SAVE OUR SANDBOX: A PROSPECTIVE APPROACH TO BIG PLAYER PARTICIPATION IN THE UNLICENSED SPECTRUM SPACE

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INTRODUCTION

As large wireless companies become increasingly interested in playing in the unlicensed sandbox, how do we maintain room for the small players, and the next generation? In other words, how do we preserve the low capital costs, low barriers to entry, and, ultimately, just space for a diverse group of innovators as commercial competition for a limited resource increases?

The Federal Communications Commission ("the Commission") has important public interest reasons for allocating unlicensed spectrum bands. Growing participation in the unlicensed bands by large licensed band incumbents will likely present challenges to the Commission's unlicensed public interest goals. To avoid reactionary regulation in the unlicensed space, the Commission should take a proactive approach to maintain the unlicensed bands as a space for fast, free innovation.

This note examines the extent to which increased participation in the unlicensed spectrum bands, particularly by large and licensed incumbent players, may hamper the kinds of innovation that unlicensed allocation purports to serve. This introduction proceeds by providing a primer on spectrum governance and on the public interest value of unlicensed spectrum. Part I considers the potential problem that big players' increasing participation presents for public interest in the unlicensed space. Part II looks to recent conflict between big players as evidence of how their increasing participation could impact small players. Part III focuses on the implications for small players, examining 1) the potential for asymmetrical bargaining in unlicensed interference dispute resolution; 2) the viability of anticompetitive exclusion; and 3) the impact of exclusion on unlicensed public policy goals. Part IV assesses four potential solutions to this problem, ultimately concluding that no individual solution offers a complete answer. Part V explains why the Commission should take proactive steps to promote the public interest in the changing unlicensed landscape. Finally, this Note concludes that the Commission should issue a notice of inquiry so it can engage in continued surveillance and further research.

A. Spectrum: A Primer

Since the Radio Act of 1912,[1] the United States government has played an increasingly important role in managing use of the electromagnetic spectrum.[2] Still in flux, use of today's commercial

1. Radio Act of 1912, 37 Stat. 302, ch. 287 (1912) (An Act to Regulate Radio Communication).

2. JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: TELECOMMUNICATIONS LAW AND POLICY IN THE INTERNET AGE 89 (MIT Press, 2nd ed.

spectrum is allocated under a mixed regime of licensed and unlicensed bands.[3] Over the years, the Commission has tried several approaches to distribute licenses in the licensed bands.[4] Rights to use licensed bands, popular historically among providers of services like broadcast television and more modernly prized by wireless services providers, are auctioned by the Commission, giving purchasers the right to operate in and exclude others from operating in those bands.[5] By contrast, use of the unlicensed bands is regulated under a commons model,[6] managed by the Commission's Part 15 Rules that limit users' transmission levels and mandate acceptance of interference.[7] Even with imperfections in federal allocation, when viewing spectrum as a publically owned natural resource, this mixed regime of unlicensed and licensed spectrum arguably leads to the most efficient and productive use of the resource.[8]

A major source of revenue for the federal treasury, licensed spectrum offers benefits similar to real property zoning.[9] By allocating specific bands and combinations of bands to specific uses, the Commission can optimize the use of bands with diverse propagation properties, maximize public safety, and encourage private investment through resource dependability and rights to exclude.[10]

Conversely, unlicensed spectrum mandates accepted interference and limited transmission levels in exchange for free use of those bands.[11] Traditionally a playground for amateur radio operators, commercial gadget manufacturers and the like, the unlicensed bands are meant to serve fast and free innovation, thereby increasing competition across commercial spectrum

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2013).

3. *Id.* at 88.

4. *Id.*

5. *Id.* at 94.

6. *See id.* at 88 (explaining a "commons model" as one where "the government would establish much of the spectrum as a public commons and rely on unlicensed users to avoid interference problems cooperatively").

7. *See* 47 C.F.R. § 15 (2016) (setting out "regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of part 15 devices." 47 C.F.R. § 15.1).

8. PAUL MILGROM, JONATHAN LEVIN & ASSAF EILAT, THE CASE FOR UNLICENSED SPECTRUM 13 (2011) ("For radio spectrum, history suggests a mixed innovation and investment story, with licensed spectrum having been valuable to encourage the necessary network infrastructure for wireless mobile handsets and unlicensed spectrum encouraging a long series of novel, valuable, and unanticipated uses."). *See also*, NEUCHTERLEIN & WEISER, *supra* note 2, at 87–89 ("Since the 1920's, the government has justified such regulation on the grounds that the 'airwaves,' like the Grand Canyon, are a 'public resource' belonging to the whole American polity, that this resource would quickly become exhausted by unregulated demand for it, and that unpoliced private use of this resource would lead to its despoliation through widespread interference.").

9. NEUCHTERLEIN & WEISER, *supra* note 2, at 90.

10. *Id.* at 90–91.

11. *Id.* at 90.

industries.[12] Most popularly known as the birthplace of Wi-Fi and Bluetooth technologies, the unlicensed bands today promise growing opportunities for innovations in drone technology, LTE-Unlicensed ("LTE-U"), Internet of Things ("IoT"), Super Wi-Fi, utility systems, and more.[13]

Though policymakers and stakeholders remain in perpetual disagreement over unlicensed spectrum allocation and management, the parties generally agree that the bands are a source of valuable, inherently unpredictable innovation.[14] Scholars credit the Commission's "management" (as opposed to "regulatory") system for enabling such innovation—by lowering the capital costs and barriers to entry of spectrum use, new entrants can develop competitive technologies that disrupt concentrated markets in the licensed bands.[15] However, as demand for unlicensed spectrum promises increased interference disputes between disparate parties, this hands-off regulatory approach provides little protection for small players. Differences in the technical properties of competing technologies and asymmetrical bargaining power among competing participants may present serious challenges to unlicensed public policy goals.

B. The Public Interest in Unlicensed Spectrum

The Commission promotes vital public interests by allocating unlicensed spectrum. In a 2015 statement to the Senate Committee on Commerce, Science, and Transportation, Commissioner Jessica Rosenworcel described the importance of unlicensed spectrum in wireless carriers' network management, its estimated $140 billion annual economic impact, and the key role it plays in fostering innovation.[16] By granting free access without the ability to exclude others, unlicensed spectrum allows diverse entities to experiment and build without the economies of scale and expensive infrastructure of established license holders—a phenomenon

12. *See* MOBILE FUTURE, THE IMPORTANCE OF PERMISSIONLESS INNOVATION IN UNLICENSED BANDS (2016), http://mobilefuture.org/wp-content/uploads/2016/02/Permissionless-Innovation.pdf [https://perma.cc/GB65-BHKD].

13. *See* Dana Floburg, *Why You Should Care — a Lot — About Unlicensed Spectrum*, FREE PRESS (July 10, 2015), http://www.freepress.net/blog/2015/07/10/why-you-should-care-lot-about-unlicensed-spectrum [https://perma.cc/7K9F-SZ4C]. *See also*, Jon Brodkin, *LTE over Wi-Fi Spectrum Sets Up Industry-Wide Fight over Interference*, ARS TECHNICA (Aug. 27, 2015 10:45 AM), http://arstechnica.com/?post_type=post&p=729969 [https://perma.cc/36A5-S4YZ] (explaining that LTE-U, originally developed by Qualcomm, is a technology allowing wireless carriers to supplement traditional licensed service with unlicensed bandwidth).

