

The Rationale for Spectrum Limits and Their Impact on Auction Outcomes

Peter Cramton¹

August 2013

Summary

I have been asked by T-Mobile USA, Inc.² to comment on spectrum aggregation limits. I focus on the rationale for limits, the overall experience with spectrum limits, and the suitability of such limits in the FCC's upcoming incentive auction.

Well-crafted spectrum aggregation limits can increase competition both in the market for mobile broadband services and in the spectrum auctions in which they are applied. The increased competition leads to consumer benefits such as increased innovation, accelerated deployment of advanced mobile services, and expanded consumer choice.³ It also can lead to improved auction efficiency and higher auction revenues.⁴

Regulators commonly use spectrum aggregation limits to encourage competition.⁵ There are many instances where the limits appear to have been effective at increasing competition in the market for mobile services and in the auction.⁶ The U.S. PCS auctions of 1994-96 are a vivid example. Limits in these

¹ I am a Professor of Economics at the University of Maryland and Chairman of Market Design Inc. My specialty is the design of complex auction markets. Since 1993, I have contributed extensively to the development of spectrum auctions. I have advised ten governments on spectrum auctions, including the United States. Most recently, I advised the United Kingdom, Canada, and Australia on their 4G auctions. I have advised 36 bidders in major spectrum auctions around the world. I have written dozens of widely-cited practical papers on spectrum auctions. This research is available at www.cramton.umd.edu/papers/spectrum.

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

³ Comments of T-Mobile, GN Docket No. 12-268, at iv, 23 (Jan. 25, 2013).

⁴ 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> (last accessed Aug. 12, 2013).

⁵ *See, e.g.,* Peter Cramton et al., *Using Spectrum Auctions to Enhance Competition in Wireless Services*, 54 J. L. & Econ. S167, S178-S180 (2011) (hereinafter "Cramton, *Using Spectrum Auctions*").

⁶ *See, e.g., id.*; Martin Cave & William Webb, "Spectrum Limits and Auction Revenue: the European Experience," (hereinafter "Cave & Webb") attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013). As discussed below, the German auction of 800 MHz included caps of 2x10 MHz, and the amount paid for that spectrum totaled over 80 percent of the entire proceeds of the auction, even though it made up only sixteen percent of the spectrum auctioned. *See* ITU, "Exploring the Value and Economic Evaluation of Spectrum" (Apr. 2012), 24, *available at* http://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_SpectrumValue.pdf (last accessed Aug. 13, 2013); *see also* Arthur D. Little, "Mobile Broadband, Competition and Spectrum Caps," GSMA (2009), 10-11, *available at* <http://bit.ly/17vb9L2> (last accessed Aug. 16, 2013) (discussing results of various auctions that included spectrum-aggregation limits and resulted in both new entrants and high revenues).

auctions led to robust competition, innovative services, and rapid price declines.⁷ In recent auctions, for example in the 4G spectrum auctions in Europe, regulators have especially focused on limits with respect to low-band spectrum (below 1 GHz).⁸ There is little evidence that these limits have harmed auction revenue.⁹

The market structure for mobile services in the United States is such that the FCC should carefully consider low-band spectrum limits in the incentive auction.¹⁰ However, caution should be taken in setting limits to avoid harming auction revenues and the attainment of a clearing target.

Rationale for spectrum limits

Spectrum is an essential input in the provision of wireless services.¹¹ Excessive concentration of this essential input undermines competition for wireless services, harming consumers. Spectrum aggregation limits can prevent excessive concentration of spectrum. This is the primary motivation for spectrum limits.

Critics of spectrum limits argue that the limits harm both auction efficiency and revenues, and ultimately are unsuccessful in promoting competition.¹² Limits that are too stringent may have these undesirable effects, but regulators can and often do design the limits to enhance competition and improve auction efficiency and revenues.¹³

At first glance, it may seem that a spectrum limit necessarily reduces auction revenues. A binding limit means that a bidder's demand has been reduced from what it would be absent the limit. Doesn't this

⁷ See, e.g., *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Fourth Report, 14 FCC Rcd 10145, 10150-51 (1999) (discussing market and consumer benefits following the PCS auctions) (hereinafter "*Fourth Mobile Competition Report*"); see also below for discussion of post-PCS auction marketplace .

