate the risk of patent hold-up that RAND commitments are intended to avoid."); *In re* Innovatio IP Ventures, LLC Patent Litigation, No. 2303, 2013 WL 5593609, at *8 (N.D. Ill. Oct. 3, 2013) ("The RAND commitment, which standard-setting organizations extract from patent holders from demanding excessive royalties that capture value beyond the value of the patented technology itself").

135. *See, e.g.*, Broadcom Corp. v. Qualcomm Inc., 501 F.3d 297, 315–316 (3rd Cir. 2007) (citations omitted) ("[T]he alleged anticompetitive conduct was the intentional false promise that Qualcomm would license its WCDMA technology on FRAND terms, on which the relevant SDOs relied in choosing the WCDMA technology for inclusion in the UMTS standard, followed by Qualcomm's insistence on non-FRAND licensing terms."); *see also* Apple Inc. v. Samsung Elecs. Co., No. 11-CV-01846, 2012 WL 1672493, at *6–7 (N.D. Cal. May 14, 2012) (noting that courts have recognized the antitrust market power conferred on a patent incorporated into a standard as opposed to a normal patent); *see also* Research in Motion Ltd. v. Motorola Inc., 644 F.Supp.2d 788, 794 (N.D. Tex. 2008) ("Even if Motorola's conduct does not eliminate competition entirely, it has the power to harm it. If Motorola licenses only at exorbitant rates, it will force its competitors to increase prices in the downstream market in order to make a profit. This increase in prices . . . except Motorola's will harm competition.").

136. *See* RUDI BEKKERS & ANDREW UPDEGROVE, A STUDY OF IPR POLICIES AND PRACTICES OF A REPRESENTATIVE GROUP OF STANDARDS SETTING ORGANIZATIONS WORLDWIDE 103 (2012), *available at* http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_072197.pdf [https://perma.cc/53GS-V6C4] ("None of the policies in the study set seeks to define the term 'reasonable' (and/or the term of 'fair' if the policy refers to FRAND). Likewise, 'non-discriminatory' also is left to the parties involved to agree upon (or to the courts, if they cannot).").

Understanding the evolution and contours of the FRAND debate can therefore provide important clues as to how the same can be done more broadly at the IP-antitrust interface.

B. "Flip-Flop" FRAND

Antitrust concerns in standard setting have arisen in several forms over the years, usually in the form of patent holdups. Patent holdups can occur when patentees leverage on standardized technology, such as the value of an end product dependent on compliance with the patentee's standard, to get outsized royalties, such as the value of an end product dependent on compliance with the patentee's standard, by threatening to exclude implementers from the market unless they take a license on terms favorable to the patentee.[137] The market power from switching costs make it unfeasible for implementers to adopt rival technologies previously available during standard setting.[138]

Some patentees deceptively fail to declare patents as essential and extract higher royalties from implementers after Standard Setting Organizations (SSOs) incorporate their technology into the standard.[139] Even if the patented technology was introduced without deception, patentees may be liable under antitrust law for leveraging on a standard to exclude rivals and exploit consumers in contravention of FRAND obligations.[140] In 2007, the DOJ and FTC issued a joint report on antitrust

137. Douglas Melamed & Carl Shapiro, *How Antitrust Law Can Make FRAND Commitments More Effective*, 127 YALE L. J. 2110, 2114–15 (2018) ("[T]he shadow of litigation is particularly problematic in the communications and technology sector, in which products typically include hundreds or thousands of patented technologies. A court-ordered injunction involving such products would deprive the implementer of not only the value of the technology covered by the patent-in-suit, but also the value of the entire product."); *id*. at 2115 ("In effect, the SEP holder is often compensated for alleged patent rights that it in fact does not own.").

138. *See, e.g.*, *Ericsson*, 773 F.3d at 1233 (noting the difficulty in adopting rival technologies because once a technology is adopted into a standard it is "necessary to comply with the standard"); *see also* Rambus Inc. v. FTC, 522 F.3d 456, 459 (D.C. Cir. 2008) ("Before an SSO adopts a standard, there is often vigorous competition among different technologies for incorporation into that standard. After standardization, however, the dynamic shifts, as industry members begin adhering to the standard and the standardized features start to dominate.").

139. *See, e.g.*, *In re* Union Oil Co. of Cal., 88 F.2d 492, 494–95 (C.C.P.A. 1937) (patentee illegally monopolized technology market through deceptive conduct by misrepresenting it lacked, or would not assert, rights in car emissions research results); *see also Rambus*, 522 F.3d at 469 (breach of a duty to disclose during standard setting could violate antitrust law if disclosure would have led SSO to switch); *see also* Daryl Lim, *Patent Holdups*, *in* ANTITRUST INTELLECTUAL PROPERTY AND HIGH-TECH HANDBOOK 249 (Daniel D. Sokol & Roger D. Blair eds., 2017) (explaining that patentees will induce adoption by offering a reasonable price and later reneging on the promise when the invention is incorporated in the invention).

140. *See* Broadcom Corp. v. Qualcomm Inc., 501 F.3d 297, 316 (3d Cir. 2007) (holding that Qualcomm's conduct and allegations of "reliance on Qualcomm's assurances" gave raise to

enforcement and IP rights, recognizing the competitive harm from holdup when patentees demand royalties reflecting the cost of switching from the standard rather than the value of their patented technology. It noted that:

> Before, or ex ante, multiple technologies may compete to be incorporated into the standard under consideration. Afterwards, or ex post, the chosen technology may lack effective substitutes precisely because the SSO chose it as the standard. Thus, ex post, the owner of a patented technology necessary to implement the standard may have the power to extract higher royalties or other licensing terms that reflect the absence of competitive alternatives.[141]

In 2012, the FTC acted against patentees seeking injunctions against locked-in implementers.[142] The agency required the patentees to refrain

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antitrust liability); Jones & Nazzini, *supra* note 34, at 381 ("[T]o exploit customers and/or to holdup implementers of the standard and adversely impact on innovation and the quality, variety, and cost of products/services available in a downstream market."); Daryl Lim, *Unilateral Conduct and Standards*, *in* THE CAMBRIDGE HANDBOOK OF TECHNICAL STANDARDIZATION LAW *COMPETITION, ANTITRUST AND PATENTS* (Jorge L. Contreras ed. 2017) (noting that Qualcomm's practices which led to standardization "'significantly expanded Qualcomm's market power by eliminating alternatives . . .' even if 'the standard did not expand Qualcomm's exclusory rights as a patent holder' . . . may constitute actionable anticompetitive conduct") .

141. *See* U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 33–36 (2007) ("These issues involve the potential for 'hold up' by the owner of patented technology after its technology has been chosen by the SSO as a standard and others have incurred sunk costs which effectively increase the relative cost of switching to an alternative standard."); *see also* Fei Deng & Mario Lopez, *The Economic Approaches Used to Determine FRAND Royalty Rates in* TCL v. Ericsson, EDGEWORTH ECONOMICS (Jan. 2018), https://edgeworthe conomics.com/files/documents/The_Economic_Approaches_Used_to_Determine_FRAND_Royalty_Rates_in_TCL_v_Ericsson.pdf [https://perma.cc/7RVP-U9XE] ("Economists have long recognized that a holdup problem can arise in the context of standard-setting: once a standard is set and implementers are locked-in to the standard, licensors have the incentive to charge rates in excess of the inherent value of the underlying SEPs.").

142. *See* Complaint at ¶ 19–20, ¶ 23, *In re* Robert Bosch GmbH, File No. C-4377 (FTC 2012) (seeking injunctive relief against SPX Service Solutions); Complaint at ¶ 19, ¶ 25–27, ¶ 31, *In re* Motorola Mobility LLC & Google Inc., File No. C-4410 (FTC 2013) (violating Section 5 of the FTC Act by breaching FRAND obligations by seeking injunctions against willing licensees distorted the negotiating process, undermining the integrity and efficiency of the standard-setting process, raising prices to consumers, and injuring competition); *see also* Edith Ramirez, Chairwoman, Fed. Trade Comm'n, Standard-Essential Patents and Licensing: An Antitrust Enforcement Perspective Address at the 8th Annual Global Antitrust Enforcement Symposium, Georgetown University Law Center 7 (Sept. 10, 2014) ("In the standard-setting context, the risk of patent holdup creates the type of competitive harm that falls properly within the scope of antitrust enforcement."); Renata Hesse, Deputy Assistant Att'y. Gen., Antitrust Div., U.S. Dep't of Justice, The Art of Persuasion: Competition Advocacy at the Intersection of Antitrust and Intellectual Property, Address in Seattle, Wash. 9 (Nov. 8, 2013) ("We also continue to explore where there is room for liability under Section 2 of the Sherman Act in cases where holders of FRAND-encumbered SEPs seek injunctive relief after a standard is in place. Even in cases where the patent holder did not intentionally deceive the SSO during the standards-setting process, competition and consumers can be harmed . . . .").

from "initiating, or threatening to initiate, any Action demanding injunctive relief" unless the implementer refused in writing to take a license or refused a license determined to be on FRAND terms.[143] That same year, the DOJ Antitrust Division emphasized the importance of policing the risk of holdups, noting that holdups were "[a]t the forefront of many of the Antitrust Division's intellectual property (IP) related enforcement and advocacy efforts . . . ."[144]

In 2014, the Federal Circuit recognized that patent holdups could result from patentees charging locked-in implementers royalties in excess of the value of their technology.[145] In 2015, the DOJ published a business review letter approving the Institute of Electrical and Electronics Engineers, Incorporated's (IEEE's) revised policy prohibiting SEP holders from seeking injunctive relief against willing licensees. It also dictated factors in determining an appropriate FRAND rate based on the "smallest saleable unit."[146] The letter noted that the IEEE's provisions would further the "procompetitive goal of providing greater clarity regarding" FRAND commitments, "which could facilitate licensing negotiations, limit patent infringement litigation, and enable parties to reach mutually beneficial bargains that appropriately value patented technology."[147]

Under the Trump administration, the DOJ dramatically changed its approach.[148] Makan Delrahim, the DOJ's new antitrust chief, dismissed FRAND-related holdouts as being an antitrust problem.[149] Holdups are

143. Decision and Order § IV.D–E, *In re* Robert Bosch GmbH, File No. C-4377 (FTC 2013).

144. Fiona M. Scott Morton, Deputy Assistant Att'y. Gen. for Econ. Analysis, Antitrust Div., U.S. Dep't. Justice, The Role of Standards in the Current Patent Wars, Presented at the Charles River Associates Annual Brussels Conference: Economic Developments in European Competition Policy 2 (Dec. 5, 2012).

145. *See* Ericsson Inc. v. D-Link Sys., 773 F.3d 1201, 1209 (Fed. Cir. 2014) ("Patent hold-up exists when the holder of a SEP demands excessive royalties after companies are locked into using a standard.").

146. Letter from Renata B. Hesse, Acting Assistant Att'y Gen., Antitrust Div., U.S. Dep't of Justice, to Michael A. Lindsay, Esq., Dorsey & Whitney LLP 13 (Feb. 2, 2015) (on file with the Department of Justice).

147. *Id.* at 11; *see also* Peter J. Levitas et al., *DOJ Shifts Focus from SEP Holders To SEP Implementers and SSOs*, MONDAQ (Nov. 23, 2017), http://www.mondaq.com/unitedstates/x/649254/Antitrust+Competition/DOJ+Shifts+Focus+from+SEP+Holders+to+SEP+Implementers+and+SSOs [https://perma.cc/75AD-XDDZ] ("The business review letter was widely considered to be an endorsement of SEP policies designed to limit the potential for patent holdup, consistent with past DOJ statements and FTC enforcement efforts.").

148. Levitas et al., *supra* note 147 ("[A] clear departure from prior agency policy and enforcement views, and a refutation of the DOJ IEEE Business Review letter.").

149. Makan Delrahim, Assistant Att'y Gen., The "New Madison" Approach to Antitrust and Intellectual Property Law, Keynote Address at University of Pennsylvania Law School (Mar. 16, 2018), https://www.justice.gov/opa/speech/assistant-attorney-general-makan-delrahim-delivers-

quite simply "an empirical enigma in the academic literature."[150] And the "proponents of using antitrust law to police FRAND commitments principally rely on models devoid of economic or empirical evidence that holdup is a real phenomenon."[151] Professor Dennis Calton observed that Delrahim is a "Chicago School thinker," and "is wary of the government's ability to mess around through intervention."[152]

Delrahim criticized prior enforcement actions against SEP holders seeking injunctions as undermining the foundation of patent rights, attacking them as "anathema to the policies underlying the intellectual property system," "a serious threat to the innovative process," and "a misuse of antitrust or competition law."[153] Instead, "[s]tating that a patent holder can derive higher licensing fees through holdup simply reflects basic commercial reality."[154] In articulating the DOJ's responsibility on dynamic efficiency, he observed that "[a]s enforcers, we have a responsibility to ensure that antitrust policy remains sound, so that United States consumers continue to enjoy the benefits of dynamic competition and innovation"[155]

Delrahim warned that "[e]very incremental shift in bargaining leverage toward implementers of new technologies acting in concert can undermine incentives to innovate."[156] Failure to account for this "risks

keynote-address-university [https://perma.cc/4PHV-2CB7] [hereinafter Delrahim, New Madison] ("[H]oldup is fundamentally not an antitrust problem, and therefore antitrust law should not be used as a tool to police FRAND commitments that patent-holders make to standard setting organizations.").

150. *Id.*

151. *Id.* ("Advocates of using antitrust law to reduce the supposed risk of patent holdup fail to identify an actual harm to the competitive process that warrants intervention."); *see also* Makan Delrahim, Assistant Att'y Gen., Take it to the Limit: Respecting Innovation Incentives in the Application of Antitrust Law, Remarks as Prepared for Delivery at the USC Gould School of Law 4 (Nov. 10, 2017), https://www.justice.gov/opa/speech/file/1010746/download [https://perma.cc/4PW4-B6UA] [hereinafter Delrahim, Take it to the Limit] (referring repeatedly to the "so-called holdup problem" to emphasize its "shaky empirical foundations").

152. Gardner, *supra* note 78.

153. Delrahim, Take it to the Limit, *supra* note 151, at 4 (arguing that using antitrust laws "threatens to disrupt the free-market bargain, which could undermine the process of dynamic innovation itself"); *see also id.* at 3 ("[A]nd perhaps risk undermining incentives for IP *creators*, who are entitled to an appropriate reward for developing break-through technologies.").

154. *See* Delrahim, New Madison, *supra* note 149, at 3 (explaining that theories claiming patent hold-up is an antitrust problem can go wrong because, for example, "a patent holder can derive higher licensing fees through hold-up simply reflects basic commercial reality").

155. *Id.*

156. Makan Delrahim, Assistant Att'y Gen., Antitrust Div., U.S. Dep't of Justice, Remarks at the USC Gould School of Law's Center for Transnational Law and Business Conference 2 (Nov. 10, 2017), transcript available at https://www.justice.gov/opa/speech/assistant-attorney-general-makan-delrahim-delivers-remarks-usc-gould-school-laws-center [https://perma.cc/PF3T-LH78].

creating 'false positive' errors of over-enforcement that would discourage valuable innovation." [157] He was convinced of an "asymmetry" disfavoring patentees who "must make significant upfront investments in technology before they know whether it will pay off, whereas implementers can delay at least some of their investments until after royalty rates have been determined." [158] To rectify this, Delrahim promised a "fresh look at concerted actions within SSOs that cause competitive harm to the dynamic innovation process."[159] In referencing the IEEE policy changes, Delrahim pointed out that the DOJ would

> be skeptical of rules that SSOs impose that appear designed specifically to shift bargaining leverage from IP creators to implementers, or vice versa. SSO rules purporting to clarify the meaning of 'reasonable and non-discriminatory' that skew the bargain in the direction of implementers warrant a close look to determine whether they are the product of collusive behavior within the SSO."[160]

Delrahim also rejected the Federal Circuit's measure of royalties, stating that "[w]hile the so-called smallest salable component rule may be a useful tool among many in determining patent infringement damages for a multiple-component product, its use as a requirement by a concerted agreement of implementers as the exclusive determinant of patent royalties may very well warrant antitrust scrutiny."[161] As to the non-discriminatory obligation in FRAND, Delrahim stated that it "does not compel" patentees to abide by the non-discriminatory obligation, as antitrust law "does not authorize courts to determine 'reasonable' licensing rates" and "does not police 'fair' prices or competition."[162]

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157. *See* Delrahim, New Madison, *supra* note 149, at 3 ("Antitrust law demands evidence-based enforcement, without which there is a real threat of undermining incentives to innovate.").

158. *Id.*; *see also* Delrahim, Take it to the Limit, *supra* note 151, at 10 ("When implementers act together within a standard-setting organization as the gatekeeper to sales of products including a new technology, they have both the motive and means to impose anticompetitive licensing terms. At the extreme, they can shut down a potential new technology in favor of the status quo, all to the detriment of consumers.").

159. Delrahim, Take it to the Limit, *supra* note 151, at 10 ("Given the incentives participants in SSOs face to bend licensing negotiations to their benefit, there is a risk that members of standard setting bodies could engage in collusive, anticompetitive behavior.").

160. *Id.* at 11; *see also* Jorge L. Contreras, *Taking It To The Limit: Shifting U.S. Antitrust Policy Toward Standards Developmen*t, 103 MINN. L. REV. HEADNOTES (Fall 2018) (manuscript at 6), https://ssrn.com/abstract=3218360 [https://perma.cc/K7NC-3JAC] ("These comments appear to be directed at IEEE's 2015 policy amendments, which seek to clarify the meaning of 'reasonable and nondiscriminatory' . . . .").

161. Delrahim, Take it to the Limit, *supra* note 151, at 11.

162. Makan Delrahim, Assistant Att'y Gen., Antitrust Div., U.S. Dep't of Justice, Remarks at IAM's Patent Licensing Conference in San Francisco: Antitrust Law and Patent Licensing in the New Wild West 3 (Sept. 18, 2018), transcript available at http://www.justice.gov/opa/speech/assistant-attorney-general-makan-delrahim-delivers-remarks-iam-s-patent-licensing

According to Delrahim, antitrust law is agnostic to the rate SEP owners charge and is "indifferent" to price discrimination.[163]

On April 10, 2018, Delrahim indicated that DOJ's support for the letter was limited. He noted that "this letter should never be cited for the proposition that what IEEE did is required, or that a patent holder who seeks an injunction is somehow in violation of the antitrust laws."[164] In December 2018, Delrahim withdrew from a 2013 joint report by the DOJ and USPTO discouraging SEP owners from blocking implementers from using their SEPs, reasoning that "[a] FRAND commitment does not and should not create a compulsory licensing scheme."[165] Indeed, according to Delrahim "[t]he fundamental right of the patent holder [is] to exclude competitors," which commentators have likened to "putting patents on the same footing as other fundamental rights like, say, freedom of speech and equal protection."[166]

Former FTC Chairman Tim Muris, who was appointed by President George W. Bush, dismissed Delrahim's skepticism toward holdups as being "wrong and miss[ing] the point."[167] Pointing to SSO policies specifically recognizing FRAND obligations that deal with holdup, Muris argued that those policies "should be conclusive evidence of its importance," and that patentees have "sought royalty rates orders of magnitudes greater than what the courts found appropriate under FRAND."[168] The need for burglar alarms suggests the risk of burglary.