14. *See* MILGROM, LEVIN & EILAT, *supra* note 8, at 2.

15. *Id.* at 14.

16. *Oversight of the Federal Communications Commission: Hearing Before the S. Comm. on Commerce, Sci. & Transp.*, 114th Cong. 2 (2015) (statement of Jessica Rosenworcel, FCC Comm'r).

widely known as "permissionless innovation."[17]

It should be noted that policymakers and stakeholders alike disagree on how valuable unlicensed spectrum is in relation to licensed spectrum.[18] Commissioner Ajit Pai, for example, raised concerns that "impairing licensed spectrum can carry much higher costs" than the benefit of allocating more unlicensed spectrum, when the Commission decided to allow unlicensed use in certain television guard bands (thereby potentially impairing established broadcast bands).[19] Commissioner Pai cited the proceeding's record stating that "even a 5% loss of spectrum capacity due to interference from guard band operations will lower spectrum values by 9%" and a "20% impairment will lower them by 43%."[20] He further noted that harmful interference caused by unlicensed use of guard bands in areas like Wireless Medical Telemetry Service, which operates in part on Channel 37 of the 600 MHz band, could have life-threatening implications.[21] More broadly, spectrum licenses provide substantial revenue for the United States Treasury and many credit the ability to secure large spectrum holdings free of interference with enabling the development and widespread adoption of wireless telephony.[22]

Despite the value of licensed spectrum, however, it does not best serve the public on its own. Stanford economists Paul Milgrom and Jonathan Levin argue that though "selling exclusive licenses to radio spectrum has been a valuable tool for eliminating conflicting uses and encouraging related investments, it has also contributed to concentrated market structures in wireless telephony and created barriers to entry and innovation."[23] They note that setting aside portions of the radio spectrum for unlicensed use has led to a number of important benefits, namely, "encouraging the development of complementary technologies that enhance the effectiveness of devices that use licensed spectrum, triggering the development of alternative technologies that compete with licensed uses, and promoting innovative business models and technologies that have brought unexpected benefits."[24] Furthermore, others like Michael Calabrese from New America's Open Technology Institute note potential disconnects in the

17. *See* MOBILE FUTURE, *supra* note 12.

18. *See* Gerald R. Faulhaber, *The Question of Spectrum: Technology, Management, and Regime Change*, 4 J. ON TELECOMM. & HIGH TECH. L. 123 (2005).

19. *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37,* GN Dkt. No. 12-268, Report & Order, 30 FCC Rcd. 9551, 9733 (2015) (statement of Comm'r Ajit Pai Approving in Part and Concurring in Part).

20. *Id.* at 1.

21. *Id.*

22. *See* NEUCHTERLEIN & WEISER, *supra* note 2, at 133–137.

23. MILGROM, LEVIN & EILAT, *supra* note 8, at 2.

24. *Id.*

licensed system between the interests of auction winners and benefits to the public consumer.[25] Where the Commission's license auctioning system tends to "create value from the perspective of the bidder,"[26] the unlicensed bands have been historically consumer and innovator friendly, providing valuable checks on the negative effects of market concentration in the licensed bands.[27] Ultimately, regardless of the balance between licensed and unlicensed allocations, the Commission maintains a vital public interest in protecting unlicensed bands as a place for permissionless innovation—a complementary sandbox to the regulated private space.

I. GROWING PUBLIC POLICY PROBLEM IN THE UNLICENSED BANDS

For many years large incumbents in the licensed bands have avoided significant participation in the unlicensed space due to unpredictability and interference concerns.[28] Now, the development of enabling technologies like Wi-Fi and Bluetooth are driving big players to enter the unlicensed sphere.[29] Though unlicensed spectrum remains a free resource for any rule-abiding participant, for the purposes of this discussion, it is valuable to distinguish between big players (commercial entities with significant legal and economic bargaining power[30]) and small players (commercial entities and individuals that have relatively little legal and economic bargaining power[31]).

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25. Press Release, Michael Calabrese, Dir., Wireless Future Project, Open Tech. Inst., FCC Protects Public Access to Unlicensed Spectrum (Aug. 6, 2015), https://www.newamerica.org/oti/fcc-protects-public-access-to-unlicensed-spectrum [https://perma.cc/8SQ7-ZWGQ] (Calabrese stated "[p]reserving public access to unlicensed spectrum in the prime TV band frequencies is more important to the public interest than more one-time revenue from an auction.").

26. MILGROM, LEVIN & EILAT, *supra* note 8, at 12 ("[L]icenses tend to be won by the firms that expect to use them most profitably and not necessarily by firms that might create competitive pressure that lowers prices.") (emphasis omitted).

27. *Id.*

28. *See, e.g.*, Reply Comments of Charles L. Jackson and Dorothy Robyn, *Unlicensed Operation in the TV Broad. Bands*, *Additional Spectrum for Unlicensed Devices below 900 MHz and in the 3 GHz Band*, ET Dkt. Nos. 04-186, 02-380, 5 (filed Mar. 2, 2007), https://ecfsapi.fcc.gov/file/6518909941.pdf [https://perma.cc/FN8U-K6PQ] ("[U]ncertainty about [spectrum] rights and licensing don't mix well.").

29. *See* Roslyn Layton, *What the LTE-U Vs. WiFi Debate Is Really About*, FORBES (Sept. 2, 2015 4:07 PM), http://www.forbes.com/sites/roslynlayton/2015/09/02/what-the-lte-u-vs-wifi-debate-is-really-about/#64990ed64a03 [https://perma.cc/PM85-L2ZA].

30. Notably, across many spectrum-related industries incumbents in one market may effectively be new entrants or small competitors in another. By no means does this note intend to argue a "big is bad" regulatory approach, but it intends rather to set a clear field of terminology for this specific discussion of legal and economic bargaining power.

31. Many diverse entities hold competing interest in the unlicensed bands—amateur users, trade associations, public interest associations, governmental organizations, military users, etc. However, the scope of this note is narrowed solely to big and small players. Furthermore, within the category of small players' interests

Rapidly developing technologies operating in the unlicensed bands are offering abundant opportunities to big players. In 2013, Amazon publicly announced plans to develop a "delivery by drone" program within the next four to five years which will purportedly start delivering packages to customers using a combination of licensed and unlicensed components.[32] Last year the Wall Street Journal reported that the IoT market (everything from FitBit to the Smart House you plan to own one day) is expected to reach $1.7 trillion by 2020, with a majority of its products operating on WiFi.[33] A point of major contention at present (as discussed in Part II, infra), wireless carriers like Verizon and T-Mobile plan to use Qualcomm's LTE-U technology in the unlicensed bands to supplement their licensed wireless service.[34]

As increased activity by big players offers exciting opportunities for innovation (in both consumer product and service offerings, as well as resource enhancing advancements like improved receiver and sharing technologies), the trend also forecasts an increase in interference disputes.[35] Though undiminishing over time,[36] spectrum is a limited resource with varying value across bands of differing propagation characteristics (i.e., wavelength, amplitude, frequency, phase).[37] Unlicensed spectrum, originally a compilation of "garbage bands," is a testament to innovations in resource optimization and sharing technologies.[38] Solutions to spectrum scarcity like "digital signal encoding, spread spectrum techniques, multiple input and multiple output (MIMO), and orthogonal frequency-division multiplexing (OFDM)"[39] stemmed from desires to utilize unlicensed bands.

