

Spectrum Auction Rules That Foster Mobile Wireless Competition

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*In the Matter of Policies Regarding Mobile Spectrum Holdings, WT Docket No. 12-269*¹

I. Introduction

A. Qualifications

I am a Professor of Law at American University's Washington College of Law. In 2011, I served as Senior Economist for Transactions at the Federal Communications Commission ("Commission"), and prior to that I was the Commission's Chief Economist for approximately two years. From 1995 to 1998, I served as the Director of the Bureau of Economics at the Federal Trade Commission.

I have also worked as a Senior Economist at the President's Council of Economic Advisers, Special Assistant to the Deputy Assistant Attorney General for Economics in the Antitrust Division of the Department of Justice, an Assistant Professor at Dartmouth's Amos Tuck School of Business Administration, an Attorney Advisor to the Acting Chairman of the Federal Trade Commission, and an antitrust lawyer in private practice. I am co-author of an antitrust casebook, a past Editorial Chair of the Antitrust Law Journal, and a past member of the Council of the American Bar Association's Section of Antitrust Law.

I have published widely in the fields of antitrust law and policy and industrial organization economics. In 2004, I received American University's Faculty Award for Outstanding Scholarship, Research, and Other Professional Accomplishments, and in 1998 I

¹ T-Mobile is also submitting this paper in WT Docket No. 12-268, *In the Matter of Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, in response to the Commission's request for comments on how to structure the forward auction of spectrum reclaimed from broadcasters.

received the Federal Trade Commission’s Award for Distinguished Service. I hold a J.D. from Harvard and a Ph.D. in Economics from Stanford University.

B. Assignment

The Commission is seeking comment on whether and how to revise its rules and policies applicable to the acquisition of spectrum by mobile wireless carriers.² Among other things, the NPRM requests comment on whether to use a case-by-case analysis for spectrum acquisitions or to prefer bright-line limits; whether to include additional spectrum bands in evaluating spectrum holdings; how to analyze geographic markets; and whether the Commission should make distinctions among spectrum bands in assessing spectrum holdings.³

I have been asked by T-Mobile to review the Commission’s NPRM and comments filed to date by various parties, and discuss relevant economic considerations for evaluating spectrum holdings. In particular, I have been requested to provide an economic analysis of T-Mobile’s proposal for spectrum caps in auctions of new spectrum and case-by-case reviews for secondary market transactions, and to contrast it with an approach in which every transaction is reviewed individually. I have also been asked to discuss some conceptual issues related to the treatment of different spectrum bands. My submission will not provide a comprehensive analysis of all issues raised by the NPRM.

C. Main themes

My main conclusions are the following:

- i. Rules restricting spectrum aggregation at the time of new spectrum auctions can foster competition in services that use wireless spectrum as an input.

² See *Policies Regarding Mobile Spectrum Holdings*, Notice of Proposed Rulemaking, 27 FCC Rcd 11710 (2012) (“NPRM”). The NPRM emphasizes the need for “rules of the road that are clear and predictable that promote the competition needed to ensure a vibrant, world-leading, innovation-based mobile economy.” *Id.* ¶ 1.

³ *Id.*; see also *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 27 FCC Rcd 12357 ¶ 384 (2012).

- ii. Spectrum caps are likely to avoid the costs and delays that would result from the use of case-by-case reviews of spectrum acquisitions after auctions, and are also likely to prevent efficiency-reducing distortions in spectrum allocation arising from uncertainty about the outcome of post-auction review.
- iii. Spectrum caps in auctions can encourage auction participation, so they have the potential to increase auction revenues.
- iv. Case-by-case reviews are more troublesome when applied to auction outcomes than when applied later to secondary market transactions in spectrum.
- v. Case-by-case reviews of secondary market transactions would be unlikely to encourage speculative bidding that could otherwise undermine spectrum caps in auctions.
- vi. Separate caps for low-frequency spectrum can be beneficial even if wireless providers can overcome disadvantages of high-frequency spectrum with sufficient capital investment.

II. Economic Considerations in Developing Spectrum Auction Rules

A. Fostering wireless competition

When spectrum ownership is concentrated, firms may be able to exercise market power downstream in the provision of services that use wireless spectrum as an input. Large incumbent firms that recognize this prospect may have an incentive and ability to obtain or maintain downstream market power by keeping spectrum away from their rivals.⁴

When spectrum is auctioned, the “foreclosure value” that large incumbents may place on spectrum acquisitions can distort spectrum allocations and downstream competition. If the incumbent can limit competition from excluded rivals by acquiring a spectrum block at auction, the value it will place on that spectrum will include its market power benefit, and will therefore

⁴ In general, this incentive and ability would be expected to increase with a firm’s market share and with aggregate market concentration.

exceed the social value of the spectrum acquisition.⁵ In consequence, these firms may outbid rivals and succeed in obtaining or maintaining market power in downstream services, when that would not be the best outcome for consumers or society as a whole. Spectrum policies, such as auction rules that incorporate spectrum ownership caps, can limit or prevent such competitive distortions.