⁸ Cave & Webb at 5-10.

⁹ See, e.g., 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).

¹⁰ 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, ¶¶ 52-53 (2013).

¹¹ See *Ex Parte* Submission of the United States Department of Justice, WT Docket No. 12-269 (Apr. 11, 2013).

¹² See, e.g., Robert Earle & David Sosa, *Spectrum Auctions Around the World: An Assessment of International Experiences with Auction Restrictions*, Analysis Group, Inc. (July 2013) (hereinafter "Earle & Sosa"), attached to *Ex Parte* Presentation of Mobile Future, GN Docket No. 12-268 & WT Docket No. 12-269 (July 31, 2013).

¹³ See Peter Cramton, *Spectrum Auctions*, in *Handbook of Telecommunications Economics* (Martin Cave, Sumit Majumdar, and Ingo Vogelsang, eds., 2001), <http://bit.ly/13MaV3l>; see also 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).

reduced demand imply lower auction revenues? The answer would be yes, but for a countervailing force that often is decisive: the spectrum limit can motivate participation in the auction and thereby increase auction revenues.¹⁴ Auction revenues are quite sensitive to the level of competition. Adding one or more bidders can have a pronounced impact in increasing revenues.

Consider an example with two incumbents in a symmetric duopoly. A spectrum auction creates the possibility that entry will occur and disrupt the duopoly. But the duopolists have a strong incentive to bid aggressively in the auction and acquire the entire award. Doing so prevents entry and preserves the higher duopoly profits. Potential entrants who anticipate this outcome will choose not to participate in the auction and avoid significant participation costs. As a result, only the two incumbents compete and they can coordinate to split the spectrum equally. The auction ends near the reserve price—well below the competitive price.

Now suppose the regulator imposed a spectrum limit that prevented the duopolists from winning the entire award. This fundamentally alters the participation decision. Potential entrants know that at least one entrant must be successful. This certainty motivates participation. The strongest potential entrants decide to participate. Prices in the auction get bid up as a result of competition among the expanded set of bidders.

The spectrum limit can also enhance auction efficiency. More societal value may come from awarding a small bidder, rather than a large bidder, a spectrum lot. Yet in an auction without limits, the large bidder may nevertheless win. The reason is that the large bidder's value is inflated by the benefits the large bidder enjoys from reduced competition in the wireless market in the event the small bidder fails to acquire spectrum. The spectrum limit lets the large bidder win some spectrum, but not so much that competition for wireless services is harmed.

These arguments certainly do not imply that spectrum limits necessarily improve auction outcomes. Overly stringent limits may allocate spectrum to less efficient providers who are unable to build out their spectrum, provide services, or increase competitive pressures.¹⁵ The conclusion instead is that the regulator must carefully design spectrum limits to best achieve the auction objectives. Spectrum limits may be undesirable in settings with robust competition and little spectrum concentration; however, spectrum limits are desirable in settings with concentrated markets and concentrated spectrum holdings.

Experience with spectrum limits

The regulator faces difficult tradeoffs in designing spectrum limits. Fortunately, the regulator can draw on experience with spectrum limits over the last twenty years in spectrum auctions worldwide.

¹⁴ Nor is there any reason to suspect that well-crafted spectrum limits in the upcoming incentive auction will reduce broadcaster participation in the reverse auction. Broadcasters are able to set their prices and withdraw if revenues are insufficient.

¹⁵ Cramton, *Using Spectrum Auctions* at S180.

