

The Year in Economics at the FCC, 2014–2015

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Published online: 20 November 2015
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Abstract We discuss several FCC proceedings and other matters of economic interest. These include: the Commission’s new Open Internet (“net neutrality”) rules and economic challenges they pose; regulatory implications of a potential reclassification of certain online video distributors as multi-channel video distributors; the proposed Comcast-Time Warner Cable merger; a set of policy experiments that involve extension of the “Lifeline” universal service program to broadband, and the IP technology transition; and, finally, two major policy initiatives to improve the management of spectrum used by mobile wireless providers.

Keywords Mergers · Media · Regulation · Internet economics · Communications

1 Introduction

This article presents economic perspectives on a selection of proceedings and policy analyses that the FCC addressed during the past year. The discussion highlights the Commission’s goals of promoting competition, innovation and investment.

We first update the developments that led to the 2015 Open Internet Order (the FCC’s most recent “net neutrality” rules) and set out future economic challenges that follow from that Order. We then discuss the potential reclassification of certain

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online distributors as multi-channel video programming distributors (MVPDs) and the economic and regulatory implications that this definitional change would have.

In the third section, we turn to the economic theories and empirical research that led to the withdrawal in April 2015 of the merger that had been proposed between Comcast and Time Warner Cable. We then showcase a set of policy experiments in wireline communications that the FCC crafted for the purpose of generating economic data for use in future regulatory decisions.

Finally, we discuss the economic analysis that has contributed to two major policy initiatives that the Commission has taken to improve its management of the spectrum that is used by mobile wireless providers.

2 The 2015 Open Internet Order

In February 2015 the FCC's Open Internet Order reclassified broadband Internet access service (BIAS) from an information service (which is regulated under Title I of the Communications Act) to a telecommunications service (which is regulated under Title II).¹ In an earlier volume of this journal, Baker et al. (2011) set out the economic reasoning behind the 2010 Open Internet Order (FCC 2010a), which preceded the Title II reclassification. In this section of the present article, we update the legal events that led to the new rules, describe how the obligations of BIAS providers have changed, and discuss the economic challenges that lie ahead.

The 2010 order established three basic rules that govern the behavior of fixed broadband service providers, or fixed ISPs²: “no blocking” (of end user access to Internet content or services or to non-harmful devices), “no unreasonable discrimination” (against Internet content or services) and “transparency” (openness about network practices). The no-unreasonable-discrimination rule did not specifically bar fixed ISPs from charging Internet content or service providers (commonly called “edge providers”) for priority service, such as faster transmission speeds, but suggested that it was skeptical of such arrangements. The 2010 rules also allowed possible exceptions for “reasonable network management,” such as the control of congestion. Mobile ISPs were subject to similar but more limited rules against blocking websites or applications that competed with their VOIP or video telephony services.

Then in *Verizon v. FCC*, 740 F.3d 623 (2014), the D.C. Circuit Court of Appeals upheld the transparency rule, but struck down the other 2010 rules against blocking and discrimination on jurisdictional grounds. The *Verizon* court agreed, however, that “Internet openness drives a ‘virtuous cycle’ in which innovations at the edges of the network enhance consumer demand, leading to expanded investments in broadband infrastructure that, in turn, spark new innovations at the edge” (par. 7). Essentially, the decision also affirmed the Commission's conclusion that

¹ FCC (2015a). The Order was adopted on February 26, 2015, and went into effect on June 12, 2015.

² In this article, we use the terms “broadband service provider” and “Internet service provider” (ISP) interchangeably. ISPs are of two types: “fixed,” or wireline ISPs such as cable television operators; and “mobile,” or wireless ISPs.

“broadband providers represent a threat to Internet openness and could act in ways that would ultimately inhibit the speed and extent of future broadband deployment,” (par. 7). In essence, the *Verizon* court recognized that broadband providers have both the incentive and the ability to harm edge providers and consumers.

In response to *Verizon*, the Commission issued a 2014 Notice of Proposed Rulemaking (NPRM) (FCC 2014a), which led to the 2015 reclassification of BIAS service as a telecommunications service, which makes it subject to common carrier regulation. The rationale for this change was that while Internet service was commonly offered in the past as a package of services, for example by AOL, that service included not only broadband Internet access, but also a variety of specific information services (such as gateways to movie rating services). Today, bundled information services are separable from the underlying telecommunications service. The Commission also found in 2015 that both fixed and mobile ISPs threatened Internet openness, and thus applied the same set of regulations to both.

In the 2015 Order, the transparency rule was essentially retained with minor enhancements, and three bright line rules were enacted: no blocking; no throttling (impairing or degrading content); and, most notably, a per se ban on “paid prioritization”—the favoring of some traffic over other traffic, such as by offering higher speeds or quality of service in exchange for third-party payment or to benefit an affiliated entity. The modified no blocking and no throttling rules allow exceptions for “reasonable network management,” but no exceptions (apart from a waiver process) are permitted to the “no paid prioritization” rule.

Title II common carrier regulation has a long history, which dates to the original 1934 Communications Act, which codified Federal regulation of telecommunications rates and a variety of other behavior of telecommunications firms. At that time, Title II primarily applied to the regulation of AT&T, which combined local monopoly telephone companies that served about 80 % of the U.S. population with a total monopoly of long distance telephone service. Over a period of many years, mostly after AT&T’s monopoly began to be dismantled in the 1980s, a large economic literature, much of it highly critical of Title II regulation, emerged. In the 2015 order, however, the Commission chose to forbear from numerous provisions of its Title II authority, notably tariffing, rate regulation, cost accounting rules, and unbundling of last mile facilities.

In the 2015 Order, the Commission found that broadband service providers still had the incentives and the ability to harm edge providers that underlay the 2010 order. First, the Commission found that competition among these providers remained limited in spite of the growth of wireless competitors. In any case, regardless of competition among broadband providers at the retail level, they retained “gatekeeper” or “terminating access monopoly” power (e.g., Armstrong 2002, 2006; Wright 2002), which was enhanced by consumer switching costs, especially due to bundling of BIAS with MVPD as well as telephone service. An important change since 2010 that the Commission found to enhance the incentive and ability of broadband providers to harm the Internet was the rapid rise of video streaming, which by 2015 had come to account for the overwhelming majority of US peak load Internet traffic. This was a growing concern because all of the major

wireline ISPs also offered multichannel video service, giving those companies an incentive to protect that business.

Notably, however, the 2015 Order specifies three significant exceptions to application of the bright line Open Internet rules: The Commission did not apply the adopted rules to interconnection agreements between BIAS providers and edge providers, content delivery networks (CDNs), or backbone networks. Two other practices—usage-based pricing (notably the use of data caps) at the consumer level, and the practice of “zero-rating” (exemptions by broadband providers of certain edge providers or groups of providers, from data caps—were not specifically banned, but are subject to a general conduct standard. The Order calls for case-by-case analysis of the complaints that are made to the Commission about these three practices.