Moreover, spectrum policies that would address this problem do not necessarily sacrifice substantial economic benefits, even if a firm's greater scale within a market confers production efficiencies. If the foreclosed rivals are limited in their ability to achieve scale economies, that will limit the investments they make and the competitive constraint they will impose on the large incumbents, and thus limit the extent to which any benefits of increased scale to large incumbents are passed on to consumers in the form of lower prices, higher quality service, or new service offerings.⁶

⁵ Peter Cramton, Evan Kwerel, Gregory Rosston & Andrzej Skrzypacz, *Using Spectrum Auctions to Enhance Competition in Wireless Services*, 54 J.L. & ECON. 167, 167-78 (2011) (“[A]n auction that awards the spectrum to bidders with the highest values may not assure economic efficiency because the bidders’ private values for the spectrum may differ from social values as a result of market structure issues. For example, an incumbent will include in its private value not only its use value of the spectrum but also the value of keeping the spectrum from a competitor.”) (internal citations omitted); *Ex Parte* Presentation of United States Department of Justice, GN Docket No. 09-51, at 23-24 (filed Jan. 4, 2010) (“The goal in assigning licenses to any such new spectrum designated for commercial services should be to ensure that it generates the greatest ultimate benefits to the consumers of those services. When market power is not an issue, the best way to pursue this goal in allocating new resources is typically to auction them off, on the theory that the highest bidder, *i.e.*, the one with the highest private value, will also generate the greatest benefits to consumers. But that approach can go wrong in the presence of strong wireline or wireless incumbents, since the private value for incumbents in a given locale includes not only the revenue from use of the spectrum but also any benefits gained by preventing rivals from eroding the incumbents’ existing businesses. The latter might be called ‘foreclosure value’ as distinct from ‘use value.’ The total private value of spectrum to any given provider is the sum of these two types of value. However, the ‘foreclosure value’ does not reflect consumer value; to the contrary, it represents the private value of forestalling entry that threatens to inject additional competition into the market. In an established oligopoly with large margins between the price and the incremental cost of existing broadband services, the foreclosure value for incumbents in a given locale could be very high.”)

⁶ See generally Jonathan B. Baker, *Beyond Schumpeter vs. Arrow: How Antitrust Fosters Innovation*, 74 ANTITRUST L.J. 575 (2007) (discussing the benefits of competition for innovation).

B. Taking a long-term perspective

Communications markets have changed dramatically since spectrum was first allocated early in the 20th century. New technologies and products have changed how communications services are provided and what buyers demand, leading to shifts in the nature of services that provide the most valuable use of various ranges of spectrum. Spectrum policies should take a long-term perspective: they should recognize that communications markets are likely to continue to change rapidly, so the best uses of spectrum today may not be the best in the future and the best future uses may not be apparent today.⁷

Changing spectrum uses are likely to exacerbate long-run problems associated with excessive spectrum aggregation. If a small number of incumbent providers end up with control over large amounts of spectrum, those incumbents may have the incentive and ability to frustrate the development of new technologies and business models brought to the market by smaller rivals and potential competitors (including future rivals that cannot now be identified), thereby preventing or delaying the development of new competition. The resulting competitive harms may not be limited to downstream markets in which producers use spectrum as an input; they may also extend to markets in complementary products and services (*e.g.*, wireless infrastructure and device vendors, wholesale wireless services, and mobile applications). Policies to ensure greater long-run competition in wireless services may benefit complementary markets, as by increasing the demand for complementary products – those that exist today and those that will be developed in the future.⁸

With future technology and demand uncertain, auction rules and limitations on secondary market transactions can be an important tool for protecting long-term competition in markets for

⁷ Cf. Evan Kwerel & John Williams, *Changing Channels: Voluntary Reallocation of UHF Television Spectrum* (FCC Office of Plans and Policy Working Paper 27, Nov. 1992) (documenting the potential welfare gains of shifting spectrum from broadcast television services to mobile wireless services in the early 1990s).

⁸ Furthermore, greater competition in downstream wireless markets will likely contribute to achieving the large economic benefits of mobile wireless services, including mobile broadband services. See COUNCIL OF ECON. ADVISERS, EXEC. OFFICE OF THE PRESIDENT, *THE ECONOMIC BENEFITS OF NEW SPECTRUM FOR WIRELESS BROADBAND*, at 14-16 (2012), available at http://www.whitehouse.gov/sites/default/files/cea_spectrum_report_2-21-2012.pdf (growth in mobile broadband is likely to generate substantial economic benefits including GDP growth, job growth, and productivity gains).

services that use spectrum resources, as well as competition in complementary markets. The alternatives for achieving these long term goals are unattractive: it is commonly impractical to reallocate spectrum by regulatory fiat,⁹ and spectrum owners that can exercise market power in downstream services as a result of excessive spectrum aggregation cannot be expected to give up that market power through voluntary spectrum transactions in secondary markets.