One of the important early uses of spectrum limits was in the U.S. PCS auctions from 1994 to 1996.¹⁶ At the time of the first PCS spectrum auction, the market structure was quite close to the duopoly example above—in every region of the country there were two cellular carriers, each with one-half of the available spectrum.¹⁷ Were the PCS auctions conducted without limits, the outcome likely would have been much less competitive. The spectrum limit implied that there would be at least five spectrum holders in each market.¹⁸ The limit motivated robust competition both in the auctions and in the market for wireless services.¹⁹ The market experienced rapid innovation and U.S. consumers enjoyed better services and lower prices. This progress is well-documented in the FCC’s annual reports on wireless competition from 1995 to 2003. Since the elimination of spectrum caps in 2003, however, market concentration has increased.²⁰

The PCS auctions also revealed that some policies distinct from the spectrum limits were mistakes. The largest mistake was providing small businesses with excessively attractive installment payment terms.²¹ This policy led to rampant speculative bidding.²² The majority of the winners defaulted on payments and many of the spectrum licenses got tied up in bankruptcy court. The FCC learned from this mistake. Installment payments were dropped from consideration in future auctions. Some critics point to this experience as a reason to avoid spectrum limits,²³ but the mistake with installment payments has nothing to do with the successful policy of spectrum limits.

¹⁶ Arthur D. Little, *MOBILE BROADBAND, COMPETITION AND SPECTRUM CAPS*, 5 (2009), *available at* <http://www.gsma.com/spectrum/wp-content/uploads/2012/07/Spectrum-Mobile-broadband-competition-and-caps-report-2009.pdf> (last accessed Aug. 12, 2013).

¹⁷ *Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, First Report, 10 FCC Rcd 8844 (1995).

¹⁸ *Amendment of the Commission’s Rules to Establish New Personal Communications Services*, Memorandum Opinion and Order, 9 FCC Rcd 4957 (1994).

¹⁹ Cramton, *Using Spectrum Auctions* at S182. Even parties otherwise critical of spectrum aggregation limits concede that, after the FCC adopted limits in the PCS auction, the “wireless industry grew rapidly through the entry of facilities-based providers,” such as Sprint, Leap, MetroPCS, and VoiceStream Wireless. See Earle & Sosa at 7.

²⁰ Peter Cramton, Andrzej Skrzypacz and 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> (last accessed Aug. 16, 2013).

²¹ 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> (last accessed Aug. 12, 2013).

²² *Id.*

²³ Earle & Sosa at i-ii, 7-8.

Nearly all of the European spectrum auctions had spectrum limits.²⁴ My overall assessment is that the limits often were effective in promoting competition both in the auction and in the market for wireless services. I discuss some relevant examples.

The United Kingdom 3G auction of 2000 illustrates well how the auction structure and spectrum limits can enhance competition. At the time of the auction the U.K. had two large incumbents and two smaller incumbents.²⁵ The regulator packaged the 3G spectrum into five licenses, two large licenses and three smaller licenses. No bidder could win more than one license.²⁶ Thus, with four incumbents and five licenses, one new entrant was guaranteed to win. The incentive for entry was further strengthened by designating one of the two large licenses for a new entrant.²⁷ This structure provided strong motivation for new entrants to participate. In fact, thirteen bidders including nine potential entrants competed in the auction.²⁸ The structure also created a battle for the one remaining large license between the two large incumbents. Revenues were £22.5 billion (\$34 billion), or approximately 2.5% of the United Kingdom's Gross National Product – substantially higher than anticipated.²⁹ At the time, the auction was widely described as the biggest auction in history.³⁰

Strictly in terms of revenues produced, the U.K. 3G auction experience contradicts claims that reasonable, pro-competitive spectrum limits always or even often reduce auction revenues.³¹ On the contrary, the U.K. case illustrates the role that spectrum limits can play in enhancing revenues by motivating participation and thereby encouraging auction competition. Had the regulator instead packaged the spectrum to be consistent with the existing market structure, two large licenses and two smaller licenses without any spectrum limits, then I would expect the outcome to be dramatically different, including a significant possibility of no participation by potential entrants and the auction quickly concluding at low prices with the two large incumbents each winning a large license and the two smaller incumbents each winning a smaller license, much like in the duopoly example. In this low-revenue outcome, the ability of the large incumbents to bid for multiple licenses is what can keep the smaller incumbents from bidding on the large licenses, since the smaller incumbents are then vulnerable to retaliation should they bid for the large licenses.

