The Revenue Impact of Competition Policy in the FCC Incentive Auction

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Summary

I have been asked by T-Mobile USA, Inc.[2] to comment on the revenue impact of spectrum-aggregation limits in the FCC's upcoming incentive auction. Elsewhere I focus on the rationale for limits, the overall experience with spectrum-aggregation limits, and the suitability of such limits in the FCC's upcoming incentive auction.[3] Here my main focus is the revenue impact of spectrum-aggregation limits in the 600 MHz auction. Auction revenues are especially important in the 600 MHz incentive auction, since the success of the auction depends on achieving sufficient revenues to compensate clearing television broadcasters.

Much of this paper provides a response to an AT&T study by Haile, Meidan, and Orszag[4] (hereafter "HMO") that argues that spectrum-aggregation limits would lead to large revenue losses. HMO's estimate hinges on the assumption that (1) AT&T and Verizon (the "Big Two") reduce their spending in proportion to their bidding restrictions, and (2) the limits do not stimulate any increased spending by other bidders. With this unrealistic assumption, the revenue loss is immediately calculated as the reduction in spending by the limit-restrained Big Two. However, reporting results based on limit-induced budget changes for only the Big Two makes little sense, particularly as HMO acknowledge the possibility of offsets. Spectrum-aggregation limits create an opportunity for the other bidders and this opportunity motivates bidders to increase participation. As a result, auction competition is increased, offsetting revenue losses from the Big Two. This participation effect is common sense—opportunity attracts investment. The participation effect has been observed in numerous auctions over the last nineteen

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[2] T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

[3] Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes*, (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013).

[4] Philip A. Haile, Maya Meidan, and Jonathan M. Orszag, *The Impact on Federal Revenues from Limiting Participation in the FCC 600 MHz Spectrum Auction* (Oct. 30, 2013) (hereinafter "HMO"), attached to *Ex Parte* Presentation of AT&T, GN Docket No. 12-268 & WT Docket No. 12-269 (Oct. 31, 2013).

years. Many of the auctions with record revenues achieved those revenues with the use of limits and other restrictions on the large bidders to create clear opportunities for smaller rivals.[5]

The revenue impact of limits on the Big Two critically depends on how much participation levels of other bidders increase in response to improved opportunities. HMO state that the participation increases necessary to offset the limits on the Big Two are "implausible." Predicting the expected increase is a difficult assessment but HMO provide no explanation or analysis of why such increases would be "implausible." My judgment from extensive experience in prior auctions is that modest spectrum-aggregation limits on the Big Two are apt to significantly increase the participation of others. For example, supposing there are seven paired lots in each market, a limit of two lots for each of the Big Two would guarantee that at least three lots would be won by others. This improved opportunity of winning is apt to motivate significantly greater participation from smaller rivals, who now have a better chance of winning and face less exposure risk. As a result revenues may increase or at least not fall by much.

Mobile broadband is a highly concentrated industry. The Big Two have 67% market share[6] and hold roughly 80% of the low-band spectrum, which is best-suited to providing coverage within buildings and in more difficult terrain.[7] Were the Big Two to dominate the 600 MHz auction, competition in the mobile broadband market would be harmed.

In setting competition policy for the incentive auction, the FCC must balance the gains from a more competitive auction outcome with the possibility of revenue effects. A modest limit on the Big Two (two lots each) is apt to induce little or no revenue loss and could even increase revenue compared to an entirely unrestricted auction; however a more stringent limit of one lot may result in revenue loss. T-Mobile has proposed a Dynamic Market Rule that would let the auction resolve this tradeoff.[8] The FCC can first conduct the forward auction with the more stringent limit and then relax the limit to two lots if the revenue requirement is not met. In this way, the FCC can foster greater competition in the post-auction market for wireless services, maximize the likelihood of a successful auction, and still generate considerable revenue for other public interest goals.

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[5] *See, e.g.*, Martin Cave & William Webb, "Spectrum Limits and Auction Revenue: the European Experience," attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013); Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes*, attached to Letter from Trey Hanbury, Counsel to T-Mobile, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 12-268, WT Docket No. 12-269 (Sept. 9, 2013).

[6] *See 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*, Sixteenth Report, 28 FCC Rcd 3700, ¶ 52 (2013) (hereinafter "Sixteenth Report").

[7] *Id.* ¶¶ 121-22.