The interconnection agreements during 2014 between Netflix and the four largest fixed ISPs, in which Netflix agreed to pay them to interconnect at the edges of their network earned wide publicity. The agreements followed periods in which Netflix’s streaming video was degraded on these service providers’ networks. Going forward, the Commission could choose to allow the interconnection market to work freely, with the possible benefit of lower broadband access rates for consumers, but also the possibility of anti-competitive interconnection rates charged by ISPs due to excessive market power. Or at the other extreme, the Commission could choose a zero-pricing rule, which has been advocated by some economists as promoting edge provider entry and competition and lower transactions costs.³

The Commission faces a similarly broad range of economic choices with respect to data caps and zero rating, which are to be evaluated case-by-case under a “no unreasonable interference/disadvantage” standard. Data caps are in widespread use by wireless ISPs, and they have been introduced in recent years by fixed ISPs, although to date the latter have generally been set at sufficiently high levels to affect a relatively small number of their subscribers. Essentially, data caps can be effective price discrimination devices in which heavier users (generally heavier video users) pay higher rates, which can result in a more efficient allocation of the largely fixed costs of ISP networks. As the Commission notes in the 2015 Order, however, data caps can also potentially be used as anticompetitive devices to drive BIAS users to the ISPs’ existing MVPD businesses, or possibly to degrade competing online video businesses.

Zero-rating has some similarity to the banned practice of paid prioritization in that it favors some edge providers over others. Zero-rating practices also encompass a broad range, from the apparently benign—e.g., of a non-profit edge provider offering health information—to the possibly anticompetitive: e.g., to exempt a vertically affiliated service for the purpose of effectively raising end-user costs of accessing a similar unaffiliated edge provider.

At this writing, the 2015 Open Internet Order faces a variety of potential legal challenges, as well as the resolution of case-by-case complaints, which are likely to take some time to resolve.

³ For economic discussion of these debates, see Becker et al. (2010), Lee and Wu (2009), Economides (2011).

3 The Definition of an MVPD

A major initiative of the FCC's Media Bureau in 2014 was a proposed rulemaking that would broaden the definition of a multichannel video programming distributor (MVPD) to include certain Internet-based video distributors (FCC 2014b).

In the 1980s, most households had only one choice for multichannel video service: the local cable operator. The entry of direct broadcast satellite ("DBS") in the 1990s provided competitive alternatives. The number of choices increased again with the entry of Verizon in 2005 and AT&T in 2006. In 2013, nearly a third of all households had access to at least four MVPDs (FCC 2015b).⁴ Competition for multichannel video service has arguably been facilitated by the Commission's rules that require programming channels with vertical ownership ties to cable operators to be made available to other MVPDs on nondiscriminatory rates, terms, and conditions (program access) (FCC 2012a); and rules that require broadcasters to negotiate "in good faith" with MVPDs for carriage of broadcast signals (retransmission consent) (FCC 2011b).⁵

The Commission now sees an opportunity to facilitate additional competition for multichannel video service by extending the benefits of the program access and retransmission consent rules to the Internet. Specifically, the Commission has proposed to modernize the definition of an MVPD to include entities that make available for purchase—by subscribers or customers—multiple streams of linear (i.e., prescheduled) video programming, regardless of the technology that is used to distribute the programming (FCC 2014b). The Commission's proposal is also designed to ensure that incumbent MVPDs do not evade regulations by migrating their services to the Internet. The Commission is considering the overall costs and benefits of the proposal, including the impact on investment in new technologies and competition between traditional MVPDs and Internet-based video distributors.

The economics of vertical integration suggests that MVPDs may have incentives to withhold their affiliated channels from rival MVPDs. Although traditional MVPDs have consistently maintained that access to at least some key cable-owned channels is essential to their ability to attract and retain subscribers, the value of program access to the new business models that offer linear programming over the Internet is less clear. Traditional MVPDs typically offer all popular channels and market their video services as very close substitutes to those that are offered by rival MVPDs. DBS and telco-operated MVPDs have argued that the program access rules played an important role beginning in the 1990s in their successful development as competitors to cable in the MVPD marketplace.

Traditional MVPDs offer both linear channels and video-on-demand ("VOD") programming. The Internet provides significant competition to that VOD programming. Netflix, Hulu Plus, and Amazon Prime Instant Video—three of the largest

⁴ The merger of AT&T and DIRECTV, which was approved by the FCC with conditions in 2015, reduces the number of households with access to four independently-owned MVPDs by approximately 33 million.

⁵ In addition to the privileges of program access and retransmission consent, MVPDs have responsibilities, which include: program carriage; the competitive availability of navigation devices; closed captioning; video description; access to emergency information; and the loudness of commercials.

companies that offer video over the Internet—offer only VOD programming on a monthly subscription basis. But we have recently seen increased competition for the linear channels that are offered by MVPDs.

For example, online video distributors (“OVDs”) such as Sling TV and PlayStation Vue have begun to offer multichannel service over the Internet. As of mid-2015, Sling TV offered approximately 20 linear channels on its basic service with seven add-on packages of various genres. These channels have included a few that are owned by cable MVPDs. Their business model targets “cord cutters”: e.g., those MVPD subscribers that are price-sensitive and satisfied with a narrower channel range, as well younger viewers who have never subscribed to a traditional MVPD. At this writing, PlayStation Vue offers more channels, including a number that are owned by cable MVPDs, but not some popular channels, such as ABC and ESPN. The new Internet multichannel services, which launched without the benefit of program access rules, are not marketed as near-perfect substitutes for traditional MVPDs, but the gap has been closing.

By extending program access for cable-owned channels and retransmission consent for local broadcast stations, the Commission’s proposal to modernize the definition of an MVPD may close the gap further and hence promote competition.⁶

It’s important to recognize that only *cable* MVPDs (e.g., Comcast, Time Warner Cable and Charter) have a regulatory obligation to make cable-owned channels available to other MVPDs. Non-cable MVPDs—e.g. DIRECTV, DISH Network, and AT&T U-verse—do not have a regulatory obligation to make any of the linear channels that they own or acquire available to other MVPDs. It’s also important to recognize that the number of cable-owned channels can vary significantly from year to year. The number dropped in 2009 when Time Warner (a major owner of cable networks) and Time Warner Cable split. It then increased in 2011 when Comcast and NBC Universal merged. Thus, the potential importance of the program access rules changes with these vertical ownership changes.

The MVPD definition proposal may be viewed as complementary to the Commission’s new Open Internet rules. End users that wish to access video programming via an OVD must contract separately for the OVD content and for transport: i.e., ISP service. As discussed above, the Commission’s 2015 Open Internet rules prevent Internet access providers from blocking, impairing, or establishing fast/slow lanes to lawful content. The Open Internet rules take account of the fact that many of the largest wireline MVPDs also offer broadband service and may have incentives to hinder OVDs that compete with their traditional MVPD services, as well as their own Internet video services.

Traditional cable, DBS, and telephone MVPDs are facilities-based providers. In contrast, many Internet-based distributors of linear programming rely on facilities that are provided by others. The Commission’s proposal to adopt a technology-neutral MVPD definition would thus extend program access and retransmission consent rules to entities that are not facilities-based providers. The Commission recognizes that granting MVPD status to these entities would be a significant change

⁶ Including Internet-based distributors in the definition of an MVPD may require changes in copyright law to facilitate OVD retransmission of copyrighted broadcast performances.

and has also sought comment on including in the new MVPD definition a requirement that entities have control over a transmission path to qualify as an MVPD (although the Commission has not recommended this requirement) (FCC 2014b). If adopted, the added requirement would limit the benefits of program access and retransmission consent to only facilities-based providers.

Although still a small industry, linear programming provided over the Internet is growing. As new Internet business models include more of the traditional MVPD linear channels, they become better substitutes for traditional MVPD service. If the Commission's proposal to modernize the definition of an MVPD is adopted, competition in the video marketplace is likely to be encouraged.