When developing policies to limit spectrum concentration in order to prevent long-run competitive harms in an environment dominated by uncertainty about future technologies and spectrum uses, the Commission would almost necessarily employ similar standards (such as a maximum ownership percentage for various spectrum bands in a market) to review auction outcomes, regardless of whether the Commission promulgates those standards by rule in advance or employs them as the basis of case-by-case reviews of auction allocations after the auction has taken place.¹⁰ Were the Commission instead to make long-run competitive judgments based on market characteristics that depend on current spectrum uses, it would risk frustrating the development of new technologies or business models. Accordingly, there may be little or no advantage in relying on post-auction review (relative to incorporating spectrum aggregation standards in auction rules) to compensate for the greater distortions, inefficiencies and transaction costs discussed in Sections III and IV below.

⁹ Spectrum licenses are generally renewed without complication. This approach helps ensure that licensees have an incentive to make investments in providing service that might not pay off during the license period. Moreover, as a general rule, spectrum reallocations by fiat are likely less efficient than secondary market transactions in shifting spectrum to its best use, if secondary market participants are discouraged from achieving or preserving market power through those transactions.

¹⁰ This is neither a claim about the relative advantages of framing spectrum ownership policies in the form of bright-line rules versus unstructured standards, nor a claim about the relative advantages of establishing prophylactic policies versus waiting until uncertainty about the future is clarified. The point is simply that structural factors tied to current technologies and spectrum uses, perhaps including the growth rates and excess capacity of market participants at the time of the spectrum transfer, however relevant to assessing short-run competitive dynamics, have limited predictive value for assuring long-run competition when future technologies and spectrum uses are uncertain. In consequence, the Commission would likely frame policies for fostering long-run competition primarily on factors that are not tied to current spectrum uses, such as ownership shares of various types of spectrum, regardless of whether those policies are implemented through auction rules or through post-auction case-by-case review. Doing so would not limit the Commission's flexibility to respond to changing circumstances. For example, the spectrum caps employed for a particular auction could be revised over time to adapt to changing circumstances, as the Commission balances the benefits of stable regulatory policy for encouraging investment against the benefits of adjustment to new information and adaptation to changed circumstances.

C. Generating auction revenues

Although my report is mainly concerned with how auction policies could achieve wireless competition goals, I will also comment briefly on their implications for auction revenues. Most importantly, there is no necessary tradeoff between fostering wireless competition through auction restrictions and generating high auction revenues.¹¹ Prices paid by the winning bidders depend on many factors including the type and quality of spectrum auctioned, the structure of the auction, the number of bidders, the valuation that bidders place on the spectrum offered, and bidders' budget constraints. Auction restrictions can affect many of these factors.¹²

While spectrum caps could reduce the quantity of spectrum that some bidders would demand, restrictions on the ability of large firms to bid could increase auction participation and the overall quantity demanded, potentially increasing auction revenues.¹³ I will further discuss the possibility that spectrum caps could increase auction participation in the section below.

III. Economic Analysis of T-Mobile's Suggested Approach

A. Benefits of T-Mobile's approach

T-Mobile recommends that the Commission address the problem of excess spectrum agglomeration through spectrum caps when auctioning new spectrum,¹⁴ and through case-by-case reviews of secondary market transactions involving spectrum. This proposal sensibly reflects differences between the two settings that call for a different tradeoff between precision and certainty.

¹¹ See Paul Klemperer, *How (Not) to Run Auctions: the European 3G Telecom Auctions*, 46 EUR. ECON. REV. 829 (2002) (survey of European spectrum auctions indicates absence of a general relationship between auction restrictions and the revenues generated).

¹² See Ian Ayres & Peter Cramton, *Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition*, 48 STAN. L. REV. 761 (1996).

¹³ The consequences of spectrum caps for revenues in any particular auction setting would depend on which effect is the more important influence in that setting.

¹⁴ A prohibition on "warehousing" spectrum would not substitute for spectrum caps, because rivals could be foreclosed and competition harmed even if the licensee used its spectrum to provide service.

In an auction setting, a spectrum cap is preferable to case-by-case reviews of auction outcomes, as it provides clear guidance to firms bidding in auctions and limits the transaction costs of regulation.¹⁵ Auctions often involve many parties, each making interdependent decisions regarding multiple alternatives available for sale at the same time. This complexity amplifies the importance of clear auction rules with certain application for achieving efficient spectrum allocation. Absent clear auction rules, firms may base their bids on potentially erroneous predictions of how the agency will react in an after-the-fact review of auction results, distorting auction bidding and outcomes.¹⁶ Once the auction is over, auction winners and losers often would make commitments to business plans that would change the valuation of any spectrum that might be reallocated in a post-auction review. Hence, the likely remedies if the Commission concludes that it should not permit an auction winner to acquire the spectrum block on which it submitted the highest bid – a rerun of the entire auction or a required divestiture in the secondary market – would likely lead to a different outcome than would have been obtained had the disqualified firm been prevented from bidding in the first place by a spectrum cap. If a full auction rerun is impractical, moreover, and the firm required to divest spectrum is permitted to choose which bands to divest or select the new owner, it would be able to make those choices in ways that reduce potential competition to itself, further enhancing the inefficiency of the resulting spectrum allocation.