[8] Gregory Rosston and Andrzej Skrzypacz, *A Dynamic Market Rule for the Broadcast Incentive Auction: Ensuring Spectrum Limits Do Not Reduce Spectrum Clearance*, attached to *Ex Parte* Presentation of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (July 31, 2013).

Introduction

Competition policy is critically important in major spectrum auctions. Excessive concentration of spectrum holdings can adversely impact competition for mobile broadband services. Low-band spectrum, below 1 GHz, is especially well-suited for providing coverage, both within buildings and in difficult terrain or less-densely populated areas.[9] Since consumers value coverage inside buildings and across varied terrain, regulators must be concerned that excessive concentration of low-band spectrum will harm competition by giving a few carriers a significant coverage advantage.[10] As a result of these concerns, regulators in nearly all recent spectrum auctions around the world have imposed low-band spectrum-aggregation limits on carriers to prevent excessive concentration of the low-band spectrum.[11]

A notable exception to this competition policy was Auction 73, the 700 MHz auction, in the United States. In that auction, there was no spectrum-aggregation limit and AT&T and Verizon (the Big Two) won 85% of the spectrum, further cementing their dominant holdings of low-band spectrum.[12] Today, the Big Two hold roughly 80% of the low-band spectrum.[13] The Big Two also have a significant coverage advantage.

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[9] Sixteenth Report ¶¶ 121-22.

[10] *See id.* ¶ 124.

[11] *See, e.g.*, Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes*,3-7 (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013); Competitive Carriers Association Notice of *Ex Parte*, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 4, 2013); Martin Cave & William Webb, "Spectrum Limits and Auction Revenue: the European Experience," attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013) (identifying spectrum-aggregation limits adopted in Germany, Ireland, Switzerland, Sweden, Spain, Portugal, Slovakia, Iceland, the Czech Republic, the United Kingdom, Italy, Norway, France, the Netherlands, and Denmark); Ken Binmore and Paul Klemperer, *The Biggest Auction Ever: The Sale of the British 3G Telecom Licenses*, 112 ECON. J. C74, C90 (2001); Veronika Grimm, Frank Riedel, & Elmar Wolfstetter, *The Third Generation (UMTS) Spectrum Auction in Germany* 3 (CESifo Working Paper No. 584, 2001).

[12] Peter Cramton, *Innovation and Market Design*, *in* INNOVATION POLICY AND THE ECONOMY, VOLUME 9 (Josh Lerner & Scott Stern, eds., 2009), *available at* http://www.nber.org/chapters/c8186.pdf (last accessed Nov. 19, 2013). Spectrum-aggregation limit opponents have mischaracterized Sprint and T-Mobile's lack of participation in Auction 73 as evidence that low-frequency spectrum is not necessary to compete because Sprint and T-Mobile "chose" not to participate. *See* Notice of Oral *Ex Parte* Presentation of AT&T Services, Inc., GN Docket No 12-268 (Oct. 29, 2013). In fact, at the time, Sprint was nearing bankruptcy following its merger with Nextel and T-Mobile, facing a severe spectrum shortage, had just spent considerable resources purchasing the first available spectrum up for auction, the high-frequency AWS band. In addition, the industry at large had not yet recognized the surge in data demands and demand for high quality indoor coverage resulting from the introduction of smartphones. To the extent Sprint and T-Mobile can be said to have "chosen" not to participate in the 700 MHz auction, it was a choice of necessity. Even if this notion of "choice" accurately described the situation, the only relevant question when assessing the competitive effects of these "choices" for the upcoming incentive auction is whether the concentration of input resources that exists today would allow the Big Two to exercise market power in the wireless broadband market now or in the future.

[13] *See* Sixteenth Report at Table 18; Comments of Sprint Nextel Corporation, WT Docket No. 12-269, at 5-6 (Nov. 28, 2012).

Given this landscape, the FCC should carefully consider competition policy in the upcoming incentive auction, which will assign the 600 MHz spectrum repurposed from TV broadcasting. The policy issues are especially difficult in the incentive auction because auction revenues play an essential role in making the spectrum available. Without sufficient revenues to compensate TV broadcasters for returning the spectrum, the auction fails. Thus, the FCC must consider the likely revenue impacts of alternative spectrum policies in addition to their impact on competition in the post-auction market for wireless services.