4 The Proposed Comcast-Time Warner Cable Merger

4.1 Introduction

In 2014, Comcast Corp., sought to acquire Time Warner Cable, Inc. (TWC). At the time that the proposed transaction was announced, Comcast was the largest MVPD and the largest broadband service provider (ISP) in the U.S. TWC was the fourth-largest MVPD and the third-largest ISP. Following some proposed divestitures and other transactions, the merged entity would control approximately 29 % of the national MVPD market and 60 % of all high-speed broadband connections in the U.S. (Comcast 2014a, b; Baer 2015).⁷ As the result of a joint venture between Comcast and NBC-Universal [approved by the FCC in 2011 with a number of conditions (FCC 2011a)], Comcast already controlled substantial interests in broadcast and video programming, including the marquee NBC broadcast network, the Universal Studios film library, and popular cable networks such as Bravo, USA Network, and CNBC.

Following an extensive review process that was coordinated with the Antitrust Division of the U.S. Department of Justice (DOJ), the FCC staff concluded that there were a number of concerns with the proposed merger. These issues arose from Comcast's position as both a leading video and broadband service provider, in addition to its role as a major content provider. Following a presentation of these concerns by FCC staff to the applicants (but before any vote could be taken by the Commission), the proposed merger was abandoned in April 2015.⁸

In this section, we outline the FCC staff's economic analysis that preceded abandonment of the merger. We first set out the main economic theories of harm and their historical origins, followed by a brief enumeration of major econometric studies that the staff undertook to support these theories.

⁷ Assistant Attorney General Baer was recused from consideration of the Comcast/TWC merger. This speech was delivered after the merger applications had been withdrawn.

⁸ Although the Chairman of the FCC concurred in the presentation to the applicants of staff concerns about the merger, the application was withdrawn before the staff could complete a draft order for Commission vote, which would likely have proposed designating the merger for a hearing pursuant to 47 U.S.C. 309(e).

4.2 The FCC Merger Review Process

The FCC's merger review authority is contained in Section 310(d) of the Communications Act: the proposed transfer of control of licenses and authorizations will serve the public interest, convenience, and necessity. The Commission's merger reviews are informed by competition principles, but they are broader in scope, based on the public interest standard. The Commission's mandate differs from that of the DOJ, which relies on the competition standard of Section 7 of the Clayton Act. For example, the FCC seeks to accelerate private-sector deployment of advanced services and to ensure a diversity of information sources and services to the public; these are objectives that are outside the reach of the Clayton Act (FCC 2014c).

4.3 Theories of Harm

General Substantial advances in technology, as well as changing patterns in how end users consume media, led FCC staff to distinguish between harms that were specific to online video distributors (OVDs) and all other harms in the transaction. The primary focus of the investigation was the former. As discussed in Section 3 above, MVPDs have increasingly faced competition from Netflix and other "over-the top" VOD streaming services, as well as a recent wave of OVD entry by HBONow, Sling, and other firms that offer the programming of broadcast or cable networks but without the "authentication" that the user also has an MVPD subscription. Recognizing the growing reliance that consumers place on accessing content online, staff determined that a post-transaction Comcast would have the incentive and the ability to thwart the nascent development of alternative video distribution services in order to preserve its legacy MVPD business.

In its merger application, Comcast argued that the transaction would not harm competition or the public interest, because Comcast and TWC did not compete within their geographic footprints. The Commission did not dispute the fact that Comcast and TWC did not compete head-to-head for subscribers in a local area; both the cable-based multi-channel video and the Internet broadband services of these firms served well-defined geographic markets with negligible overlap. Instead, the Commission focused on other areas of competition, namely those at the national level.

The economic rationale for the FCC staff's focus on the merged firm's ability to harm OVDs derives from basic features of market structure and the characteristics of media products. OVDs have large economies of scale because of the inherent "public good" nature of the products they sell: The larger is the number of subscribers or viewers that they serve, the lower are their average costs per subscriber or viewer. Partly for these reasons, in fact, OVDs primarily serve national markets. They are thus vulnerable—particularly due to the industry's nascent state—to foreclosure of access to a significant fraction of their potential subscribers.

On the downstream side of the market, so-called "last-mile" wireline networks have strong economies of scale in distribution due to high fixed infrastructure costs, as well as evident economies of scope in providing both MVPD and ISP service at the local level (FCC 2014d).

The economic theory of how significant harms to the OVD industry—and thus reduced diversity of online content and provider entry—could result in this market environment from the accumulation of significant national market shares of the ISP or MVPD service had been recognized in legislation and FCC policies toward cable television more than two decades before. Following an influential 1990 FCC Report on the cable industry (FCC 1990), a provision of the 1992 Cable Act mandated that the FCC set a limit on the percentage of all MVPD subscribers that a single Multiple System Operator (MSO) could serve.

According to a 2007 order, the Commission set the limit at 30 % in 1993 with the justification that large MSOs could gain “enhanced leverage from increased horizontal concentration” to “unfairly impede the flow of video programming to consumers” (FCC 2007, 22). The 30 % limitation was later rejected by the courts (in a case that was brought by Comcast); but the figure has lingered as a heuristic device.⁹ It is ironic that in its 2014 merger application, a stated justification for divestiture of a number of cable systems in the transaction was that the merged firm’s MVPD holdings would not exceed the FCC’s former 30 % limit on MVPD subscribers (Comcast 2014b, p. 6). The Commission’s focus of attention, however, had shifted from the MVPD market to the ISP market, where the merged firm’s share of high-speed broadband subscribers was much higher and (as we discuss below) of greater risk to competition and consumers.

Harms from the Combination of Distribution Assets FCC staff considered whether Comcast’s consolidation of MVPD and especially ISP subscribers at the national level could allow the merged firm to preserve its current industry model by limiting or degrading access to two primary OVD inputs: its “last-mile” broadband network and programming.

Theoretically, Comcast could degrade access to its broadband network through several actions. First, the merged firm could use its greater bargaining leverage derived from its combination of ISP assets to negotiate higher interconnection fees¹⁰—such as the widely publicized payments made in 2014 by Netflix to Comcast and other ISPs—for access to the ISP’s network (Wyatt and Cohen 2014). At the subscriber level, the merged firm could also limit access to OVDs by imposing data caps (a limit on the amount of data that may be consumed by a household over a period of time) or other measured service plans on broadband subscribers, thus effectively discouraging their online video consumption. Staff further considered whether the merged entity could more explicitly degrade the transmission quality of OVD signals, or foreclose access entirely.

With respect to programming inputs, staff considered whether the merged firm could use its greater bargaining power derived from its greater combination of MVPD assets to induce video programming suppliers to withhold their programming from OVDs by means of restrictive contract terms. Similarly, post-merger Comcast could use its bargaining power to secure exclusive or restrictive contract

⁹ *Comcast Corp. v. FCC*, 579 F.3d 1 (D.C. Cir. 2009).

¹⁰ Charges paid by online content providers, or “edge providers” such as Netflix, or by the content delivery networks (CDNs) such as Level 3, which transport them to ISPs.

provisions with third-party programmers that would be designed to limit the access of rival MVPDs to programming.