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among small commercial players, amateur users, and non-profit entities may diverge or align. This note focuses primarily on the interaction between actors of disparate bargaining power operating in the unlicensed bands.

32. *See Amazon Unveils Futuristic Plan: Delivery By Drone*, CBS NEWS, (Dec. 1, 2013), http://www.cbsnews.com/news/amazon-unveils-futuristic-plan-delivery-by-drone [https://perma.cc/5ZAQ-2PAX];
Michael J. Marcus, *Spectrum Policy Challenges of UAV/Drones*, INSIGHT (Nov. 9, 2015), http://insight.ieeeusa.org/insight/content/policy/174812 [https://perma.cc/W93N-WHJJ] (synopsis of spectrum regulatory hurdles for drone use); *see also* David Pogue, *Exclusive: Amazon Reveals Details About Its Crazy Drone Delivery Program*, YAHOO!TECH (Jan. 18, 2016), https://www.yahoo.com/tech/exclusive-amazon-reveals-details-about-1343951725436982.html [https://perma.cc/9RAJ-ZA26].

33. Steve Norton, *Internet of Things Market to Reach $1.7 Trillion by 2020: IDC*, WALL ST. J. (June 2, 2015 7:41 AM), http://on.wsj.com/1M0ckqf [https://perma.cc/PN8Z-7V8T].

34. Brodkin, *supra* note 11.

35. *See* MILGROM, LEVIN & EILAT, *supra* note 8, at 11.

36. Like a good spot in which only one person can be sitting but is equally good for someone else after that person gets up (i.e., the quality doesn't depreciate over time).

37. The limitations are exacerbated by the differing propagation characteristics of certain bands. Transmission on a band with a longer wavelength allows a signal to travel farther and through barriers (like walls). This "beachfront property" is extremely limited under current technology, and thus incredibly valuable.

38. MILGROM, LEVIN & EILAT, *supra* note 8, at 9.

39. *Id.* at 15–16.

Though spectrum sharing and optimization technologies continue to improve, increasing demand of the physically limited supply, along with insufficient receiver technology, suggest that the number and magnitude of interference disputes in these bands will likely increase as well.[40]

Although licenses have historically sufficed to mitigate spectrum interference, the Commission maintains important public policy reasons for unlicensed spectrum to remain a "managed commons" rather than a regulated property, meaning that the bands should have mandated rules for use, but no authority to exclude others.[41] Lower capital costs and barriers to entry enable diverse innovation; free access to unlicensed spectrum "encourages a more competitive market structure in the provision of wireless services," thereby helping to "protect consumers from excessive market power possessed by spectrum owners;"[42] and many argue that an increased pace of innovation in "unlicensed spectrum facilitates the adoption and spread of new technologies."[43] Furthermore, the dual system allows for complementarity and cross-pollination of innovation and investment that may enhance the value of licensed spectrum or create service competition benefiting consumers.[44]

With these benefits, however, the unlicensed management system offers no protection from competitor interference.[45] General conditions of the Part 15 rules state that operation in unlicensed spectrum is "subject to the conditions that no harmful interference is caused and that [some level of] interference must be accepted."[46] While this mandated acceptance of interference by unlicensed users can lead to efficient bargaining and cooperation between users; as demand for unlicensed spectrum increases so too will interference disputes.[47] Growing activity by big players, particularly wireless

40. *See* FCC SPECTRUM POLICY TASK FORCE, REPORT OF THE SPECTRUM EFFICIENCY WORKING GROUP 4 (Nov. 15, 2002) ("Demand for access to spectrum has been growing dramatically, and is likely to continue to grow for the foreseeable future.").

41. *See* MILGROM, LEVIN & EILAT, *supra* note 8, at 14-15.

42. MILGROM, LEVIN & EILAT, *supra* note 8, at 15.

43. *Id.* at 15–16.

44. *Id.* at 23.

45. 47 C.F.R. § 15.3(m) (2016) (defining harmful interference as "any emission, radiation or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with this chapter").

46. 47 C.F.R. § 15.5(b) (2016) (stating specifically that "[o]peration of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator").

47. *See generally* J. PIERRE DE VRIES & PHILIP J. WEISER, HAMILTON PROJECT, *UNLOCKING SPECTRUM VALUE THROUGH IMPROVED ALLOCATION, ASSIGNMENT, AND ADJUDICATION OF SPECTRUM RIGHTS* (2014), https://www.brookings.edu/wp-content/uploads/2016/06/THP_DeVriesWeiserDiscPaper.pdf [https://perma.cc/SFQ3-

license incumbents, may threaten the viability of less dominant technologies, while the asymmetrical bargaining power between increasingly diverse players may produce anticompetitive effects. In other words, increasing participation by more big players may inhibit the ability of small players to bargain effectively.

II. BIG PLAYER VS. BIG PLAYER: THE TECHNICAL "CROWD OUT"

As big players, Internet Service Providers (ISPs) and behemoth information technology companies have held large stakes in the unlicensed bands since the proliferation of Wi-Fi in the early 2000s.[48] But other big players, namely wireless service providers, have been entering the fray.[49] While any number of technical characteristics might allow one technology to crowd out another in the unlicensed bands, current contention over the threat LTE–U may pose to Wi-Fi serves as a clear example of the technical "crowd out" problem.[50] An emerging technology originally developed by Qualcomm, LTE-U allows wireless networks to alleviate congestion by supplementing their licensed spectrum with unlicensed bandwidth.[51] Wi-Fi stakeholders fear that by embedding LTE-U chips into handheld devices, wireless carriers will "dominate the bandwidth of the unlicensed bands" and effectively crowd out Wi-Fi.[52] Because LTE-U is not subject to the same strict standards (the Wi-Fi "Politeness Protocol"),[53] many stakeholders worry that "Wi-Fi's Politeness Protocol could put the technology at a distinct disadvantage when going up against LTE."[54] Touting consumer advantages and the legality of free unlicensed use, proponents of the new technology argue that "LTE-U has been tested and proven to co-exist with Wi-Fi" in the unlicensed bands and that any conflict should be resolved by stakeholders, without government intervention, as is traditional in the unlicensed space.[55]

Though the Wi-Fi Alliance has solicited intervention by the Commission, lack of license rights, mediation systems, or consistent standards will likely make these sorts of disputes difficult to resolve going forward. The Commission has recognized that LTE-U

2RXF], [hereinafter *Hamilton Paper*].

48. *E.g.*, Comcast and Google.

49. *E.g.*, Verizon and AT&T.