[https://perma.cc/SSA9-Q4TL].

163. *Id.*

164. Makan Delrahim, Assistant Att'y Gen., Antitrust Div., U.S. Dep't of Justice, Keynote Address at the LeadershIP Conference on IP, Antitrust and Innovation Policy: The Long Run: Maximizing Innovation Incentives Through Advocacy and Enforcement 3 (Apr. 10, 2018), transcript available at https://www.justice.gov/opa/speech/assistant-attorney-general-makan-delrahim-delivers-keynote-address-leadership-conference [https://perma.cc/PGE6-MDHP].

165. Victoria Graham, *Changing U.S. Patent Policy on Tech Standards Stirs Concerns*, BLOOMBERG LAW (Dec. 26, 2018, 4:31 AM), https://news.bloomberglaw.com/mergers-and-antitrust/changing-us-patent-policy-on-tech-standards-stirs-concerns [https://perma.cc/9EBJ-CP2Z].

166. Thomas Cotter, *DOJ Speech May Leave SEP Implementers In Dire Straits*, LAW360 (Dec. 10, 2018, 2:21 PM), https://www.law360.com/articles/1109674/doj-speech-may-leave-sep-implementers-in-dire-straits [https://perma.cc/8C4M-VXXV] ("Never mind, of course, that the Constitution only authorizes, but does not command, Congress to grant patents and copyrights—or that Congress itself didn't get around to authorizing the federal courts to grant injunctions in patent infringement actions until some 40 years after the Constitution itself entered into force, in 1819.").

167. Muris, *supra* note 23, at 9.

168. *Id.*; *see, e.g.*, *In re* Innovatio IP Ventures, LLC Patent Litig., No. 11 C 9308, 2013 WL 5593609, at *9 (E.D. Ill. Oct. 3, 2013) (concluding that "patent holdup is a substantial problem that [F]RAND is designed to prevent"); *see also* Microsoft Corp. v. Motorola, Inc., No. C10-1823JL R, 2013 WL 5373179, at *7 (W.D. Wash. Sept. 24, 2013) (noting that "holdup took place in this case").

Similarly, these policies, as well as efforts by implementers to avoid holdup, all reflect the threat of holdups is real and avoiding that threat imposes a real cost to society.[169] Muris also argued that holdouts in standard-setting are more serious than those that occur in contractual situations, noting that "[t]he lock-in value exists only on one side of the exchange. No such asymmetry is present in the typical contractual holdout scenario."[170] Accordingly, "antitrust cases have attacked anticompetitive conduct related to patents essential to industry standards, violations of SSO [patent] policies, and FRAND commitments. These cases reflect the potential harm to competition that can arise with patents incorporated into industry standards."[171]

Similarly, Doug Melamed, who headed the Justice Department's Antitrust Division under the Clinton Administration, criticized Delrahim's position as "not well-reasoned" and "potentially dangerous."[172] He explained that it "could deter SSOs from strengthening FRAND requirements; innovation and economic welfare would be better served by making clear that the antitrust laws require SSOs to adopt FRAND-type rules that are effective in preventing exploitation by SEP holders of the monopoly power that standard-setting often creates."[173] Others cautioned that "[t]he government's shift could increase the risk of litigation for product manufacturers that use standard-setting technology patents and decrease their incentives to innovate"[174] As more companies steer away from interoperability, they warn that United States dominance in technology will be reduced.[175]

Melamed, together with Carl Shapiro, the Obama Administration's Chief Economist at the DOJ and Member of the President's Council of Economic Advisers, warned that "Delrahim's approach is inconsistent

169. Muris, *supra* note 23, at 9 ("Patent holdup skeptics tend to ignore the costs borne by potential infringers to avoid patent holdup. Similarly, the great efforts of SSOs to avoid holdup and of others to oppose clarifying FRAND are all costs attributable to the holdup problem.").

170. *Id.*; *see also* Melamed & Shapiro, *supra* note 137, at 2120 ("[O]thers who oppose effective measures to prevent ex post opportunism argue that so called 'patent holdout' by implementers—the unwillingness of some implementers to bargain in good faith for patent licenses—is a more serious problem. We know of no factual support for this argument.").

171. Muris, *supra* note 23, at 10.

172. Giorgio Motta et al., *Antitrust in the Technology Sector: Policy Perspectives and Insights from the Enforcers*, SKADDEN (Mar. 7, 2018, 4:31 AM), https://www.skadden.com/insights/publications/2018/03/antitrust-in-the-technology-sector [https://perma.cc/F5N9-4ZJM].

173. *Id.*

174. Graham, *supra* note 165.

175. *Id.* ("The DOJ's view 'represents a threat to U.S. competitiveness in standardized technologies' . . . . 'This kind of uncertainty creates a real disincentive to invest in standardized technologies within the U.S.'").

with both sound economic analysis and the policies animating patent law," as "excessive royalties [to patentees] undermine incentives for follow-on innovation and can have other adverse economic consequences as well."[176] Patentees make FRAND commitments "to gain volume (by including their technologies in the standard) in exchange for unit price (by agreeing to charge only FRAND royalties)."[177] The research and development costs patentees experience "[are] common in the development of all types of products."[178] In contrast, implementers are "vulnerable to extraction of supra-competitive royalties based not just on the value of the patented technology, but on the entire value of the implementer's standard-compliant product."[179] For this reason, antitrust law prohibits patentees seeking to introduce a new product from acting anticompetitively on the pretext that they need to recoup sunk R&D expenses.[180] As Meleamed and Shaprio note:

> [t]hat kind of self-help would be especially inappropriate in the context of SEP licensing, because enabling SEP owners to engage in opportunism would harm all implementers, including those who would readily pay the patent holder the ex ante value of its invention. Allowing SEP owners to engage in such opportunism would inhibit innovation and the adoption of new technologies by implementers, which are often significant innovators themselves.[181]

FRAND obligations are intended to limit patentees to the royalties to which they are entitled.[182]

With respect to Delrahim's stance on injunctions, they note that the Supreme Court rejected an automatic right to injunctive relief.[183] Moreover, "the purpose of patent law is to promote innovation, not to maximize the returns to patent holders, and the remedies for patent infringement provided by the patent statute reflect that goal."[184]

176. Melamed & Shapiro, *supra* note 137, at 2121.

177. *Id.* at 2118 ("If the standard is successful, that bargain is generally very profitable; if the standard is not successful, the bargain leaves the SEP holder no worse off than if it had not made the commitment.").

178. *Id.* at 2119.

179. *Id.* ("The implementer is therefore vulnerable to a kind of ex post opportunism that is very different from the risk knowingly incurred by a technology developer.").

180. *See* United States v. Apple Inc., 791 F.3d 290, 298 (2d Cir. 2015) (rejecting the argument that a firm might engage in otherwise illegal conduct if necessary to compete against an incumbent monopoly as "a concept of marketplace vigilantism that is wholly foreign to the antitrust laws").

181. Melamed & Shapiro, *supra* note 137, at 2119–20.

182. *Id.* at 2121 (noting that FRAND obligations were intended to "reduce excessive royalties further the policies of both the antitrust laws and the patent laws").

183. *Id.*

184. *Id.* at 2122.

Automatic injunctive relief would facilitate "patent holdup [which] would *obstruct* innovation by leading to royalties in excess of those in an ex ante market bargain."[185] More broadly, they note that [t]o effectively prevent ex post opportunism involving SEPs, antitrust law should be used in conjunction with contract law and patent law to constrain anticompetitive conduct by both SEP holders and SSOs.[186]

What should judges, attorneys, and members of industry make of this deep divide in the agencies' approaches to SEPs? To answer this question, it would be helpful to understand the key points of contention: what is a "fair" royalty? When should injunctions be granted on a FRAND-encumbered license? When should a patentee's licensing strategy be curtailed?

1. What is a "Fair" Royalty?

Antitrust law generally permits patentees to freely structure patent royalties.[187] Where boundaries exist, they do so to prevent overreaching, such as clauses that insist licensees continue to pay royalties post-patent expiration.[188] The problem in assessing "fairness" is that it requires at least one counterfactual that accounts for rates that sufficiently reward risk and investment in innovation for highly differentiated products.[189]

The first battleground is between whether to use ex ante or ex post royalties. For some, an ex ante price most accurately recreates the hypothetical negotiation parties are assumed to undertake with all the

185. *Id.*

186. *Id.* ("[C]ontract and patent law are not sufficient to ensure that FRAND commitments are effective in preventing ex post opportunism. Antitrust law is also needed to constrain anticompetitive conduct by both SEP holders and SSOs.").

187. *See, e.g.*, Automatic Radio Mfg. Co., Inc. v. Hazeltine Research, Inc., 339 U.S. 827, 830–33 (1950) (noting that a patentee may seek a single lump-sum payment, fixed payments, or per-unit royalties or alternatively, that a patentee can set the royalty as a percentage of total downstream sales so long as licensees need not to pay for unpatented products and may request a royalty rate based upon actual use); Zenith Radio Corp. v. Hazeltine Research, Inc., 395 U.S. 100, 135–36 (1969) (noting that patentees may decide how they wish to determine royalties on their patents); Aronson v. Quick Point Pencil Co., 440 U.S. 257, 265–66 (1979) (noting that patentees may also seek royalties on pending patents).

188. *See* Kimble v. Marvel Entm't, LLC, 135 S. Ct. 2401, 2415 (2015) (Alito, J., dissenting) (noting that nothing in the Patent Act prohibits post-expiration royalties, and patent holders may insist they be paid); *see also* Lim, *Patent Misuse*, *supra* note 105, at 352 (noting that courts have allowed post-expiration payments under certain conditions).

189. Padilla et al., *supra* note 15 (manuscript at 31) ("Absent information about the prices of unconstrained market transactions, it can be particularly difficult to identify a "fair" price."); *see also id.* ("Indeed, it is even more difficult to assess the 'fairness' of prices associated with licensing IPRs both because the fixed costs of innovation requires prices well above marginal cost in order to secure an adequate return on investments in innovation, and because IPRs themselves are highly differentiated products, which makes reliable price comparisons difficult, if not impossible.").

facts, including the non-infringing alternatives available.[190] For others, *ex ante* pricing lacks "real-world applicability."[191] This is in part because "it is impossible even to hypothesize what parties negotiating 'ex ante' would do if they had all the facts."[192]

Determining whether royalty rates are excessive requires a baseline. However, "agencies do not have the requisite information to determine market prices generally, let alone royalty rates for a particular invention."[193] It is also tricky to say what a "fair" royalty means when the standard involves a large number of patents.[194] Methods for calculating FRAND royalties, even for patents covering the same standard, have varied "dramatically from court to court and case to case."[195] Conventional wisdom teaches that a fair royalty rate reflects the incremental value of the technology.[196] SSOs choose between alternative technologies and the difference in the value between the chosen technology and the next best alternative. The next best alternative gives a notional "upper bound" to that value.[197] However, SSO meetings often consist of engineers whose focus is the quality of the technical contribution, not its price.[198] Moreover, the reward required to entice patentees to contribute toward the standard may be a winner takes all value of the technology post-standardization.[199]

A second battleground is the correct royalty base—the point of reference by which a percentage royalty is multiplied to derive the actual

190. Jonathan D. Putnam, *Economic Determinations in "FRAND Rate"-Setting: A Guide for the Perplexed*, 41 FORDHAM INT'L. L.J. 953, 975–76 (2018) ("[T]he point of the hypothetical negotiation rule in patent damages is to determine what hypothetical reasonable parties might have done, had they had all the facts, including knowledge of non-infringing alternatives.").

191. Microsoft Corp. v. Motorola, Inc., No. C10-1823JLR, 2013 WL 2111217, at *13 (W.D. Wash. Apr. 25, 2013).

192. Putnam, *supra* note 190, at 976.

193. Padilla et al., *supra* note 15 (manuscript at 31).

194. Putnam, *supra* note 190, at 956 ("Given that it is hard for economists to price large numbers of patents, pricing them 'fairly' invites speculation and expands the scope for error, not to mention mischief.").

195. *Id.*

196. *See id*. at 976 (citing long-established patent damages law, the standard FRAND paradigm states that the standardized invention should be priced based on its "incremental value").

197. *Id.* ("The difference in the value of the standardized product when using these two alternatives is the value of the chosen alternative, or potentially an "upper bound" on that value."); *id*. at 983 ("FRAND arbitrators are likely to be told that computing a standardized invention's 'ex ante incremental' value is the only legally and economically acceptable method for valuing it.").

198. *Id.* at 977 ("No prices are involved, because the discussion of prices (and commercial terms more generally) is banished from the standardization process. . . . The only thing that matters to the SDO is the quality of the contribution.").

199. *Id.* at 980 ("For this system to be economically rational, the winner's compensation must pay the cost of everyone's R&D—not just its own.").

amount owed to patentees. One option is the "smallest saleable patent practicing unit" (SSPPU), which uses the sale price of the smallest infringing component sold as a stand-alone product (e.g., a chip). As early as 2011, the FTC endorsed this as the proper standard, noting that "[t]he practical difficulty of identifying a royalty rate that accurately reflects the invention's contribution to a much larger, complex product often counsels toward choosing the smallest priceable component that incorporates the inventive feature."[200] In 2014, the Federal Circuit adopted this view "to help our jury system reliably implement the substantive statutory requirement of apportionment of royalty damages to the invention's value."[201]

The alternative royalty base is the "entire market value rule," which uses the end-product implementing the patented feature (e.g., a smartphone). Patentees may target device makers to extract their royalties because of monitoring difficulties in dealing with players at intermediate stages of the value chain. A royalty determined by the finished product reflects different connectivity needs, which prices should reflect.[202] However, chip makers are best placed to determine the value of the technology since they have the most proximate relationship to the suppliers. The law on patent damages therefore uses SSPPU rather than the entire market value as the denominator for calculation.[203]

A third battleground is the extent that patentees under a FRAND obligation can discriminate in what they charge to similarly situated licensees.[204] At least one district court has held that similarly situated firms include "all firms reasonably well-established in the world market" for telecommunications products.[205] Low-end producers enjoy the same

200. Federal Trade Comm'n, The Evolving IP Marketplace: Aligning Patent Notice & Remedies with Competition 212 (Mar. 2011), https://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307patentreport.pdf [https://perma.cc/UB6N-3FAW].

201. *See* Ericsson, Inc. v. D-Link Sys. Inc., 773 F.3d 1201, 1226 (Fed. Cir. 2014) (explaining apportionment and balance of damages); *see also* Commonwealth Sci. & Indus. Research Org. v. Cisco Sys., Inc., 809 F.3d 1295, 1303–04 (Fed. Cir. 2015) (reiterating the SSPPU measure as "the most effective method of estimating the asserted patent's value").

202. Foroohar, *supra* note 25.

203. *See Ericsson*, 773 F.3d at 1229–30 (holding that the appropriate basis for the calculation of a royalties is the smallest saleable unit rather the revenues associated with the end product).

204. Jorge L. Contreras, *Global Rate-Setting: A Solution for Standards-Essential Patents*?, WASH. L. REV. (forthcoming 2019) (manuscript at 16) [hereinafter Contreras, *Global Rate-Setting*] ("Today, most courts and commentators agree that in order to comply with the non-discrimination prong of a FRAND commitment, a SEP holder must treat "similarly situated" licensees in a similar manner.").

205. *See* TCL Commc'n Tech. Holdings, Ltd. v. Telefonaktiebolaget LM Ericsson, No. CV 15-2370 JVS(DFMX), 2018 WL 4488286, at *30 (C.D. Cal. Sept. 14, 2018) ("The Court concludes

favorable royalty rates previously offered to high-end producers. Whether or not the patentee breached its non-discrimination obligation is a conclusion that follows from "an examination of the whole of each license agreement, and not just the effective royalty rate."[206] Patentees may violate both the non-discrimination requirement and antitrust law if they grant certain implementers exclusive licenses or preferential terms.[207] Patentees who tie SEPs with non-SEPs or other goods in licensing implementers could also violate antitrust law on the theory that "the SEP holder can extract more consideration for the other patents" than attributable to the SEPs alone.[208]

Does it make a difference that implementers want both SEPs and non-SEPs, or the goods embodying the SEPs? Commentators argue it should not. The rationale for excusing such an agreement is that if implementers want both sets of products, patentees cannot charge the same monopoly profit twice.[209] However, "[t]his rationale has no application in the FRAND context, where the SEP holder has already agreed to limits on its market power. The tying arrangement simply serves to enable the SEP holder to violate the FRAND commitment and thus to exercise market power not otherwise available to it."[210] This position has also been embraced in Europe.[211]

The debate on level discrimination is an important one because it

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that for purposes of license comparisons the analysis should include all firms reasonably well-established in the world market.").

206. Certain Wireless Devices With 3G Capabilities and Components Thereof, Inv. No. 337-TA-800 USITC Pub. 46, 432 (June 28, 2013) (Final).

207. Melamed & Shapiro, *supra* note 137 ("[T]hose agreements could violate Section 1 of the Sherman Act if they injure or are likely to injure competition among implementers."). *See, e.g.*, *In re* Toys "R" Us, Inc., 126 F.T.C. 415 (Oct. 13, 1998), *aff'd on other grounds*, 221 F.3d 928 (7th Cir. 2000) (holding that "exclusive dealing contracts that tie up 40% or more of the supply in a relevant antitrust market can create cognizable competitive problems").

208. Melamed & Shapiro, *supra* note 137, at 2127 ("[B]ecause the SEP holder has market power in the technology market in which the SEPs are licensed, the arrangement could well be deemed to be an unlawful tying arrangement."). *See* Jefferson Parish Hosp. Dist. No. 2 v. Hyde, 466 U.S. 2, 19–22 (1984), *abrogated by* Illinois Tool Works Inc. v. Independent Ink, Inc., 547 U.S. 28 (2006) (finding tying violation if there is separate demand for them); *id*. at 9, 13–14 (unlawful per se tying when seller has market power at least one of them).

209. Melamed & Shapiro, *supra* note 137, at 2128 ("Even if that language might ordinarily preclude a tying claim involving multiple products that the buyer wants to purchase from the seller, it should not do so in the case of a tying arrangement that violates a FRAND commitment.").