One aspect of the FCC staff's theory of harm to OVDs was that the combination of distribution assets increased not only the ability but also the incentive of the merged firm to harm OVDs. Any given MVPD could potentially profit from degrading OVDs in order to protect or enhance its MVPD business. That incentive is mitigated, however, because most of the potential benefits to MVPDs from degradation of OVDs (on the assumption that the MVPD serves only a minority of total national subscribers) are spillover effects on other MVPDs. By merging, however, the larger firm internalizes a higher proportion of the benefits from degrading OVDs, thus increasing its incentive to take such actions.

Harms from the Combination of Programming Assets and Distribution Assets Following the precedent that was set in its analysis of the Comcast-NBCU transaction, FCC staff explored a theory of harm with respect to program access and carriage. This approach identified discriminatory actions that would follow directly from the combination of Comcast's programming assets with TWC's distribution assets. Staff posited that the proposed transaction would increase Comcast's bargaining power when it negotiates NBCU programming deals with rival MVPDs as well as with OVDs.

In its previous analysis of the Comcast-NBCU transaction, the Commission characterized that transaction as potentially raising the opportunity cost of providing programming to rival distributors (Baker et al. 2011). Because the combined entity would compete with rival MVPDs and OVDs over a larger footprint, there existed an increased incentive and ability to charge higher prices for vertically affiliated programming, or to withhold it entirely. This was due to the recapture of lost programming profits by the vertically integrated firm's downstream MVPD division when video subscribers leave rival MVPDs due to withholding of programming. The details of this vertical theory and relevant calculations of harm are discussed in Baker (2011).

Theoretically, the combined entity also would have a greater ability to disadvantage rival programming suppliers because it would be able to limit a supplier's access to subscribers by denying its carriage over a larger footprint.

Summary FCC staff considered other theories of harm in addition to those discussed above, but did not find that any one adverse action or category of actions would in isolation necessarily make the proposed transaction contrary to the public interest. Rather, staff concluded that the confluence of adverse actions would likely result in significant harm to OVDs, rival MVPDs, and third-party programmers. There was also the understanding that Comcast could, for strategic purposes, spread the cumulative effect of anti-competitive actions across these various levers and fine tune the impact of the competitive harm, thereby limiting the ability of regulators to monitor and address their ultimate impact.

4.4 Empirical Analysis Supporting Staff Findings on Theories of Harm

FCC staff relied upon several empirical studies to determine whether the transaction would be in the public interest. The studies relied mostly on highly confidential or

privileged data, and we primarily limit the discussion to their general methodologies and purpose.

Several analyses were used to determine if Comcast had the potential to disadvantage OVDs in the interconnection market. Comcast's share of broadband subscribers would significantly increase following the transaction. Staff examined the effect that a larger subscriber base would have on the ability to charge higher prices for interconnection. To the extent that larger broadband providers have more bargaining power, the studies focused on whether Comcast would leverage its enhanced position to negotiate higher interconnection fees with OVDs or other edge providers. Staff recognized the growing reliance by consumers on high-speed data connections for services such as ultra-high definition video, and explored whether higher speed broadband plans—particularly 25/3 plans (i.e., 25 Mbps download, 3 Mbps upload)—constituted a separate relevant product market within broadband. Staff also used the 2014 Netflix dispute as a natural experiment to estimate the marginal effect of the alleged degradation in signal quality on subscriber behavior.

FCC staff also considered whether the transaction would substantially increase the national share of MVPD subscribers that would be served by Comcast—particularly in the top 10 media markets—and consequently increase Comcast's bargaining power in the programming supply market. To determine the relationship between firm size and bargaining power, FCC staff estimated the relationship between an MVPD's size and the per-subscriber price that it pays for programming. Separately, FCC staff investigated whether a post-transaction Comcast would have a greater incentive to engage in foreclosure strategies with respect to NBCU content.

FCC staff also examined whether the combination of Comcast's programming assets with TWC's distribution assets would increase Comcast's bargaining power when it negotiated programming deals with rival MVPDs, with the result of higher license fees. A theoretical bargaining framework was implemented to determine whether Comcast could leverage its increased size post-transaction to negotiate programming price increases for its NBCU content. Staff separately conducted an empirical investigation to determine whether Comcast has historically attempted to disadvantage rival programmers by denying them carriage on its cable systems in more competitive MVPD markets.

5 Policy Experimentation in Wireline Services

5.1 Overview

In the last year, the FCC's Wireline Competition Bureau (WCB) has been incorporating policy experimentation into its regulatory work. Specifically, the Bureau conducted a series of pilot projects to study how broadband service might be supported by the Lifeline low-income universal service program.¹¹ The Bureau also

¹¹ The FCC's Lifeline program provides discounted telephone service for eligible low-income households. The program supports both landline and mobile telephone service for approximately 14.5 million subscribers as of 2013 (FCC 2014e, *Universal Service Monitoring Report* available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-330829A1.pdf). As of December 2013, there were 310.7

continued working with a carrier that is conducting a “service-based trial” to understand likely effects of the TDM-to-IP transition.¹² In both cases, the Commission crafted these efforts as policy experiments to generate economic data that could be relied upon for future FCC decisions. This section provides an overview of these efforts and discusses some of the issues that the Bureau has faced in conducting these experiments.

The goal of well-designed policy experiments is to gather useful, unbiased data on whether—and to what extent—a policy achieves its intended goals.¹³ Experimentation thus entails implementing a set of policies in such a way that credible information about the *causal* effect of the policies can be estimated. In the most general (and ideal) sense, this means a scientific approach to determine the effects of such policies, generally by setting up treatment and control groups over which to vary the policies in some plausibly exogenous manner (*e.g.* randomization).

As part of the rulemaking process, policy experiments may also serve as an information source that parallels the notice and comment cycle that is required by the Administrative Procedure Act. While outside parties may submit formal comments with their views and data on the expected effects of a policy, an agency can also generate its own information through a policy experiment.

Other segments of the Federal government have also sought to promote the use of policy experiments. Encouragement has come from an Office of Management and Budget memorandum (OMB 2013), a chapter in the Economic Report of the President (USGPO 2014), and a bill in Congress to create a new evidence-based policy commission (HR 5754 2014). The Government Accountability Office has released a primer on how to conduct rigorous evaluation of policies (GAO 2012).

While there has been a recent wave of interest in policy experimentation, it is not new to Federal agencies. The Department of Housing and Urban Development ran a 10-year “Moving to Opportunity for Fair Housing” experiment to learn the effects of providing rental assistance that allowed families to move out of high-poverty neighborhoods (HUD 2015). The Department of Health and Human Services conducted a high profile randomized controlled experiment to study effects of the Head Start program (HHS 2010). The Department of Labor has supported a variety of experiments to find out what works in job training assistance (DOL 2014).

A fairly rare, though important example of a pure regulatory experiment was the 2005–2007 Securities and Exchange Commission’s (SEC) short-sale price experiment. There has been a long-standing debate over the benefits and costs of restrictions on short sales, so the SEC designed an experiment to gather data that it could credibly use to guide short-sale regulations (SEC 2007). Essentially, the SEC randomly selected one-third of the Russell 3000 Index stocks, which it exempted from a short-selling restriction. This allowed for a clean comparison of the markets

Footnote 11 continued

mobile telephone subscribers and approximately 130 million fixed (switched access and VOIP) telephone subscribers (https://apps.fcc.gov/edocs_public/attachmatch/DOC-329975A1.pdf).

¹² The TDM-to-IP transition refers to the network changes that occur when networks that use older time-division multiplexing (TDM) technologies are replaced with those using Internet Protocol (IP) technology.