50. Ben Munson, *Wi-Fi's Problem with LTE over Unlicensed Spectrum*, WIRELESS WEEK (May 26, 2015, 10:01 AM), http://www.wirelessweek.com/article/2015/05/wi-fis-problem-lte-over-unlicensed-spectrum [https://perma.cc/8YC6-332V].

51. Layton, *supra* note 29.

52. Robert K. Ackerman, *Spectrum Competition Increases in Frequency*, SIGNAL (Sept. 1, 2015), https://shar.es/1E85bg [https://perma.cc/Q2TY-RNS9].

53. *See* Comments of Google, *Office of Eng'g and Tech. and Wireless Bureau Seek Info. on Current Trends in LTE-U and LAA Tech.*, ET Dkt. No. 15-105, 19 (filed June 11, 2015), https://ecfsapi.fcc.gov/file/60001078145.pdf [https://perma.cc/G7CS-B26Y].

54. Munson, *supra* note 51, at 2 (citing Ellen Satterwhite).

55. Layton, *supra* note 29, at 2.

participation may have a more significant immediate impact in already established bands than it will in newly allocated ones without entrenched stakeholders, however, the problem of increasing scarcity translates across the spectrum.[56] Innovators of all sizes will be forced to compete with incumbent wireless providers across the licensed bands and that could mean less opportunity for the little guys. While the potential implications of technology "crowd out" on the public policy goals of unlicensed spectrum offer vast room for further research, such exploration lies beyond the scope of this paper.[57]

III. BIG PLAYER / SMALL PLAYER: MARKET FORCE EXCLUSION

The potential for anticompetitive exclusion driven by asymmetrical bargaining power in the unlicensed bands presents a more theoretical problem. If the Commission allows big players to use unlicensed spectrum unchecked by equivalent bargaining power by small players and new entrants, is it *de facto* granting them free licenses? This question is predicated on the notion that they can deter interference with private bargaining rather than license rights. While the lack of exclusionary rights makes the notion of a *de facto* license seem a bit hyperbolic, big players may have an ability to exclude anyway.

Whether big players might be able to use market force to exclude small players begs several questions. First, how likely is increased participation by big players to engender interference conflicts subject to asymmetrical bargains? Second, if so, would such asymmetrical bargaining power actually enable anticompetitive exclusion? Finally, what impact might such exclusion have on the Commission's unlicensed spectrum public policy goals?

A. The Potential for Asymmetrical Bargaining in Unlicensed Interference Dispute Resolution

As both licensed and unlicensed spectrum bands become increasingly valuable, large companies have more incentives to utilize the free unlicensed space. Spectrum scarcity matched with

56. *Office of Eng'g and Tech. and Wireless Bureau Seek Info. on Current Trends in LTE-U and LAA Tech.*, ET Dkt. No. 15-105, Public Notice, 30 FCC Rcd. 4457 (2015) ("We observe that the impact of LTE-U and LAA on unlicensed operations and technologies such as Wi-Fi would be quite different in each bands — the 3.5 GHz band is generally newly available spectrum while the 5 GHz bands are already heavily used by Wi-Fi and other unlicensed devices.").

57. *See* Julius Knapp, *The Next Step for LTE-U: Conducting Limited LTE-U Performance Tests*, FCC BLOG (Jan. 29, 2016, 11:45 AM), https://www.fcc.gov/news-events/blog/2016/01/29/next-step-lte-u-conducting-limited-lte-u-performance-tests [https://perma.cc/2UCB-NYV3] (showing that much will hinge on performance tests currently underway).

the growing number of products and services clamoring for bandwidth will continue to make free unlicensed bands attractive to large commercial entities. While such companies often have diverse interests when it comes to spectrum—wireless carriers that are large incumbents in the licensed bands may be considered new entrants in unlicensed bands—economic might and legal expertise garnered in parallel or unrelated markets may influence large company participation in the unlicensed space.

B. The Viability of Anticompetitive Exclusion

As big players develop an increasing presence in the unlicensed bands, they will likely have incentives to dominate and exclude others. A 2012 report to Congress by the United States Government Accountability Office observes:

> [f]rom an economic perspective, when a consumer pays the market price for a good or service and thus cannot get more of it without this expense, the consumer has an incentive to get the most value and efficiency out of the good as possible. If no price is attached to a good . . . the normal market incentive to use the good efficiently may be muted.[58]

While traditionally Part 15 transmission limitations have forced competing unlicensed users to share or negotiate efficient behavior,[59] where one user has the economic power to eliminate competing users, the drive to maximize profits might encourage elimination over cooperation.

Look to the history of market concentration in wireline and wireless telephony: telecommunications service companies—due to network effects, high capital costs of infrastructure development, and high economies of scale—tend to accumulate into fewer, larger companies.[60] When companies are forced to compete for a valuable resource (like spectrum, coal, etc.), market forces drive integration and the acquisition of smaller companies.[61]

There are at least three ways to exclude a competing unlicensed band user: private exclusionary agreements, competitor acquisition, or some flavor of monopoly leveraging.

Method One: Could a big player pay smaller players to stay out of certain unlicensed areas? Many unlicensed stakeholders laud the culture of privately negotiated interference dispute resolution

58. U.S. GOVERNMENT ACCOUNTABILITY OFFICE, SPECTRUM MANAGEMENT: INCENTIVES, OPPORTUNITIES, AND TESTING NEEDED TO ENHANCE SPECTRUM SHARING 11 (Nov. 2012) http://www.gao.gov/assets/660/650019.pdf [https://perma.cc/3DEC-U8PH].

59. *See* MILGROM, LEVIN & EILAT, *supra* note 8, at 7.

60. NEUCHTERLEIN & WEISER, *supra* note 2, at 3.

61. *See generally* KATALIN JUDIT CSERES, COMPETITION LAW AND CONSUMER PROTECTION (Kluwer Law International, 2005).

in the unlicensed space. However, growing large private interests, who are not subject to the politeness protocol of the Wi-Fi Alliance, could allow for anticompetitive practices through non-compete agreements.[62] In general, the unlicensed bands are governed by the Commission's Part 15 Rules, which have a great deal to say about what levels users may transmit at and what kinds of equipment will be approved.[63] Though the Part 15 Rules mandate acceptance of interference, they do not speak to whether one user may privately contract with another to free up certain bandwidth.[64] While actors could try to pay each other "under the table" for exclusive use of an unlicensed piece of spectrum, the practice would likely be ineffective because there are an unlimited number of people who could start using that band if a big player is paying individual entities not to, and there are no exclusionary property rights preventing users from disregarding the bargain.

Method Two: Could big players acquire all or part of small players operating in the same band of unlicensed spectrum? This method of anticompetitive exclusion seems most viable in the unlicensed bands. Behemoths like Amazon and Google continue to buy start-ups merely to acquire their employee talent or intellectual property. Should a large company develop technology presence in a particular unlicensed band, it might be economically efficient for it to acquire commercial users competing for bandwidth. Traditionally, large companies have acted on incentives to eliminate competition in their direct market, and they could find similar incentives to eliminate competition in their direct band.