By laying out clear rules governing the initial auction, the Commission would prevent such distortions. Auction rules also avoid the cost and time involved with regulatory reviews after the

¹⁵ It would be wrong to picture spectrum caps as rigid screens that would need later correction through case-by-case reviews. Spectrum caps can be fine-tuned auction-by-auction to address changing conditions, such as increases in suitable and available spectrum.

¹⁶ Erroneous predictions could be minimized if the Commission applies clear, detailed, and well-specified criteria to review auction results after the auction is completed. But if the Commission does that, there would be no advantage in applying those criteria in an after-auction review rather than in advance. To the extent the criteria are instead flexible in interpretation or ambiguous, erroneous predictions and the resulting distortions in spectrum allocation would arise notwithstanding the best efforts of bidding firms and their outside counsel to forecast the outcome of after-action reviews. In an analogous context – the efforts merging firms and their outside counsel make to determine how the antitrust agencies will treat proposed acquisitions – the evidence shows that outside parties can be surprised by policy changes for several years before catching on fully. See Jonathan B. Baker & Carl Shapiro, *Detecting and Reversing the Decline in Horizontal Merger Enforcement*, 22 Antitrust A.B.A. 29, 31 (2008) (using merger enforcement statistics to identify two four-year periods when the Antitrust Division surprised the antitrust bar with their lack of interest in challenging mergers).

auction has taken place, as well as any additional distortions associated with prolonging the uncertainty about how spectrum would be allocated.

Case-by-case reviews to avoid excessive spectrum agglomeration make more sense for secondary market transactions, regardless of whether they take place as a two-party negotiation or an informal auction. Secondary transactions permit the reallocation of spectrum to more efficient uses as time passes and circumstances change since the original spectrum allocation. At that later time, delays in resolving the ownership of the spectrum would be less costly, and lack of certainty less troublesome, than with reviews of spectrum allocations resulting from large scale multi-player auctions. The additional precision allowed by an individualized review of secondary transactions may outweigh the costs of such approach, even though the cost-benefit calculus would differ in the auction setting.

B. Critiques of approach

Some commenters have claimed that T-Mobile's recommended approach of treating initial auctions differently from secondary transactions is "unworkable" and would allow arbitrage profiteering.¹⁷ Their main theory, as I understand it, is that the spectrum caps would be circumvented by smaller firms not bound by the cap. Those firms would make speculative purchases of spectrum in initial auctions with the main purpose of "flipping" it to firms for which the cap is binding. In this story, the small firms would reap profits at the expense of government revenues. I find this argument unconvincing.

The flipping argument supposes that a bidder that could not bid in the auction due to the cap would prevail in a case-by-case review of its purchase of the same spectrum in a secondary market transaction in the wake of the auction. This is unlikely because the Commission would be expected to apply similar principles to case-by-case reviews that it would apply in determining the initial spectrum cap (as I discuss further in Section IV.C). It is particularly difficult to imagine the Commission applying different standards when conducting a case-by-case review not long after a spectrum auction, the time when a pure speculative bidder would

¹⁷ E.g. Reply Declaration of Mark A. Israel and Michael L. Katz, WT Docket No. 12-269, at 36-39 (Jan. 7, 2013), *attached as* Attachment B to Reply Comments of AT&T, Inc., WT Docket No. 12-269 (filed Jan. 7, 2012) ("Israel and Katz Reply Declaration").

find it most profitable to sell. Moreover, speculative bidders, interested in spectrum only for the purpose of resale, would be unlikely to accept the significant risk that the Commission would not approve a secondary transaction with a firm that was prohibited from bidding in the initial auction, particularly when speculators also recognize that they must bear the costs of participating in the auction, the costs of negotiating a resale, the costs of participating in a Commission proceeding reviewing the transfer of the spectrum to a buyer unable to purchase it initially, and the cost arising from the time it takes to negotiate resale and resolve the Commission's review.¹⁸ These risks and the transaction costs would likely deter speculative bidding.¹⁹

C. Impact on auction participation and revenues

T-Mobile's suggested approach has the additional benefit of encouraging auction participation, which I understand to be one of the Commission's goals. A firm that must bid against a large incumbent that would obtain a "foreclosure value" from acquiring the spectrum may expect to be outbid for that reason. Given the non-trivial fixed costs of auction participation, a firm expecting to be outbid could readily be deterred from participating in the auction in the first place. If auction participation is thin as a result of this dynamic, the large incumbent firms that are in principle willing to pay to obtain foreclosure benefits may enjoy these benefits without bidding up the auction price to a level that pays for those benefits fully, leaving the public with a less competitive wireless sector and the government with lower revenues than could be obtained.