210. *Id.*

211. Edward J. Kelly & Regina Sam Penti, *Comparing EU & US Standard-Essential Patent Guidance*, AIPLA NEWSSTAND (Dec. 28, 2017), https://www.ropesgray.com/en/newsroom/alerts/2017/12/Comparing-EU-And-US-Standard-Essential-Patent-Guidance.aspx. [https://perma.cc/FW47-QA8L] ("While the commission endorses the practice of licensing entire patent portfolios, it notes that rights holders cannot require a licensee to accept non-SEPs in order to license SEPs.").

reflects the core points of tension at the Interface. Level discrimination properly compensates patentees since their technology enhances the functionality of the entire product. Unlike non-SEPs, when an implementer needs to comply with the standard, there are no substitutes that it can use. On the other hand, the essentiality of a function with the value of its contribution is different from the end-product. Patentees are no worse off aligning themselves with component manufacturers since both seek the common goal of maximizing their profits based on the end-product manufacturer's marginal utility. The patentee's contribution to the standard is therefore already captured in the price of the component incorporated into the end-product. Indeed, patent exhaustion prevents the patentee from double-dipping into the end-product's revenue.

2. Of Injunctions & Property Rights

While antitrust law may sometimes appear to treat IP rights with more deference than non-IP, antitrust rules for licensing are like those governing other types of property.[212] Antitrust law is sensitive to the risk of setting the bar too low for compulsory access to technology. A low bar may encourage lazy rivals or cheap implementers seeking an easy crack at getting to the technology rather than encourage them to innovating themselves or paying a "fair" price for the technology.[213] It may also encourage collusion between implementers.[214] At the same time, this is not an absolute rule. Courts have required access be granted in instances when the party seeking access is willing to pay the market rate for access and where prior access had been terminated.[215] Similarly, commentators observe that in the IP context, the "[t]he benefits of compulsory licensing will be greatest when: (a) the IP is indispensable to compete, and (b) the refusal to license (i) causes the exclusion of all competition from the downstream market, and (ii) prevents the emergence of markets for new products for which there is substantial demand."[216] The USPTO issued a

212. *See* Jones & Nazzini, *supra* note 34, at 377 ("[C]ompetition law frequently sets the bar particularly high for a finding of breach of its rules when an IP right is involved (the rules of engagement of antitrust liability are set higher than in non-IP rights cases). Antitrust law thus recognizes the need to preserve innovation incentives in justifying "conduct that would otherwise be held to be anti-competitive.").

213. *See* Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398, 407–08 (2004) (warning that sharing could "lessen the incentive for the monopolist, the rival, or both to invest in those economically beneficial facilities").

214. *See id.* at 408 (calling collusion "the supreme evil of antitrust").

215. *See generally* Aspen Skiing Co. v. Aspen Highlands Skiing Corp., 472 U.S. 585 (1985).

216. Padilla et al., *supra* note 15 (manuscript at 12). *See also* Lim, *Triangulating the End Game*, *supra* note 23, at 90 ("Defendants facing a potential patent holdup may be able to show an actual or constructive reneging of the FRAND commitment in bad faith, such as where SEP owners refuse

Joint Statement with the DOJ in 2013, recognizing that:

> In some circumstances, the remedy of an injunction or exclusion order may be inconsistent with the public interest. This concern is particularly acute in cases where an exclusion order based on a F/RAND-encumbered patent appears to be incompatible with the terms of a patent holder's existing F/RAND licensing commitment to an SDO. A decision maker could conclude that the holder of a F/RAND-encumbered, standards-essential patent had attempted to use an exclusion order to pressure an implementer of a standard to accept more onerous licensing terms than the patent holder would be entitled to receive consistent with the F/RAND commitment—in essence concluding that the patent holder had sought to reclaim some of its enhanced market power over firms that relied on the assurance that F/RAND-encumbered patents included in the standard . . . .[217]

This insight informs the conditions for patentees whereby they can exclude implementers on FRAND-encumbered patents since injunctions amount to a constructive refusal to license.[218] Injunctions may force implementers to delay the time-to-the-market business and increase entry costs through litigation.[219] Accordingly, a case for compulsory access exists where SEP owners refuse access to FRAND-encumbered technology indispensable to downstream competition resulting in the stifling of the emergence of standard-compliant products and services. As Professor Rudy Peritz noted, "[i]n a fundamental sense, current antitrust policy reflects longstanding tensions between public policies favoring competitive markets and those favoring private rights of property and contract."[220]

In 2018, the Supreme Court clarified that patents were not property rights, but more akin to a public franchise.[221] Earlier on, Federal Circuit precedent held that a unilateral refusal to license a lawfully obtained

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to have the decision adjudicated or where it hinders implementers from offering a new product for which there is unmet consumer demand.").

217. DOJ & USPTO, *Policy Statement on Remedies for Standards-Essential Patents Subject to Voluntary FRAND Commitments*, U.S. DOJ (Jan. 8, 2013), https://www.justice.gov/atr/page/file/1118381/download [https://perma.cc/8239-VVKF].

218. Giorgio Corda & Antonio Nicita, *"That's What Frands Are For": The Antitrust Boundaries of The Patent Holdup Problem*, CPI (2017), https://www.competitionpolicyinternational.com/wp-content/uploads/2017/11/CPI-Corda-Nicita.pdf [https://perma.cc/F8ZR-9MTH].

219. *Id.*

220. Horton, *supra* note 55, at 194.

221. *See* Oil States Energy Serv., LLC v. Greene's Energy Grp., LLC, 138 S. Ct. 1365, 1373–75 (2018) (noting that "patents are 'public franchises' that the Government grants to [] inventors" by statute).

patent does not violate the antitrust laws.[222] That view has been criticized for shielding patentees from antitrust law scrutiny, despite being neither exempted by the Patent Act nor similarly extended to owners of tangible property.[223]

Cases purporting to confer that sort of immunity should be treated with some skepticism. Indeed, this line of precedent suggests that SEP owners who refuse to license in violation of FRAND commitments that allow them to create or enhance market power in a related market may be similarly vulnerable.[224] Antitrust precedent finding a violation for refusals to deal potentially enjoy a new lease of life.[225] Such an outcome would bring the United States in line with norms abroad. Professor Tom Cotter noted that "the civil law doctrine of abuse of right, nebulous that it sometimes may appear to be, arguably could provide a basis for more frequently denying injunctive relief on proportionality grounds, or in a manner analogous to the discretionary standards for injunctive relief applied in common-law countries."[226] Japan, as well as several European countries including Belgium and the Netherlands have uniformly denied injunctions to SEP owners when it is found that they have abused their rights.[227]

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222. *In re* Indep. Serv. Orgs. Antitrust Litig., 203 F.3d 1322, 1327 (Fed. Cir. 2000) ("In the absence of any indication of illegal tying, fraud in the Patent and Trademark Office, or sham litigation, the patent holder may enforce the statutory right to exclude others from making, using, or selling the claimed invention free from liability under the antitrust laws.").

223. *See, e.g.*, Howard A. Shelanski, *Unilateral Refusals To Deal in Intellectual and Other Property*, 76 ANTITRUST L.J. 369 (2009) ("[F]actors will be magnified where IP is at stake, but they are not so systematically different for IP that refusals to supply IP should be exempted from the antitrust standard applicable to other property."); A. Douglas Melamed, Ali M. Stoeppelwerth & Barbara Blank, *Refusals to Deal in Patents and Patented Goods*, 3 ISSUES IN COMPETITION LAW AND POLICY 2061, 2066–68 (Wayne D. Collins et al., eds., 2008) (discussing how circuit courts have reached conflicting conclusions regarding a patent holder's immunity from antitrust law when it refuses to licenses patents or to sell products to other firms—despite general unwillingness to mandate that patent holders deal with others).

224. Melamed & Shapiro, *supra* note 137, at 2126 ("This would be true if the refusal to deal enhanced the SEP holder's market power as an implementer of the standard or if the SEP holder's refusal to deal enabled an unaffiliated implementer to gain market power for which it compensated the SEP holder by inflated royalties for a license to the SEPs or otherwise.").

225. *See generally* Otter Tail Power Co. v. United States, 410 U.S. 366, 389 (1973).

226. Thomas F. Cotter, *Léonard on Abuse of Right Under Belgian, French, and E.U. Law*, COMP. PAT. REMEDIES (Mar. 15, 2017), http://comparativepatentremedies.blogspot.com/2017/03/leonard-on-abuse-of-right-under-belgian.html [https://perma.cc/9PWM-8QFU].

227. *Id.* ("For further guidance, the Belgian courts have developed a list of 'specific' criteria, including (1) an owner's exercise of a right with an intention to harm; (2) the exercise of a right contrary to the objective intended by the legislation granting it; (3) a disproportionate exercise of a right; (4) the exercise of a right without a legitimate and reasonable interest; and (5) when a right could be exercised in different ways, and the owner chooses the own most prejudicial for third parties or for the general interest."); Kelly & Penti, *supra* note 211 ("The right to an injunction

In contrast, those who view patents as property rights conclude that when patentees decide to refuse to license even under FRAND obligations, there is nothing illegal as a matter of antitrust law.[228] According to Delrahim, to conclude otherwise would "fundamentally transform the nature of patent rights away from their constitutional underpinnings. [Advocates of the public franchise position] convert a property rule into a liability rule, and amount to a troubling de facto compulsory licensing scheme."[229] This would allow "an implementer [to] freely infringe, knowing that the most he or she will eventually have to pay is a reasonable royalty rate."[230]

Until such a time that Delrahim's views become the law, the settled position is that while injunctions are essential when compensatory damages are insufficient to deter willful or delaying behavior,[231] SEP owners can violate antitrust law by refusing to license if the refusal accrues or preserves market power in a market in which patentees would otherwise have to compete.[232] Refusing to license SEPs to rivals may amount to improper leverage where the patentee, as the technology owner, is vertically integrated into the chipset supply.

If the patentee is a producer, it would be guilty of monopoly maintenance. If not, it would still be an exclusionary abuse of the patent right, and there may be an unmet demand which the patentee itself does not attempt to meet and is preventing others from meeting. The FRAND commitment functions both as a shield against infringement actions, as well as a sword to compel licensee access to the technology. Whether that is indeed so in practice was the key question in the FTC's case against Qualcomm.

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remains subject to principles of proportionality, an often-used European doctrine of fairness.").

228. Delrahim, New Madison, *supra* note 149 ("Equipping patent holders with the property right to exclude therefore goes hand-in-hand with the goals Madison envisioned for the U.S. patent regime.").

229. *Id.*

230. *Id.* ("Antitrust laws should not be used to transform an inventor's one-time decision to offer a license to a competitor into a forever commitment that the inventor will continue licensing that competitor in perpetuity.").

231. *See, e.g.*, Padilla et al., *supra* note 15 (manuscript at 16) ("The threat of injunctive relief induces implementers of patented technology to negotiate reasonable terms and conditions without undue delay.").

232. *See, e.g.*, Image Tech. Servs., Inc. v. Eastman Kodak Co., 125 F.3d 1195 (9th Cir. 1997); Data Gen. Corp. v. Grumman Sys. Support Corp., 36 F.3d 1147 (1st Cir. 1994); BellSouth Advert. & Publ'g Corp. v. Donnelley Info. Publ'g, Inc., 719 F. Supp. 1551 (S.D. Fla. 1988). For a general discussion, see Daryl Lim, *Beyond* Microsoft*: Intellectual Property, Peer Production and the Law's Concern with Market Dominance*, 18 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 291 (2008).

3. The Qualcomm Question

It should be easy for antitrust law to love a company like Qualcomm, the world's largest maker of baseband chipsets. Its microprocessor technology beats at the heart of countless smartphones and tablets. However, in 2017 the FTC sued Qualcomm in federal district court, alleging it maintained a monopoly for baseband processors used in mobile telephones to "impose onerous and anticompetitive supply and licensing terms" on licensees that manufacture mobile phones.[233] In January 2019, the suit proceeded to trial.[234]

The court found that Qualcomm's "no license, no chips" policy, combined with its refusal to license, foreclosed licensees from challenging Qualcomm for fear of losing access to its chipset supply.[235] This forced handset makers to do business with Qualcomm even if they may prefer to buy chips from a Qualcomm rival. The court also held that Qualcomm's non-discriminatory obligations required it to license even to rivals.[236] FRAND obligations do not allow patentees to engage in "level discrimination," where they license only handset makers and not rival chip makers. The issue arises in multicomponent products such as tablets and smartphones where the technology is implemented at multiple levels. Qualcomm's insistence on package licensing does not allow licensees to exclude patents from a package that it does not regard as "essential," useful, or valid. Finally, Qualcomm's five percent royalty rate on the total value of the end-use device, imposed on implementers since 2006, likely breached FRAND obligations because "both handset technology and Qualcomm's SEP portfolio ha[ve] changed dramatically over the past decade," and connecting to a cellular network is just one of many things smartphones do today, even as phones themselves have become more expensive.[237]

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233. Press Release, Federal Trade Commission, FTC Charges Qualcomm with Monopolizing Key Semiconductor Device Used in Cell Phones, Jan. 17, 2017, https://www.ftc.gov/news-events/press-releases/2017/01/ftc-charges-qualcomm-monopolizing-key-semiconductor-device-used [http://perma.cc/7VUG-CPRE].

234. Fed. Trade Comm'n Complaint for Equitable Relief at ¶ 147, Fed. Trade Comm'n v. Qualcomm Inc., No. 5:17-cv-00220-LHK, 2018 WL 5848999 (N.D. Cal. Nov. 6, 2018).

235. *In re* Qualcomm Antitrust Litig., 292 F. Supp. 3d 948, 960 (N.D. Cal. 2017).

236. Fed. Trade Comm'n v. Qualcomm Inc., No. 17-CV-00220-LHK, 2018 WL 5848999, slip op. at *10 (N.D. Cal. Nov. 6, 2018) ("Qualcomm's FRAND commitments include an obligation to license to all comers, including competing modem chip suppliers.").

237. Jay Jurata, FTC v. Qualcomm*: Trial and Possible Implications*, CPI, Jan. 2019, at 3 (quoting Fed. Trade Comm'n v. Qualcomm Inc., No. 5:17-cv-0020-LHK, at 28 (N.D. Cal. June 26, 2017) (order denying motion to dismiss)); *see also* Michael E. Salzman, *Antitrust Fight*, INTELL. PROP. MAG., Feb. 2018, at 47, 49 ("The rate has stayed the same, but the rate base, even on a per unit basis, has risen several fold."); *id.* ("The FTC's complaint alleges that Qualcomm's proportion

As one commentator noted, "the holding is consistent with the patent law damages principle requiring that reasonable royalty damages for infringement be apportioned to the smallest salable unit that actually practices the relevant patent, as opposed to the entire device."[238] In the face of rising smartphone prices, it is doubtful implementers are willing to pay ever more royalties for ever less value. Excessive pricing is not an antitrust offense, but forcing implementers to pay more for less using market power obtained from excluding rival chipset makers in violation of FRAND commitments is arguably a different kettle of fish.

In favoring the FTC's arguments, the judge was decidedly more Arrovian than Schumpeterian in her approach. There was no serious attempt to deal with Qualcomm's complaint that the FTC was trying to enjoin "legitimate, procompetitive business practices that facilitated the growth of a phenomenally successful industry that bears all the hallmarks of healthy and vigorous competition."[239] Nor did the court deal with Qualcomm's argument that margin squeezing is an invalid antitrust theory unless the low-priced product is sold for less than marginal cost.[240]

The DOJ's "flip-flop" and cases like *Qualcomm* illustrate susceptibility to ideology and biases.[241] In a recent article titled *Rediscovering Antitrust's Lost Values*, Professor Thomas Horton investigated congressional intent underlying antitrust law.[242] Congress, he observed, intended to promote a system of competitive capitalism "designed to also protect such sacred American values as equality of opportunity, diversity, and economic ethics and morality."[243] That process of economic decision-making "invariably requires normative values judgments," and different individuals "bring different ideological views to bear on antitrust enforcement."[244] For that reason, he argues, we "need to stop treating neoconservatives' economic values as a supposedly

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of SEPs in smartphones has declined to 13% as the phones evolved from 2G to 4G.").

238. Jurata, *supra* note 237, at 3.

239. Reuters, *Long-awaited Qualcomm Antitrust Trial Begins, Probing Key Cellular Patent Practices*, VENTUREBEAT (Jan. 4, 2019, 10:12 AM), https://venturebeat.com/2019/01/04/long-awaited-qualcomm-antitrust-trial-begins-probing-key-cellular-patent-practices/ [http://perma.cc/LY56-HYYH].

240. Fed. Trade Comm'n v Qualcomm Inc., No. 5:17-cv-00220-LHK, at 35–38 (N.D. Cal. June 26, 2017) (order denying motion to dismiss) (distinguishing Pac. Bell Telephone Co. v. LinkLine Comm., Inc., 555 U.S. 438 (2009)).

241. Lao, *supra* note 59, at 653 (attributing this to the fact that "economic theory and empirical evidence are indeterminate.").

242. Horton, *supra* note 55, at 188.

243. *Id.*

244. *Id.* at 188–89.

neutral set of scientifically objective economic laws."[245]

Professor Horton's observation reflects the fact that antitrust decision-making is biased because humans are biased in their decision making. People decide in surprisingly irrational ways, not because they intend to do so, but limited time and brainpower force them to rely on heuristics to make judgments.[246] Decisionmakers can over generalize from small bits of data, can infer causality where none exist, and can confuse the ease with which an event comes to mind with the probability of it occurring.[247] In addition, they can compound the problem through their overconfidence in the quality of their decisions. Agencies, attorneys, and even judges may operate as advocates for their own biased views rather than as impartial appliers of the law.[248] Biases will similarly affect how stakeholders decide to optimize dynamic efficiency in FRAND and other antitrust cases involving IP. This is where neoclassical antitrust falters and an alternative model must be found.

Behavioral economics incorporates biases and heuristics into its analysis that neoclassical antitrust assumes away. Professor Richard Thaler won the 2017 Nobel Prize in economics for his work on behavioral economics.[249] He noted that neoclassical economics is "deduced from axioms of rational choice, whether or not those axioms bear any relation to what we observe in our lives every day."[250] In contrast, "the real point of behavioral economics is to highlight behaviors that are in conflict with the standard rational model."[251]

Similarly, neoclassical antitrust accounts for deviations from its economic models by including error terms and assuming stakeholders'

245. *Id.* at 239–41.

246. RICHARD H. THALER, MISBEHAVING: THE MAKING OF BEHAVIORAL ECONOMICS 22 (2015) ("Humans have limited time and brainpower. As a result, they use simple rules of thumb—heuristics—to help them make judgments."). *See also* MLODINOW, *supra* note 31, at 34 ("Some scientists estimate that we are conscious of only about 5 percent of our cognitive function. The other 95 percent goes on beyond our awareness and exerts a huge influence on our lives—beginning with making our lives possible.").

247. *See generally* DANIEL KAHNEMAN, THINKING, FAST & SLOW (2011).