Unfortunately, it is extremely difficult to assess likely revenue impacts of alternative policies. The main determinant of auction revenues is competition. More competitive auctions yield higher revenues. The question then is whether spectrum limits reduce or increase competition, and by how much. Typically there are two countervailing effects of spectrum-aggregation limits: (1) competition is reduced from those bidders facing a binding limit, and (2) competition is increased from bidders who decide to expand participation as a result of the opportunity created by the binding limit on others—more spectrum is now available for the others.

AT&T recently commissioned the HMO study to assess the revenue impacts of alternative spectrum limits in the 600 MHz auction.[14] I begin by commenting on the HMO study. Since no party has proposed excluding AT&T or Verizon from the auction, I focus on less extreme policies in which the Big Two face a potentially binding spectrum-aggregation limit in each market.

HMO's use of the BLM approach does not accurately predict how revenue levels adjust to limit-created opportunities

HMO frame their analysis as an application of the approach used by Bulow, Levin, and Milgrom (2009) ("BLM").[15] However, the BLM approach is poorly suited to the question HMO seek to answer. The central question that must be addressed in determining the revenue impact of limits is how the spectrum-aggregation limits impact auction competition. In particular, how will the opportunities created by the limits stimulate participation from others? The BLM approach is mute on this point since participation levels are assumed as exogenously fixed.

BLM provide a method for estimating final auction prices (and revenues) in a simultaneous ascending auction based on the maximum total exposure.[16] A bidder's exposure in a round is the sum of all its bids. Total exposure in a round is the sum of the exposure for each bidder. The maximum total exposure is the highest total exposure achieved in the rounds conducted so far. If bidding is limited by budgets, rather than license values, then the maximum total exposure can provide a good estimate of

[14] HMO at 1 n. 1.

[15] HMO at 5 (citing Jeremy Bulow, Jonathan Levin, and Paul Milgrom, WINNING PLAY IN SPECTRUM AUCTIONS 7-11 (Feb. 2009), *available at* http://www.stanford.edu/~jdlevin/research.htm (last accessed Nov. 19, 2013)).

[16] Jeremy Bulow, Jonathan Levin, and Paul Milgrom, WINNING PLAY IN SPECTRUM AUCTIONS 7-11 (Feb. 2009), *available at* http://www.stanford.edu/~jdlevin/research.htm (last accessed Nov. 19, 2013).

final prices, especially late in the auction when the vast majority of revenues have been realized. BLM have shown that this is a useful way to forecast final revenues from the bidding that has occurred so far in the auction.[17] Empirically, maximum total exposure is reached well before the end of the auction, so this is a useful way to forecast final revenues before the end of the auction. The conclusion from BLM is that a bidder's budget plays an important role in determining the bidder's spending in the auction, and that these budgets are revealed before the end of the auction and therefore can be used to forecast final revenues after a sufficient number of bidding rounds have occurred.[18]

The BLM approach uses the bid data from an ongoing auction to estimate budgets in the auction, and therefore final revenues. Importantly, the BLM approach tells us nothing about how budgets are set and how participation decisions are made. This is the information that HMO need in order to estimate revenues from future auctions with alternative spectrum limits. And the lack of information on how bidders are setting their budgets or making participation decisions is why the BLM approach is not helpful in determining the impact of spectrum limits on revenues.

Indeed, the BLM estimation approach has nothing to do with the revenue estimates in HMO. Instead, the HMO revenue estimates are wholly driven by HMO's assumption that the budgets deployed by AT&T and Verizon will be proportional to the total MHz-pop pursued by the firm. It is this assumption that determines the size of the budget HMO place into their model and thus controls the revenue estimate produced by their calculations. However, HMO do not justify this assumption at all, save to say that is "natural."[19] In fact, the proportionality assumption is wrong in this case.

First, the proportionality assumption contradicts the basic framework of HMO's model. To adjust their budget proportionally in a practical manner, bidders must have a pre-determined target price per MHz-pop.[20] If this approach accurately described bidder behavior, a bidder would budget for $1 per MHz-pop, *e.g.*, and then scale their budget up or down depending on the MHz-pop available. However, the BLM "budget bidding" model, which HMO adopt, expressly rejects this theory of bidding.[21] Indeed, BLM's key insight was that bidders enter an auction with fixed budgets and bid to those budgets, *regardless of the price per MHz-pop*.[22] The ultimate price per MHz-pop is important only insofar as it governs the number of licenses a bidder wins, *not* as a predictor of their total budget. HMO cannot cherry-pick when to apply critical assumptions in order to support their case.

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[17] *Id.* at 2.

[18] *Id.*

[19] HMO at 8.