²⁴ For a further discussion of the European experience see Cave & Webb.

²⁵ See Tilman Börgers and Christian Dustmann, *Rationalizing the UMTS Spectrum Bids: The Case of the UK Auction*, 5 (CESifo Working Paper No. 679 (9), 2002).

²⁶ Cramton, *Using Spectrum Auctions* at 179.

²⁷ *Id.*

²⁸ Ken Binmore and Paul Klemperer, *The Biggest Auction Ever: The Sale of the British 3G Telecom Licenses*, 112 *ECON. J.* C74, C90 (2001).

²⁹ *Id.* at C74.

³⁰ *Id.*

³¹ See, e.g., Gregory J. Vogt, Free State Foundation, *Achieving Unanimity: Getting to "Yes" for Incentive Auctions* (Aug. 13, 2013), <http://freestatefoundation.blogspot.com/> (claiming that spectrum-aggregation limits "almost certainly" diminish revenues).

In addition to the record-setting auction revenues, the U.K. 3G auction gave rise to the operator “3,” which has had a disruptive influence on pricing, service, and innovation in the market.³² 3UK was the first operator to roll out 3G in the U.K. and it pioneered video telephony and video download.³³ It was also the first operator to offer unlimited data and the first to offer MiFi capability.³⁴

The German 3G auction came shortly after the U.K. 3G auction.³⁵ The market structure in Germany was quite similar to the U.K. with four incumbents: two larger and two smaller.³⁶ The regulator chose the same 2x15 MHz spectrum limit, but the available spectrum was split into twelve 2x5 MHz lots.³⁷ A bidder could win either two or three lots, which meant that there would be between four and six winners.³⁸ Two outcomes appeared especially likely: (1) five winners with the two larger incumbents each winning three lots and (2) six winners with each winning two lots, including two new entrants.³⁹ Seven bidders participated in the auction.⁴⁰ The larger incumbents fought furiously for three lots and the five-winner outcome, but the two strongest potential entrants refused to exit the auction. Ultimately, facing pressure from capital markets, the larger incumbents acquiesced, reducing their demands from three to two lots and ending the auction with two new entrants.⁴¹ At the same time, the auction raised record revenues of €50.5 billion (\$45.8 billion), or 35% more than the United Kingdom’s 3G auction and some five times more than had been expected.⁴²

In the case of Germany, the spectrum limits did not bind in the final outcome, so it is possible that the limits played no role in the outcome. However, the limits may have motivated the participation of three well-capitalized potential entrants and that participation made for a highly competitive auction.

After paying many billions of euros to the German government for the 3G licenses, both new entrants ended up returning the licenses.⁴³ The spectrum went unused until the 4G auction. Earle & Sosa point to

³² Cave & Webb at 13.

³³ *Id.*

³⁴ *Id.* at 14.

³⁵ Veronika Grimm, Frank Riedel, & Elmar Wolfstetter, *The Third Generation (UMTS) Spectrum Auction in Germany 3* (CESifo Working Paper No. 584, 2001).

³⁶ *Id.* at 7.

³⁷ *Id.* at 5.

³⁸ *Id.* at 3.

³⁹ *Id.* at 5.

⁴⁰ *Id.* at 4.

⁴¹ *Id.* at 7-10.

⁴² *Id.* at 2; Nigel Deighton, Gartner, Inc., German Auction of 3G Mobile Phone Licenses Raises 50.5 Billion Euros (Sept. 1, 2000), available at <http://www.gartner.com/id=314369> (last accessed Aug. 12, 2013).