248. MLODINOW, *supra* note 31, at 208 ("[W]hen people want to believe in a scientific conclusion, they'll accept a vague news report of an experiment somewhere as convincing evidence. And when people don't want to accept something, the National Academy of Sciences, the American Association for the Advancement of Science, the American Geophysical Union, the American Meteorological Society, and a thousand unanimous scientific studies can all converge on a single conclusion, and people will still find a reason to disbelieve.").

249. Richard H. Thaler, Nobel Prize Lecture, *From Cashews to Nudges: The Evolution of Behavioral Economics*, NOBEL PRIZE (Dec. 8, 2017), https://www.nobelprize.org/prizes/economic-sciences/2017/thaler/lecture/ [http://perma.cc/RJE7-DTFP].

250. THALER, *supra* note 246, at 348.

251. *Id.* at 261.

random errors cancel out on average. Behavioral economics adds nuance to the analysis by positing that deviations from rational choice models are not random, but predictable, because people decide under conditions of uncertainty.[252] Ironically, those in the neoclassical antitrust opposed to incorporating behavioral antitrust resemble dominant undertakings, who when challenged by maverick entrants, attempt to exclude them.[253] The forms those biases take, how antitrust law should be retooled, and how it illuminates the FRAND debate is the subject of Part II.

II. INSIGHTS FROM BEHAVIORAL ECONOMICS

Optimizing can be hard work. Anyone shopping at Costco faces millions of combinations of items within their budget. Neoclassical economics, on the other hand, assumes shoppers can optimize their utility.[254] In reality since we cannot reflect our utility perfectly in our combination of goods and services, we cannot and do not optimize our budget. Instead, our minds have found an easy solution when faced with the task of doing so. We rely on heuristics and biases to make the shopping experience manageable and even enjoyable. As Professor Bailey commented, "decision-makers do not make the best choice after maximizing a complex optimization problem. Rather, decision-makers make choices by taking short cuts, such as using rules-of-thumb, or through satisficing, by making a choice that exceeds some minimally acceptable level. These short cuts make complex problems more tractable."[255]

Behavioral economics informs choice architecture by recognizing these factors that influence decision-making. Human judgment is tainted with cognitive biases such as an "insensitivity to the quality of the evidence on which the judgment is based."[256] In a study done by Tversky

252. Bailey, *supra* note 9, at 2 ("Behavioral economics, and the concept of bounded rationality, recognizes the real-world limitations on fully rational behavior."). Richard Thaler, *Behavioral Economics: From Nuts to "Nudges"*, CHI. BOOTH REV. (May 7, 2018), http://review.chicagobooth.edu/behavioral-science/2018/article/behavioral-economics-nuts-nudges [http://perma.cc/ALK8-C9CV] [hereinafter Thaler, *From Nuts to "Nudges"*] ("This was a crucial insight. It implies that, at least in principle, it would be possible to improve the explanatory power of economics by adding psychological realism.").

253. *See* Joshua D. Wright & Judd E. Stone II, *Misbehavioral Economics: The Case Against Behavioral Antitrust*, 33 CARDOZO L. REV. 1517, 1530–31 (2012) (arguing that dissatisfaction with mainstream antitrust jurisprudence has led to a "behaviorally informed" approach to competition policy).

254. THALER, *supra* note 246, at 326 ("Nudges are effective for Humans, but not for Econs, since Econs are already doing the right thing.").

255. Bailey, *supra* note 9, at 2.

256. TETLOCK & GARDNER, *supra* note 32, at 35 ("A defining feature of intuitive judgment is

and researchers from Harvard Medical School, a group of physicians had to decide between radiation or surgery for cancer.[257] When told that the one-month survival rate was ninety percent, eighty-four percent chose surgery. When told that there was a ten percent mortality rate in the first month, that rate fell dramatically to fifty percent. Both phrases meant the same thing, but framing affected the outcome in a way which an AI decision-maker would not, a point discussed in detail in Part III.

Policymakers and judges employing behavioral economics resemble architects who determine a building's functionality before they determine its form. It recognizes that the answer to "what is the chance the patentee will not innovate if forced to share its proprietary technology?" may be influenced by how easy it is for the decisionmaker to recall instances of innovators they like and what they think about patents.[258] Like a fly print on a urinal,[259] behavioral nudges can be used positively to attract our attention and influence our behavior. In doing so, nudges offer both a more realistic and useful way of understanding how patentees and other stakeholders think about innovation harms and incentives. Accounting for systematic biases allows us to better understand and either minimize or correct those biases. That knowledge in turn can help courts and policymakers achieve dynamic efficiency more effectively.[260]

IP owners and implementers are subject to these biases and heuristics even if they operate through corporations.[261] For instance, neoclassical

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its insensitivity to the quality of the evidence on which the judgment is based."); *id.* at 23 ("In forecasting, as in other fields, we will continue to see human judgment being displaced—to the consternation of white-collar workers—but we will also see more and more syntheses, like "freestyle chess," in which humans with computers compete as teams, the human drawing on the computer's indisputable strengths but also occasionally overriding the computer.").

257. AGRAWAL ET AL., *supra* note 33.

258. Thaler, *From Nuts to "Nudges"*, *supra* note 252 ("People guess that in the United States today, gun deaths by homicide are more frequent than gun deaths by suicide, although the latter are about twice as common. The bias comes because homicides are more publicized than suicides, and thus more available in memory.").

259. Christopher Ingraham, *What's A Urinal Fly, And What Does It Have to With Winning a Nobel Prize?*, WASHINGTON POST (Oct. 9, 2017), https://www.washingtonpost.com/news/wonk/wp/2017/10/09/whats-a-urinal-fly-and-what-does-it-have-to-with-winning-a-nobel-prize/ [http://perma.cc/8WQD-KA8U] ("Thaler calls the urinal fly his "favorite illustration" of a nudge."). *See also* RICHARD H. THALER & CASS R. SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS 6 (2008) (What's a nudge? In, their 2008 book on the topic, Richard Thaler and co-author Cass Sunstein define it as a choice "that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives.").

260. THALER, *supra* note 246, at 131 ("The primary reason for adding Humans to economic theories is to improve the accuracy of the predictions made with those theories.").

261. Bailey, *supra* note 9, at 2 ("Like consumers, firms make decisions using short cuts and rules of thumb.").

economics teaches that firms would reduce output when demand falls, allowing them to cut wages and prices and still make a profit. Princeton economist Richard Lester showed that corporations do not adjust output or wages based on demand.[262] Instead, wages and prices are "sticky," and firms respond instead by laying off workers to remain profitable. One explanation is that firms prefer to avoid making workers angry by cutting their salaries, and instead to eliminate excess workers who would then not be around to complain while waiting for inflation to reduce real wages.[263]

Incorporating behavioral economics does not require overhauling neoclassical antitrust. Behavioral economics functions as a refinement rather than a replacement. There are four specific ways that behavioral economics can improve outcomes in IP cases: (1) analyzing incentives to innovate and harm to innovation, (2) explaining the ideological gap between the SEP and implementer camps, (3) crafting smarter remedies, and, (4) explaining why regulatory sandboxes and safe harbors are critical to developing the IP-antitrust interface.

A. Incentives & Harm

Neoclassical antitrust gives little weight to either incentives or harms and systematically fails to recognize and remedy practices which may be harmful.[264] When faced with the task of predicting how patentees and implementers will act, stakeholders usually use heuristics to guide them. As a result, innovators may be less induced to innovate by high profits than we might think. Similarly, implementers may suffer from more anticompetitive harm than neoclassical antitrust law predicts. Moreover, confirmation and availability biases provide a cogent narrative as to why parties, such as those from the current DOJ and their critics, speak past each other. These are considered below.

1. Overestimating Incentives

Some advocates of IP deference view a near absolute right to refuse

262. *See generally* Richard Lester, *Shortcomings of Marginal Analysis for Wage-Employment Problems*, 36 AM. ECON. REV. 63 (1946) (doubting the validity of conventional marginal theory and the assumptions on which it rests).

263. THALER, *supra* note 246, at 131–32 ("[W]hen a recession hits, either wages do not fall at all or they fall too little to keep everyone employed . . . [because] firms find it better to keep pay levels fixed and just lay off surplus employees (who are then not around to complain). It turns out, however, that with the help of some inflation, it is possible to reduce "real" wages (that is, adjusted for inflation) with much less pushback from workers.").

264. Hovenkamp, *supra* note 10, at 596 ("The claim that technical antitrust is underdeterrent has some traction.").

access and dictate terms of that access as the key to promoting dynamic efficiency.[265] For instance, in 2004 Delrahim, then deputy head of the antitrust division, argued that antitrust law should "support the rights of intellectual property owners to decide independently whether to license their intellectual property to others," even on FRAND encumbered patents.[266] Professor Michael Carrier, disagreeing, noted that "[i]n addition to mischaracterizing antitrust policy, AAG Delrahim mischaracterizes the conduct at issue."[267] Specifically, Professor Carrier faulted Delrahim for referring to FRAND as "'compulsory licensing' even though a patent holder voluntarily chooses to license on FRAND terms to increase its likelihood of obtaining high volume from being part of the standard."[268] Professor Carrier also observes that FRAND "is essentially a duty to deal" as quid pro quo for enjoying "benefits of [a] high volume" of licensees.[269] As a matter of law, he concludes that the Supreme Court made clear that "'[a]ntitrust analysis must always be attuned to the particular structure and circumstances of the industry at issue' and a central aspect of the Court's decision was its emphasis on context and reliance on 'a regulatory structure designed to deter and remedy anticompetitive harm.'"[270]

The assumption that exclusive rights incentivize innovation has a visceral appeal to it, but the length that exclusive right needs to persist in order to achieve those incentives is surprisingly short due to hyperbolic discounting. Deference may encourage a patentee's incentives to innovate, but the effect loses its intertemporal significance. Since at least 1759, economists like Adam Smith recognized gratification now is better than gratification later.[271] In 1937, Economics Nobel Laureate Paul Samuelson formalized the idea of discounting future utility.[272] So if next

265. Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, 540 U.S. 398, 407–08 (2004) ("Compelling such firms to share the source of their advantage is in some tension with the underlying purpose of antitrust law, since it may lessen the incentive for the monopolist, the rival, or both to invest in those economically beneficial facilities.").

266. Makan Delrahim, *Maintaining Flexibility in Antitrust Analysis: Meeting the Challenge of Innovation in the Media and Entertainment Industries*, 28 COLUM. J.L. & ARTS 343, 356 (2005).

267. Carrier, *DOJ Giving Cover*, *supra* note 23.

268. *Id.*

269. *Id.*

270. *Id.* (quoting *Verizon Commc'ns*, 540 U.S. at 399).

271. ADAM SMITH, THE THEORY OF MORAL SENTIMENTS 284 (2nd ed. 1759) ("The pleasure which we are to enjoy ten years hence interests us so little in comparison with that which we may enjoy to-day.").

272. Paul Samuelson, *A Note on the Measurement of Utility*, 4 REV. ECON. STUDIES 155 (1937), https://econpapers.repec.org/article/ouprestud/v_3a4_3ay_3a1937_3ai_3a2_3ap_3a155-161..htm [https://perma.cc/6YCZ-EGVT].

year's dinner is worth ninety percent of dinner today, we would discount it by ten percent.[273] In the same way, behavioral economics suggests that humans are incapable of forecasting more than a few years in advance.[274] Gains to IP owners become less meaningful once they have covered their costs, including those related to research and development only a few years out.

In terms of innovation policy, even innovators who ascend the heights of power with technological breakthroughs cannot be depended on to innovate because they gradually become insensitive to financial incentives as they grow more distant in time. Today's incentives are best, tomorrow's less so, and those five years out may have much less effect on their R&D decisions. Arguments by the successful incumbent promising the "next big thing" should, therefore, be taken with a grain of salt.

In one study, gamblers ahead in a game treated their winnings more liberally than the money that they had brought into the casino with them, almost as if there were two ledger columns in their minds. This behavior is so pervasive that there is even a term for it—"gambling with the house's money."[275] This conclusion is contrary to the idea that money is fungible. Royalties above sunk costs have a smaller positive impact on patentees' incentive to innovate than advocates of a "property rights" view of patents may care to acknowledge. Indeed, this "house money" effect—along with a tendency to extrapolate immediate returns into the long run—may encourage "innovation bubbles" driven not by actual returns, but perceived returns based on current royalties.[276] Similarly, Dr. Amos Tversky published a 1988 study of basketball players showing that players who made a shot were no more likely to make the next one. Indeed, the study surprisingly revealed that the player who made a shot may even be a little less likely to do so the next time.[277]

Those who think there can never be an "innovation bubble" should

273. *See* THALER, *supra* note 246, at 131.

274. TETLOCK & GARDNER, *supra* note 32, at 88–89 ("[H]uman cognitive systems will never be able to forecast turning points in the lives of individuals or nations several years into the future—and heroic searches for superforecasters won't change that.").

275. THALER, *supra* note 246, at 81 (describing this behavior as "gambling with the house's money").

276. *Id.* at 83 ("It occurs whenever there are two salient reference points, for instance where you started and where you are right now. The house money effect—along with a tendency to extrapolate recent returns into the future—facilitates financial bubbles.").

277. Karen Freeman, *Amos Tversky, Expert on Decision Making, Is Dead at 59*, N.Y. TIMES, Jun. 6, 1996, at B016 ("There is no 'hot hand' in basketball, he showed by analyzing every shot taken by the Philadelphia 76ers in a year and a half.").

look at the stock market. Like innovation, stock prices are intrinsic and not susceptible to scientific observation the way plant growth might be.[278] Financial economists thus believed for a long time that there was no way to beat the market, since all publicly available information is reflected in stock prices.[279] John Maynard Keynes, however, observed that emotions, or what he called "animal spirits," played an important role in investment decisions.[280] Every time fund managers buy stocks, they are predicting which ones other investors will later decide are worth more than they are today, even with ephemeral and insignificant data. In contrast, behavioral economics teaches that loss aversion will lead individuals and firms to view risks to their bottom line more severely. An investment banker who makes a large profit will receive relatively modest rewards, but incurring an equal-sized loss will likely get him fired.[281] Even risk-neutral stakeholders will, over time, tend toward risk aversion.[282]

Consistent with the Arrovian view prioritizing market contestability over profits to IP owners, innovation is driven by IP owners striving to maintain their bottom line, which will have a greater impact on spurring innovation. At the same time, antitrust enforcement can be consistent with strong IP rights and higher royalties where IP owners are driven by consumer demand rather than anticompetitive shenanigans. Indeed, rewarding IP owners under these circumstances provides an incentive for others to innovate and compete against the incumbent. This in turn promotes precisely the kind of dynamic competition we want.[283]

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278. THALER, *supra* note 246, at 206 ("[F]inancial economists lived with a false sense of security that came from thinking that the price-is-right component of the EMH could not be directly tested—one reason it is called a hypothesis.").

279. *Id.* at 207 ("Because all publicly available information is reflected in current stock prices, it is impossible to reliably predict future prices and make a profit."); *id.* ("Most of the early academic research on the EMH stressed the second component of the theory, what I call the 'no free lunch' principle—the idea that there is no way to beat the market. . . . Michael Jensen's PhD thesis provided the most convincing analysis. In it he showed that professional money managers perform no better than simple market averages, a fact that remains true today. If the pros can't beat the market, who can?").

280. *Id.* at 209 ("Keynes was particularly insightful on this front. He thought that emotions, or what he called 'animal spirits,' played an important role in individual decision-making, including investment decisions.").

281. *Id.* at 187 ("In many companies, creating a large gain will lead to modest rewards, while creating an equal-sized loss will get you fired.").

282. *Id.* ("Under those terms, even a manager who starts out risk neutral, willing to take any bet that will make money on average, will become highly risk averse.").

283. Delrahim, New Madison, *supra* note 149 ("Antitrust law is intended to protect this behavior, not punish it, so that others will have incentives to innovate and compete themselves, all for the benefit of consumers. Such dynamic competition should be encouraged by our enforcement policies.").

It follows too that behavioral economics would caution against adopting a total welfare view of IP deference. The total welfare view includes welfare both accrued and lost by all stakeholders whether it "actually produces higher prices" or whether "lower output is permissible, provided that efficiency gains to producers are at least as large as consumer losses."[284] Professor Hovenkamp observed that this standard "is impossible to apply in any but the most obvious cases."[285] He explained that there is great difficulty quantifying consumer losses and comparing them with producer efficiency gains.[286] In contrast, the current "consumer welfare standard queries only whether output will be higher or lower (or prices lower or higher) under the restraint."[287] This standard is "difficult enough, but is nevertheless much simpler than the proof requirements for a general welfare standard."[288]

Professor Elhauge concluded that "the consumer welfare standard not only better comports with the law, but also ironically better advances overall societal total welfare."[289] Protecting consumer welfare means condemning anticompetitive practices that limit downstream access to technology.[290] In some instances where patentees have bound themselves with FRAND commitments, behavioral economics could support the conclusion that a "liability approach" would better facilitate access at a fair rate without the owner's consent and may be more likely to achieve dynamic efficiency.[291] As with indefinite concepts like "fairness" and

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284. Hovenkamp, *The Rule of Reason*, *supra* note 89, at 118.

285. *Id.* at 84, 119 (footnotes omitted) ("Measuring consumer harm under a general welfare test requires not only predicting whether the price will rise or fall, but also what will be the size of the 'deadweight' loss cause by inefficient consumer substitutions. There are almost no cases that have ever attempted to assess general welfare in reasonably close situations, and very likely no United States cases at all where a court has actually found an anticompetitive output reduction and price increase that was justified by offsetting efficiencies.").

286. *Id.* at 118 ("This is far easier than quantifying all consumer losses and producer gains, and netting them out against each other.").

287. *Id.* at 84 ("This approach is consistent with antitrust's consumer welfare principle, which identifies antitrust's goal as competitively low prices and high output, whether measured by quantity or quality."); *id*. at 118 ("Suffice it to say that, whatever its ultimate value, the consumer welfare approach has one enormous advantage over a general welfare principle—administrability.").

288. *Id.* at 84.

289. *See* Elhauge Interview, *supra* note 65.

290. *Id.* ("Any anticompetitive harm to upstream suppliers will suppress upstream output, and if that has any effect on downstream output, it will be to reduce it and thus harm consumer welfare.").