[20] Theoretically, a bidder could also effect a proportional adjustment by calculating a budget for an unrestricted auction and then reducing it as a percentage of the spectrum that they are restricted from. However, this is not a realistic option – bidders prepare for the auction as currently structured; they do not construct counterfactual situations and then apply arbitrary percentage reductions to them.

[21] *See id.* at 5; BLM at 2 ("it is bidders' *budgets*, as opposed to their *license values*, that determine average prices in a spectrum auction.").

[22] *See* BLM at 2.

Moreover, HMO's methodological difficulties persist even if their incorrect proportionality assumption is accepted. HMO produce their revenue predictions by estimating the percentage reduction in AT&T and Verizon's eligibility to bid at 70 percent for a one-third sub-1 GHz spectrum-aggregation limit and at 50 percent for the same limit with T-Mobile's 5x5 Minimum Access Exception. However, HMO never explain how they arrived at these numbers, only stating that they are the result of "rough calculations" based on information contained in advocacy documents produced by AT&T and Verizon themselves. These undisclosed "rough calculations" allow HMO to arbitrarily set the budget estimate they will enter into their model, which in turn determines their resulting revenue prediction.[23] Such skewed inputs, though, inexorably lead to skewed results.

Nor is it clear how HMO's "rough calculations" would have led to their numbers from the information contained in AT&T and Verizon's advocacy pieces. For example, the referenced Verizon *ex parte* only provided conclusory statements that Verizon Wireless would be barred from bidding in certain percentages of top-10 and top-20 markets if various spectrum-aggregation limits were adopted.[24] The *ex parte* provides no additional detail beyond these incorrect assertions.[25] The cited AT&T statement provides, if anything, even less information.[26] It is difficult to perceive how this extremely limited information was used to create a robust estimate of eligibility. The HMO errors are particularly puzzling as the 5x5 Minimum Access Exception ensures AT&T and Verizon are not barred from any market. Even with the Minimum Access Exception, HMO assert without showing any backup that the 5x5 MHz Minimum Access Exception scenario would result in a 50% reduction in eligibility to bid.

These assumptions are the critical elements of HMO's entire study. They directly determine all of HMO's results. Despite their importance, however, HMO provide virtually no information justifying these assumptions, despite compelling reasons to doubt their accuracy.

HMO's reported revenue loss ignores the impact limits have on the participation of others

Working from its flawed proportionality assumption, HMO's model produces flawed revenue predictions. Moreover, the large revenue losses are the direct result of the highly asymmetric

[23] HMO at 8.

[24] *See Ex Parte* of Verizon, GN Docket No. 12-268 & WT Docket No. 12-269, at 1-2 (July 17, 2013).

[25] *See Ex Parte* Notice of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269, at 1-3 (Sept. 26, 2013) (T-Mobile demonstrates that Verizon could acquire at least one 5x5 MHz license in every top 10 market and AT&T could acquire at least one 5x5 MHz license in 9 of 10 top 10 markets. Verizon arrives at its lower estimates by always rounding down any available capacity under the limit for acquiring additional spectrum (*i.e.,* headroom), rather than rounding up or down to the nearest 10-MHz increment. Verizon's approach triggers the limit even with only the most modest of overages. T-Mobile's figures are derived by following the common practice of rounding the amount of available headroom to the nearest 10 MHz increment.).

[26] *See* Yeon-Koo Che and Philip A. Haile, *Comments on T-Mobile's "Dynamic Market Rule" Proposal*, at 1 n.3, attached to Letter from David L. Lawson, Counsel for AT&T, to Marlene H Dortch, Secretary, Federal Communications Commssion (Aug. 13, 2013).

assumptions about the bidding behavior of the Big Two and the other bidders in the auction. Though the Big Two are assumed to proportionately reduce their participation, HMO never calculate the amount other bidder's spending can be expected to increase in response to spectrum-aggregation limits, despite acknowledging that such offsets could occur. Using these different methods gives a misleading impression of the size of potential revenue reductions.

The key flaw is that HMO assume proportionate change for the Big Two, but no change for other bidders. HMO's stated revenue loss therefore is simply equal to the assumed reduction in spending by the Big Two. HMO give no justification for the highly asymmetric treatment of spending. In fact, there is every reason to expect robust expansion of in spending from other parties as there will be more spectrum available for purchase. This greater opportunity will naturally increase spending and participation.