⁴³ German Regulatory Authority for Telecommunications and Posts, ANNUAL REPORT 2004 57 (2004), available at http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/ReportsPublications/2004/AnnualReport2004Id2043pdf.pdf?__blob=publicationFile (last accessed Aug. 12, 2013); Andreas Grünwald,

this outcome as a failure of spectrum limits,⁴⁴ but this is incorrect. The new entrants did not win spectrum because of the limits; they won because they outbid incumbents who were *not* constrained by the limit. Stated differently, the spectrum-aggregation limits did not prevent incumbents from outbidding new entrants, but rather promoted so much participation and enthusiasm that the new entrants outbid the incumbents. The failure of the auction had nothing to do with limits, which had no effect, but rather rested on the entrants assigning too high a value to being a new entrant in a six-carrier German market, perhaps in part because of continued fallout from the dot com bubble.

Given the experience of the German 3G auction and the subsequent bursting of the dot com bubble, it is not surprising that the Austrian 3G auction had a much different outcome despite having essentially the same market and auction structure (12 lots with a 3-lot limit). The government set a very low reserve price that was one-eighth of the reserve set in the German auction, and the auction ended quickly with each of the six bidders winning two lots.⁴⁵ With only six bidders, this low-price equilibrium was focal. The two strongest incumbents knew that they could end the auction quickly by reducing demand from three lots to two lots early in the auction, while trying for a third lot would require much higher bidding to drive out another bidder. The incumbents therefore did not bid at their limits and so this low-price outcome with six winners had nothing to do with the spectrum limits.

Limits in the Canada AWS auction of 2008 set aside 40 MHz of AWS spectrum exclusively for new entrants.⁴⁶ The limits motivated the participation of nineteen potential new entrants.⁴⁷ The result was a highly competitive auction that generated \$4.25 billion in revenue, nearly three times initial revenue expectations.⁴⁸ Canada represents another clear case where the spectrum limits (in this case a set-aside for new entrants) increased auction revenues.

The Canada AWS auction has also resulted in a reinvigorated challenger, Wind Mobile, to the three Canadian incumbents. Wind, a carrier with more than 600,000 subscribers, has been rumored to be in talks with Verizon and may emerge as an even stronger competitor.⁴⁹

International Spectrum Review, German Court confirms 3G license revocation with no fee refund (Aug. 28, 2011), *available at* <http://www.hlspectrumreview.com/2011/08/articles/mobile-and-fixed-wireless/german-court-confirms-3g-license-revocation-with-no-fee-refund/> (last accessed Aug. 12, 2013).

⁴⁴ Earle & Sosa at ii.

⁴⁵ Paul Klemperer, *How (not) to run auctions: The European 3G telecom auctions*, 46 EUROPEAN ECON REV. 829, 837-838 (2002).

⁴⁶ Kyle Hyndman 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).

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ Hugo Miller, Scott Moritz, & Serena Saitto, *Verizon Says It's Considering Deal for Canada's Wind Mobile*, Bloomberg (June 18, 2013), *available at* <http://bloom.bg/14fd1X5> (last accessed Aug. 12, 2013).

The most recent wave of spectrum auctions was the 4G auctions in Europe and elsewhere beginning in Germany in 2010. These typically were multiband auctions involving both low-band (below 1 GHz) and high-band (above 1 GHz) spectrum.⁵⁰

To provide service in a market, carriers require a portfolio of spectrum together with network infrastructure (cell sites, backhaul, etc.) that provides both coverage and capacity.⁵¹ Low-band spectrum has propagation characteristics that make it ideally suited to provide coverage in less populated areas as well as within buildings.⁵² High-band spectrum is better suited to provide capacity in more densely populated areas.⁵³

Low-band spectrum is especially scarce and as such regulators are concerned that excessive concentration of the low-band spectrum may adversely impact competition for wireless services.⁵⁴ For this reason, regulators typically have set spectrum limits for low-band spectrum in the recent auctions.⁵⁵ Low-band auction prices were high in several countries despite the limits, for example in Germany and Italy. In many countries, a combinatorial clock auction was used, which does not give prices for individual lots. The U.K. 4G auction included both low-band spectrum limits and a spectrum floor that guaranteed that at least four companies would win a sufficient portfolio of spectrum for effective operation in the U.K. wireless market.⁵⁶