291. Corda & Nicita, *supra* note 218 ("If the SEP holder is not allowed to issue an injunction against the implementer, when a commercial agreement has not been signed in the first instance, granting a 'FRAND defense' for licensees is equivalent to saying that the implementer has a right of access without the need of obtaining a preliminary consent by the SEP. That is to say that the

"beauty," consumer welfare is only as defensible and well-defined as it appears to the beholder.[292] Those who favor little or no intervention invoke a total welfare standard to justify presumptive legality to patentee conduct, no matter how the gains are eventually allocated between patentees and the rest of society. In contrast, those favoring greater scrutiny of patentee conduct give more weight to consumer choice and market contestability in their goal setting.[293] Total welfare is more of an ideal state than a tool of economic analysis and makes antitrust an even more nebulous enterprise than it needs to be.[294]

2. Underestimating Harm

According to behavioral economic theory, implementers of FRAND encumbered patents may make less rational judgments about whether a price is "fair" than neoclassical antitrust would entertain.[295] As the licensors, SEP owners know their licensing terms' rates but have no incentive to disclose them to potential implementers. The result is that "[t]he information on those costs that is available to purchasers tends to be anecdotal, and service providers lack the incentive to disclose the data that they possess."[296] Implementers must then decide whether to take a license or not based on an advertised FRAND rate and not on the total lifecycle cost of the portfolio. This makes implementers susceptible to hyperbolic discounting, underestimating how much the royalties aggregate over the duration of the license, and paying more than they think they will over the lifetime of the agreement.[297]

SEP holder's right is protected by a liability rule.").

292. William A. Galston & Clara Hendrickson, *What the Future of U.S. Antitrust Should Look Like*, HARV. BUS. REV. (Jan. 9, 2018), https://hbr.org/2018/01/what-the-future-of-u-s-antitrust-should-look-like. [https://perma.cc/7Q5S-3RC5]. ("Both conservatives and progressives invoke 'consumer welfare' as antitrust's core concern, but they offer divergent interpretations of this concept.").

293. *Id.* ("For their part, progressives also focus on the consequences for consumers, but employ a broader understanding of consumer welfare that encompasses quality, innovation, and choice as well as price.").

294. Hovenkamp, *supra* note 10, at 621 ("[W]e lack the econometric tools to apply them in litigation in any but the clearest cases.").

295. Cowen & Dnes, *supra* note 63, at 8 ("Analysis should reflect these increased risks, which are an order of magnitude greater than they were during the period when Chicago school thinkers called vertical foreclosure theories into question.").

296. Max Huffman, *Marrying Neo-Chicago with Behavioral Antitrust*, 78 ANTITRUST L.J. 105, 137 (2012).

297. Avishalom Tor, *Understanding Behavioral Antitrust*, 92 TEX. L. REV. 573, 588 (2014). ("While perfectly rational consumers in the primary market would have sufficed to deter Kodak from exploiting aftermarket power, the same does not necessarily hold for boundedly rational consumers who may systematically underestimate or fail to consider the future costs of parts.").

Once implementers decide to adopt a standard, the likelihood of them switching is reduced by sunk costs. This weakens competition by exacerbating their perceived switching costs.[298] Similarly, deciding to go to a concert despite a snowstorm allows attendees to settle their mental account without taking a loss on their ticket purchases. Foregoing the price of the ticket does not. The tendency for people to continue futile efforts was vividly illustrated by the United States' decision to continue its war in Vietnam because it had invested too much to quit. Professor of organizational behavior Barry Staw called this an "escalation of commitment."[299]

Behavioral economics also sheds light on anticompetitive conduct that neoclassical antitrust may regard as irrational and therefore improbable. While an entrant like Intel may view its market share increase as a gain, Qualcomm, as the incumbent chip producer, perceives this as a loss of market share. This may lead Qualcomm to choose a risk-seeking strategy with a negative present value. Moreover, overconfidence bias and the benefits from gaining a reputation for toughness may have led Qualcomm to err in their assessment of the potential benefits of its "no license, no chips" policy.[300]

What may at first glance seem irrational is contextualized as an action plan for systematic biases. This may be worth Qualcomm's time and effort, particularly if it manages to deter entry by new entrants. If implementers are not aware of total costs and do not learn over time, competition in the market for wireless technology does not sufficiently tame Qualcomm's power to behave independently on the chipset market. By the same token of logic, patentees should treat rivals and implementers alike as far as from where their pennies come. If they do not, it creates at least a rebuttable presumption that their refusal to do so is fueled by the expectation of higher royalties from device makers than they would otherwise receive from chipset makers.

In the FRAND context, behavioral economics suggests courts should continue to peg royalty rates to the SSPPU as the Federal Circuit did,

298. Amelia Fletcher, *The EU* Google *Decisions: Extreme Enforcement or The Tip Of The Behavioral Iceberg?*, CPI ANTITRUST CHRON. 3 (2019) ("For example, if consumers exhibit *status quo* bias or myopia—both common behavioral tendencies—they are less likely to take the time to seek out better options that may be available in the market. But if this is the case, then firms will in turn have less incentive to improve their offerings, since they will gain fewer customers by doing so, and the process of competition will thus be less vigorous.").

299. Barry M. Staw, *Knee-Deep in the Big Muddy: A Study of Escalating Commitment to a Chosen Course of Action*, 16 ORG. BEHAV. & HUM. PERFORMANCE 27, 41 (1976).

300. ZAMIR & TEICHMAN, *supra* note 2, at 32–33 ("Existing game theoretic models based on a rational-choice approach have shown that predation can also emerge from the reputation that predation generates.").

rather than the end-product. Patentees prefer to license the device makers because royalties tend to be larger due to (1) a reference point bias, (2) the larger economic impact of obtaining an injunction over an entire phone rather than a chip within the phone, and (3) the fact that device makers are less well-informed about the value added of the patented chip technology than a chip maker. All these conditions also suggest that the risk of holdup is more likely at the device level.

It is harder for juries to apportion the value of the SEPs when the anchor point is a complex multicomponent product. With such a wide base value, jurors may overestimate the royalty rate since they cannot accurately account for royalty stacking. During actual negotiations, it is also easier for the component manufacturer to estimate the contribution of the patented technology than the end-product manufacturer or retailer. Even if plaintiffs can show that end-product manufacturers are charged excessive royalties, that in and of itself is not illegal under United States law. However, that may be the smoking gun that prompts closer scrutiny of conduct, agreements, or both, which facilitate excessive royalties.

Neoclassical antitrust sees no problems with high prices. Patentees are simply maximizing profits by charging whatever the market will bear. Those profits will attract entrants to compete until those profits go away soon enough. Yet, humans do not think quite so rationally. For instance, while people generally understand that the rich have access to better health care, the notion of auctioning access to the highest bidder is repugnant. Similarly, when Uber raised the prices of its rides after a blizzard, New Yorkers were viscerally upset at the company's price gouging.[301] The New York attorney general launched a probe, and Uber had to agree to cap surge charges in emergency situations.[302] In contrast, companies like Walmart and Home Depot, who offer emergency supplies in regions affected by disasters, forgo profit maximization. Thus seen, the fairness of patentee-set royalties and other license terms is not merely a cognitive exercise in rationality.

It is difficult to show competitive harm when end-product manufacturers continue to offer products containing the patented technology. Equating some degree of innovation with a dynamically

301. THALER, *supra* note 246, at 129 ("When a store raises the price of snow shovels the day after a blizzard, people feel very much like someone has poked them with a sharp object. And indeed, in many places there are laws against gouging, suggesting that people find the practice offensive.").

302. Thaler, *From Nuts to "Nudges"*, *supra* note 252 ("They were later sued by the New York State attorney general for violating a law that bans 'unconscionably excessive prices' and agreed to a settlement in which surge pricing is capped during emergency situations.").

efficient outcome is a mistake, since intervention could deliver considerably more innovation or even innovation on a whole different level. In this, pro-patentee advocates fall into hindsight bias, which is the propensity to overestimate the probability of an event once people know that the event has occurred. Hindsight bias is compounded by our tendency to see bias in others but not in ourselves, which the discussion moves onto next.[303]

3. Confirmation & Availability Biases

Neoclassical antitrust assumes people impartially weigh the costs and benefits of their peferences, both present and future.[304] In contrast, behavioral economics shows IP stakeholders may treat evidence supporting their biases as independent and robust, when it is not.[305] Confirmation bias can cause belief to transmute into evidence, rather than beliefs forming based on evidence.[306] In an experiment, University of Chicago graduate students were required to rate reports, but they did not know that the reports were phony.[307] A significant number of students regarded the reports supporting their opinion as being true.[308] Moreover, the stronger they felt about an issue, the stronger their belief in the research's robustness.[309] Sometimes decision-makers ignore unfavorable evidence altogether.

People also may actively avoid information that undermines their beliefs.[310] In a study, respondents were randomly assigned the role of

303. THALER, *supra* note 246, at 22 ("What makes the bias particularly pernicious is that we all recognize this bias in others but not in ourselves.").

304. Russell Golman et al., *Information Avoidance*, 55 J. ECON. LITERATURE 96, 102 (2017); Shahram Heshmat, *What Is Behavioral Economics?* PSYCHOL. TODAY (May 3, 2017), https://www.psychologytoday.com/us/blog/science-choice/201705/what-is-behavioral-economics [https://perma.cc/JEG8-2TMP] ("The rational person is assumed to correctly weigh costs and benefits and calculate the best choices for himself. The rational person is expected to know his preferences (both present and future), and never flip-flop between two contradictory desires.").

305. MLODINOW, *supra* note 31, at 158 ("The challenge science presents to the legal community is to move beyond that, to address the more difficult issue of unconscious discrimination, of bias that is subtle and hidden even from those who exercise it.").

306. Ziva Kunda, *The Case for Motivated Reasoning*, 108 PSYCHOL. BULL. 480, 490 (1990) (noting that human thought processes consistently tend to point from belief to evidence, not vice versa).

307. Jonathan J. Koehler, *The Influence of Prior Beliefs on Scientific Judgments of Evidence Quality*, 56 ORG. BEHAV. & HUM. DECISION PROCESSES 28, 34–35 (1993) (where students were asked to rate research reports dealing with issues on which they already had an opinion).

308. *Id.* at 37.

309. *Id.* at 37 (showing that they had indeed judged the studies that supported their beliefs to be more methodologically sound and clearly presented than the otherwise identical studies that opposed their beliefs—and the effect was stronger for those with strong prior beliefs).

310. *Id.* at 29 (noting that people sometimes avoid information, even if acquiring this knowledge

plaintiff or defendant in a vehicle personal injury lawsuit based on an actual case.[311] If they guessed what the judge actually awarded the plaintiff, they would be given a cash bonus. Rational actors would ignore whether they were playing the role of plaintiff or defendant and focus solely on the law and evidence. Yet those playing plaintiffs and those playing defendants differed greatly, each tending toward their own sides while purporting to objectively rely on the evidence and law they had.[312] This explains why it is so hard to bridge the beliefs of those who are pro-patentee and those who are pro-implementer; even though both appear to support, in broad terms, the value of both innovation and competition.[313]

The more ambiguous the law and policy benchmarks, the greater the tendency for this divide.[314] Antitrust law is notoriously ambiguous. This explains why the Interface has been so vulnerable to swings throughout its history.[315] The divide between those seeking IP deference and those cautioning against opportunism results from a basic desire to favor traits similar to our own, however detached.[316] For instance, a study showed that people married others with similar family names to their own as much as they married others with different family names, even when those different names are more common.[317] The attributes that decision-makers favor may have no empirically provable correlation with innovation or competition.[318] For instance, our trust in our physician may

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would be to their own benefit).

311. *See* Linda Babcock & George Loewenstein, *Explaining Bargaining Impasse: The Role of Self-Serving Biases*, 11 J. ECON. PERSP., 109, 112 (Winter 1997) (noting that researchers randomly assigned volunteers to the role of plaintiff or defendant in a mock lawsuit based on a real trial that occurred in Texas).

312. MLODINOW, *supra* note 31, at 212–13.

313. Kerber, *supra* note 14, at 2 ("[W]e generally have so many problems to deal with innovation in competition law—despite the broad consensus that innovations are one of the important benefits of market competition.").

314. MLODINOW, *supra* note 31, at 205 (noting that this was "especially in the social sciences, in which there is greater ambiguity than in the physical sciences").

315. *See, e.g.*, E. Bement & Sons v. Nat'l Harrow Co., 186 U.S. 70, 91 (1902); Carbice Corp. of Am. v. Am. Patents Dev. Corp., 283 U.S. 27, 34 n.4 (1931); Ethyl Gasoline Corp. v. United States, 309 U.S. 436, 456–58 (1940); United States v. Masonite Corp., 316 U.S. 265, 282 (1942); Mercoid Corp. v. Mid-Continent Inv. Co., 320 U.S. 661, 670 (1944); Int'l. Salt Co., Inc. v. United States, 332 U.S. 392, 396 (1947).

316. N.J. Blackwood et al., *Self-Responsibility and the Self-Serving Bias: An fMRI Investigation of Causal Attributions*, 20 NEUROIMAGE 1076, 1076 (2003) (identifying a discrete area of the brain, called the dorsal striatum, as the structure that mediates much of this bias).

317. MLODINOW, *supra* note 31, at 19 (demonstrating that people tended to marry others with the same family name as themselves as often as they married those with different family names, even when the different family names were more common; for instance, Browns would marry other Browns as often as they married Smiths, even though Smiths are more common than Browns).

318. *Id.* at 20 ("Most of us are satisfied with our theories about ourselves and accept them with

have more to do with his or her listening skills than his or her technical expertise.[319] This bias accentuates the ideological gap that exists at the Interface, and accounts for much of the impasse we see today.

Neoclassical antitrust teaches that without transaction costs, resources will flow to their highest valued use.[320] Even when transaction costs were zero, however, behavioral economics indicates resources do not necessarily flow to their highest valued use due to the "endowment effect." People value what they had more than what others would give them for it by a factor of about two.[321] A FRAND royalty for patentees will always be higher than FRAND royalties for implementers. This is because the SEP owner values its technology more highly because it has formed part of their endowment. In contrast, implementers have yet to acquire access to the technology and value it less.

Knowing this, the solution would then be to write FRAND obligations in such a way as to keep parties on track to resolve disputes in this way until the parties opt out. By tying increases in usage to royalty increases, loss aversion would be averted. By asking parties to commit to a decision that would manifest in the future, the present bias would be mitigated.

Patentees and implementers may also decline what may be FRAND terms if either or both regard the terms as "unfair."[322] One legal study interviewed attorneys from twenty civil cases in which injunctive relief was sought. In all cases, the parties did not attempt to negotiate after the court had issued its order.[323] Perceptions of "fairness" are also affected by the endowment effect in the sense that both patentees and licensees feel entitled to the terms to which they have become accustomed. These parties then treat pressure to deviate from the status quo to less favorable terms as a loss and dig in to fight.[324] One may suggest that the endowment effect is simply a transaction cost. However, the endowment effect is a

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confidence, but we rarely see those theories tested. Scientists, however, are now able to test those theories in the laboratory, and they have proven astonishingly inaccurate.").

319. *Id.* ("You might think you trust your gastroenterologist because she is a great expert, but you might really trust her because she is a good listener.").

320. R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 40 (1960).

321. THALER, *supra* note 246, at 265 ("[T]he reason was the endowment effect: people given mugs valued them about twice as much as people not given the mugs.").

322. *Id.* at 268 ("For the Coase theorem to work, that losing party has to be willing to make an offer to the other side if he puts a greater value on the property right he just lost. But if people are angry, the last thing they want to do is talk to the other side.").

323. Ward Farnsworth, *Do Parties to Nuisance Cases Bargain after Judgment? A Glimpse Inside the Cathedral*, 66 U. CHI. L. REV. 373, 382, 384 (1999).

324. Thaler, *From Nuts to "Nudges"*, *supra* note 252 ("[T]his feature immediately offers an explanation for the difference in the buying and selling prices . . . . I demand more to sell an object than to buy it because giving it up would be coded as a loss.").

preference, not a "cost" as neoclassical economics understands it. Professor Thaler explained that "[i]f we are free to re-label preferences as "costs" at will so that behavior appears to be consistent with the standard theory, then the theory is both untestable and worthless."[325]

People value the ability to avoid losses more than the same amount of monetary gains.[326] Whether something is framed as a discount or a charge matters to the irrational decision-maker.[327] Framing also informs the "non-discriminatory" aspect of FRAND. Studies show that consumers are willing to pay more for beer sold at a fancy restaurant than at a beach shack because in their minds, it is unfair for the shack owner to charge as much as the restaurant.[328] The ability to punish is particularly important in situations where there are repeated interactions, as often is the case between licensors and licensees. Behavioral economics teaches that most people are "conditional cooperators," cooperating if enough people do the same.[329] Maintaining a critical mass of cooperative players requires the ability to punish wrong-doers such as free-riders, the bane of IP owners.[330]

B. Smarter Remedies

Behavioral economics offers insights to craft smarter solutions. Nudging is one way to get consumers to make better choices.[331] The European Commission found Microsoft guilty of tying its Windows operating system to its Media Player, but noted that while users could have downloaded competing media players they did not.[332] Professor

325. THALER, *supra* note 246, at 266, 268.

326. *Id.* at 34 ("Roughly speaking, losses hurt about twice as much as gains make you feel good. . . . The fact that a loss hurts more than an equivalent gain gives pleasure is called loss aversion. It has become the single most powerful tool in the behavioral economist's arsenal."); Daniel Kahneman, Jack L. Knetsch & Richard H. Thaler, *Fairness and the Assumptions of Economics*, 59 J. BUS. 285, 288 (1986) (noting that buyers were willing to pay about half of what sellers would demand, even with markets and learning).

327. DANIEL KAHNEMAN & AMOS TVERSKY, CHOICES, VALUES, AND FRAMES 46 (2000) (calling this distinction "framing").

328. Kahneman, Knetsch & Thaler*supra* note 326, at 288.

329. Ernst Fehr & Simon Gächter, *Cooperation and Punishment in Public Goods Experiments*, 90 AM. ECON. REV. 980, 984 (2000) (finding that a large proportion of people can be categorized as conditional cooperators).

330. *Id.*

331. Thaler, *From Nuts to "Nudges"*, *supra* note 252.

332. R. Hewitt Pate*, The Thirteenth Chime of the Clock*, 4 CPI 51, 54 (Spring 2008), ("Just as before the decision, consumers consistently choose to install the fully functional version of Microsoft Windows. WMP is present on practically every (non-Apple) PC sold, and consumers retain the option to purchase or down-load—often for free—alternative media players from other providers. The CFI in fact recognized that the use of multiple competing media players was becoming increasingly common among consumers throughout the period in question."); *see also*

Andreas Heinemann observed that status quo bias imposed a real cost on rival media player developers, who had to "expend resources to overcome end-users' inertia and persuade them to ignore the pre-installation of WMP."[333]

To remedy this, the European Commission imposed a duty on Microsoft to offer a version of Windows without the media player.[334] The Commission also required Microsoft to make a ballot screen available that allowed users to download the browser of their choice instead of, or in addition to, Internet Explorer.[335] This ballot screen helped in "overcoming the default bias and giving consumers an autonomous choice of the browser they are going to use . . . . [T]he remedy promotes competition on the merits since the product is not chosen because of its immediate availability but because of its quality."[336] At the same time, Microsoft had to avoid overloading consumers with choices. "Consequently, the ballot screen should not strive for completeness but contain the most important products plus a choice of the less usual products which should vary randomly."[337]

C. Sandboxes & Safe Harbors

Antitrust law develops through cases "rather than by statute or regulation and frequently—approaching always, at the appellate and Supreme Court levels—enjoying the benefit of expert insights by amici from the federal and state enforcers, the academy, and sophisticated think-tanks representing all political views."[338] Agencies, courts, and attorneys should be encouraged to try new theories, run simulations, and keep track of what happens internally. It will take time, but eventually the antitrust system should allow and even encourage stakeholders to make evidence-based decisions regardless of the outcomes ex post. This will encourage everyone to contribute toward the common enterprise of advancing the "useful Arts" that lie at the heart of technological

Case T-201/04, Microsoft Corp. v. Comm'n of the European Communities, 2007 WL 2693858 (Sept. 17, 2007).