Under such circumstances, auction rules, such as spectrum caps that curb bidding for the sake of foreclosure, would encourage entry into the auction by potentially-foreclosed rivals.

¹⁸ Delay would be costly for a speculative purchaser. It would bear either a financing cost or an opportunity cost on the capital it has invested. Moreover, if it is required to offer service by Commission auction rules, it may be required to make substantial irreversible investments if it does not flip the spectrum quickly.

¹⁹ Even if spectrum "flipping" were to occur, moreover, it may not shift significant revenues from the government to spectrum speculators. In this hypothetical scenario, there would be many speculative bidders, and speculators would bid more aggressively in the initial auction when they see a potential for receiving a high value in the secondary market under a "flipping" scenario. The resulting bidding competition would be expected to limit the windfall that speculators would receive to a discount reflecting their participation costs and risks.

Since auction revenues generally increase with auction participation, the increase in revenues associated with enhanced participation could offset, or more than offset, the revenue effect of the reduced spectrum demand from large incumbents with holdings that exceed the cap. This mechanism, by which spectrum caps may increase auction revenues, is well understood in the auction economics literature, both on theoretical grounds and as demonstrated empirically.²⁰

Spectrum caps also have an advantage over case-by-case post-auction reviews in raising auction revenues by encouraging more aggressive bidding by large incumbent firms that would be under the cap in various markets but would be uncertain about the outcome of a post-auction review. With post-auction review, those firms would discount their bids to account for the risk that they might later bear the costs of divesting the spectrum they have won. This possibility could be prevented by rules applied to assess bidding eligibility in advance of the auction, such as spectrum caps.

IV. The Risks of Case-by-Case Reviews in Auctions

This section discusses in more detail several problems that would arise if the Commission chose to address the problem of excessive spectrum agglomeration through post-auction reviews rather than through spectrum caps.

A. “False positives” and “false negatives”

Section III.A of this report explained that when bidders lack clear guidance about whether they will be barred from acquiring spectrum blocks, their uncertainty about the results of an

²⁰ Peter Cramton, *Spectrum Auctions*, in HANDBOOK OF TELECOMMUNICATIONS ECONOMICS 605, 631 (Martin Cave, Sumit Majumdar & Ingo Vogelsang eds., 2002) (“Typically, spectrum caps lower auction revenues, but there is one important exception. In situations where incumbent bidders have an advantage, a spectrum cap may actually increase revenues and promote efficiency. In such a situation without a spectrum cap, non-incumbents may be unwilling to participate in the auction, knowing that the incumbents will ultimately win. As a result, in the auction without the cap only the incumbents show up, there is a lack of competition, and the incumbents split the licenses up among themselves at low prices. With the cap, the non-incumbents know that non-incumbents will win licenses, giving them the incentive and ability to secure the needed financing from capital markets. A competitive auction with market prices results. This phenomenon of incumbent bidders getting good deals, because of a lack of non-incumbent competition has been seen in some US auctions, but is most vivid in the Dutch UMTS auction.”). See also Cramton, Kwerel, Rosston and Skrzypacz, *supra* note 5, at 174 (2011) (“revenues in unrestricted auctions do not need to be strictly higher than those in auctions with spectrum caps or set-asides”).

after-the-fact review could distort their bidding and lead to an inefficient allocation of spectrum. A case-by-case approach may lead to “false positives” and “false negatives.”

A “false positive” arises if a firm that wins in an auction is prohibited from retaining the spectrum it acquired after a regulatory review. The costs associated with such an outcome are potentially substantial, as rivals that might have won in the initial auction but were outbid by the large firm (or decided not to bid because they expected to be outbid) may have found work-arounds by the time the winning firm is required to divest. These firms may not bid for the divested spectrum, and the eventual acquirer of the spectrum may be different from the bidder that would have obtained the spectrum had the initial auction not been distorted. The latter concern would be exacerbated by the ability of the divesting firm to select the firm that would purchase the divested spectrum. Such a situation would result in an inefficient spectrum allocation and wasteful transaction costs.

A “false negative” arises if a firm that would have bid and won does not bid because it falsely believes that its acquisition may be rejected, or fails to win because it reduces its bid due to the risk of post-auction divestitures. In either case, this will result in an inefficient spectrum allocation and likely lower auction revenues.²¹

B. Time-inconsistency distortions

While the spectrum misallocation situations described above are perhaps the most transparent potential distortions that could result from relying on a case-by-case review to address excessive spectrum agglomeration, they are not the only—or even the primary—concerns arising from post-auction review. Distortions created by case-by-case reviews could extend to situations in which the auction result is not reversed in a subsequent review and firms were not deterred from participating.

In particular, outcomes may be distorted if firms bid even though their acquisition of spectrum would likely harm wireless competition, on the hope that they could later convince the Commission to approve their acquisition. Under a case-by-case review system, by the time the

²¹ If the auction rules include a “safe harbor” for firms that might otherwise be uncertain about the outcome of a post-auction review, however, this will reduce or eliminate the likelihood of “false negatives.”