While anticompetitive mergers and acquisitions fall under the purview of either the Federal Trade Commission (FTC) or the Department of Justice (DOJ) Antitrust Division, whether these sorts of acquisitions among competing unlicensed spectrum users would merit action from these agencies remains unclear.[65] As an initial matter, market definition could prevent antitrust enforcement action. Because the types of products and services operating in the same band of unlicensed spectrum could be wildly

62. *See* Vijay Nagarajan, *Politeness Isn't Only for People: Why It's Important for Networks, Too,* BROADCOM (Aug. 19, 2014), https://www.linkedin.com/pulse/20140820194500-8357840-politeness-isn-t-only-for-people-why-it-s-important-for-networks-too [https://perma.cc/9C4Y-EPWX].

63. Gerald R. Faulhaber & David Farber, SPECTRUM MANAGEMENT: PROPERTY RIGHTS, MARKETS, AND THE COMMONS 10 (unpublished manuscript) (on file with Colorado Technology Law Journal) ("Manufacturers are required to submit their devices to the FCC or an FCC-approved testing lab. The FCC may sample the product for compliance. Certification is required for imported as well as domestically produced electronic products. While there are opportunities for cheating the system, the consensus within the industry and the FCC20 is that type certification has generally worked well at controlling interference, and industry cooperation on device design to control interference has been successful.").

64. *See* 47 C.F.R. § 15.

65. *See generally* DOJ, HORIZONTAL MERGER GUIDELINES (Aug. 19, 2010).

different, such acquisitions might easily look like vertical integration (generally considered procompetitive market behavior and—almost—*per se* lawful), rather than horizontal elimination of competition subject to a higher level of scrutiny.[66] Market definition tends to draw the anticompetitive concern to competition in specific markets, not competition for resource use by innovators in separate markets.[67] Even if defined most favorably to the prosecution (i.e. commercial entities providing products and services in this specific unlicensed band), the market may not look concentrated enough to merit a ban on the acquisition.[68] Merging entities enjoy myriad procompetitive defenses under the current antitrust regime.[69]

Perhaps more significantly, acquisitions of competing resource users may fail to offer clear evidence of antitrust harm. Antitrust law focuses primarily on harm to the consumer, not the competitor.[70] One can argue that eliminating competing users of a particular resource eliminates diversity in product and service offerings in a way that disadvantages consumers, but eliminating competition for use of a resource not actually used for the same product or service may be a step too removed for antitrust enforcers.[71] The merger of producers of different products or services that make use of the same resource looks too vertical.

Furthermore, such acquisitions would likely face little chance of private enforcement. Some small companies would love to be acquired, while other smaller players might have serious trouble showing antitrust harm as competitors.[72] While it is impossible to predict whether this *will* come about, anticompetitive acquisitions among competing users of unlicensed spectrum do seem possible: big players certainly have incentives to maximize their ability to use the resource.

Method Three: Could big players exercise power in parallel markets to discourage small players from interfering in desired unlicensed bands? Take the hypothetical example of a small IoT

66. *See* CSERES, *supra* note 62, at 259.

67. HORIZONTAL MERGER GUIDELINES, ("When the Agencies identify a potential competitive concern with a horizontal merger, market definition plays two roles. First, market definition helps specify the line of commerce and section of the country in which the competitive concern arises. In any merger enforcement action, the Agencies will normally identify one or more relevant markets in which the merger may substantially lessen competition. Second, market definition allows the Agencies to identify market participants and measure market shares and market concentration.").

68. *See Herfindahl-Hirschman Index*, DOJ (updated July 29, 2015), http://www.justice.gov/atr/herfindahl-hirschman-index [https://perma.cc/T5YG-EG9J].

69. *E.g.,* Efficiency, failing firm, flailing firm, etc.

70. CSERES, *supra* note 62, at 291.

71. *See* HORIZONTAL MERGER GUIDELINES, *supra* note 67 (explaining that the DOJ and FTC make inquiries into market power, etc. Though the guidelines discuss "Mergers of Competing Buyers" at 32, they omit discussion of competing resource users).

72. *See, e.g.*, Sharon E. Foster, *Harm to Competition and the Competitive Process: A Circular Charade in the LIBOR Antitrust Litigation,* 10 B.Y.U. INT'L L. & MGMT. REV. 91 (2014).

developer wanting its product to be able to utilize a platform owned and operated by a big player competing for the same unlicensed bandwidth. Might the IoT developer be coerced into using other unlicensed bands in exchange for interoperability? Such a scenario would certainly require monopoly power in the platform market, but such power might be easily wielded if an IoT provider wanted to utilize something like Facebook's social networking platform or Google's search engine.

While some circumstances might garner antitrust regulator interest in competing use of unlicensed bands, antitrust law only reaches so far. Competition policy focuses primarily on maintaining competitive markets, meaning low prices and meaningful consumer choice.[73] In allocating and managing unlicensed spectrum, however, Congress has tasked the Commission with a broader purpose: to promote "the public interest, convenience, and necessity."[74] The public interest standard might require more protection of small players, i.e., diverse competing users, than does contemporary antitrust law. Therefore, such a scenario might better be addressed through a future net neutrality enforcement action.[75]

In any case, even if big players were not allowed to anticompetitively acquire small players, asymmetrical bargaining power between big players and small players still presents a public policy concern in the unlicensed bands. Economic might and legal familiarity offer important advantages to big players, even when participating as new entrants in a related space.

Large companies such as AT&T, Google, and Microsoft, often already have significant legal experience in the spectrum space, valuable relationships at the federal level, and teams of lawyers to advocate or negotiate on their behalf. Should small innovators find themselves embroiled in an interference conflict with one of these large companies, they will be at a major disadvantage as new players in the legal game. This asymmetrical bargaining power could lead to increased barriers to entry for small players, especially new entrants, and popular technologies developed in the unlicensed spaces could mean higher capital costs for competing users. If a large company (such as Google) develops a technology in the unlicensed space that becomes valuable to consumers and the economy, would that lead policymakers and the public to justify their dominance in the unlicensed band, effectively sanctioning the *de facto* license and preventing future innovations by other players in those bands? Licenses are limited and expensive; if a big player *can* dominate a band, why wouldn't they?

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73. *See id.*

74. *See* 47 U.S.C § 307 (2012); 47 U.S.C. § 309 (Supp. 2015).

75. *See Protecting and Promoting the Open Internet,* GN. Dkt. No. 14-28, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd. 5601 (2015).

C. Impact of Exclusion on Unlicensed Public Policy Goals

In allocating unlicensed spectrum, the Commission has voiced several important public policy goals. In a 2015 address to the Senate Committee on Commerce, Science and Transportation, Commissioner Jessica Rosenworcel touted the importance of unlicensed technologies in access, innovation, and economic stimulation.[76] Proponents of greater unlicensed spectrum allocation emphasize its importance as an enabling resource with inherently incalculable benefits.[77] Since its initial allocation, unlicensed spectrum has embodied a public interest desire for a free space to enable rapid innovation and foster competition by lowering capital costs and barriers to entry. These benefits are not meant solely for small players, but were certainly thought of with small players in mind. Increased participation in the unlicensed bands by large corporate entities risks the elimination of small player innovative space.