333. Andreas Heinemann, *Facts Over Theory: The Contribution of Behavioral Economics to Competition Law*, CPI ANTITRUST CHRON., Jan. 2019, at 1, 5, https://www.competitionpolicyinternational.com/wp-content/uploads/2019/01/CPI-Heinemann.pdf [https://perma.cc/9XM5-LM2J].

334. *Id.* at 6 ("This product did not have any success on the market, though.").

335. Commission Decision No. AT.39.530 (*Microsoft*), 2013 O.J.C 120/15, http://ec.europa.eu/competition/antitrust/cases/dec_docs/39530/39530_3162_3.pdf [https://perma.cc/L5S4-7DD4].

336. Heinemann, *supra* note 333, at 6.

337. *Id.*

338. Huffman, *supra* note 29, at 3.

progress.[339]

However, behavioral economics suggests managerial decisions are judged more harshly in hindsight, even to the extent of imputing negligence.[340] Hindsight bias may chill the willingness of litigants or lower courts to advance antitrust theories on dynamic efficiency even if they are sound or if they may be excoriated when the result turns out badly at court, or on appeal. Judicial meekness and self-doubt harms consumers since we want stakeholders to take efficient risks, even if they turn out wrong.

This can be fostered by a safe-harbor norm that protects stakeholders if they make a value-maximizing decision ex ante with all the information available to them, even if it turns out badly ex post.[341] Hindsight bias, however, will make implementing the safe-harbor difficult since "[w]henever there is a time lapse between the times when a decision is made and when the results come in, the boss may have trouble remembering that he originally thought it was a good idea too."[342]

Remaining open to creative theories of harm, or even sorting through mundane ones, can be cognitively taxing. To use a simple example, a lunch menu in a foreign language contains many choices, but people sometimes have waiters choose for them or limit their own options to popular choices because they cannot read it. Getting to the right outcome comes at a cognitive tax that decision-makers ignore.

Just as behavioral economics supplies a theoretical rudder to steer one form of predictive analytics used at the Interface, AI supplies the engine to power it. AI offers stakeholders at the Interface, for the first time, the possibility of enhanced predictive capabilities to achieve dynamically efficient outcomes. A properly trained system could allow stakeholders to predict key antitrust metrics; such as market entry, innovation trajectories, and price effects; with considerably more confidence than the current system powered by neoclassical antitrust theory alone.

As a concept, predictive analytics may sound esoteric, but anyone with a credit card has likely already been assessed by an AI-enabled system for their credit risk. Credit card companies also use predictive analytics

339. U.S. CONST. art. I, § 8, cl. 8 (the basis for United States IP law).

340. ZAMIR & TEICHMAN, *supra* note 2, at 7 ("Judging managerial decisions in hindsight may have a chilling effect on managers, deterring them from taking efficient risks, for fear that if these decisions turn out badly, they will be held legally liable.").

341. THALER, *supra* note 246, at 190 ("The misbehavior is in failing to create an environment in which employees feel that they can take good risks and not be punished if the risks fail to pay off.").

342. *Id.*

to guess if a purchase was fraudulent. They use multi-dimensional customer data to do this, including past purchases, geographical location, age, and gender.[343] Predictive analytics enables credit card companies to confidently block a card and issue a new one without their customers even experiencing the inconvenience of being declined.[344] Its accuracy gets better the longer it is used, the more frequently it is used, and the more legitimate transactions it receives.

AI can speed up the process of investigation and dispute resolution in antitrust cases, a reason for the revolt against neoclassical antitrust as discussed in Part I. Rather than analyze each option one at a time, AI lowers the cost and accelerates the speed of identifying options for stakeholders to determine the payoffs. Over time, the continual feedback loop enables the algorithm to improve its predictive capabilities. How this happens at the Interface is the subject of Part III, which the discussion turns to next.

III. LEVERAGING ARTIFICIAL INTELLIGENCE

AI permeates our daily lives. It powers popular features in our smartphone apps, guides autonomous vehicles on our roads, and informs merchants of our unconscious purchasing preferences.[345] AI raises important legal questions. Who is the inventor when the AI made the primary inventive contribution?[346] Should companies that use training data be allowed to hide behind the fair use exception in copyright law?[347] Should companies who use AI to track market movements be liable for violating antitrust law?[348] Does big data constitute a cognizable antitrust

343. AGRAWAL ET AL., *supra* note 33, at 24–25.

344. *Id.* at 27 ("Innovations in prediction technology are having an impact on areas traditionally associated with forecasting, such as fraud detection. Credit card fraud detection has improved so much that credit card companies detect and address fraud before we notice anything amiss.").

345. *Id.* at 133 (noting how Amazon's Echo uses AI to predict the intention of user speech, Apple's Siri to predict command context, and Amazon's recommendations to predict purchases).

346. *See* Jeff O' Neill, *Predicting Future Patent Outcomes*, IPWATCHDOG.COM (May 30, 2018), http://www.ipwatchdog.com/2018/05/30/predicting-future-patent-outcomes/id=97410/ [https://perma.cc/P8HA-MKSU]. Patent attorneys have begun using data analytics to improve prosecution strategy. Allowance rates give attorneys valuable insights into the probability of obtaining a patent after a first office action, such as how difficult an examiner is and when the applicant can expect to be granted the patent. *See* Lim, *AI & IP*, *supra* note 1, at 818.

347. Dan L. Burk, *Algorithmic Fair Use*, 86 U. CHI. L. REV. 283, 283 (2019).

348. *See, e.g.*, Press Release, Department of Justice Office of Public Affairs, Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution (Apr. 6, 2015) (on file with the Department of Justice) (rivalling online sellers implemented an agreement not to undercut each other's prices through repricing software that automatically set prices in line with other online sellers); Matthew Levitt et al., *EU Antitrust Enforcement 2.0—European Commission Raises Concerns About Algorithms And Encourages*

barrier to entry?[349] This author has dealt with several of these questions elsewhere.[350]

With the advent of AI-enabled predictive analytics, it would be foolish to rely solely on human judgment for Interface cases when doing so would be inferior.[351] Like the rule of reason, predictive analytics requires fact gathering, weighing alternative interpretations, and selecting the most likely future. AI can scour depositions and provide a quicker and more consistent analysis of facts and law than attorneys can, and will be better at accounting for interactions among different indicators.[352] One key reason AI can do this is that it can avoid cognitive bias involved in ignoring salient information. [353] It most closely approximates neoclassical economics' rational person.[354] Another reason is that AI can make connections that escape us because of how we contextualize and associate information with what we—both individually and within our traditional legal, scientific, or economic disciplines—are personally familiar with.

As discussed earlier in Part I, merger review comes closest to the kind of forecasting that analysis at the Interface requires to more reliably achieve dynamically efficient outcomes, and it requires us to do so

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Individual Whistleblowers, KLUWER COMP. L. BLOG (Mar. 21, 2017), http://kluwercompetitionlawblog.com/2017/03/21/eu-antitrust-enforcement-2-0-european-commission-raises-concerns-about-algorithms-and-encourages-individual-whistleblowers/ [https://perma.cc/4RTM-7RNX] (noting that "[p]ricing algorithms need to be built in a way that doesn't allow them to collude" and that "companies can't escape responsibility for collusion by hiding behind a computer program").

349. Kelly Smith Fayne et al., *FTC Hearing Evaluates Regulatory Oversight of Big Data and Privacy*, LATHAM & WATKINS CLIENT ALERT COMMENT. (Nov. 14, 2018), https://www.lw.com/thoughtLeadership/FTC-hearing-regulatory-oversight-big-data-privacy [https://perma.cc/2WBG-LXS8].

350. *See generally* Lim, *AI & IP*, *supra* note 1.

351. TETLOCK & GARDNER, *supra* note 32, at 21–22 ("Today, it's no longer impossible to imagine a forecasting competition in which a supercomputer trounces superforecasters and superpundits alike. After that happens, there will still be human forecasters, but like human *Jeopardy!* contestants, we will only watch them for entertainment. . . . And machine learning, in combination with burgeoning human-machine interactions that feed the learning process, promises far more fundamental advances to come. 'It's going to be one of these exponential curves that we're kind of at the bottom of now,' Ferrucci said.").

352. AGRAWAL ET AL., *supra* note 33, at 69 ("As the number of dimensions for such interactions grows, the ability of humans to form accurate predictions diminishes, especially relative to machines.").

353. *Id.* at 68 ("Humans often overweigh salient information and do not account for statistical properties.").

354. Jim Guszca & Timothy Murphy, *Cognitive Collaboration: What Data Science Can Learn from Psychology*, BEHAV. ECON. GUIDE 2017, http://www.behavioraleconomics.com/BEGuide2017.pdf [https://perma.cc/43HQ-M55A] ("[A]lgorithms don't suffer from bounded rationality, cognitive biases, or simple fatigue.").

quickly in order that market conditions have not rendered the analysis irrelevant.[355] Industrial organization already uses data to estimate demand and cross-price effects. These advances allow economists to simulate mergers, factor in simple market reactions, and test the accuracy of their predictions.[356] However, results currently vary wildly based on functional assumptions.[357] In theory, using more non-parametric techniques such as natural experiments can mitigate these variations.[358] In practice, without fully embracing predictive analytics, what can be done is of limited use.

A. The Science & Art of Predictive Analytics

Predictive analytics is a science because the likelihood of innovation being harmed or the likelihood of antitrust intervention being appropriate is measurable. Courts or agencies assessing possible antitrust intervention face a similar challenge to sports fans deciding whether to buy next year's season tickets. Fans prefer to go to games where their team wins, and will need both data from past seasons and current data about teams to make a good prediction.[359] Data from past seasons provide the training data used to generate the algorithm, current data help contextualize predictions made by the algorithm, and feedback data from its human users improve the AI's performance.

AI needs to be trained in the relationships between variables such as market power, price, output, and innovation.[360] The variables the AI needs will depend on the strength of each variable as a predictor and how

355. Boyer et al., *supra* note 57, at 30–31 ("[E]conomists must predict effects on competition and efficiencies based on an analysis that will normally require that they (i) define markets; (ii) assess the importance of barriers to entry; (iii) contemplate possible theories of harm; (iv) quantify the potential harm to competition, (v) quantify the potential efficiencies; (vi) combine harm and efficiencies into a net effect, allowing for various approaches to the trade-offs; and (vii) assess the potential impacts on the market of any proposed remedies, such as divestitures. And, given that many reviewable mergers will involve multiple product and geographic markets, all of these tasks may need to be undertaken many times, all with a clock ticking as the merging firms press for clearance to proceed with their transaction quickly.").

356. *Id.* at 30 ("Developments in empirical industrial organization—and better data—have allowed us to estimate systems of demand relationships and measure cross-price effects. This has opened up the possibility of simulating mergers to allow for simple reactions by other firms.").

357. *Id.* ("There is concern, for example, that different functional form assumptions can lead to very different predictions on post-merger prices.").

358. *Id.* ("Alternatives to merger simulations using more non-parametric techniques may be available—perhaps through the use of natural experiment opportunities.").

359. AGRAWAL ET AL., *supra* note 33, at 47 ("[C]ombination of input data and outcome measures to create the prediction machine, and then use input data from a new situation to predict the outcome of that situation.").

360. *Id.* at 74 ("That prediction is possible because training occurred about relationships between different types of data and which data is most closely associated with a situation.").

costly a mistaken prediction will be. For instance, if the relevant market is of little economic importance and mistakes are not a big deal, the AI needs only a few sources of data. If the allegedly anticompetitive conduct is a weak predictor of a violation, or if a false positive could jeopardize the nation's economic future, then many more data points are needed. The more AI can observe technology markets and its stakeholders, the better it will be at predicting the static and dynamic outcomes that result from their interactions.[361]

Like other scientific processes, predictive analytics can be honed by improving the process of collecting better data and revising variables upon which we make predictions.[362] Ex-post analysis goes some way to determining whether antitrust intervention was appropriate.[363] The exercise helps improve the effectiveness of future intervention to the extent that past lessons are transferrable.[364] It also promotes transparency and accountability in the enforcement process provided that the results are made public.[365] In practice, the complexity of ex-post evaluations, scarcity of data, and the resources needed, make these cases rare.[366]

For instance, predictive analytics can provide information on churn in relation to an allegedly anticompetitive licensing strategy. Licensees can be difficult to acquire and losing them through churn can be costly. Business consultants traditionally use multivariate regression to predict churn.[367] The problem is that this method relies on theoretical robustness

361. *Id.* at 18 ("Prediction facilitates decisions by reducing uncertainty, while judgment assigns value. In economists' parlance, judgment is the skill used to determine a payoff, utility, reward, or profit. The most significant implication of prediction machines is that they increase the value of judgment.").

362. TETLOCK & GARDNER, *supra* note 32, at 18 ("It is the product of particular ways of thinking, of gathering information, of updating beliefs.").

363. Juan Delgado & Hector Otero, *Why Ex-Post Evaluation Is So Important (And So Little Used) In Antitrust*, CPI ANTITRUST CHRON. (Apr. 17, 2016), https://www.competitionpolicyinternational.com/why-ex-post-evaluation-is-so-important-and-so-little-used-in-antitrust/ [https://perma.cc/F35M-6US4] ("Such quantification should not only consider direct effects on consumer welfare but also the potential deterrence effect on future anticompetitive conducts.").

364. *Id.* ("The ex-post evaluation of impact provides essential feedback for improving future antitrust and merger decisions.").

365. *Id.* ("It does not only help improve antitrust decisions but also internal organization decisions regarding prioritization and resource allocation. . . . Ex-post analysis is useful to audit their activities and also to increase the public awareness about the benefits from competition.").

366. *Id.* ("Even though there are powerful reasons to develop ex-post evaluation schemes, the evidence shows their use is fairly rare. . . . There are structural obstacles limiting the implementation of ex-post analysis schemes, related mostly to the complexity of the analysis and the amount of resources and data needed."); *id.* ("A related structural obstacle is the availability of public statistics and industry data.").

367. AGRAWAL ET AL., *supra* note 33, at 32 ("Historically, the core method for predicting churn

and can lead to systematically wrong results in practice, and it is limited in the number of combinations and interactions.[368] In contrast, machine learning allows bias in exchange for reducing variance by proving it works better in practice.[369] It also gives programmers the ability to fine-tune their algorithm with big data and combine variables in unexpected ways.[370]

A challenge in data gathering is that antitrust cases are rare compared to cases in other areas such as contract, tort, or criminal disputes.[371] That is a good thing, but courts and agencies also are reduced to making speculative predictions about innovation.[372] While cases cannot be replicated to provide the data points needed to know whose narrative of dynamic efficiency is empirically true, AI offers the possibility of doing realistic simulations to provide glimpses of "but for" worlds that can help illuminate determinations whether and how to intervene.[373]

One way to generate more data points is to look at more granular

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was a statistical technique called 'regression.'"); *id.* at 33 ("It finds a prediction based on the average of what has occurred in the past. For instance, if all you have to go on to determine whether it is going to rain tomorrow is what happened each day last week, your best guess might be an average. If it rained on two of the last seven days, you might predict that the probability of rain tomorrow is around two in seven, or 29 percent.").

368. *Id.* at 34 ("Regression can keep missing several feet to the left or several feet to the right. Even if it averages out to the correct answer, regression can mean never actually hitting the target."); *id.* at 36 ("Because they are hard to foresee, modelers do not include them when predicting with standard regression techniques. Machine learning gives the choices of which combinations and interactions might matter to the machine and not the programmer.").

369. *Id.* at 35.

370. *Id.* at 40–41 ("Traditional statistical methods require the articulation of hypotheses or at least of human intuition for model specification. Machine learning has less need to specify in advance what goes into the model and can accommodate the equivalent of much more complex models with many more interactions between variables. Recent advances in machine learning are often referred to as advances in artificial intelligence because: (1) systems predicated on this technique"); *id.* at 36 ("Now, machine learning methods, and especially deep learning methods, allow flexibility in the model and this means variables can combine with each other in unexpected ways.").

371. *Id.* at 59 ("[W]e know our predictions will be relatively poor in situations where we do not have much data."); *id.* at 60 ("While computer scientists are working to reduce machines' data needs, developing techniques such as "one-shot learning" in which machines learn to predict an object well after seeing it just once, current prediction machines are not yet adequate.").

372. Delgado & Otero, *supra* note 363 ("There is little information on whether the application of competition law is too harsh or too lenient. Even if the literature has made an extensive analysis of the problems with under-application and over-application of competition policy, it is not clear how far we are from an optimal scenario. In addition, it is not clear whether competition policy is having sufficient deterrent effects.").

373. *Id.* ("To do so, one has to determine what would have happened in the absence of intervention by a Competition Authority, and then measure the degree to which the intervention by the antitrust agency has contributed to enhance consumer welfare in comparison with the counterfactual scenario.").

variables. For instance, presidential elections are rare, but focusing on state-level elections gives fifty results per election.[374] As with all policy tools, the results of predictive analytics should be tested whenever possible using randomized control trials, the gold standard of scientific research.[375] Agencies should have similar teams conducting tests of new ideas. The rate of that process depends on both observations and the rate at which stakeholders can find new things to test.[376]

At the same time, predictive analytics is an art because the results require judgment and context to be meaningful and effective. Like other forms of art, it works best with an open-mind, curiosity, focus, and a self-critical attitude.[377] How good we can get at it depends on what we are trying to predict, how far into the future, and under what circumstances.[378] Predictions about tomorrow's weather are reasonably reliable. Each added day farther out in time makes the forecast significantly less so.[379] If an event has never happened before, human judgment is needed to provide an analogical bridge. In his book *The Black Swan*, Nassim Nicholas Taleb reminds us that old data is insufficient to enable users to predict new events.[380] Technological innovations, such as the transition from buying CDs in record stores to digital music files over the Internet, dislocated the music industry. The human decision-maker can intervene when the AI has insufficient data to make a good prediction.[381]

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374. TETLOCK & GARDNER, *supra* note 32, at 62 ("We could focus on the state level in presidential elections, for example, which would give us fifty results per election, not one.").