Consider how the HMO conclusion would change if we make consistent symmetric assumptions for all bidders about how spending changes in response to limits. The two assumptions are "no change" and "proportionate change." Under "no change" a bidder's spending does not change in response to changes in the quantity of spectrum won; under "proportionate change" a bidder's spending changes proportionately with the quantity of spectrum won. HMO apply the "proportionate change" assumption to the Big Two and the "no change" assumption to the others.

HMO assumptions regarding bidder behavior

	AT&T and Verizon	**Other bidders**
Assumed behavior	Proportionate change	No change
Revenue implications	–$ billions	$0

Under these assumptions, of course the net effect of spectrum-aggregation limits is to reduce revenue. However, there is no reason for HMO to present their revenue estimates as final when relying on contradictory assumptions for the different bidders, particularly as HMO later consider the expanded participation from other bidders that would be required to offset their inflated revenue loss estimates. Without a justification for this differential treatment, the assumptions could just as easily be reversed – "no change" for the Big Two and "proportionate change" for other bidders. In that case, the result would be significant revenue increase.

Alternative assumptions regarding bidder behavior

	AT&T and Verizon	Other bidders
Assumed behavior	No change	Proportionate change
Revenue implications	$0	+$ billions

I do not mean to suggest that this case is correct. Rather, my point is that the revenue loss presented in HMO is little more than an assumption. Different assumptions yield different results. The HMO result is not at all robust to alternative assumptions about how a bidder's spending varies with the quantity won.

HMO also choose its percentage calculations in a manner that seems designed to exaggerate the magnitude of the increase in budgets the remaining players would need to offset possible spending reductions by the Big Two attributable to spectrum-aggregation limits. As suggested by the table above, the *source* of capital spending is irrelevant to auction revenue. Every dollar counts equally. Therefore, even if reasonable spectrum-aggregation limits were to reduce the top two carriers' aggregate spending, revenue would remain unchanged so long as every dollar in spending reductions by the Big Two were replaced by a dollar of spending increases by smaller carriers, new entrants, and other auction participants.

HMO do not actually contest how dollar-for-dollar replacement would render spending reductions inconsequential, but instead change the denominator of the formula in a manner that makes replacing any lost dollars seem especially daunting. Suppose, for example, an unrestricted auction closes at $300, with the Big Two bidding $200 and smaller bidders bidding the remaining $100. If a limit on resource concentration were to reduce revenues from the top two players by 33 percent, the remaining players would only have to increase their bids by $66 to match the revenue of an unrestricted auction. However, expressed as a *percentage* increase of the bid amount, a 67 percent increase is required (*i.e.*, $66/$100). If the limits were to reduce revenue from the top two players by 50 percent, then the increase from the other participants would be 100 percent (*i.e.*, $100/$100). HMO use a denominator to make the replacement of a presumptive $1 of lost spending with $1 of gained spending seem less feasible and likely than it actually is.

Spectrum-aggregation limits stimulate auction competition by creating opportunities for smaller bidders

HMO's failure to calculate the expansion in participation from other bidders that would be expected with spectrum-aggregation limits is particularly misleading because HMO expressly recognize that any revenue loss from spectrum-aggregation limits is mitigated to the extent that the limits motivate greater participation from bidders other than the Big Two.[27] Greater participation should be expected because

[27] HMO at 4.

when the Big Two win less spectrum there is more spectrum and a lower exposure risk for the other bidders. This improved opportunity motivates the other bidders to bring larger budgets to the auction and motivates additional bidders that otherwise would not participate to enter the auction. This expansion of demand and resources from others either partially or fully offsets the inflated revenue loss HMO calculate.

However, after calculating the increased participation required to offset their inflated revenue loss estimates, HMO assert without any justification that "[s]uch budget increases are implausible."[28] But why is it implausible that more money from existing bidders plus money from new bidders would offset the reduction in spending of the limit-constrained Big Two?

Facing an opportunity to buy more spectrum, bidders naturally bring larger budgets to the auction for the same reasons as a shopper going to buy a week's worth of groceries will bring more cash than a shopper buying groceries for the day. Capital markets will similarly respond to the increased opportunities to provide additional capital to unrestricted bidders. Capital markets are highly fluid and are able to efficiently reallocate capital to offset their reduced investment in restricted bidders. In fact, by opening up new opportunities for non-dominant carriers, spectrum-aggregation limits may generate higher revenues. Limits and other restrictions on dominant incumbents in spectrum auctions have often led to high revenues. Clear examples include the UK 3G auction,[29] more recently the Canadian AWS auction,[30] and most recently the Taiwan 4G auction.[31] In these cases and many others, auction competition was stimulated by restrictions on incumbents. These restrictions created opportunities for others, and investors responded to the opportunities with capital.