Commission has to make its decision about approving a spectrum purchase, one set of distortions – the distortions in the outcome of the auction itself – has already been created. Moreover, reversing the auction could result in significant delays in the spectrum deployment, and to complaints about the “penalty” the acquiring firm must pay if it resells the licenses at a loss. A forward-looking Commission might consider these distortions as “sunk” and approve an acquisition that it would have earlier considered to be anti-competitive. Firms that foresee this possibility could take advantage of the Commission’s time-inconsistency by bidding for spectrum that they would be prohibited from acquiring by a spectrum cap, knowing that their anticompetitive purchases will be too costly to reverse. Under such circumstances, post-auction reviews would impose costs on firms without adequately protecting competition.

C. Spectrum cap v. case-by-case review approach

If the Commission would frequently reach a different and better outcome through post-auction case-by-case reviews compared to the outcomes it would reach by specifying a spectrum cap as part of its auction rule, then a case-by-case approach would warrant closer consideration. This situation is unlikely often to occur, however. A case-by-case review could not practically avoid applying general guidelines for preventing undue spectrum concentration, and those guidelines are unlikely to differ markedly from those that would be specified in developing a spectrum cap. By using a spectrum cap, the Commission can implement those guidelines while avoiding the inefficiencies and distortions associated with post-auction review described above.²²

Accordingly, any potential advantage of case-by-case review of auction outcomes in the precision with which it can identify harmful spectrum concentration is likely limited, and outweighed by the disadvantages associated with the distortions inherent in this approach. A case-by-case approach for auctions is unlikely to do better in protecting long-run competition than a spectrum cap and is likely to prove more costly to implement when compared with spectrum caps. For that reason, T-Mobile’s suggested approach for fostering competition in mobile

²² As previously discussed, *supra* note 15, spectrum caps can be fine-tuned to address changing conditions, or even waived in unique circumstances, so are unlikely to perform substantially worse than case-by-case reviews in targeting competitive concerns.

wireless services is likely to perform better than an across-the-board case-by-case approach under most circumstances.

V. Should All Bands of Spectrum Be Treated Equally?

I have not conducted an in-depth study of the relative merits of different bands of spectrum, but it is widely understood that different frequency bands have different attributes, and in particular that spectrum below 1 GHz possesses particularly valuable properties for mobile wireless services providers.²³ In this section, I will share some observations about the benefits of imposing separate spectrum caps for different spectrum bands on account of these differences.

A. Complementarities between bands of spectrum

The different characteristics of low-frequency spectrum bands and high-frequency spectrum bands make them complements in providing mobile wireless services. In general, wireless providers think of lower frequency spectrum as better suited for expanding a wireless network's "coverage" (because a base station offering service in a lower frequency band will have greater geographic coverage and superior in-building penetration than a similar station offering service in a higher band), and higher frequency spectrum as better suited for expanding a network's "capacity" (as demand grows for existing services, for example). In consequence, mobile wireless services of any given geographic coverage and quality and typically can be

²³ *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Fifteenth Report 26 FCC Rcd 9664 ¶ 292 (2011) ("*Fifteenth Competition Report*") (noting that "lower frequency bands" (below 1 GHz) "possess more favorable intrinsic spectrum propagation characteristics than spectrum in higher bands," allowing mobile wireless providers using those band to "provide superior coverage over larger geographic areas, through adverse climates and terrain, and inside buildings and vehicles"); *Application of AT&T Inc. and Qualcomm Incorporated For Consent To Assign Licenses And Authorizations*, Order, 26 FCC Rcd 17589 ¶ 49 (2011) ("*AT&T and Qualcomm Order*") (explaining that "spectrum resources in different frequency bands can have widely disparate technical characteristics that affect how the bands can be used to deliver mobile services" and noting that the propagation characteristics of spectrum below 1GHz, as "allow for better coverage across larger geographic areas and inside buildings" while the higher frequency spectrum is "ideal for delivering advanced wireless services to rural areas").

provided more efficiently using a mix of low and high spectrum frequencies than using either frequency exclusively.²⁴

The cost penalty for providing service without using a mix of spectrum frequencies is not symmetric: it is likely to be particularly high for providers that mainly employ high-frequency spectrum, with limited use of low-frequency spectrum.²⁵ Low-frequency spectrum can serve the capacity function more typically associated with high-frequency spectrum. But the physical properties of high-frequency spectrum make it costly and less practical for wireless providers to use high-frequency spectrum to serve the coverage function more typically associated with low-frequency spectrum. Under such circumstances, a wireless provider may disadvantage rivals (raising their production costs) by denying them access to low-frequency spectrum, even if high-frequency spectrum can physically substitute for low-frequency spectrum to some extent with additional capital investment. Accordingly, the Commission should consider whether excessive agglomeration of low-frequency spectrum in the hands of large incumbents would constrain the ability of those rivals with limited access to low-frequency spectrum to compete aggressively in wireless services markets, and thereby allow the large incumbents to obtain or maintain market power, independent of its concern about the competitive consequences of excessive aggregation of wireless spectrum overall.