Earle & Sosa argue that limits ultimately have been ineffective in increasing the number of competitors in a market and therefore limits are both ineffective and costly.⁵⁷ I disagree. Spectrum limits have played an essential role in creating competition and fostering innovation in wireless communication. Moreover, the overall impact on auction revenues has been positive. While it is true that there has been some

⁵⁰ GSMA, Digital Dividend: Auctions Summary, <http://www.gsma.com/spectrum/wp-content/uploads/DigitalDividend/DDtoolkit/auctions-summary.html> (last accessed Aug. 7, 2013); Mark Colville, "Bidding Halted in Czech Republic's LTE Auction: Can Spectrum Auctions Raise Too Much Money?," *Analysys Mason* (Mar. 15, 2013), available at <http://www.analysismason.com/About-Us/News/Insight/Czech-LTE-auction-Mar2013/#.UgKZ6dLqI8F> (last accessed Aug. 13, 2013).

⁵¹ 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, ¶ 127 (2013).

⁵² *Id.* ¶¶ 121-22.

⁵³ *Id.* ¶ 126.

⁵⁴ See *id.* ¶ 124; Cave & Webb at 4-5.

⁵⁵ See, e.g., GSMA, Digital Dividend: Auctions Summary, <http://www.gsma.com/spectrum/wp-content/uploads/DigitalDividend/DDtoolkit/auctions-summary.html> (last accessed Aug. 7, 2013); Mark Colville, "Bidding Halted in Czech Republic's LTE Auction: Can Spectrum Auctions Raise Too Much Money?," *Analysys Mason* (Mar. 15, 2013), available at <http://www.analysismason.com/About-Us/News/Insight/Czech-LTE-auction-Mar2013/#.UgKZ6dLqI8F> (last accessed Aug. 13, 2013).

⁵⁶ Geoffrey Myers, "Spectrum Floors in the UK 4G Auction: An Innovation in Regulatory Design," Available at SSRN: <http://ssrn.com/abstract=2239123>.

⁵⁷ Earle & Sosa at 22.

consolidation in recent years as the wireless industry has matured, this is a natural tendency in most industries. The process of competition inevitably involves entry of some companies who succeed and grow and other companies who fail and exit or merge with successful rivals. As the industry matures, entry and exit become less common.⁵⁸ The competition shifts to fights over market share.⁵⁹ In these more mature markets, spectrum limits still may have a role in avoiding excessive concentration.

Spectrum limits in the incentive auction

The U.S. mobile market consists of four national carriers, two large carriers (Verizon and AT&T) and two smaller carriers (Sprint and T-Mobile), and a number of regional carriers serving a small segment of the market.⁶⁰ Verizon and AT&T (the “Big Two”) have roughly two-thirds of the market in terms of subscribers and a much larger share in terms of earnings.⁶¹ The Big Two also hold the vast majority of the low-band spectrum.⁶²

The 700 MHz auction threatened the Big Two’s dominance in the low-band spectrum. However, for a number of reasons including the absence of spectrum limits and a fragmented band plan, the Big Two won about 85% of the 700 MHz spectrum.⁶³ Sprint and T-Mobile did not participate in the auction.⁶⁴

⁵⁸ See, e.g., Gordon Walker, MODERN COMPETITIVE STRATEGY 65-94 (2004).

⁵⁹ See, e.g., *id.*; J.W. Mullins & O.C. Walker, McGraw Hill Education, Marketing Strategies for Mature and Declining Markets, <http://answers.mheducation.com/business/marketing/marketing-strategy/marketing-strategies-mature-and-declining-markets> (last accessed Aug. 13, 2013); Michael Kennedy, “Market maturity, competition force service providers to adopt more sophisticated business models,” FierceTelecom (Aug. 1, 2011), available at <http://www.fiercetelecom.com/story/market-maturity-competition-force-service-providers-adopt-more-sophisticate/2011-08-01#ixzz2brfyy6er> (last accessed Aug. 13, 2013).

⁶⁰ 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, ¶¶ 52-53 (2013).

⁶¹ See *id.*

⁶² *Id.* ¶ 131.