Likewise, it is not "implausible" to expect that spectrum-aggregation limits will galvanize significant numbers of new bidders to participate. Absent limits, some potential bidders may be so discouraged about their prospects of winning that they decide not to bid. The expected gains from participation are insufficient to cover the cost. The limits therefore bring more bidders, greater competition, and potentially higher revenues.

The benefits of limits are greatest in settings with high concentration and high fixed costs. As an example, suppose there are two dominant incumbents. The two incumbents enjoy cost advantages as a result of their size and existing infrastructure. In addition, the two incumbents benefit from their dominant position and therefore benefit from foreclosing competition in the post-auction market.

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[28] HMO at 20.

[29] Ken Binmore and Paul Klemperer, *The Biggest Auction Ever: The Sale of the British 3G Telecom Licenses*, 112 ECON. J. C74, C90 (2001).

[30] Kyle Hyndmany and Christopher F. Parmeter, EFFICIENCY OR COMPETITION? A STRUCTURAL ECONOMETRIC ANALYSIS OF CANADA'S AWS AUCTION AND THE SET-ASIDE PROVISION 4 (2013), *available at* http://www.hyndman-honhon.com/hyndman/HP-AWS-Auction.pdf (last accessed Aug. 12, 2013).

[31] *Taiwanese 4G auction winners revealed*, TeleGeography (Oct. 31, 2013), http://www.telegeography.com/products/commsupdate/articles/2013/10/31/taiwanese-4g-auction-winners-revealed/ (last accessed Nov. 19, 2013).

Without limits, these factors can make it impossible for either entrants or smaller incumbents to acquire spectrum in the auction. If they are sufficiently discouraged, they may decide not to participate. But if they do not participate, then the two dominant incumbents can win all the spectrum at a low price, absent competition from others. Limits would prevent this extreme outcome. Competition would be improved in both the auction and in the post-auction market for wireless services.

The 600 MHz auction shares many attributes of the above example. The Big Two hold about 80% of the low-band spectrum, have a market share of 67%, and an even higher share of earnings.[32] The Big Two enjoy cost advantages from scale and infrastructure that comes in part from their dominance in the low-band spectrum. Given these facts, it would be natural for some potential and existing competitors to not like their chances of winning in an auction without spectrum-aggregation limits in place.

The positive impact of limits on competition and auction revenues is not just a theoretical possibility. It has been observed in numerous spectrum auctions over the last 19 years in the United States and elsewhere.[33] Well-designed spectrum limits can both increase competition in the post-auction market and increase auction revenues. Unfortunately, I have also witnessed spectrum auctions where a small number of incumbents were able to win all the spectrum at low prices without any competition from small carriers or entrants.

One reaction to the debate on limits is, "surely limits would reduce auction prices for otherwise the smaller carriers would not be lobbying for limits." This result, however, does not necessarily follow. Limits enable the smaller carriers to win more licenses. This is the main benefit that a smaller carrier derives from limits—the opportunity to win more licenses, not reducing the prices paid.[34]

Competition policy in the incentive auction should avoid extremes

If I were retained to advise the FCC on competition policy in the 600 MHz auction, my first piece of advice would be to avoid the two extremes: no limits on the Big Two or exclusion of the Big Two.[35]

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[32] *See* Sixteenth Report ¶ 52.

[33] *See, e.g.*, Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes*,3-7 (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013); Competitive Carriers Association Notice of *Ex Parte*, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 4, 2013); Martin Cave & William Webb, "Spectrum Limits and Auction Revenue: the European Experience," attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013).

[34] Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes*,3-7 (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013); *see also* Martin Cave & William Webb, "Spectrum Limits and Auction Revenue: the European Experience," attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013).

[35] *See* Peter Cramton, Lessons from the United States Spectrum Auctions: Testimony Before the United States Senate Budget Committee (Feb. 10, 2000), *available at* http://www.cramton.umd.edu/papers2000-2004/00-02-10-cramton-senate-testimony-on-spectrum-auctions.pdf.