IV. POTENTIAL SOLUTIONS

To date, the potential for negative effects on unlicensed public interests from increased big player participation has been largely undefined though lessons from other dispute discussions may offer components to a solution. Phil Weiser and Pierre de Vries proffer a tripartite solution for licensed interference disputes.[78] Parallels between unlicensed disputes and international resource disputes could offer new strategies for a resolution. In this vein, Professor Anna Spain of the University of Colorado suggests that international resource disputes necessitate an integrated alternative dispute resolution method.[79] In direct response to increasing unlicensed interference disputes, diverse stakeholders ask the Commission to free up more bands for unlicensed use. Still others argue that the Commission's Part 15 rules have served adequately so far, and may continue to do so in the course of regulatory evolution.[80] The following sections explore how each of these might work to address this issue and how they may fall short.

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76. Statement of Commissioner Jessica Rosenworcel, *supra* note 16 ("After all, Wi-Fi is how we get online—in public and at home. Wi-Fi is also how our wireless carriers manage their networks. In fact, today nearly one half of all wireless data connections are offloaded onto unlicensed spectrum. Wi-Fi is how we foster innovation. That's because the low barriers to entry for unlicensed airwaves make them perfect sandboxes for experimentation. Wi-Fi is also a boon to the economy. The economic impact of unlicensed spectrum has been estimated at more than $140 billion annually. So we need to make unlicensed services like Wi-Fi a priority in our spectrum policy.").

77. *See* MILGROM, LEVIN & EILAT, *supra* note 8, at 19–22.

78. *See Hamilton Paper*, *supra* note 48.

79. Anna Spain, *Beyond Adjudication: Resolving International Resource Disputes in an Era of Climate Change*, 30 STANFORD ENV. L. J. 343 (2011).

80. *See* Layton, *supra* note 29.

A. *De Vries & Weiser: Clear Property Rights and the Administrative Law Judge Model*

Drawing heavily on the work of economist Ronald Coase, de Vries and Weiser offer a three-pronged solution for resolving spectrum interference in both licensed and unlicensed bands.[81] First, they advocate defining harms claims thresholds to govern what signal levels of in-band and out-of-band interfering must be exceeded to constitute "harmful interference," thereby reducing current uncertainty regarding the responsibilities of receivers to tolerate interference.[82] Second, their plan addresses the disadvantages of excessive band fragmentation by establishing band agents, "entities that could represent large groups of licensees in negotiating changes in operating rights with neighbors."[83] Third, and perhaps most importantly with respect to unlicensed disputes, they propose that the Commission "transform adjudication from the current ad hoc and politically charged process to a more fact-based procedure that could resolve spectrum-related disputes in a timely fashion using judges with expertise in spectrum policy, either in the FCC and/or in a newly created Court of Spectrum Claims."[84]

While primarily focused on improving dispute resolution in the licensed space, this proposal offers some benefits that could impact future conflict between unlicensed users, but ultimately fails to adequately address struggles in the unlicensed space. As a general matter, more clearly defined property rights for license-holders means greater determinacy and predictability in the system overall.[85] This security could reinforce the appeal of license investments for big players and divert attention away from unlicensed use. However, given the exponential growth and potential of unlicensed technologies and existing big player investments in them, such a diversion seems unlikely and even undesirable. While such determinacy certainly offers a boon to spectrum stakeholders across the board, it fails to directly address the looming asymmetrical bargaining problem.

Similarly, while band agents could address asymmetrical bargaining power within a property rights model (where conflicting users may contract between each other to define more specific boundaries), in the unlicensed commons model they provide value

81. *See Hamilton Paper*, *supra* note 48. *See also* NUECHTERLEIN & WEISER, *supra* note 2, at 97 ("Coase was the first major exponent of what has now come to be known as a 'property-rights model' for spectrum management . . . Coase's advocacy for a private-property-like regime of spectrum management rested on his more general proposition—now known as the *Coase Theorum*—that, with well-defined property rights, the free market will generally allocate resources to their most efficient uses so long as transaction costs are low enough.").

82. *Hamilton Paper*, *supra* note 48, at 6.

83. *Id.*

84. *Id.*

85. *Id.* at 13.

as informational entities at best. As discussed above, any attempts to privately negotiate exclusive use in the unlicensed bands are likely ineffective and unenforceable.

An Administrative Law Judge (ALJ) adjudicatory model might help address this issue. If users in the unlicensed band negotiated private operating rules (as the WiFi Alliance did with the politeness protocol), an ALJ would create a clear path to conflict resolution with a specialized mediator to hear cases.[86] Asymmetrical bargaining power might be neutralized through entities like the described band agents representing aggregated like-party interests.[87] This method makes more sense in the unlicensed space when combined with the sort of integrated alternative dispute model detailed in the next section.[88] Ultimately, however, any use of an ALJ by unlicensed participants would require major change within the Commission.

There is a core problem, however, with this approach in the unlicensed space. By creating determinacy and enforceable dispute resolution, the Commission could chill the same fast, free experimentation it aims to protect. Engineers have expressed concerns that to the extent the Commission creates a more formalized dispute resolution system for spectrum interference, it will eliminate beneficial behind-the-scenes negotiating and hinder innovation.[89] While a helpful comparison, and important in the licensed context, this proposal cannot tackle the issue of big player/small player conflict in the unlicensed space while effectively promoting the unlicensed public interest.

B. Integrated International/Alternative Dispute Resolution

Though uncommon in domestic discussions of spectrum governance, similarities between unlicensed spectrum management and international resource disputes may offer important lessons from International Dispute Resolution (IDR). Like the landscape of international resource disputes, the unlicensed space manages many different players, with disparate levels of bargaining power, pursuing diverse interests.[90] Like actors

86. *Id.* at 3.

87. *Id.*

88. *See, e.g.*, Spain, *supra* note 80.

89. *Amendment to Commission Technology Law & Rules Concerning Adjudication Policy Clinic (TLPC) of Spectrum Interference Disputes*, RM-11750, Comments of T-Mobile USA, Inc. 7 (filed July 27, 2002), https://ecfsapi.fcc.gov/file/60001118928.pdf [https://perma.cc/8KGD-5HZK] (explaining that though the current Part 15 "rules do not prescribe rigid requirements for the resolution of complaints, commenting parties widely agree that this flexibility often enables parties to resolve their disputes collaboratively without FCC intervention").

90. *Hamilton Paper*, *supra* note 48, at 7 (noting that "[b]ecause there are so many different services that use spectrum, there are many different actors with stakes in how spectrum rights are managed").

in international resource disputes, unlicensed participants lack clear property rights and their conflicts involve technical facts, which require area expertise to effectively address.[91] Perhaps most importantly, underlying both situations are strong public policy interests in promoting cooperation while maintaining flexibility for the future.[92]

Drawing lessons from international environmental resource disputes may be of particular use in the unlicensed space. The electromagnetic spectrum, like other environmental resources, is a naturally occurring phenomenon with myriad applications.[93] Spectrum is scarce, meaning that any given piece may only serve a limited number of purposes at any given time, and value judgments (by varying methods) must be made about how to use it.[94] However, spectrum's infinite renewability makes it a unique resource, as use of spectrum neither degrades nor depletes the resource over time.[95] Some argue spectrum is not *truly* scarce because developments in technology are allowing, and will continue to allow, for increased use of spectrum (i.e. smaller cells / more receivers, better receivers, enhanced sharing technical methods, etc.). Regardless, the current allocation and assignment system treats spectrum as a natural resource, so comparisons to dispute resolution methods in other natural resource regimes should prove informative.