¹³ For a non-technical explanation of policy experiments, see Abramowicz et al. (2011).

for the two groups of stocks (SEC 2007, pp. 4–5). The SEC Office of Economic Analysis report on the experiment found that the restriction reduced short selling volume but had no effect on the bid-ask spread of a stock (SEC 2007, pp. 34–51).

With this background, we now discuss the two recent experimental efforts at the FCC.

5.2 Lifeline Broadband Pilots

The Lifeline program has supported purchase of telephone service by low-income households since the mid-1980s. In 2012 the FCC approved the *Lifeline Reform Order (LRO)* which, as part of a host of reforms, contemplated that the Commission might one day consider supporting broadband service through Lifeline. To learn more about how FCC support could be applied to broadband, the *LRO* called for a Lifeline Broadband Pilot Program and directed the WCB to solicit applications from ETCs [Eligible Telecommunications Carriers] to participate in the Pilot Program and to select a relatively small number of projects to test the impact of variations in the monthly discount on broadband adoption over a 12-month period (FCC 2012b, para. 325).

While the FCC had conducted other pilot programs, the WCB took a decidedly different approach for the Lifeline pilot. Previous pilots tended to implement a single policy or program without also establishing an exogenously chosen control group for the purpose of comparing the intervention's impact.¹⁴ In calling for applications to participate, the WCB said it “would strongly favor pilot projects designed as field experiments that would test the impact on how variations on broadband service offerings impact adoption.”¹⁵

To ensure that the Commission received standardized data across all of the projects, pilot participants would have to submit a uniform set of data (including surveys of participating households) that could be analyzed by the Commission and outside parties (FCC 2012c, Appendix). Thus, the WCB sought to prepare for the future possibility that Lifeline would support broadband by estimating causal impacts of policy variables on one important outcome measure: adoption.¹⁶ All of the data that were collected would be posted online for public inspection and analysis.

Ultimately, the WCB selected 14 pilot projects that represented both mobile and fixed providers and covered urban, rural, and tribal areas. Together, the projects studied the effect of subsidy levels on adoption—including the effect of offering

¹⁴ Such non-experimental pilots can often yield a wealth of information: for example, by highlighting practical challenges or demonstrating a proof of concept. What uncontrolled policy implementation cannot generally show is a causal link between policy and outcomes.

¹⁵ The Bureau explained that “ETCs should submit a detailed description of the experimental design and other experimental protocols used suitable for a replication study, what variations on broadband service offerings [would] be tested (e.g., discount amount, duration of discount, speeds, usage limits, digital literacy training or any other factors impacting broadband adoption) and how the project(s) [would] randomize variations on broadband service offerings (e.g., geographic randomization)” (FCC 2012c).

¹⁶ A full description of the pilots and a link to the public datasets is available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0522/DA-15-624A1.pdf.

digital literacy training—and the types of services that new adopters would choose. For instance, experimental and quasi-experimental projects varied the offered subsidy amounts and then observed if the customer adopted. Some projects varied

Table 1 Low-income broadband pilot projects

Project	States	Key questions	Service and device	Methodology
TracFone	FL, MA, MD, TX, WA, WI	Effect of monthly price and hardware cost on adoption	Mobile, smartphone	Geographically randomized controlled trial
Nexus	CA, IA, LA, MI, MS, NJ, NV, OH	Effect of monthly price and digital literacy training on adoption and data plan choice	Mobile, smartphone or MiFi	Randomized controlled trial
Virgin mobile	OH, MA	Effect of monthly price and hardware cost on adoption and retention	Mobile, MiFi	Geographically randomized controlled trial
Frontier	OH, WV	Effect on adoption and retention of a digital literacy incentive	Fixed	Geographically randomized controlled trial
Vermont telephone	VT	Effect of price on adoption and retention	Fixed	Comparison group quasi-experiment
Xchange	NY	Effect of monthly price on adoption	Fixed	Comparison group quasi-experiment
Partnership for a connected Illinois	IL	Effect of digital literacy offering on adoption and retention	Fixed	Comparison group quasi-experiment
Troy cable	AL	Effect of monthly price on adoption and retention	Fixed	Comparison group quasi-experiment
Gila river	AZ	Effect of monthly price on adoption	Fixed	Individual randomized controlled experiment
Hopi	AZ	Effect of monthly price on adoption	Fixed	Individual randomized controlled experiment
PR wireless	PR	Consumer preferences for devices	Mobile, Smartphone or MiFi	Nonexperimental
T-mobile puerto rico	PR	Consumer preferences for devices	Mobile, Smartphone or MiFi	Comparison group quasi-experimental/ Nonexperimental (No variation in offerings, variation in advertising)
Puerto Rico Telephone Co.	PR	Consumer preferences for speeds	Fixed/Mobile, Tablet	Nonexperimental
NTCA	IA, NM	Consumer preferences for speeds	Fixed	Nonexperimental (comparison of non-similar areas)

device costs and whether digital literacy was offered. In some cases customers had only one plan option; but in others, customers could apply the subsidy to several plans and thus pay different end-user charges. Eligibility to receive the pilot subsidy was conditional on a household's being eligible for Lifeline and not currently being a broadband adopter. This allowed for a focus on the effect of policy variables only on broadband non-adopters: a group about which there is great policy interest.

Table 1, which is reproduced from the *Low-Income Broadband Pilot Staff Report*, summarizes the 14 projects (FCC 2015c). The table shows the various methodologies that were used and the key questions that were addressed by each pilot. Many of the 14 pilots used randomly assigned control and treatment groups, while others used quasi-experimental assignment methods. Projects with experimental or quasi-experimental designs allow for data analysis to estimate the causal impacts of policy variables on broadband adoption.

While preference was given to experimental projects, some of the approved pilots were non-experimental. Such projects cannot speak to the causal impacts of policies, but they did allow for the observation of low-income consumers' preferences. For example, several projects allowed new adopters to choose either a smartphone or mobile hotspot device at a reduced price. Observing the fractions of customers choosing each might be helpful in future rulemakings.

While data are still being analyzed, an initial May 2015 *Staff Report* describes details of each pilot project and reports aggregate subscribership numbers by treatment group. As an example, Table 2, reproduced from the *Staff Report*, shows for the Virgin Mobile project the eight treatments that were randomly assigned across existing Lifeline customers based on ZIP code. Virgin Mobile offered

Table 2 Virgin mobile treatments

Treatment description	Monthly subsidy amount	Equipment discount	Digital literacy offered	Total subscribers
Group 1; No discount on device or service; with digital literacy	\$0.00	\$0.00	Yes	24
Group 1; No discount on device or service; without digital literacy	\$0.00	\$0.00	No	31
Group 2; Discount on device and service; with digital literacy	\$20.00	\$40.00	Yes	286
Group 2; Discount on device and service; without digital literacy	\$20.00	\$40.00	No	178
Group 3; Discount on service, but not device; with digital literacy	\$20.00	\$0.00	Yes	97
Group 3; Discount on service, but not device; without digital literacy	\$20.00	\$0.00	No	77
Group 4; Discount on device, but not service; with digital literacy	\$0.00	\$40.00	Yes	126
Group 4; Discount on device, but not service; without digital literacy	\$0.00	\$40.00	No	82

discounted mobile service via a hotspot device and varied the monthly service price, the equipment cost, and whether or not digital literacy training was offered during the solicitation (FCC 2015c, pp. 11–12).