A policy of no limits runs a real risk that the Big Two will dominate the 600 MHz auction. This risk may deter smaller carriers from participating in the auction or cause them to bring less money should they decide to participate. This negative impact on the participation of other bidders may reduce revenues. Moreover, competition in the post-auction market for wireless services would be harmed. Vigorous competition is essential to a healthy wireless industry. This realization is the basic motivation for spectrum-aggregation limits.

At the other extreme, a policy of excluding the Big Two from the auction is unlikely to be best. The reality is that the Big Two account for the vast majority of the earnings in the wireless industry. Their capital likely is needed in order to assure the auction's clearing targets are met and broadcasters are motivated to participate. In addition, Big Two participation can speed the rollout of the 600 MHz band as a result of greater economies of scale in equipment manufacturing.

The best policy strikes a balance between these two extremes. In this scenario, the Big Two contribute to auction revenues, yet are prevented from dominating the auction. Thus, smaller carriers see an opportunity to win significant spectrum and so invest in participating in the auction, including securing the necessary capital. Relative to the no-limits policy this middle ground will enhance competition and may increase auction revenues.

Where is the middle ground that strikes the right balance? Assume again that there are seven 5x5 MHz paired lots in each market. The seven lots are contiguous and interoperable as in the Down from 51 band plan. Given this, it seems there are just two possibilities for striking a balance: a limit on the Big Two of one lot or two lots each.[36] A two-lot limit means that at least three lots would be available for other bidders; a one-lot limit means that at least five lots would be available for others. The one-lot limit does more to reduce the concentration of low-band spectrum, but the two-lot limit on the Big Two may yield greater revenues by capturing more revenue from the Big Two and intensifying competition for the remaining lots, while still creating opportunities for smaller carriers.

T-Mobile's proposed Dynamic Market Rule lets the auction determine which limit is best.[37] First the forward auction is run with the one-lot limit on the Big Two. If the revenues are sufficient to meet the revenue requirements from the reverse auction then the incentive auction concludes. Otherwise, the forward auction continues with AT&T and Verizon being able to expand demand to two lots. This creates excess demand and prices continue to ascend, increasing revenues.

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[36] The same cap applies to all carriers as in the T-Mobile proposal: a cap of 1/3 of the low-band spectrum with the exception that all bidders can bid for at least one lot. Given the large holdings of the Big Two this amounts to a cap of one lot each for AT&T and Verizon in most markets. The two-lot limit gives bidders a two-lot exception. Each bidder can bid for at least two lots.

[37] *See* Gregory Rosston and Andrzej Skrzypacz, *A Dynamic Market Rule for the Broadcast Incentive Auction: Ensuring Spectrum Limits Do Not Reduce Spectrum Clearance*, attached to *Ex Parte* Presentation of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (July 31, 2013).

Notably, the Dynamic Market Rule motivates smaller carriers both to bring more money to the auction and to spend that money to buy more spectrum so that the clearing target is met when the Big Two face a one-lot limit.[38] In this way, the Dynamic Market Rule maximizes the chances that the more pro-competitive outcome will be successful, but allows the forward auction to continue with a more relaxed limit if it does not.

HMO argue that their calculated revenue losses are relevant in evaluating the Dynamic Market Rule.[39] They would be if HMO's assertion that the necessary offsetting increases in other bidders' level of participation were "implausible" held true. However, as I have argued and experience has shown, the HMO assumption is false. The limit creates clear opportunities for the smaller carriers and the carriers respond to these opportunities with capital. Moreover, the Dynamic Market Rule not only motivates the smaller carriers to bring the money to auction but to spend it, so as to achieve the revenue target. Demand reduction is discouraged.[40]

Conclusion

Given the high level of concentration in the mobile broadband industry and the especially high level of concentration in low-band spectrum holdings, the FCC should adopt spectrum limits in the 600 MHz auction that prevent the auction from cementing further concentration. The auction should promote improved competition and innovation in the wireless industry, not stifle it.

In setting the limits, the FCC must recognize the essential role of auction revenues in the incentive auction. Without sufficient revenues to compensate clearing TV broadcasters the auction will fail. Fortunately, by setting reasonable limits and using the DMR, the FCC can promote competition both in the 600 MHz auction and in the post-auction market for wireless services. Effective limits will result in little or no revenue loss. The reason is that limiting the winnings of the Big Two creates opportunities for other bidders. These opportunities motivate a higher level of participation from others and make

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[38] In fact, Dr. Leslie Marx predicts that smaller bidders will respond in just this way in her submission on behalf of Verizon and raise their bids. *See* Leslie M. Marx, *Economic Analysis of Proposals That Would Restrict Participation in the Incentive Auction*, ¶ 135 (Sept. 18, 2013), attached to Letter from Tamara Preiss, Vice President, Federal Regulatory Affairs, Verizon, to Ruth Milkman, Chief Wireless Telecommunication Bureau, Federal Communications Commission, Gary Epstein, Chief, Incentive Auctions Task Force, Federal Communications Commission, and William Lake, Chief, Media Bureau, Federal Communications Commission, GN Docket No. 12-268 (Sept. 18, 2013).