International legal scholar, Anna Spain, postulates that resource disputes may necessitate an integrated method of resolution.[96] Spain points out that empirical studies show "incidents of conflict increase significantly when there is a large, rapid change to an ecosystem or political setting when existing governance structures cannot effectively manage that change."[97] Therefore, to the extent new entry and rapidly increasing participation in unlicensed bands by large players and licensed incumbents may be considered a rapid change to the unlicensed ecosystem, the space will experience increased conflict.

Under either the proposed ALJ model or the Commission's current administrative regime, drawing on alternative dispute resolution (ADR) may be helpful in unlicensed disputes to come. ADR scholar Thomas H. Oehmke's treatise on commercial

91. Spain, *supra* note 80, at 376; *see also Hamilton Paper*, *supra* note 48, at 3–4.
92. *See also Hamilton Paper*, *supra* note 48, at 3–4.
93. NUECHTERLEIN & WEISER, *supra* note 2, at 88.
94. *Id.*
95. *Id.*
96. Spain, *supra* note 80, at 384 (Spain's case studies show that IDR methods are particularly useful in border and resource disputes where property rights are not clearly defined, fact finding is necessary, the dispute is between multiple diverse parties with disparate bargaining power and some precedent is sought, but parties desire flexibility in the future. Domestically, these ideas may be implemented through ADR, a process involving mediation, negotiation, conciliation, arbitration, and more.).
97. *Id.* at 352.

arbitration suggests that ADR "is particularly suited to disputes that impact the environment where a neutral's technical expertise is needed and there are substantial dollars at stake."[98] Though when describing environmental dispute resolution Oehmke points specifically to "land use, natural resource management and public land use, water resources, energy, air quality, and toxic substances,"[99] spectrum disputes fit well within his archetypical scenario.

A few key distinctions pull unlicensed disputes away from the realm of international dispute resolution. Unlike conflicts between international actors, domestic spectrum disputes fall more clearly under United States sovereignty, generally subject to the Commission's jurisdiction.[100] Where bargaining between international actors may be driven by each party's sovereign autonomy, unlicensed spectrum users operate perpetually under the authority of the Commission.[101] Thus, the two landscapes—international resource disputes and domestic spectrum interference disputes—may find differing incentives at work. Furthermore, scholars often argue that viable international dispute resolutions require a "mutually hurting stalemate . . . optimally associated with an impending, past, or recently avoided catastrophe."[102] Little to no threat of physical violence may be anticipated in unlicensed spectrum disputes; therefore, the disputes may find less chance for reaching the same mutually hurting stalemate that drives international parties to participate productively in integrated resolution methods. IDR primarily aims to diffuse violent situations and therefore may prove to be less applicable in this space. Use of spectrum in the unlicensed bands serves business and recreational activities, and interference disputes tend not to be battled with physical violence. Whether the threat of physical violence may effectively parallel economic interests remains undetermined.

Despite these differences, integrated IDR and ADR approaches

98. THOMAS H. OEHMKE & JOAN M. BROVINS, COMMERCIAL ARBITRATION § 33:1 (3d ed. 2015).

99. *Id.*

100. *See* 47 U.S.C. § 33 (2012). Though jurisdictional questions can arise at the geographical margins or between the Commission and the National Telecommunications and Information Association (NTIA), which regulates spectrum assets held by the federal government itself, these jurisdictional questions do not seem analogous to the higher authority vacuum posed by conflict between two sovereign states.

101. *See* Spain, *supra* note 80.

102. I. William Zartman, *The Timing of Peace Initiatives: Hurting Stalemates and Ripe Moments*, GLOBAL REV. OF ETHNOPOLITICS, Sept. 2001, at 8 (The concept of a mutually hurting stalemate "is based on the notion that when the parties find themselves locked in a conflict from which they cannot escalate to victory and this deadlock is painful to both of them (although not necessarily in equal degree or for the same reasons), they seek an alternative policy or Way Out," thereby enabling effective mediation, etc.).

may be worth considering as the unlicensed landscape continues to experience rapid change. Perhaps most appropriate in conjunction with some sort of adjudicative process by trade associations, or through a standard setting process at the Commission, current designs may not offer a direct solution to the problem of anticompetitive exclusion through asymmetrical bargaining power addressed in this note. However, as the world moves towards an increasingly globalized society, to the extent policy makers can create systems that are compatible internationally, nations will benefit from more experienced, capable lawyers at the international level, and create efficiencies for companies operating internationally.

C. Allocate More Unlicensed Bands

Stakeholders from across the board have urged the Commission to allocate more spectrum for unlicensed use. Many argue that the licensed regime has and continues to favor incumbent users in a way that fails to properly align with benefits to the consumer. In contrast, the benefits engendered by innovation in the unlicensed space, while unforeseeable, are vast.[103] In addition to the low capital costs that encourage widespread diverse participation, proponents argue that unlicensed allocation leads to a more competitive (and therefore consumer-friendly) market structure. Milgrom, Levin, and Eilat suggest that new unlicensed products that displace established license regimes could actually protect consumers from the excessive market power possessed by spectrum owners.[104] Through the adoption and spread of new technologies, more unlicensed spectrum might actually increase government revenue as complementarity drives demand.[105] Moreover, "[i]f the aggregate demand for unlicensed spectrum is relatively inelastic, a reduction in the supply of licensed spectrum is highly likely to increase its per-unit price."[106] Complementarity engendered by unlicensed allocation, or the way licensed and unlicensed technologies enhance each other, can increase demand for spectrum in general, driving up auction revenues for the government, as well as dollars in the market.[107]

Proponents of increasing unlicensed allocation predominately

103. *See* MILGROM, LEVIN & EILAT, *supra* note 8, at 15.

104. *See id.* at para. 39–41 ("For example, voice calls on Wi-Fi networks – in applications such as Skype – compete with calls on traditional cellular networks that use licensed spectrum. With a Skype-enabled phone, a receiver can move from place-to-place and, so long as his device is connected to a Wi-Fi network, can make calls without using the 3G networks.").

105. *See id.* at 23.