375. THALER, *supra* note 246, at 338 ("In an RCT, people are assigned at random to receive different treatments (such as the wording of the letters in the tax study), including a control group that receives no treatment (in this case, the original wording).").

376. RICHARD P. FEYNMAN, THE MEANING OF IT ALL: THOUGHTS OF A CITIZEN-SCIENTIST 27 (2005) ("[R]ate of the development of science is not the rate at which you make observations alone but, much more important, the rate at which you create new things to test.").

377. TETLOCK & GARDNER, *supra* note 32, at 20 ("I'll describe this in detail, but broadly speaking, superforecasting demands thinking that is open-minded, careful, curious, and—above all—self-critical. It also demands focus.").

378. *Id.* at 13 ("How predictable something is depends on what we are trying to predict, how far into the future, and under what circumstances.").

379. *Id.* at 13 ("Weather forecasts are typically quite reliable, under most conditions, looking a few days ahead, but they become increasingly less accurate three, four, and five days out.").

380. *See generally* NASSIM NICHOLAS TALEB, THE BLACK SWAN (2007) (referring to the Europeans' discovery of a new type of swan in Australia); see also AGRAWAL ET AL., *supra* note 33, at 60 ("To eighteenth-century Europeans, swans were white. Upon arrival in Australia, they saw something totally new and unpredictable: black swans. They had never seen black swans and therefore had no information that could predict the existence of such a swan.").

381. AGRAWAL ET AL., *supra* note 33, at 69 ("[H]umans are often better than machines when understanding the data generation process confers a prediction advantage, especially in settings with thin data.").

Humans have a comparative advantage when it comes to predicting with little data. We recognize faces we see again only years later, and can recognize them from different angles though we may have only seen them once before.[382] Humans can make judgments based on little or no data because they can analyze by analogy and mental modes which even deep-learning-enabled AI cannot.[383] This underscores the need for predictive analytics to include a safety valve—a protocol where AI calls in human judgment when needed. In this, AI functions much like the human's assistant to provide recommendations rather than decisions.

B. Prediction & Judgment

David Ricardo espoused a theory of labor allocation based on comparative advantage.[384] With predictive analytics, AI reduces the cognitive bias in human judgment while humans mitigate the systemic weakness in an AI's ability to predict outcomes when there is little data or when it requires goal-setting and weighted values.[385] As seen in Part II, we are resistant to evidence that undercuts our own beliefs, which can be a serious issue in the malleable environment where legal policy or case law are decided, such as with antitrust law.[386] At the Interface, the AI can provide an initial prediction which stakeholders can use to factor into their own assessments. This is particularly useful in counterfactual analyses. It also can provide a retrospective analysis to validate or invalidate human judgment.

The superiority of AI-human outcomes was illustrated in 2016 by a Harvard/MIT team competing to produce algorithmic detections of metastatic breast cancer from biopsy slides.[387] The deep-learning AI correctly predicted 99.5 percent of the time when paired with a

382. *Id.* at 60 ("We can identify a fourth-grade classmate forty years later, despite numerous changes in appearance.").

383. *Id.* at 120 ("Humans use analogies and models to make decisions in such unusual situations."); *id.* ("Machines cannot predict judgment when a situation has not occurred many times in the past.").

384. *See generally* DAVID RICARDO, ON THE PRINCIPLES OF POLITICAL ECONOMY AND TAXATION (1817).

385. AGRAWAL ET AL., *supra* note 33, at 2 ("AI is a prediction technology, predictions are inputs to decision making, and economics provides a perfect framework for understanding the trade-offs underlying any decision.").

386. *See generally* ZIVA KUNDA, SOCIAL COGNITION: MAKING SENSE OF PEOPLE (1999) (discussing confirmation bias).

387. Dayong Wang et al., *Deep Learning for Identifying Metastatic Breast Cancer*, CAMELYON GRAND CHALLENGE (June 18, 2016), https://arxiv.org/pdf/1606.05718.pdf [https://perma.cc/LRJ2-6ETZ] (combining the predictions of their algorithm and a pathologist's; the result was an accuracy of 99.5 percent).

pathologist, reducing the human error rate from 3.4 percent to 0.5 percent, and translating into an error reduction of eighty-five percent.[388] Beyond improving accuracy, however, this illustration also shows the comparative strength of AI and human counterparts: pathologists were usually right when identifying the presence of cancer while the AI was better at identifying its absence.[389] Similarly, human-AI predictive analytics could dramatically reduce the concern for false positives at the Interface. How then should that judgment be employed?

The first step is to observe. For instance, in looking at a patentee refusing to license rivals or implementers, one question to ask first is where is the origin of the innovation? The patentee is one obvious source, but there may be others. Would deference to the patentee result in continued innovation? To answer that question, predictive analytics would not simply look at the patentee's current efforts. Rather, it would look at how often the patentee innovated in the past, say on a five-year model, to predict the future. However, rivals and implementers aggregating technology onto a single interoperable standard may contribute to innovation too. Each additional way in which a patentee could have made its rights commercially available, but did not, tilts the probability toward the conclusion that it may have acted to stifle innovation by others.

The second step is to consider who might be harmed. AI can recognize demand beyond existing products and services in a way that human analysis, focusing only on markets that fulfilled past demand, cannot. At the Interface, technologies from different industries could substitute previously supplied products just as phones and computers, considered two markets for so long, now often substitute each other. It is important to start from an outside estimate rather than an inside estimate to draw conclusions because of the tendency for the anchoring bias to set in and be fixated on an estimate that has little or no meaning.[390] In contrast, an external view will have a better contextual basis.[391] Equally important is to find evidence that cuts the other way in order to avoid confirmation bias. The judgment, once made, should be written down, which provides

388. *Id.*

389. AGRAWAL ET AL., *supra* note 33, at 65 (noting it was unusual to have a situation in which the human said there was cancer but was mistaken; "[i]n contrast, the AI was much more accurate when saying the cancer wasn't there").

390. Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCI. 1124, 1128 (1974) (influencing judgment merely by exposing them to even obviously meaningless numbers, like one randomly selected by the spin of a wheel).

391. TETLOCK & GARDNER, *supra* note 32, at 120 ("But if she starts with the outside view, her analysis will begin with an anchor that is meaningful. And a better anchor is a distinct advantage.").

distance from the conclusions and can be useful to avoid anchoring and status quo biases. The judgment should also be open to critique.[392] This allows others in the organization to spot flaws and offer their own perspectives.[393] Analyzing the issue in this way avoids the biases and lays out a road map for subsequent analysis.

The third step is to have defined terms, timelines, and to use numbers.[394] Numerous repeated simulations are also necessary to calibrate the predictions over time.[395] If the analysis shows a sixty-to-forty percent chance of the event occurring, and the event does not occur, those putting the figures forward risk being pilloried either way. The safe route would be to use elastic and vague terms such as "a fair chance" and "a serious possibility."[396] Without quantitative measures, however, the ability of the AI to measure, learn, and improve its predictions, the accuracy of prediction, will be stymied. A good forecast should also filter out "noise"—irrelevant information—while updating the forecast based on relevant information. The change is usually small—a few percentage points.[397]

Thus, if the hypothesis is that the patentee shuts its rival out, what would it take for that to be true? First, the patentee had, or could obtain, market power to do so. Second, the patentee wanted its rival out badly enough to take the risk of violating antitrust law. Each of these elements can be researched to get a sense of the likelihood of the components of the hypothesis being true. A prima facie case that persuades courts and agencies that the case is worth looking into means that the likelihood of

392. *Id.* at 126 ("People should take into consideration evidence that goes against their beliefs.").

393. Stefan Herzog & Ralph Hertwig, *The Wisdom of Many in One Mind*, 20 PSYCHOL. SCI. 231, 234 (2009) (finding that merely asking people to assume their initial judgment is wrong, to seriously consider why that might be, and then make another judgment, produces a second estimate which, when combined with the first, improves accuracy almost as much as getting a second estimate from another person).

394. TETLOCK & GARDNER, *supra* note 32, at 59 ("Forecasts must have clearly defined terms and timelines. They must use numbers.").

395. *Id.* ("And one more thing is essential: we must have lots of forecasts. We cannot rerun history so we cannot judge one probabilistic forecast—but everything changes when we have many probabilistic forecasts.").

396. *Id.* at 58 ("If the event happens, 'a fair chance' can retroactively be stretched to mean something considerably bigger than 50%—so the forecaster nailed it. If it doesn't happen, it can be shrunk to something much smaller than 50%—and again the forecaster nailed it. With perverse incentives like these, it's no wonder people prefer rubbery words over firm numbers.").

397. *Id.* at 168 ("And notice how small Tim's changes are. There are no dramatic swings of thirty or forty percentage points. The average update was tiny, only 3.5%. That was critical. A few small updates would have put Tim on a heading for underreaction. Many large updates could have tipped him toward overreaction. But with many small updates, Tim slipped safely between Scylla and Charybdis.").

a violation is considerably above zero, say 20 percent. It would not be 100 percent or else it would have been dealt with summarily, so it would be safe to say between 20–80 percent, which gives a midrange of 50 percent. Fifty percent then becomes the anchor.

The key idea is to train the AI and refine results by looking for the variables that would cause innovation to be affected, and what information would allow predictive analytics to make a useful forecast. For instance, if we need to calculate the number of rival innovators it would take to ease a competitive bottleneck, then that number of rival innovators would depend on how much room there is for licensing and the number of resources it takes to sustain a rival innovator. The question therefore depends on four facts: (1) the number of licenses; (2) how much demand there is for the licenses; (3) how long it takes for market entry; and (4) what the average innovator provides. By breaking down the question, we can better identify what we can know from what we cannot. This reduces the scope for "black box" guesswork and promises more accurate predictions than whatever pops out of the "black box" of judges' or enforcers' minds.

An element of predictive analytics is the confidence in which the analysis is made. If innovation is very likely to be dampened by antitrust liability for breach of FRAND obligations, the only way to settle it definitively would be to find the probability based on all possible counterfactuals. Even if we could attribute a figure, say 70 percent to it, we would not know whether that would be "very likely." When the CIA planned to topple the Castro regime in 1961, President Kennedy turned to the military for their prediction that the small army of Cuban expatriates at the Bay of Pigs would succeed in its mission. The answer came back—"fair chance"—which was intended to mean about thirty percent. However, President Kennedy was never told what it meant, and reasonably assumed it was much more positive.[398]

The lesson here is that predictive analytics should narrow the range of estimates and have designated numerical values.[399] For instance, "probable" would mean a 60–80 percent chance of happening and reducing the risk of confusion. Moreover, by requiring predictive analytics to translate terms like "fair chance" to numbers, it encourages

398. RICHARD E. NEUSTADT & ERNEST R. MAY, THINKING IN TIME 143 (1988).

399. *Sherman Kent and the Profession of Intelligence Analysis*, CENT. INTELLIGENCE AGENCY (Nov. 2002), https://www.cia.gov/library/kent-center-occasional-papers/vol1no5.htm. [https://perma.cc/NET3-2BHA] ("[A]nalysts should narrow the range of their estimates whenever they can. And to avoid confusion, the terms they use should have designated numerical meanings, which Kent set out in a chart.")

those involved in the process to think more carefully about how they arrived at the numerical range, reducing cognitive bias by metacognition.[400] Over time and with practice, the AI-human team will get better at distinguishing finer shades of uncertainty.

Predictive analytics can deal with epistemic uncertainties, which are in theory knowable. It can predict the workings of legal doctrine by looking at how it has been applied over the years. Legal rules are after all, clocklike at least in how they are articulated. AI systems are already deployed to address simple tax, family, and contract questions. In 2018, twenty top corporate lawyers were pitted against an AI system developed by LawGeex, where they reviewed and approved contracts, including non-disclosure agreements, over two months. LawGeex's AI notched a ninety-four percent accuracy rate and completed a task within twenty-six seconds, compared to the human lawyers' eighty-five percent accuracy taking rate over ninety minutes.[401] Courts use AI to assess the risk of recidivism in criminal cases, a development which raises concerns over bias that are also relevant to its use in IP law and antitrust law, both individually, as well as at the Interface which this Article discusses in Part III.C.1.

Unpacking the question into components allows us to distinguish between what is known and what is not. It lays out the rules and assumptions. The problem should then be viewed using an "outside view"—a "comparative perspective that downplays its uniqueness and treats it as a special case of a wider class of phenomena."[402] By breaking a decision down into elements, stakeholders can more effectively outsource predictive analytics to AI where the value of human input is small.

As AI becomes more commonly used in predictions, the value judgments that stakeholders make will be more valuable. For instance, only an appointed judge, agency official, or company can decide which innovation outcomes are most critical. Rival search engines produce similarly good results for common search terms.[403] Should we focus on

400. TETLOCK & GARDNER, *supra* note 32, at 57 ("And they have another benefit: vague thoughts are easily expressed with vague language but when forecasters are forced to translate terms like 'serious possibility' into numbers, they have to think carefully about how they are thinking, a process known as metacognition.").

401. Kyree Leary, *The Verdict Is In: AI Outperforms Human Lawyers in Reviewing Legal Documents*, FUTURISM (Feb. 27, 2018), https://futurism.com/ai-contracts-lawyers-lawgeex [https://perma.cc/F2GZ-7UHU].

402. TETLOCK & GARDNER, *supra* note 32, at 153.

403. AGRAWAL ET AL., *supra* note 33, at 50 ("For example, most search engines provide similar results to common searches. Whether you use Google or Bing, the results from a search for 'Justin

process innovation that presents that information in unusually helpful ways? [404] Or would more incremental innovation coupled with the promise of greater dissemination among competing implementers be the way forward? The ubiquity of AI in predictive analytics will also present stakeholders with a more vivid picture of the alternatives and more opportunities to make decisions about them.

Any system is only as good as its weakest link, and predictive analytics is no exception. The synergistic possibilities that humans and algorithms offer depend on their interplay. The AI must be constantly tweaked to remain one step ahead of other networks that may be used to outwit it. Judgment requires time, effort and experimentation.[405] And each slice of human ingenuity comes spiked with a dose of cognitive bias. For this reason, it becomes imperative to understand, mitigate, and where appropriate, harness those biases.

C. Limitations & Recommendations

1. Data Points

The first limitation is the data. To improve predictive accuracy, stakeholders will have to devote resources to collecting data and training the AI at the expense of short-term considerations such as operational performance. It will also mean encouraging more data transparency. The value of each data point decreases as the number of data points increase, making biases less likely. The twentieth set of licensing terms of the relevant technology in a FRAND dispute will skew the average much less than the third and help improve the prediction.

Aggregating the FRAND licenses in different contexts is effective because the collective pool of information becomes much bigger. Collectively, these licenses offer stakeholders many data points. Like dragonflies, which have a vision so superb that they can see in almost every direction simultaneously, an AI system fed with a wealth of FRAND license terms can synthesize them with clarity and precision.

In this regard, Professor Jorge Contreras suggests establishing a non-

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Bieber' are similar.").

404. *Id.* ("Most people use Google for both rare and common searches. Being even a little better in search can lead to a big difference in market share and revenue.").

405. *Id.* at 94 ("Figuring out the relative payoffs for different actions in different situations takes time, effort, and experimentation."); *id.* ("Under conditions of uncertainty, we need to determine the payoff for acting on wrong decisions, not just right ones."); *id.* ("Often, however, there are too many action-situation combinations, such that it is too costly to code up in advance all the payoffs associated with each combination, especially the very rare ones. In these cases, it is more efficient for a human to apply judgment after the prediction machine predicts.").

governmental, global FRAND rate-setting tribunal to determine "FRAND royalty rates in a transparent, consistent and comprehensive manner."[406] The Searle Center Database at Northwestern University consists of quantifiable characteristics of nearly 800,000 documents related to standards, including a database of over 3.8 million references between standard documents. The Searle Database also includes and describes rules of thirty-six SSOs on SEPs, openness, participation, and standard adoption procedures.[407] It provides a rich repository of prevailing license rates upon which courts can adjudicate notions of "fairness."

Sample bias could creep into training data when the data fails to accurately represent the technological or business environment. In this case, the algorithm would be trained on data that persistently represent the variables in an inaccurate manner. Since an algorithm cannot be trained on the entire universe of data it might interact with, this is a systemic issue.[408] At the same time, choosing a subset of that universe large and representative enough can mitigate sample bias.[409]

In this regard, a ProPublica investigation about judges who use AI-generated recidivism scores to determine the likelihood of individuals reoffending is instructive. Used since 2000, a low scorer benefits from a shorter sentence.[410] Since the score seems objective, it can be pivotal to the judge's determination. However, the investigation revealed that it

406. Contreras, *Global Rate-Setting*, supra note 204 (manuscript at 8).

407. Justus Baron & Daniel F. Spulber, *Technology Standards and Standard Setting Organizations: Introduction to the Searle Center Database*, 27 J. ECON. & MGMT. STRATEGY 462, 463 (2018) ("The Database identifies institutional membership for a sample of 191 standards organizations including SSOs and other organizations directly involved in the development of technology standards. Using the Internet Archives, we track both institutional member-ship and SSO rules and procedures over time since the inception of the Archives in 1996. We identify 69,572 organizations (including companies, universities and public authorities) participating in at least one standards organization.").

408. Sara Chodosh, *Courts Use Algorithms to Help Determine Sentencing, but Random People Get the Same Results*, POPULAR SCI. (Jan. 18, 2018), https://www.popsci.com/recidivism-algorithm-random-bias [https://perma.cc/N34R-DL5K] ("It seems reasonable to assume that turning our decisions over to a data-crunching computer would save us from potential human biases against people of color, but that's not the case. The algorithms are just doubling down on the same systemic mistakes we've been making for years, but churning out results with the misleading veneer of impartiality.").

409. Glen Ford, *4 Human-Caused Biases We Need to Fix for Machine Learning*, THE NEXT WEB (Oct. 27, 2018), https://thenextweb.com/contributors/2018/10/27/4-human-caused-biases-machine-learning/ [https://perma.cc/H28Y-C2EU]; *id.* ("This science is well understood by social scientists, but not all data scientists are trained in sampling techniques."); *id.* ("This kind of bias can't be avoided simply by collecting more data.").