[39] HMO at 22.

[40] HMO assert the opposite, "anticipation of the possibility of relaxation could distort bidding behavior, likely leading to reduced revenues." HMO at 22 n.35. But the primary strategic behavior that reduces revenues is demand reduction. Incentives for demand reduction are reduced for the small carriers. Demand reduction by the Big Two can be mitigated by a rule that allows the Big Two to increase demand to two lots only in markets where they are bidding for one lot; that is, the Big Two can go from one to two lots but not from zero to two lots. In addition, if AT&T believes HMO that revenues will be adversely affected due to spectrum limits, then AT&T should expect the DMR to relax the spectrum aggregation limits, leaving AT&T unaffected by the rule. *See* Gregory Rosston and Andrzej Skrzypacz, *Further Explanation of the Dynamic Market Rule*, at 5 (Sept. 2013), attached to *Ex Parte* Notice of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 23, 2013).

the auction more competitive. More competitive auctions yield higher revenues. Absent a limit, potential competitors may fear that the Big Two will dominate the auction, making participation a costly and risky bet.

While AT&T's study by HMO argues that any limit on the Big Two would result in large revenue losses, this conclusion rests on fundamentally unsound assumptions regarding the proportionality of budget reductions, the size of the limits' impact on Big Two bidding, and the magnitude of other bidder increases in participation. These assumptions defy the extensive experience with limits in spectrum auctions. Limiting the winnings of the Big Two creates an opportunity for others and this opportunity motivates participation and thereby competition in the auction. Enhanced competition tends to increase auction revenues.

References

Ian Ayres & Peter Cramton, *Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition*, 48 STANFORD L. REV. 761 (1996), *available at* http://www.cramton.umd.edu/papers1995-1999/96slr-deficit-reduction-through-diversity.pdf.

Ken Binmore & Paul Klemperer, *The Biggest Auction Ever: The Sale of the British 3G Telecom Licenses*, 112 ECON. J. C74, C90 (2001).

Martin Cave & William Webb, *Spectrum Limits and Auction Revenue: the European Experience*, attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013).

Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes*,3-7 (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013).

Peter Cramton, *Spectrum Auctions*, *in* Handbook of Telecommunications Economics 605-639 (Martin Cave, Sumit Majumdar, and Ingo Vogelsang, eds., 2001), *available at* http://www.cramton.umd.edu/papers2000-2004/01hte-spectrum-auctions.pdf.

Peter Cramton, Lessons from the United States Spectrum Auctions: Testimony Before the United States Senate Budget Committee (Feb. 10, 2000), *available at* http://www.cramton.umd.edu/papers2000-2004/00-02-10-cramton-senate-testimony-on-spectrum-auctions.pdf.

Peter Cramton, Evan Kwerel, Gregory Rosston, & Andrzej Skrzypacz, *Using Spectrum Auctions to Enhance Competition in Wireless Services*, 54 CHI. J. L. & ECON. 167, 187 (2011).

Peter Cramton, Andrzej Skrzypacz & Robert Wilson, *The 700 MHz Spectrum Auction: An Opportunity to Protect Competition In a Consolidating Industry* (Nov. 13, 2007) *available at* http://www.cramton.umd.edu/papers2005-2009/cramton-skrzypacz-wilson-competition-in-700-mhz-auction.pdf

Veronika Grimm, Frank Riedel, & Elmar Wolfstetter, *The Third Generation (UMTS) Spectrum Auction in Germany* 3 (CESifo Working Paper No. 584, 2001).

Paul Klemperer, *How (not) to run auctions: The European 3G telecom auctions*, 46 EUROPEAN ECON REV. 829, 837-838 (2002).

Gregory Rosston & Andrzej Skrzypacz, "A Dynamic Market Rule for the Broadcast Incentive Auction: Ensuring Spectrum Limits Do Not Reduce Spectrum Clearance," attached to *Ex Parte* Presentation of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (July 31, 2013).