106. *Id.*

107. *Id.*

cite the bands' value as an enabling resource.[108] The opportunity cost of eschewing potential unlicensed innovations may exceed immediate short-term gains of auction revenues by unknown quantities.[109] Availability of unlicensed spectrum must be sufficiently reliable. If specific bands are "only sporadically available, the incentive of innovators to invest in research and development of new technologies, and of manufacturers to build equipment that exploits those bands would be greatly diminished."[110] Ultimately, proponents argue that "to facilitate innovation in new services, to encourage competition from services using unlicensed spectrum for ones using licensed spectrum, and to grow complementary services using unlicensed spectrum to match those using licensed spectrum, the quality and capacity of unlicensed spectrum should grow apace" to keep with the public interest.[111]

While allocating more bands for unlicensed use may be a good idea for the Commission, it too fails to address the asymmetrical bargaining problem. Though more allocation could stave off congestion in the short-term, spectrum is fundamentally a scarce resource; and as demand increases, so will disputes.[112] Again, this may offer a piece of a solution, but not a complete one.

D. Bolster the Part 15 Rules

In perhaps a more direct approach, the Commission could incorporate general prohibitions on anticompetitive conduct within the unlicensed bands targeted to prevent specific behaviors, or perhaps incorporate some form of merger review within those bands. Such an approach offers a number of benefits to unlicensed participants and consumers alike. By simply adding to the Part 15 operating requirements, the Commission could maintain the current managed regime (as opposed to a regulated one), which many credit with unlicensed innovation's past success.[113] The Commission already has the necessary authority to promulgate and revise the Part 15 rules, so this type of change would be free of the arduous political hassle inherent in the first two approaches.[114] Promulgating these rules under current authority would allow some flexibility in the future, so the rules could be changed or tailored later, if need be.[115] Through the rulemaking proceeding, the

108. *Id.* at 19.
109. Calabrese, *supra* note 25.
110. MILGROM, LEVIN & EILAT, *supra* note 8, at 24.
111. *Id.*
112. NUECHTERLEIN & WEISER, *supra* note 2, at 91.
113. MILGROM, LEVIN & EILAT, *supra* note 8, at 18.
114. 47 U.S.C. § 15 (2012) (describing that Congress delegated authority to the Commission to promulgate Part 15 Rules).
115. *Id.*

Commission could take an experimental approach to protecting unlicensed public interests so that the evolving solution would be narrowly tailored to the specific problem of anticompetitive bargaining among competing unlicensed users.[116] Moreover, this solution could encourage spectrum sharing among competing users, a practice that has led to great strides in beneficial sharing technology.

However, using the Part 15 Rules to address anticompetitive practices in the unlicensed space is not without its problems. Consumer protection at the federal level from anticompetitive behavior traditionally falls under the purview of the FTC and the DOJ.[117] The FTC and the Commission have already begun a turf war in the wake of the Commission's net neutrality order.[118] Further expansion into FTC territory may be ill advised. Beyond the political implications of Part 15 expansion, creating enforceable rules proactively could prevent efficiencies and incentives to innovate within a particular band, or simply chill big player participation altogether. Increasing big player participation in the unlicensed space presents a competing interest for consumers and the public at large, and taking such a definite step now might be using an axe to do a scalpel's job. While certainly the Commission should promote spectrum sharing, it cannot offer a complete solution either. Sharing has ultimate limitations, namely, Shannon's Law.[119] While "ultra-wideband and other spread-spectrum technologies enable network engineers to exploit given spectrum resources more efficiently," they cannot "eliminate interference concerns altogether."[120]

Though enhancing the Part 15 Rules may be a logical step down the road, this action seems more appropriate in the event that anticompetitive behavior in the unlicensed space becomes an evidenced problem. For now, active information gathering may be enough.

V. WHY THE COMMISSION SHOULD TAKE A PROACTIVE APPROACH

While presenting possibilities for both exciting innovation and problematic challenges to the public interest, growing licensed

116. Kenneth W. Abbott, et al., *Soft Law Oversight Mechanisms for Nanotechnology*, 52 JURIMETRICS J. OF L. SCI. & TECH. 279, 305 (Spring 2012).

117. *See* CSERES, *supra* note 62.

118. *Tale of Two Agencies – Overlapping Jurisdiction of the FCC and FTC – Audio/Video*, THE FEDERALIST SOC'Y, http://www.fed-soc.org/multimedia/detail/tale-of-two-agencies-overlapping-jurisdiction-of-the-fcc-and-ftc-audiovideo [https://perma.cc/T8M8-85Q6] (last visited Nov. 15, 2016).

119. *See* NUECHTERLEIN & WEISER, *supra* note 2, at 114 (explaining "in mathematically precise detail, that the information-carrying capacity of a communications channel increases in direct relation to the breadth of the frequencies employed and the 'signal-to-noise' ratio").

120. *See id.* at 115.

incumbent interest in unlicensed participation at minimum portents rapid change within the unlicensed landscape. Such change will likely lead to increasing disputes.[121] Columbia Professor Tim Wu argues that proactive informal measures by an agency "are best justified when the industry is undergoing rapid change—under conditions of 'high uncertainty.'" [122] Informal regimes, he suggests, are most useful "when the agency faces a problem in an environment in which facts are highly unclear and evolving."[123] As more big players begin utilizing unlicensed bands, the Commission should be an active participant in the evolving landscape, soliciting information from stakeholders and offering guidelines where appropriate.[124]

CONCLUSION

In her extensive work on governance systems for managing commons resources, Nobel laureate Elinor Ostrom "identifies several key principles: the creation of clear rules that respond to local conditions; collective decision-making that allows the participation of most community members; effective monitoring, enforcement, and conflict-resolution mechanisms; and coordination between organizations that manage common-pool resources."[125] As the Commission looks ahead to challenges facing users of unlicensed spectrum, an integrated solution incorporating these principles may prove most successful.

The unlicensed bands draw important benefits from the Part 15 Rules management system that enable complementary incentives to innovation and investment between licensed and unlicensed spectrum. However, growing participation in the unlicensed space, particularly by big players and licensed incumbents, will undoubtedly present challenges to the Commission's goals of free innovative space. Though how best to preserve low capital costs, low barriers to entry, and ultimately just space for a diverse group of innovators remains unclear, these policy goals are vital in the management of unlicensed spectrum. Going forward, the Commission and stakeholders should keep an eye out for anticompetitive behavior as big players become increasingly active in the unlicensed bands. To facilitate further

121. *See* Spain, *supra* note 80, at 344.

122. Tim Wu, *Agency Threats*, 60 DUKE L.J. 1841, 1842 (Importantly, Wu notes, "[u]nder conditions of uncertainty, absent the threat mechanism, the agency would have two options: to make law—through a rulemaking or adjudication—or to ignore the area altogether. Neither is particularly satisfying. The former forces the agencies to make law likely to last a long time based on poorly developed facts, and it invites long periods of uncertainty created by the judicial review process. The latter surrenders any public oversight or input during what may be a critical period of industry development.").

123. *Id.*

124. *See id.*

125. MILGROM, LEVIN & EILAT, *supra* note 8, at 14.

research, the Commission should issue a Notice of Inquiry to raise awareness of these issues and solicit stakeholder perspectives on how best to avoid or address them.

The Commission has significant public interest reasons for allocating unlicensed bands. Growing participation in the unlicensed spectrum bands by large licensed band incumbents will likely present challenges to the Commission's unlicensed public interest goals. To avoid suboptimal reactionary regulation in the unlicensed space, the Commission should take a proactive approach to maintain the unlicensed bands as a space for fast, free innovation.