

Calculating the Value of Unencumbered AWS-III Spectrum

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Spectrum is a valuable scarce resource, and as the FCC continues to allocate and auction spectrum licenses, the U.S. Treasury continues to collect record sums from the communications industry for spectrum rights. In 2006, wireless providers bid \$14 billion for Advanced Wireless Service licenses and, earlier this year, the industry bid a record \$19 billion for licenses in the 700 MHz band that is being cleared by analog television broadcast stations.

Last week, the FCC announced plans to auction an additional 25 MHz nationwide license in the Advanced Wireless Services (AWS) band, often called AWS-III. Significantly, the FCC proposed to attach several substantial conditions and encumbrances upon use of the AWS-III spectrum.¹ These conditions should be expected to lower the value of this license by an appreciable amount.²

In this PERSPECTIVE, I utilize a methodology developed in earlier research to estimate the unencumbered value of the proposed 25 MHz AWS-III license. Having an estimate of the raw, unencumbered (or less encumbered) value will provide a baseline for exploring the impact on auction revenues from the proposed conditions on that license. For example, I have estimated that the open access obligations imposed upon on the Upper C block in the 700 MHz auction cost approximately \$3.1 billion in lost auction revenues, or about a 40% loss in auction revenue relative to an unencumbered state.³

I make no judgment of the efficacy or utility of such conditions and encumbrances. However, I

do believe that policymakers should be aware of the impact that their decisions to condition or encumber spectrum licenses might have upon the auction value of spectrum and the services offered over such licenses.

Analysis

The AWS-III auction includes a nationwide block of spectrum at the 2.1 Ghz band (2155-2180 MHz). My forecast is based on the earlier AWS-I and 700 Mhz auctions (excluding the "open access" C band), so an implicit assumption of the prediction is that the terms and condition of AWS-III spectrum are similar to those earlier auctions.

... it is reasonable to assume that the AWS-III auction, absent spectrum encumbrances, could render revenues in the upper \$2 billion range. These estimates suggest a Price-Mhz-Pop of about \$0.40, with a 90% confidence interval of \$0.21 to \$0.75.

The forecast equation includes six blocks from Auction 66 (AWS-III) and three blocks from Auction 73 (700 Mhz). Aggregating up to the REA level for consistency, I run the following regression:

$$\ln P_{i,b} = \beta_0 + \beta_1 \ln POP_i + \beta_2 \ln MHZ_b + \beta_3 DREA_b + \beta_4 A73_b + \beta_5 BB73_b + \beta_6 UNPAIR_b + \varepsilon_{i,b} \quad (1)$$

where $P_{i,b}$ is the final gross bid of the auction for REA i and block b , POP is the population of the REA i , MHZ is the size of the auctioned block b , $DREA$ is a dummy variable indicating whether or not the block was auctioned at the REA level (rather than aggregated up to that level), $A73$ is a dummy variable for Auction 73 blocks, $BB73$ is a dummy variable for the B block of Auction 73, $UNPAIR$ is a dummy variable for the E block of Auction 73 which was sold as unpaired spectrum, and ε is the econometric disturbance term. All continuous variables are expressed in natural log form (“ln”).

Estimating Equation (1) with the 72 observations from Auctions 66 and 73, I get

$$\ln P_{i,b} = -6.4 + 1.32 \cdot \ln POP_i + 1.0 \cdot \ln MHZ_b + 0.23 \cdot DREA_b + 0.82 \cdot A73_b + 0.85 \cdot BB73_b - 0.40 \cdot UNPAIR_b + \varepsilon_{i,b} \quad (2)$$

with all regressors statistically significant at the 5% level or better except $UNPAIR$ which is significant at the 8% level. The R^2 of the regression is 0.98, so the model predicts almost all the variation in auction prices.⁴ The results indicate that price rises proportionately with the size of the block ($\beta_2 = 1.0$), but more than proportionately with population ($\beta_1 = 1.3$).⁵

Large geographic aggregations are sold a premium ($\beta_3 > 0$). Auction 73 brought higher prices, which is probably due to a number of factors including, but not limited to, the high quality of the spectrum and the growth in the wireless market. The B block in Auction 73 sold at a substantial premium that likely reflects its adjacency to another block in the same band thus creating an effective 20 Mhz block (rather than the 10 Mhz that was auctioned in Auction 73). These results are all comparable with those

found in the Phoenix Center’s POLICY BULLETIN NO. 20.⁶

The unpaired E block in Auction 73 sold at a 33% discount [$\exp(-0.40)-1$]. This finding is relevant since the AWS-III auction is for unpaired spectrum. Evidence from Auctions 44 and 49, which included both paired and unpaired blocks, also suggests about a 33% discount on unpaired blocks.⁷

Using Equation (2) I can get an estimate of the auction value of the AWS-III spectrum simply by plugging in the relevant values. I assume the spectrum is sold at the REA level, and exclude the coefficients related solely to Auction 73 except for the discount on unpaired spectrum. Since the auction is at the national level, then this approach should, if anything, understate the revenue potential of the auction.⁸

For each REA, then, the prediction of the auction revenue for the AWS-III auction is

$$P_{i,b} = \exp[-6.4 + 1.32 \cdot \ln POP_i + 1.0 \cdot \ln MHZ_b + 0.23 - 0.40]; \quad (3)$$

these REA level predications are then summed to get the aggregate auction revenue.