The *Staff Report* notes in its general conclusions based on the pilots that customers strongly prefer smartphones over hotspot devices, that adopters have little interest in paying for the highest fixed broadband speed tiers, and that the subsidy clearly impacts adoption rates. The *Staff Report* also found that having Lifeline providers offer digital literacy training had no discernable positive impact (FCC 2012b, p. 2). This finding illustrates how experiments can provide valuable information by testing the effects of a particular policy option. Further analysis of the full data set will allow investigation of such issues as the relative importance of monthly charges versus one-time equipment charges as barriers to low-income adoption, the elasticity of demand for new adopters, the new adopters' preferences over device types, the expected rate of adoption per dollar subsidy, and how newly adopting households used the service.

5.3 Technology Transitions Service-Based Trials

One of Chairman Wheeler's first major blog posts ("The IP Transition: Starting Now") discussed how the Commission would "begin a diverse set of experiments that will allow the Commission and the public to observe the impact on consumers and businesses of such [technology] transitions" (Wheeler 2013). In a January 2014 Report and Order, the Commission called for telecommunications providers voluntarily to propose "service-based" experiments (FCC 2014e). These experiments were intended to provide the Commission with data on how the IP transition might impact consumer experiences, technical performance, and public safety.

Making clear what the Commission expects from the service-based experiments, the item goes on to say that "To ensure high quality data, we expect each experiment to include a 'control group' by which to evaluate the performance of the 'experimental group'..." and "The Commission is open to suggestions about how to select each group; however, a priori we favor a transparent process and believe random selection of some type is likely the best choice for mitigating bias and strengthening credibility" (FCC 2014e, Appendix B para. 51). With this request for service-based trials designed as experiments, the FCC again took a route toward generating credible data by encouraging an experimental methodology.

In this instance, the FCC sought to employ experiments in an area that is much closer to its core regulatory functions than with the Lifeline pilots. AT&T responded by proposing a consumer-focused TDM-to-IP trial that would take place in Carbon Hill, AL, and Kings Point, FL wire centers (e.g., exchanges), with plans also to incorporate control wire centers into the trials. Work on developing the evaluation plan for these service-based trials between the FCC and AT&T is ongoing, but the stage has been set for the trials to produce credible data that will inform the Commission as the IP transition progresses. For example, data on consumers' experiences, knowledge, or perception of the transition may be studied.

5.4 The Challenges and Promises of Experimentation at a Regulatory Agency

The FCC's recent foray into policy experimentation highlights some challenges that regulators using this tool need to be aware of. By and large, experiments in other parts of government are employed to estimate the impact of an intervention on individuals or households, such as job training programs, educational interventions, and social assistance. In such cases, there is a recognition that participants' behaviors may change because of the experiment, such as a possible desire to please the experimenter. Researchers have well-developed ways to minimize such possibilities.¹⁷

Among other challenges, some parties might wish to manipulate the results of the experiment, with the knowledge that the government will rely on the results in a future rulemaking. The January 2014 *Technology Transitions Order* hinted at this concern, for example, when firms themselves are the experimental subjects (FCC 2014e, para. 25).

We suggest several ways to mitigate the latter concern: First, market forces may prevent manipulation, as was the case with the SEC's short selling experiment. Second, the regulator (as part of the experiment) could use monitoring methods (e.g., "secret shopper") to see if firms are behaving differently in treatment and control groups in ways that could skew the results. The regulator may also be able to prevent manipulation by making it known to firms in the experiment that there will be monitoring. Third, direct gaming of experimental set ups can be reduced if the regulator assigns treatment and control groups. If this is not possible, then standard statistical tests can be used to check the quality of the randomization.

Other challenges to policy experimentation that have confronted the FCC are logistical in nature. Planning and conducting experiments takes time, which means that the experiments must be synchronized with the schedule of a rulemaking. Another issue is obtaining the necessary resources. If designed and conducted in-house, the agency will need to devote staff that are knowledgeable about experiments to the effort. Otherwise, funding may be needed to hire a third-party evaluator to work with the agency. While some experiments can be conducted very inexpensively if relevant data are already being collected, most will require additional resource commitments.

In conclusion, the regulatory environment can present ample opportunities for experimentation. Formal filed comments are a self-selected sample (because only some choose to comment) and "biased" (because they intentionally represent a viewpoint). Thus, well-designed experiments can add important informational value to regulatory deliberation. While large-scale, high-profile experiments may be useful when facing a major fork in the regulatory road ahead, agencies should also consider "nuts and bolts" issues that are fairly easy to study. In the last few years, as demonstrated by the Lifeline Broadband Pilots and the technology transitions

¹⁷ "Hawthorne effects" (behavior changes due to being observed) and "John Henry effects" (control subjects who change their behavior due to the knowledge that they are in the control group) are two of the most common concerns, and thus the use of a double-blind experiment is advisable whenever possible. See Glennerster and Takavarasha (2013, ch. 7).

service-based experiment, the FCC has productively begun to use a range of experiments to improve its decision making.

6 Managing Spectrum in the Mobile Wireless Marketplace

The provision of mobile wireless service requires a combination of inputs. These include spectrum to transmit signals between base stations and end users' devices, as well as cellular base stations, towers, and backhaul that routes voice and data traffic from the base stations. Spectrum is a critical input because it affects if and when existing service providers and potential entrants will be able to expand capacity or deploy networks. Incumbent licensees are likely to need additional spectrum to increase their coverage or capacity as they grow their subscriber bases, while new entrants need access to spectrum to enter the marketplace successfully.

The FCC has primary responsibility for managing spectrum that is not allocated for federal government use. The Commission's two broad goals in this task are: (1) to promote competition in the mobile wireless marketplace; and (2) to encourage the efficient and intensive use of spectrum. Competition in the wireless space ensures that consumers have meaningful choices among multiple service providers; and, as the Commission has established, competition tends to reduce prices, improve quality, and increase innovation (FCC 2014f, pp. 11–12). To encourage the efficient and intensive use of spectrum, the Commission has a number of tools available, including: the assignment of previously unassigned frequencies; reallocation to higher-valued uses; and promulgation of rules that facilitate spectrum sharing. In recognition of a rapidly growing demand for spectrum, the Commission has recommended that an additional 500 MHz be made available for provision of mobile service by 2020 (FCC 2010b).

We present two major policy initiatives, which are centered in the Wireless Telecommunications Bureau, that the Commission is implementing to further its broad goals. On the competition front, the 2014 *Mobile Spectrum Holdings Report and Order* updated the spectrum screen for secondary market transactions; determined that transactions that involve frequencies below 1 GHz would potentially be subject to more intense scrutiny; and implemented a market-based reserve for the upcoming Broadcast Television Spectrum Incentive Auction (FCC 2014f). On the issue of spectrum use, we discuss a new approach that the Commission is taking to make spectrum available to mobile service providers in the 3.5 GHz band.¹⁸

¹⁸ An analysis that was conducted in 2012 by the President's Council of Advisors on Science and Technology (PCAST) concluded that, given the needs of both commercial providers as well as federal users of the spectrum, the provision of additional spectrum for broadband services will require sharing between commercial and federal users. See PCAST, Report to the President: Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth (rel. July 20, 2012) (PCAST Report). Available at: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf.