²⁴ See, e.g., *Fifteenth Competition Report* ¶ 307 (“[G]iven the superior propagation characteristics of spectrum under 1 GHz, particularly for providing coverage in rural areas and for penetrating buildings, providers whose spectrum assets include a greater amount of spectrum below 1 GHz spectrum may possess certain competitive advantages for providing robust coverage when compared to licensees whose portfolio is exclusively or primarily comprised of higher frequency spectrum. As discussed above, holding a mix of frequency ranges may be optimal from the perspective of providing the greatest service quality at low cost.”); *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, Fourteenth Report, 25 FCC Rcd 11407 ¶ 283 (2010) (“*Fourteenth Competition Report*”).

²⁵ See, e.g., *AT&T and Qualcomm Order* ¶ 49 (2011) (“AT&T itself has recognized this distinction [between low- and high-frequency spectrum] in the context of its bid to acquire T-Mobile, where it asserted that a significant benefit to T-Mobile customers would be their newly acquired access to AT&T spectrum below 1 GHz, enabling those customers to receive both extended rural coverage and ‘superior in-building and in-home service’ due to access to AT&T’s spectrum below 1 GHz.”).

B. Trade-off between spectrum attributes and capital investments

Some commenters in this proceeding have suggested that competition would not be affected if some firms are limited to high-frequency spectrum holdings, as those firms would be able to acquire their spectrum assets at a lower cost and then apply these cost savings towards greater infrastructure investments. By doing this, they say, the wireless provider would duplicate the scope and quality of service offered by a firm that has substantial holdings of low-frequency spectrum for a cost that is similar overall. Therefore, their argument goes, differences in attributes of spectrum bands are unimportant, and there is no justification for separate restrictions on each band in order to protect competition.

I disagree. Even if it were true that differences in spectrum prices exactly offset the difference in discounted present value of the capital investments needed to equalize the quality of service (a proposition I have not evaluated empirically), large incumbents could still obtain or maintain market power by foreclosing rivals from access to low-frequency spectrum, and separate spectrum caps by band could still benefit competition more effectively than a single cap on overall spectrum. This possibility arises because firms need to decide not only *whether* to build out using their spectrum, but also *how much* to spend on doing so.²⁶

To see this point, suppose that in a hypothetical competitive auction – a setting that rules out the possibility that large incumbents would obtain or maintain market power by foreclosing their rivals – a firm would choose to purchase low-frequency spectrum and use that spectrum to offer service comparable in quality and scope to what the large incumbents provide (which I will term “equivalent” service). High-frequency spectrum is also available, at a lower price, but at that price differential, the firm would prefer to purchase and build out low-frequency spectrum.

Now relax the assumption that large incumbent could not take into account the foreclosure value of bidding for the low-frequency spectrum and suppose it bids up the price of low-frequency spectrum to the point where the rival firm prefers instead to purchase high-

²⁶ The hypothetical example suggested by Israel and Katz involving a backyard swing set that sells at a lower price disassembled misleads because it does not allow for this possibility. Israel and Katz Reply Declaration, *supra* note 17, at 18-19. In their example, the family buying a disassembled swing has no practical choice other than to assemble it identically to the way that the factory would, using the same materials. The family does not consider how much to spend on assembly because the example does not allow them any substitution possibilities.

frequency spectrum. Then the large incumbent has foreclosed its rival from access to low-frequency spectrum. As the commenters hypothesize, moreover, suppose that the cost of providing equivalent service (summing both the price of spectrum and the cost of build out) using the high-frequency spectrum the firm has purchased is identical to the hypothetical cost the firm would have borne had it been able to purchase low-frequency spectrum at the auction price paid by the large incumbents and built out that spectrum to provide equivalent service.

If the firm's only option once it purchased the high-frequency spectrum were to use it to provide equivalent service, then that is what it would do. But the firm may have another option for using the high-frequency spectrum: to spend less on build-out and offer service with less coverage, more limited building penetration, or lower capacity (which I will call "targeted" service).²⁷ That option may be its preferred method of using high-frequency spectrum, so when foreclosed from purchasing low-frequency spectrum, it would adopt this targeted build-out approach rather than spending more on build-out to provide equivalent service.²⁸ Although it would pay less for spectrum than it would have paid for low-frequency spectrum, its best

²⁷ This outcome may arise even if the firm anticipates offering equivalent service eventually, but reaches it at a much later time because it may find it cost-effective to delay some of its investment decisions or spread them over a prolonged period of time.