⁶³ 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 Aug. 12, 2013). When analyzing the competitive effects of an auction, simply noting the number of license winners of an auction is meaningless from an economic perspective. See, e.g., Joan Marsh, AT&T Public Policy Blog (Aug. 13, 2013), <http://www.attpublicpolicy.com/fcc/why-t-mobiles-dynamic-market-rule-wont-work/>. Thus, while there were 101 winners in the 700 MHz auction, two of those winners – Verizon and AT&T – accounted for 85% of the spectrum sold – a result that, analysts note, may have “cemented” these two carriers dominance over the U.S. wireless market for the next decade. J.P. Morgan, *Telecom Services and Towers* 9-10 (Dec. 5, 2012), attached to Letter from Trey Hanbury, Counsel to T-Mobile US, Inc. to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 & WT Docket 12-269 (July 26, 2013).

⁶⁴ *Auction of 700 MHz Band Licenses; 214 Bidders Qualified to Participate in Auction 73*, Public Notice, AU Docket No. 07-157, Attachment A (2008).

Prices were still bid up to \$19 billion, based largely on competition from the small regional providers.⁶⁵ The price impact of the small operators was especially great in the B-block, which was offered in small (CMA) service areas, which better fit the small operators' needs and budgets. Although there were 101 winners in the 700 MHz auction, 85 percent of the spectrum value went to two operators—Verizon and AT&T. The auction failed to improve the market structure, but instead reinforced the already high level of concentration in the low-band spectrum holdings.

The incentive auction presents another opportunity to strengthen competition. As in the 700 MHz auction, we can anticipate aggressive bidding by the Big Two to maintain their dominant position in the low-band spectrum and the resulting coverage advantage. To avoid excessive concentration of low-band spectrum and motivate participation in the auction from the smaller rivals, it may be desirable to impose a low-band spectrum limit. This was the conclusion of the U.S. Department of Justice in its submission to the FCC on the incentive auction.⁶⁶

Well-crafted spectrum limits can enhance competition for wireless services and increase competition in the auction. As Earle & Sosa acknowledge, the PCS auction was a success in bringing fresh competition and innovation to the mobile marketplace. Following the initial round of auctions in 1994 and 1995, Earle & Sosa note that “the wireless industry grew rapidly through the entry of facilities-based providers” and companies including Sprint, Leap, MetroPCS, and VoiceStream Wireless entered the U.S. wireless market by acquiring spectrum in these auctions.⁶⁷ Similarly in its 1997 Report to Congress on the results of the PCS auctions, the FCC observed that fifty-three percent of the licenses awarded went to small businesses, which had the result of “improving wireless service at lower prices.”⁶⁸ The FCC also noted that as a result of the auctions, capital investment in wireless networks increased to \$26.7 billion in 1996, up from just \$12.8 billion in 1993, while the average cellular subscriber bill decreased 27 percent during the same period.⁶⁹ By 1999, the date of the Commission's Fourth Report on Commercial Services, PCS deployment had resulted in the expansion of the mobile market to include at least five

⁶⁵ Federal Communications Commission, Auction 63: 700 MHz band, http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=73 (last accessed Aug. 12, 2013). Notably, the failure of the auction to meet the reserve price for the Lower D Block was the result of uncertainty regarding the actual cost of building and maintaining the public safety network. By contrast, spectrum-aggregation limits are clear, *ex ante* rules that are not uncertain.

⁶⁶ *Ex Parte* Submission of the United States Department of Justice, WT Docket No. 12-269 (Apr. 11, 2013) (recommending the Commission take action to ensure the two smaller nationwide carriers are “are not foreclosed from access to more spectrum, and particularly [not from] low-frequency spectrum.” In particular, the Department of Justice recommended adopting “a set of well-defined rules for spectrum acquisitions in auctions.”).

⁶⁷ Earle & Sosa at 7.

⁶⁸ The FCC Report to Congress on Spectrum Auctions, WT Docket No. 97-150, Report, FCC 97-353, 23-24 (Oct. 9, 1997) (hereinafter “*FCC Report on Spectrum Auctions*”).