6.1 Competitive Issues in Spectrum Aggregation and Mobile Spectrum Holdings Policies

During the past decade, demand for mobile wireless services has increased significantly, and the industry's focus has shifted from voice to broadband. The drivers of these changes include the combined effects of rapid smartphone and tablet adoption, widespread use of mobile applications, and greater deployment of high-speed 3G and 4G technologies (FCC 2010b, 2014f, p. 14). At the same time, there has been significant consolidation in the marketplace. As of December 2003, the top six facilities-based nationwide providers accounted for approximately 79 % of total mobile wireless subscribers in the country; by December 2013, the top four providers accounted for approximately 97 % of subscribers (FCC 2014f, p. 15).

As service providers deploy next-generation mobile networks, the technical characteristics and deployment capabilities of particular spectrum bands have become increasingly important, especially since multi-band phones allow providers to take advantage of the properties of different spectrum bands to offer additional or improved services (FCC 2014f p. 12, g p. 43). Specifically, the propagation characteristics of low-band (below-1-GHz) spectrum provide important advantages for network deployment, while spectrum in higher bands is relatively less scarce (FCC 2014f p. 2, g, p. 43).¹⁹

Competition in the mobile wireless marketplace is likely to be best promoted by multiple service providers that have access both to low-band spectrum that can provide in-building penetration and coverage over large geographic areas, as well as high-band spectrum that can provide the increased throughput for mobile broadband applications (FCC 2014f, p. 26). In recent years, the Commission has been evaluating how the technical characteristics of different spectrum frequencies might affect its competitive review of spectrum acquisitions, as well as whether it should adopt spectrum aggregation limits that depend on frequency in both auctions and secondary market transactions (FCC 2014f, p. 13).

In certain situations, for example, a dominant firm might attempt to raise its rivals' costs, such as by monopolization of key inputs, notably spectrum, in the provision of mobile wireless services (FCC 2014f, p. 22; Krattenmaker and Salop 1986; Granitz and Klein 1996; Salop and Scheffman 1987; Salop 2005; Hemphill and Wu 2013). Today's mobile wireless market has characteristics likely to increase the potential for such anticompetitive conduct: high market concentration, high

¹⁹ Below 1-GHz spectrum has distinct propagation advantages for network deployment over long distances and also reaches deep into buildings and urban canyons, while high-band spectrum possesses certain technical advantages that allow for the transmission of large amounts of information. In this sense, spectrum below 1 GHz may be thought of as "coverage" spectrum, and spectrum above 1 GHz may be thought of as "capacity" spectrum. There are currently 580.5 megahertz of spectrum that are considered suitable and available, and included in the FCC's spectrum screen. Of that 580.5 megahertz, 134 (or approximately 23 %) are below-1-GHz.

profit margins, barriers to entry, and highly concentrated holdings of below-1-GHz spectrum (FCC 2014f, p. 34).²⁰

In particular, the two largest nationwide providers—AT&T and Verizon Wireless—hold well over 70 % of the total below-1-GHz spectrum that is currently suitable and available for the provision of mobile wireless service. If these firms were to acquire all, or substantially all, of the remaining low-band spectrum, they might benefit independently of any deployment to the extent that their rivals are denied the use of that low-band spectrum (FCC 2014f, p. 32). Further, rival service providers that lack an appropriate mix of low-band and higher-band spectrum may be less able to provide a robust competitive alternative, and may not be able quickly to expand coverage or provide new or innovative services (FCC 2014f, pp. 32–34).

Consequently, the Commission recognized that given ever-increasing consumer demand for more bandwidth-intensive services, excessive concentration in the relatively scarce below-1-GHz spectrum band would be likely to harm the public interest (FCC 2014f, p. 37).

The Commission therefore implemented a market-based reserve of up to 30 MHz in the upcoming incentive auction for bidders that lack significant holdings of low-band spectrum.²¹ The market-based reserve was implemented primarily to provide an opening to multiple service providers to acquire and deploy newly-licensed low-band (600 MHz) spectrum: an opportunity that will not come again in the foreseeable future. Access to this spectrum is critical not only for the efficient deployment of existing wireless services, but also for next-generation service and devices (FCC 2014f, p. 76).

In addition, the FCC implemented “enhanced factor review” of secondary market transactions: These transactions are subject to a heightened competitive evaluation if they involve enough aggregation of low-band spectrum such that (post-transaction) the acquiring entity would hold more than approximately one-third of the currently suitable and available low-band spectrum. This policy is designed to ensure that further concentration of such low-band spectrum would not adversely affect competition either in particular local markets or on a regional or national level (FCC 2014f, pp. 110–111).²²

²⁰ The DOJ asserts that “In a highly concentrated industry with large margins between price and incremental cost of existing wireless broadband services, the value of keeping spectrum out of competitors’ hands could be very high” (DOJ 2013, p. 11). In addition, the DOJ concludes that the Commission should “consider the potential that the acquisition of specific blocks of spectrum may have to foreclose or raise the costs of competitors in its policies on spectrum acquisition” (DOJ 2013, p. 11).

²¹ Note that the actual amount of the spectrum reserve is tied to the quantity that is demanded by reserve-eligible bidders in each geographic license area at the point that the final stage rule is satisfied in the forward auction (FCC 2014f, p. 79). Thus, spectrum is reserved only where there is demand at market-based prices, and the amount of reserved spectrum in each geographic license area will be set at the level that is demanded by reserve-eligible entities, up to the maximum amount of 30 megahertz (FCC 2014f, pp. 80–81).

²² The Commission’s enhanced factor review was applied for the first time in the *AT&T-Plateau Wireless* transaction, in which AT&T acquired Plateau Wireless’s spectrum licenses that covered parts of New Mexico and Texas, as well as approximately 40,000 subscribers, along with network equipment and other assets (FCC 2015e). The Commission analyzed the likely competitive effects and found that the likelihood of competitive harm was low – notwithstanding the fact that AT&T would hold more than one-third megahertz of below-1-GHz spectrum in one of the markets—in its evaluation of the particular factors that are ordinarily considered. These factors include, but are not limited to: the rural nature of the market; the number of rival service providers and their market shares; coverage by technology; and the

6.2 The 3.5 GHz Band: A New Approach to Spectrum Sharing Between Federal and Commercial Users

To promote the efficient and intensive use of spectrum and to make more of it available, the Commission is undertaking an innovative approach for the 3.5 GHz Band. In recent years, the dynamic nature of the mobile wireless industry has led to the development of new technologies along with new business models. In turn, the FCC faces challenges of how best to enable these technologies and business models to serve the public interest.

One of the more prominent challenges is how to allow for more intensive use, and in particular, more spectrum sharing. Many of the spectrum bands that are appropriate for shared use—notably the 3.5 GHz Band—have incumbent federal users. Making spectrum available for commercial use in these bands thus requires a regulatory approach that facilitates the transition from federal to commercial use, or that promotes sharing between federal and various commercial and private users.²³

The FCC's recent proceeding on the 3.5 GHz Band adopts a new set of rules to make 150 MHz currently used by federal government and other incumbents available to commercial and private operators (FCC 2015d). This band currently is needed for U.S. military applications, and relocation of these systems would be prohibitively expensive. However, federal government sharing with commercial and private operators in particular locations and at particular times could be permitted, as long as federal operations can be protected.