Summing the predictions from Equation (3), the 25 MHz AWS-III block is predicted to generate \$2.8 billion in revenues.⁹ The 90% confidence interval on the prediction is \$1.5 to \$5.3 billion.

Based on this analysis, it is reasonable to assume that the AWS-III auction, absent spectrum encumbrances, could render revenues in the upper \$2 billion range. These estimates suggest a Price-MHz-Pop of about \$0.40, with a 90% confidence interval of \$0.21 to \$0.75.

Of course, these estimated values assume that that the AWS-III license has similar terms and conditions on the license, and that the design of the auction is similar, to those in Auction 66 and Auction 73. The FCC’s Notice, however, proposes substantial conditions on the AWS-III

license, including, but not limited to, open access regulation, free Internet service obligations, expedited build-out obligations and a mandatory “‘always on’ network-based filtering mechanism.” All of these obligations are certainly expected to reduce the revenue generated by the auction, but I make no prediction as to how much since in most cases there are not direct comparables. In POLICY BULLETIN NO. 20, I found that the open access obligation imposed upon the Upper C block reduced auction bids by 40%, and I see no reason to believe such a substantial discount would not appear in the AWS-III auction given the proposed conditions. The free Internet service obligations for 25% of the capacity of the AWS-III license are likely to have a substantial revenue-reducing effect for the operator, and this impact will be revealed directly in auction revenues.

Caveats

Predicting the future is always difficult, so some caveats are required.

First, I am predicting auction revenues, not the social benefit generated by use of the spectrum. Revenues are a just a portion of the aggregate value of putting the spectrum to use.

Second, the wireless market and the economy have changed since the AWS-I auction in 2006, and the results from this auction form the basis of my predictions. Indeed, the economy is presently in an economic downturn, and this

downturn—especially the impact that the downturn has upon credit markets—may impact bidding. However, there are numerous reports that the wireless market is not much affected by recent cyclical factors.¹⁰

Third, the wireless market has grown considerably even since 2006, so spectrum may be more valuable today than in the past. Auction 73 produced substantially more revenues than Auction 66 (*ceteris paribus*), and a part of that difference may be attributable to (unexpected) market growth. I have made adjustments to my predictions to reflect growth so, in this respect, my forecast is probably low.

Finally, the addition of the 700 MHz spectrum to the market could reduce the value of other spectrum, particularly spectrum like AWS-III, which is unpaired. However, the rapid growth of demand for wireless services may limit this effect. Because spectrum will remain a scarce and critical input for these services even after the AWS-III auction, the value of spectrum should remain robust for some time.

There may be a variety of other factors impacting the auction value of this spectrum; I have not considered them all. I have provided a rather straightforward prediction on the auction value of the AWS-III spectrum in an unencumbered state. Absent a profound change in the economic situation, my forecast seems reasonable.

NOTES:

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¹ In the Matter of Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, FCC 08-158, *Further Notice of Proposed Rulemaking*, __ FCC Rcd __ (rel. June 20, 2008) (available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-158A1.pdf).

² For example, when the FCC imposed “open access” policies upon the Upper C block in the 700 MHz auction, it noted that “even if the limited requirements we impose today have some potential for reducing the monetary value and decreasing efficient use of spectrum in some respects, we believe that they are in the public interest.” See Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, WT Docket No. 06-150, Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, Section 68.4(a) of the Commission’s Rules Governing Hearing Aid-Compatible Telephones, WT Docket No. 01-309, Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services, WT Docket 03-264, Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission’s Rules, WT Docket No. 06-169, Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, PS Docket No. 06-229, Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010, WT Docket No. 96-86, Declaratory Ruling on Reporting Requirement under Commission’s Part 1 Anti-Collusion Rule, WT Docket No. 07-166, *Second Report and Order*, FCC 07-132 (rel. Aug. 10, 2007) at ¶ 215 (available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-07-132A2.pdf).

³ G. S. Ford, T. M. Koustky, L. W. Spiwak, *Using Auction Results to Forecast the Impact of Wireless Carterfone Regulation on Wireless Networks*, PHOENIX CENTER POLICY BULLETIN No. 20 (Second Edition) (May 2008)(available at: <http://www.phoenix-center.org/PolicyBulletin/PCPB20Final2ndEdition.pdf>).

⁴ I include only the largest 8 REAs covering the continental U.S. and 6 blocks included in the data. Thus, there are 48 observations.

⁵ I easily reject the null hypothesis that $\beta_1 = 1.0$ (F-Stat = 128.2).

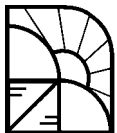
⁶ Ford, Koustky & Spiwak, *supra* n. 3.

⁷ From For Auctions 44 and 49, I computed the percentage difference in the price per megahertz per pop. This calculation rendered a discount of 34% (\$0.029 versus \$0.044)%.

⁸ Absent encumbrances, a buyer of a national license could always partition the spectrum into REAs in a secondary transaction.

⁹ The respective (robust) t-statistics for the coefficients are -10.09, 52.62, 5.92, 2.01, 5.53, 5.13, and -1.80. The F-statistic of the regression is 503.2, which is highly statistically significant.

¹⁰ See, e.g., REUTERS, *AT&T Sees Economy Recovering in 2nd Half* (May 22, 2008); DOW JONES NEWSWIRES, *Verizon Communications 1Q Net Rises, Boosted By Wireless Unit* (May 28, 2008); FORBES.COM, *Verizon Posts In-Line 1Q Adjusts Eps; Wireless Biz Adds 1.5M Customers* (Apr. 28, 2008).



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