²⁸ There is nothing remarkable about the possibility that a mobile wireless provider would prefer to offer equivalent service if it can obtain a mix of low-frequency and high-frequency spectrum, but prefer to offer targeted service if it instead owns mainly high-frequency spectrum. The marginal benefit the firm receives from infrastructure investment likely differs depending on which spectrum it owns, and varies with how much investment the firm makes. In addition, it may take longer to build out to provide a given level of service using high-frequency spectrum than low-frequency spectrum, because it must employ many more cells to do so. *See Fifteenth Competition Report* ¶ 293 (citing National Institute of Standards and Technology (NIST) study to demonstrate that achieving similar geographic coverage requires nine cells at 2.4 GHz, four cells at 1.9 GHz, and one cell at 700 MHz). Moreover, the firm may anticipate that it would become more difficult to build or acquire cells as time goes by, for example, if delay means that best cell locations would be taken by other firms, zoning approvals for new sites would become harder to come by, or backhaul would become more costly. *See, e.g.* American Tower Corp., Annual Report (Form 10-K) (2012), available at <http://quote.morningstar.com/stock-filing/Annual-Report/2012/12/31/t.aspx?t=XNYS:AMT&ft=10-K&d=a658a6283642d603be47c235c8f78f2a> ("Local zoning authorities and community residents often oppose construction in their communities, which can delay or prevent new tower construction, new antenna installation or site upgrade projects, thereby limiting our ability to respond to customer demand. In addition, zoning regulations can increase costs associated with new tower construction, tower modifications, and additions of new antennas to a site or site upgrades."). The greater number of cells required to serve any given level of customer demand likely also would make the marginal cost of adding capacity higher for a provider relying largely on high-frequency spectrum. For all these reasons, a firm would not be expected to provide the identical level of service using high-frequency spectrum as it would choose if it had instead owned a mix of low-frequency and high-frequency spectrum.

decision after acquiring the spectrum might not be to spend its spectrum “savings” on additional build-out.

Under such circumstances, a large incumbent may be able to obtain or maintain market power by foreclosing rivals’ access to low-frequency spectrum. Absent foreclosure, the rivals would have purchased low-frequency spectrum and offered service comparable to what the large incumbents provide. When foreclosed, the rivals would instead purchase high-frequency spectrum and offer targeted service. If, as a result, the rivals provide less of a competitive constraint for the large incumbents,²⁹ those incumbents may be able to obtain or maintain market power, to the detriment of consumers.

Here, a cap on low-frequency spectrum (in addition to an overall cap) would benefit consumers by preventing large incumbents from intentionally focusing their acquisitions on low-frequency spectrum. Applying a separate cap to low-frequency spectrum holdings may offer a better way to achieve this competitive benefit than simply tightening a cap on overall spectrum holdings, moreover, because it targets the competitive problem and thus reduces the risk of preventing forms of spectrum aggregation that would confer scale economies without harming competition.

C. Policy decision-making perspective

It is likely worse, from an overall policy perspective, to fail to impose separate caps for different bands when such caps are justified than to impose such caps and later discover they are not necessary. If the Commission imposes separate caps but later concludes, notwithstanding the evidence presented by T-Mobile and others, that wireless services can be offered effectively using spectrum of any frequency, then the auction restriction would not make much practical difference to outcomes in mobile wireless services markets. In this scenario, by assumption,

²⁹ Different firms may offer different quality levels in a competitive market, and this possibility does not by itself present a competitive problem. When many buyers view low-price, low-quality products as close substitutes for high-price, high-quality products, competition among the firms selling both types of products may prevent firms of either type from exercising market power. The concern here is that not enough buyers may view the products as close substitutes to protect the many buyers that prefer premium service from supracompetitive prices. Put differently, excessive agglomeration of low-frequency spectrum by large incumbents may induce a greater level of quality differentiation than would be provided by a competitive market, allowing the incumbents to exercise market power to the detriment of consumers.

spectrum frequency does not affect service quality, so firms that were blocked from increasing their holdings of low-frequency spectrum should be able to purchase other bands of spectrum to compensate.³⁰ By contrast, if the Commission does not impose separate caps for individual bands when such restrictions are warranted, it would allow wireless competition to be harmed.

VI. Conclusion

Spectrum auction rules to address excessive spectrum aggregation can foster competition in mobile wireless services. Auction rules with spectrum caps avoid costs, delays, and distortions in spectrum allocation that would result from relying on post-auction case-by-case review. Moreover, spectrum caps in auctions can encourage auction participation, so they have the potential to increase auction revenues. Separate caps for low-frequency spectrum can be beneficial even if wireless providers can overcome disadvantages of high-frequency spectrum with sufficient capital investment.

Case-by-case reviews are more troublesome when applied to review auction outcomes than when applied to review secondary market transactions. When used in the latter case, moreover, they would be unlikely to undermine spectrum caps by encouraging speculative bidding in auctions.

I certify that all statements made in this document are true to the best of my knowledge.



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³⁰ Following the same logic, the fact that the two large incumbent providers most likely to be subject to national or regional caps on low-frequency spectrum oppose such a cap over-and-above their objection to spectrum caps is surprising given their claim that high-frequency bands could easily substitute for low-frequency bands.