The new rules that govern sharing of the 3.5 GHz Band have six key aspects, which we enumerate below:

First, three tiers of users are established. In order of priority, these are: federal and other incumbents such as Fixed Satellite Service; Priority Access (PA) (commercial and private users who must not interfere with the incumbents); and General Authorized Access (GAA) (a type of right to operate that is similar to unlicensed in that they must not interfere with the two higher-priority users) (FCC 2015d, paras. 44–59). With these different priority levels, the FCC's rules protect the operations of incumbents while allowing for sharing by lower-priority commercial and private users; the latter can decide whether the priority status that is available to them, and the sharing that must take place, warrant their investment in this band.²⁴

Footnote 22 continued

spectrum holdings of the acquiring entity, as well as by rival service providers (FCC 2015e). In addition, certain public interest benefits such as the deployment of advanced broadband technologies and increased network quality were found to be likely (FCC 2015e).

²³ In addition to regulatory approaches, sharing may be facilitated by advances in technology, ranging from dynamic spectrum assignment to systems that allow for operation of smaller cells at lower power.

²⁴ The FCC's rules to allow new commercial and private operations, while protecting federal and other incumbent users, are based on a multi-phased approach that was recommended by the National Telecommunications and Information Administration. The first phase will establish geographic exclusion zones around areas of incumbent use, especially near coastlines, with no operations by PA or GAA users allowed in these areas. The second phase will be initiated when environmental sensing capability is established for these PA and GAA users. At this time, exclusion zones will be converted into protection zones, and PA and GAA users will be allowed to operate in these areas when there are no federal incumbent operations (FCC 2015d, paras. 247–268).

An open question that is considered in the Commission's Further Notice in this proceeding is how to define "use" of the 3.5 GHz Band for the purposes of determining when the spectrum that is allocated to a PA licensee is not in use and therefore available for GAA operations. The FCC asks whether and how unused channels may serve an economic purpose, and observes that it is administratively difficult to enforce against "license saver" strategies in which licensees attempt to block, perhaps for anticompetitive purposes, the use of the spectrum by other parties (FCC 2015d, paras. 422–423).²⁵

Second, the new rules create a novel right for PA licenses that is based on dynamic—not fixed—assignment. A PA license will not guarantee a *specific* 10-MHz frequency in the band. Instead, it will grant a *generic* right to exclude other commercial and private users from 10 MHz of spectrum that will be assigned to it by an administrator (FCC 2015d, paras. 334–341). To coordinate operations of PA and GAA users, a Spectrum Access System (SAS) will be created using multiple FCC-authorized private administrators. Given the multiple layers of users in this band (including federal incumbents that are higher in right), dynamic assignment by the SAS allows for better coordination and more intensive use by all parties.

Third, up to seven 10-MHz PA licenses will be made available in any given geographic license area (70 MHz out of 150 total in the 3.5 GHz Band). The remaining portion of the band that is not used by PA licensees or incumbent operators will be available for GAA use. PA licenses will be subject to auction in the event that mutually exclusive applications are filed. If mutually exclusive applications are not filed, no PA licenses will be made available.²⁶ In addition, a spectrum aggregation limit is established. Any one party may acquire up to four licenses, or up to 40 MHz of 3.5 GHz spectrum in total in a given license area (FCC 2015d, paras. 114–121). The main reason for an aggregation limit is that for areas where there is high demand for Priority Access licenses, at least two providers will have access to the spectrum under rules for PA use. This approach may make it easier for multiple providers to experiment with business models and with innovative sharing mechanisms (FCC 2015d, paras. 119–120).

Fourth, PA licenses will be auctioned for three-year terms. At the first auction only, an applicant may bid on two consecutive three-year terms for spectrum in the same geographic area, thus allowing up to 6 years for initial licensees. Importantly, and unlike most commercial wireless licenses that are appropriate for broadband

²⁵ An alternative that is under consideration in the Further Notice is for the FCC to define use in terms of how PA licenses would exclude GAA users. In this alternative arrangement, the PA licensee would pay a portion of the winning bid when the license is awarded, then pay the remaining portion only at the time that it wished to operate in the spectrum. The proposed approach is designed to facilitate sharing with GAA users while providing PA licensees with an incentive to consider the opportunity cost of this resource as well as a mechanism to ensure access to it when needed (FCC 2015d, paras. 425–426). See Reply Comments of William Lehr, "PALs as Option to Exclude GAA," in Amendment to the Commission's Rules with regard to Commercial Operations in the 3550–3650 MHz Band, GN Docket No. 12-354. Available at <http://apps.fcc.gov/ecfs/document/view?id=7521763142>.

²⁶ To ensure mutual exclusivity and competition for PA licenses that are auctioned, the FCC will auction one fewer license than the number of applications in each market (up to a maximum of seven licenses). If it should happen that only one PA license application is filed in a given market, then no PA licenses will be made available in that market and the spectrum will be made available for GAA use.

service, the PA licenses in this band are not renewable, and there are no performance requirements.

In establishing this policy, the FCC reasoned that shorter license terms would be appropriate for a band in which spectrum will be shared among several tiers of users, and where low entry barriers make possible a variety of business models and experimentation by different types of users. Similarly, capital requirements in this band are expected to be low relative to traditional cellular systems. Longer license terms should therefore not be needed to amortize these investments. The allowance of up to 6 years (over two terms) for a single license provides an additional step for recovery of capital investments, should this be needed (FCC 2015d paras. 102–113).

Fifth, the geographic license areas for PA licenses will be smaller than the license areas in most other bands that are used by mobile service providers (FCC 2015d, paras. 94–101).²⁷ While any one provider may acquire licenses in multiple geographic areas, the use of small license areas may lower barriers to entry and also allow for multiple small systems to emerge. The flexibility that is afforded by small license areas could mean that several small systems emerge in those markets that have a significant demand for broadband. In other markets, commercial and private operators might find that the GAA shared-use rules are sufficient to meet their spectrum needs. It is therefore possible that “densification” of this band would occur, with many small systems that are more analogous to WiFi operations than to large, capital-intensive commercial wireless operations.

Finally, maximum transmission power limits for PA licenses, as well as limits on the power that may be in place at the border of a license area, are lower than those that have been established by the FCC for most other mobile wireless operations, such as cellular and PCS. These lower power limits are compatible with small cells and with the presence of both higher-priority incumbent and lower-priority GAA users, and thus may facilitate sharing as well as lowering entry barriers for PA use. In addition, the FCC establishes protection limits for receivers in the 3.5 GHz Band, which allow device manufacturers, operators, and users all to know the maximum interference that they should be able to tolerate from neighboring operations (FCC 2015d, paras. 198–214).

In summary, the FCC’s new rules for allocation and use of the 3.5 GHz Band are an innovative and very promising regulatory regime for spectrum use.

Acknowledgments We are grateful to the editor, Larry White, and to Claude Aiken, Hillary Burchuk, Hillary DeNigro, William Dever, Jack Erb, Scott Jordan, Evan Kwerel, Paul Lafontaine, Eric Ralph, Jonathan Sallet, Paroma Sanyal, Susan Singer, Phil Verveer, Stephanie Weiner—and especially to Jonathan Levy—for their very helpful comments and suggestions. Daniel Herder and Pierre-Alexander Low provided expert editorial support. The opinions expressed in this paper are those of the authors and do not necessarily represent the positions of the Federal Communications Commission or of the United States Government.

²⁷ The geographic area for PA licenses will be based on census tracts (with 74,000 units as compared to 734 license areas for Cellular Market Areas).

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