410. Chodosh, *supra* note 408 ("Algorithms sold to courts across the United States have been crunching those numbers since 2000.").

wrongly predicted black defendants who didn't go on to reoffend as "high risk" while mistakenly assigning a higher number of "low risk" labels to white convicts who did. Investigators found that the AI used 137 features to make its prediction.[411] When pared down to two: age and number of prior convictions, accuracy was about the same, revealing that those are the two biggest factors determining recidivism.[412] For a given white or black person who committed the same crime, the black person was more likely to get arrested, convicted, and incarcerated. Over time and on a national scale, blacks were more likely to have criminal records which were "most likely what caused the false positive and false negative error rate."[413]

The risk here too is that the AI provides wrong answers with confidence that they are correct. Consider that low prices may be associated with low sales, such as with hotel prices during the off-peak season. A simple and erroneous correlation may lead to the conclusion that raising prices will raise sales. A human can guide the AI to identify the right data metrics, such as considering seasonality and other market factors to better model pricing and predict sales. The same can be said about determining fair FRAND rates and judging the justifiability of injunctions on SEPs. The takeaway here is that the AI data needs to be transparent and stakeholders need to be aware of the limitations and biases that abound. If the data contains biases, the algorithms trained on them would reflect these biases.

Predictive analytics must also address the wrong side of certainty. If the system predicts a 60 percent chance of implementers and consumers being harmed and it does not happen, was it wrong? Not necessarily, since the analysis also indicates a 40 percent chance it will not happen, so it might have been right. One prediction does not provide enough data to judge the accuracy of the prediction.[414]

Sometimes, all stakeholders can do is to wait for the prediction to manifest and use it as feedback. Then, the outcome provides a data point that becomes feedback to improve the next prediction. Similarly, even the human-AI form of predictive analytics cannot deal with aleatory uncertainty. These predictions are too far out and infused with too many uncertainties, such as whether it will rain in Chicago a year from now. Likewise, innovation trajectories and counterfactuals will likely only be

411. *Id.*
412. *Id.*
413. *Id.*
414. TETLOCK & GARDNER, *supra* note 32, at 57 ("It's not possible to judge with only that one forecast in hand. The only way to know for sure would be to rerun the day hundreds of times.").

robust within a period spanning months rather than years. Not quite a moonshot, but much better than blind speculation.

2. The Algorithm

The second limitation is the algorithm itself. Algorithms are inherently limited by the linearity of their equations and data.[415] The multiplicity and chaos of real-world innovation limits the ability of predictive analytics to model the evolution of present decisions and their impact on future innovation outcomes.[416] However, this may soon change for the better. Scientists have recently harnessed machine learning to predict the evolution of chaotic systems out into stunningly distant time horizons by relying on data rather than equations.[417] The algorithm, called reservoir computing, learns the dynamics of an archetypal chaotic system and predicts eight times further into the future than previous methods.[418] Just as reservoir computing could significantly enhance weather predictions and monitoring cardiac arrhythmias, it can enable stakeholders to better predict the outcome of intervention.[419]

As discussed in Part II, there need to be sandboxes and safe harbors to develop the law. Error tolerance depends on the consequences of the error, the likelihood it will occur, and the benefits of the decision. It will also mean being willing to give users a relatively untrained AI to start

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415. Jason Brownlee, *Gentle Introduction to the Bias-Variance Trade-Off In Machine Learning,* MACHINE LEARNING MASTERY (Mar. 18, 2016), https://machinelearningmastery.com/gentle-introduction-to-the-bias-variance-trade-off-in-machine-learning/ [https://perma.cc/2FMG-VW29].

416. Natalie Wolchover, *Machine Learning's "Amazing" Ability to Predict Chaos*, QUANTA MAG. (Apr. 18, 2018), https://www.quantamagazine.org/machine-learnings-amazing-ability-to-predict-chaos-20180418 [https://perma.cc/MZ3H-PCYA] ("[I]t typically sets the horizon of predictability. . . . [I]n many cases, the equations describing a chaotic system aren't known, crippling dynamicists' efforts to model and predict them.").

417. *Id.* ("In a series of results reported in the journals *Physical Review Letters* and *Chaos*, scientists have used machine learning—the same computational technique behind recent successes in artificial intelligence—to predict the future evolution of chaotic systems out to stunningly distant horizons.").

418. *Id.* (explaining reservoir computing as a three-step procedure). Assuming the question is predicting how fire might spread, (1) feeding data-streams in to randomly chosen artificial neurons, which triggers connected neurons in turn and sending a cascade of signals throughout the network; (2) monitor, weight, and combine signal strengths of randomly chosen neurons to consistently match the next set of inputs; (3) the reservoir, having learned the system's dynamics, can reveal how it will evolve by essentially asking itself what will happen next. *See also id*. (noting that the Kuramoto-Sivashinsky equation "describes drift waves in plasmas and other phenomena, and serves as 'a test bed for studying turbulence and spatiotemporal chaos'").

419. *Id.* ("Besides weather forecasting, experts say the machine-learning technique could help with monitoring cardiac arrhythmias for signs of impending heart attacks and monitoring neuronal firing patterns in the brain for signs of neuron spikes.").

collecting data. One way to reduce real-world risk is to use a simulated environment. Pilots use simulators for their training. This was also how Google trained DeepMind's AlphaGo AI to "to defeat the best Go players in the world not just by looking at thousands of games played between humans but also by playing against another version of itself" through adversarial machine learning.[420]

3. Biases

Third, human biases can only be mitigated, never eliminated. Human biases can creep into judgments, creating contradictory inconsistencies when done without a formula.[421] Princeton economist Professor Orley Ashenfelter devised a means of predicting the future value of Bordeaux wine based on information available in the year that the wine was made.[422] Like antitrust intervention, wine takes time to produce results, and like technology that is heterogeneous, the price of the same wine product may vary dramatically across different vintages. Ashenfelter's formula provided more accurate forecasts than experts.[423]

This may have been because, according to Professor Daniel Kahneman, the experts "try to be clever, think outside the box, and consider complex combinations of features in making their predictions."[424] He notes that "[c]omplexity may work in the odd case, but more often than not it reduces validity. Simple combinations of

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420. DeepMind's AlphaGo AI is trained by:

> pit[ting] the main AI and its objective against another AI that tries to foil that objective. For example, Google researchers had one AI send messages to another using an encryption process. The two AIs shared a key to encoding and decoding the message. A third AI (the adversary) had the messages but not the key and tried to decode them. With many simulations, the adversary trained the main AI to communicate in ways that are hard to decode without the key.] Such simulated learning approaches cannot take place on the ground; they require something akin to a laboratory approach that produces a new machine learning algorithm that is then copied and pushed out to users. The advantage is that the machine is not trained in the wild, so the risk to the user experience, or even to the users themselves, is mitigated. The disadvantage is that simulations may not provide sufficiently rich feedback, reducing, but not eliminating, the need to release the AI early. Eventually, you have to let the AI loose in the real world.

AGRAWAL ET AL., *supra* note 33, at 187–88.

421. *See* KAHNEMAN, *supra* note 247, at 225 (observing that experienced radiologists contradicted themselves one in five times when evaluating X-rays; auditors, pathologists, psychologists, and managers exhibited similar inconsistencies, and concluding that if there is a way of predicting using a formula instead of a human, the formula should be considered seriously).

422. *Id.* at 223.

423. *Id.* at 224.

424. *Id.*

features are better."[425] Another reason is that "humans are incorrigibly inconsistent in making summary judgments of complex information. When asked to evaluate the same information twice, they frequently give different answers."[426] Kahneman noted that "[t]he surprising success of equal-weighting schemes has an important practical implication: it is possible to develop useful algorithms without any prior statistical research. Simple equally weighted formulas based on existing statistics or on common sense are often very good predictors of significant outcomes."[427]

Further, decision-makers may engage in attribute substitution, which functions as a bait and switch. When asked for the correct judgment to a complex antitrust question, the decision-maker may unconsciously replace it with a simpler one: "what do I think of patent rights?" The easier question becomes the proxy for the original harder question, and the answer for one will become the answer for the other.[428] Similarly, hindsight bias replaces an assessment of the decision with an assessment of the outcome. The saying "All's well that ends well" does not validate a judgment call itself, since the outcome may have taken place in spite of, rather than because of, that judgment call. Any validation from the experience may be false and misleading.

A study of bail decisions by judges in New York revealed the foibles of human bias and the benefits of AI data analysis.[429] That decision depends on the risk that the accused may flee or commit other crimes while out on bail. The AI, trained using 750,000 records spanning five years, predicted that sixty-two percent of the one percent of riskiest accused persons would commit crimes while out on bail. [430] Despite this, judges granted bail to almost half of them based on irrelevant factors like their appearance and demeanor in court, while discounting relevant factors like length of unemployment in a way that biased their prediction. [431] Eventually, sixty-three percent of those offenders

425. *Id.* at 224–25.

426. *Id.* at 225–26.

427. *Id.* at 226.

428. TETLOCK & GARDNER, *supra* note 32, at 40 ("That question becomes a proxy for the original question and if the answer is yes to the second question, the answer to the first also becomes yes.").

429. AGRAWAL ET AL., *supra* note 33.

430. *Id.* ("The information included prior rap sheets, the crimes people were accused of, and demographic information.").

431. *Id.* ("One possibility is that judges use information unavailable to the algorithm, such as the defendant's appearance and demeanor in court. That information might be useful—or it might be deceiving. Given the high crime rate of those released, it's not unreasonable to conclude that it is more likely the latter; the judges' predictions are fairly horrible.").

committed crimes while out on bail. Had the AI made the call, those crimes might have been averted.[432]

Stakeholders involved in predictive analytics need to be told what they are expected to do when making judgment calls, and they must be held accountable to those standards. Further, the process should consider contrary evidence and alternative hypotheses.[433] Even with an AI-human combination some bias, whether in the data or in the decision makers themselves, may be inevitable. The key is to minimize those biases by expressly accounting for them. Adjustments may need to be made to the level of confidence in the prediction. A bar set at "beyond a reasonable doubt," might flip a decision to intervene if the decision were downgraded from seventy percent to sixty percent because of bias.

CONCLUSION

The premise of this Article is that we should not continue to build doctrine at the IP-antitrust interface on theoretical neoclassical assumptions alone, but also on the reality of markets using all that AI has to offer us. Behavioral economics and AI do not replace traditional antitrust analysis. Rather they are complements and imbue antitrust law with continuing durability.

Predicting competitive effects is difficult and we need tools to predict outcomes as precisely and reliably as possible. Until now, antitrust law has only been able to operate before a veil of assumptions and rhetoric. Stakeholders have only been able to think about whether and how to intervene in the exercise of IP rights, particularly patent rights, in the broadest terms since even the smallest perturbations in a complicated set of variables can set off ripples that lead to dramatically divergent outcomes. Facts have always mattered in antitrust law, and a more expansive toolkit can only increase our likelihood of getting it right.

Behavioral economics sheds light on anticompetitive conduct that neoclassical antitrust may regard as irrational and therefore improbable. Once we recognize that it is rational and probable, we need to quantify and value the effects of the conduct. To do this, we need to employ more of the analogical reasoning intrinsic in antitrust law. For that, predictive analytics is very good at helping stakeholders with pattern recognition and simulation runs. This brings us closer to being able to ascribe value,

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432. TETLOCK & GARDNER, *supra* note 32, at 23 ("So what I want is that human expert paired with a computer to overcome the human cognitive limitations and biases.").

433. *Id.* at 87 ("To have accountability for process but not accuracy is like ensuring that physicians wash their hands, examine the patient, and consider all the symptoms, but never checking to see whether the treatment works.").

to which human judgment can be brought to bear. In these value judgments, AI provides stakeholders with augmented capabilities to confront the computational challenges these tasks require.

As much ground as this Article has covered, more work remains to be done.[434] Predictive analytics can provide useful range estimates to uncertain behavioral responses in IP markets. At the same time, the output is only as good as the input. Where would the data come from? Much of the data, particularly in the FRAND space, remains tightly under wraps. But as the Searle Center database shows, meaningful progress can continue to be made. How one inputs valuation measures and probability estimates also matters. And further research is needed to illuminate how predictive analytics takes valuation uncertainties into account. These should indicate how the data can be distilled into "markers" that can help identify dynamically inefficient outcomes, prognosticate how the arc of innovation might have been affected, and formulate smarter remedies to address them.

Challenging questions also remain as to how those employing predictive analytics can code for hindsight biases as well as other heuristics and biases—should they be ignored, included, or discounted (and at what rate) for predicting and selecting outcomes? If information asymmetries result in SEP licensing rates that are "irrational" because implementers lack information, what does this inform us about antitrust law decisions?

Behavioral economics makes it easier for stakeholders to identify how they decide so they can make more informed decisions. AI-enabled data is a key component for stakeholders to make decisions under uncertainty, but it should not be conflated with the decision itself, which involves judgment and execution. AI and humans should work in tandem, as each is good at different aspects of the decision-making process, to build a more accurate model of the complicated world where IP resides. The maturation of behavioral economics and AI will provide us with the tools to fill gaps in our knowledge. In the meantime, the insights should continue to be relevant as behavioral economics and AI mature, and as predictive analytics become more accurate and capable of dealing with new, emerging scenarios at the IP-antitrust interface.

434. I am grateful to Josh Sarnoff for these insights.

POSTSCRIPT

On May 21, 2019 Judge Koh handed down her judgment against Qualcomm.[435] She found Qualcomm had market power in the modem chip market.[436] Losing Qualcomm's chip supply would have devastated handset makers, forcing them to sign on to Qualcomm's terms so that "[c]ollectively, the harms caused by Qualcomm's anticompetitive practices take repeated aim at the elements necessary for a rival modem chip supplier to compete in the market" and "create insurmountable barriers for rivals."[437] Specifically, Qualcomm's market power in turn enabled it to harm competition in three ways.

First, Qualcomm required that its OEM customers separately license technology rather than exhausting patent rights on that technology through the sale of the chips themselves.[438] Qualcomm's "carrot and stick" strategy against OEMs allowed it to both secure higher royalty rates than comparable chips and provide conditional rebates on chip sales that created near-exclusive supply arrangements.[439]

Second, Qualcomm breached its duty to deal with its rivals. It unilaterally terminated a voluntary and profitable course of dealing and refused to deal even though it was being compensated at retail price and refuses to provide rivals with a product that is other customers could buy in a retail market.[440] Despite Qualcomm having the same understanding of its FRAND commitments as its rival chip makers, it willfully reneged on those obligations and breached its antitrust duty to license SEPs to rivals in accordance with Supreme Court precedent.[441] Emails, handwritten notes, recorded statements to tax authorities and internal company presentations showed "Qualcomm knew its licensing practices could lead to antitrust liability, knew its licensing practices violate FRAND, and knew its licensing practices harm competition, yet continued anyway—even in the face of government investigations in Japan, Korea, Taiwan, China, the European Union, and the United

435. Fed. Trade Comm'n v. Qualcomm Inc., No. 17-CV-00220-LHK, slip op. at *233 (N.D. Cal. May 21, 2019).

436. *Id.* at 21–42. The court found two relevant chip markets, including CDMA and "premium" LTE modem chips, which are generally used to enable cellular communications in handheld devices. *Id.* at 37–68; *aee also id.* at 102 ("We are the only supplier today that can give them a global launch. . . . [W]ithout us they would lose big parts of North America, Japan and China. That would really hurt them.").

437. *Id.* at 193.

438. *Id.* at 113.

439. *Id.* at 114.

440. *Id.* at 134–42.

441. *Id.* at 141.

States."[442] Further, despite earning profits from collecting royalty fees, Qualcomm ultimately chose to stop this practice. In doing so, Qualcomm exhibited "anticompetitive malice" in terminating a profitable course of dealing with its rivals, and in doing so shut off an existing retail market for licensing from competition.[443]

Significantly, Judge Koh noted that "Qualcomm stopped licensing rival modem chip suppliers not because Qualcomm's view of FRAND changed, but rather because Qualcomm determined that it was far more lucrative to license only OEMs."[444] Refusing to extend licenses delayed or prevented to rival chip makers from introducing alternatives in the marketplace, which "promoted rivals' exit, and delayed rivals' entry," "limited OEMs' chip supply options, which has enabled Qualcomm's anticompetitive conduct toward OEMs, sustained Qualcomm's unreasonably high royalty rates, and required OEMs to spend more money on royalty payments to Qualcomm rather than on new technology and product development for consumers."[445]

Third, Qualcomm's exclusive deals with Apple shrunk rivals' sales and foreclosed rivals from dealing with Apple to maintain its modem chip monopoly.[446] Apple and Qualcomm agreed that Apple would receive conditional incentive payments for Qualcomm chips it used in iPhones and iPads. Qualcomm incentivized handset markers to buy chips through "chip incentive funds" that reduced the price of Qualcomm's chips. [447] This exclusive deal substantially foreclosed Qualcomm's rivals from Apple's business and other network effects in doing business with Apple.[448] Those deals also allowed Apple to charge royalty rates set by its chip market share rather than the value of its patents, which had declined in proportion to the value of new features found in new generations of handsets. [449] Judge Koh also found that Qualcomm's pegging of its royalty to the handset rather than its chip was inconsistent

442. *Id.* at 208.

443. *Id.* at 139–40. (highlighting a Qualcomm presentation that urged employees to "make sure [a competitor] can only go after [certain] customers" to accomplish the goal of "reduc[ing the] number of [competitor's] 3G customers."). The court found that these statements and others demonstrated that Qualcomm's conduct was "characterized by a 'willingness to sacrifice short-term benefits'—like profitable licenses from modem chip rivals—'in order to obtain higher profits in the long run from the exclusion of competition.'" *Id.*

444. *Id.* at 128.

445. *Id.* at 124.

446. *Id.* at 142–58.

447. *Id.* at 185–90.

448. *Id.* at 146–47.

449. *Id.* at 167–72.

with Federal Circuit law on royalty apportionment.[450]

Judge Koh concluded that "[b]y attacking all facets of rivals' businesses and preventing competition on the merits, these practices '"harm the competitive process and thereby harm consumers.'"[451] The Justice Department filed a Statement of Interest to provide input on appropriate remedies should Judge Koh find an antitrust violation.[452] She declined on the basis of the "considerable testimony, evidence and argument" presented at trial and the lack of "acute factual disagreements."[453] Qualcomm has appealed to the Ninth Circuit but the district court has denied its motion with to stay the order pending appeal.[454] The Ninth Circuit granted Qualcomm's request for a partial stay, pending appeal, of an injunction from the district court, and ordered oral argument to be set in January 2020.[455]

450. *Id.* at 172–73 (citing Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc., 904 F.3d 965 (Fed. Cir. 2018) and LaserDynamics, Inc. v. Quanta Computer, Inc., 694 F.3d 51 (Fed Cir. 2012)).

451. *Id.* at 194.

452. *Id.* at 226.

453. *Id.* at 227.

454. Stephen Nellis, *U.S. Judge Blocks Qualcomm Effort to Put Antitrust Ruling on Hold*, REUTERS, (Jul. 3, 2019) https://www.reuters.com/article/us-qualcomm-antitrust/u-s-judge-blocks-qualcomm-effort-to-put-antitrust-ruling-on-hold-idUSKCN1TY2P6 [https://perma.cc/74GM-B5EW].

455. Fed. Trade Comm'n v. Qualcomm Inc., 935 F.3d 752 (9th Cir. 2019).