⁶⁹ *See id.* at 24; *see also Fourth Mobile Competition Report*, 14 FCC Rcd at 10150-51 (1999) (“[B]ecause of growing competition in the marketplace, it appears that the average price of mobile telephone service has fallen substantially...since the *Third Report* [1998], continuing the trend of the last several years.”).

mobile telephone providers in each of the thirty-five largest regions of the U.S., and at least three mobile providers in 97 of the 100 largest regions.⁷⁰

Earle & Sosa also acknowledge that the PCS auctions “benefited consumers and competition by providing existing carriers with additional spectrum and new competitors with the spectrum required to enter the nascent wireless market and offer service.”⁷¹ These authors nonetheless argue that, despite these and other tangible benefits to consumers, the policy behind the PCS auctions did not encourage the participation of small operators that was the motivation behind the spectrum-aggregation limits. In 2004, however, the Commission concluded in its annual assessment of competition in the mobile marketplace that “the auctioning of PCS spectrum produced the significant variation in the number of mobile telephony carriers across different geographic regions” that characterized the contemporary marketplace, and these “market-based policies resulted in significantly greater numbers of mobile competitors entering many regional geographic markets as compared with countries in Western Europe and Asia.”⁷² Moreover, even a casual student of today’s mobile marketplace can observe that the wireless providers born of the PCS auction, such as Sprint, Leap, MetroPCS, and T-Mobile (formerly VoiceStream Wireless) remain active competitors today.

Meanwhile, even two of the authors Earle & Sosa cite for the proposition that spectrum-aggregation limits somehow delayed or discouraged entry actually found just the opposite. In their 2009 RAND Journal study, Thomas Hazlett and Robert Muñoz described how expanded spectrum availability resulting from the PCS auction promoted market entry. As evidence for this finding, Hazlett and Muñoz pointed to the “six competing national networks” that existed in 2000 compared to the duopoly structure of the cellular telephone market that existed prior to the PCS auction.⁷³ And while Hazlett and Muñoz criticized the FCC’s installment payment program as ill-advised policy that diminished consumer welfare, the authors pointedly did not extend this critique to spectrum aggregation limits. On the contrary, Hazlett and Muñoz conclude that “[a]uction rules that focus on revenue extraction,” which Earle & Sosa cite as an ostensible benefit of an auction without spectrum-aggregation limits, “may conflict with the goal of maximizing social welfare.”⁷⁴

If well-crafted, spectrum limits can enhance competition for wireless services and increase competition in the auction while generating little risk that the limits would adversely impact the auction outcome. As always, care should be taken in setting spectrum limits. This is especially true in the incentive auction,

⁷⁰ *Id.* at 10150.

⁷¹ Earle & Sosa at 7.

⁷² *Implementation of Section 602(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Ninth Report, 19 FCC Rcd 20597, 20631 (2004).

⁷³ Thomas W. Hazlett & Robert E. Muñoz, “A Welfare Analysis of Spectrum Allocation Policies,” (Dec. 1, 2008), 12, available at http://www.arlingtoneconomics.com/studies/Rand_TH_RM_12_5_08.pdf (last accessed Aug. 16, 2013).

⁷⁴ *Id.* at 20.

where revenues play an important role to the success of the auction. Yet in the incentive auction, auction rules can be combined with the spectrum limits to reduce the possibility of limits harming revenues to the point of preventing a clearing target from being reached. For example, Rosston & Skrzypacz have suggested a dynamic market rule that allows for the gradual weakening of limits whenever the limits stand in the way of achieving a clearing target.⁷⁵ Such a rule should be carefully considered by the FCC as a safety valve in the incentive auction.

Conclusion

Recognizing market concentration in the mobile wireless marketplace, the Department of Justice has recommended that the Commission ensure that larger market participants do not foreclose smaller participants from acquiring critical low-band spectrum to improve their coverage.

Experience from the United States and around the world shows that spectrum limits, when properly applied, are an effective tool for promoting competition and consumer welfare.

⁷⁵ 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).