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Regulation in financial translation

Neutral Spectrum Auctions: Maximizing Proceeds and Consumer Benefit

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Executive Summary

As Congress continues to consider legislation authorizing spectrum incentive-auctions, there has been considerable debate about auction design, with a focus on two issues:

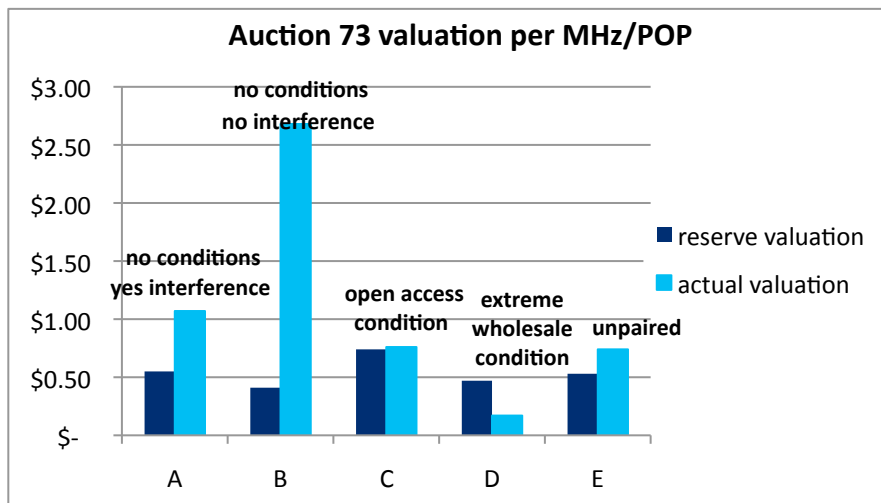
- Should the auctions be open to all bidders?
- Should there be conditions on the spectrum?

We examine these two options from the perspective of two of the key goals that underlie the provision of additional spectrum: Reducing the deficit while enhancing the wireless broadband experience for consumers.

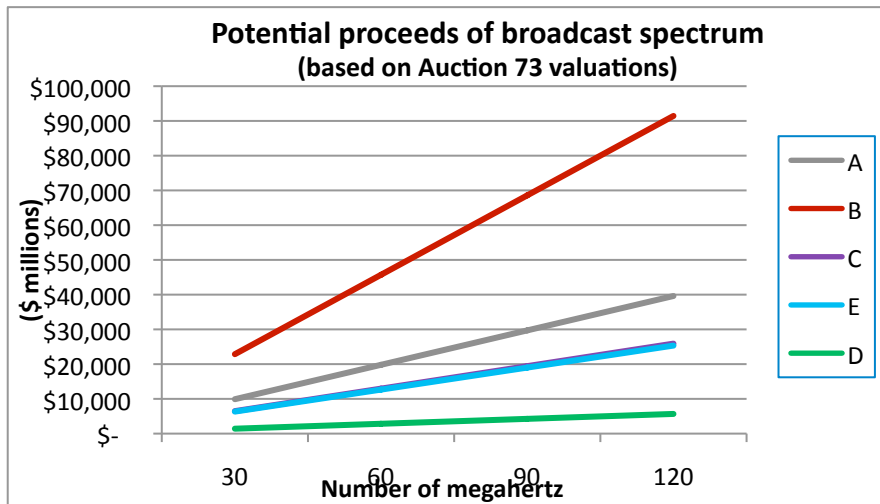
The Congressional Budget Office (CBO) scored the value of spectrum likely to be auctioned by 2021 at \$24.5 billionⁱ. Others have valued it more highly. Coleman Bazelon of the Brattle Group, for example, in the July 28, 2011 paper, *Expected Receipts From Proposed Spectrum Auctions*, valued the potential receipts from a potential 444 MHz of spectrum at about \$100 billionⁱⁱ. And John W. Mayo, in *The (Not-so) Dismal Science and the Super Committee: The Spectrum Option*, pointed out Congress has the opportunity of allowing spectrum to move from its current lower-valued use in broadcasting to a higher-valued use in wireless broadband communication, thereby both reducing federal deficits and fueling economic growthⁱⁱⁱ.

We do not attempt to arrive at a precise estimate. Rather, we use Auction 73, the 700-MHz auction run in 2008, as a test case. Auction 73 showed that an auction open to all bidders can be successful from both the competitive and financial perspectives. However, Auction 73 also demonstrated that placing conditions on spectrum reduces the value of that spectrum. The key lesson of Auction 73 is that a neutral auction—one that is open to all bidders and free of conditions—benefits consumers and competition, as well as the Treasury.

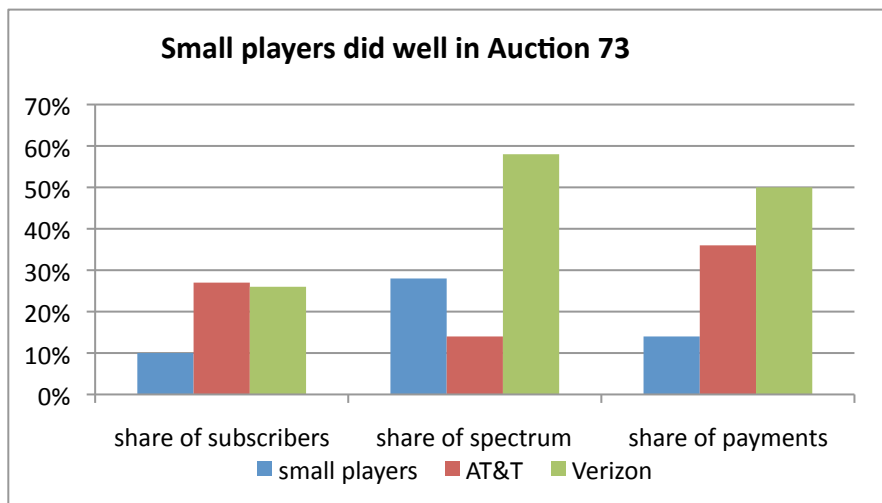
Congress—directly or through the Federal Communications Commission (FCC)—has substantial control over the amount of proceeds that an auction raises, since conditions as well as amounts of spectrum for sale affect proceeds. Specifically, welcoming all bidders and minimizing conditions helps maximize proceeds.



- In Auction 73, spectrum that was heavily-conditioned resulted in a much lower valuation than spectrum that was free of conditions. In Auction 73, the average valuation of the spectrum ranged from \$0.17 per megahertz per unit of population (MHz/POP) to \$2.67 per MHz/POP.
- For amounts of spectrum that range from 30 megahertz to 120 megahertz, that translates to potential auction proceeds that range from \$1 billion to \$91 billion.



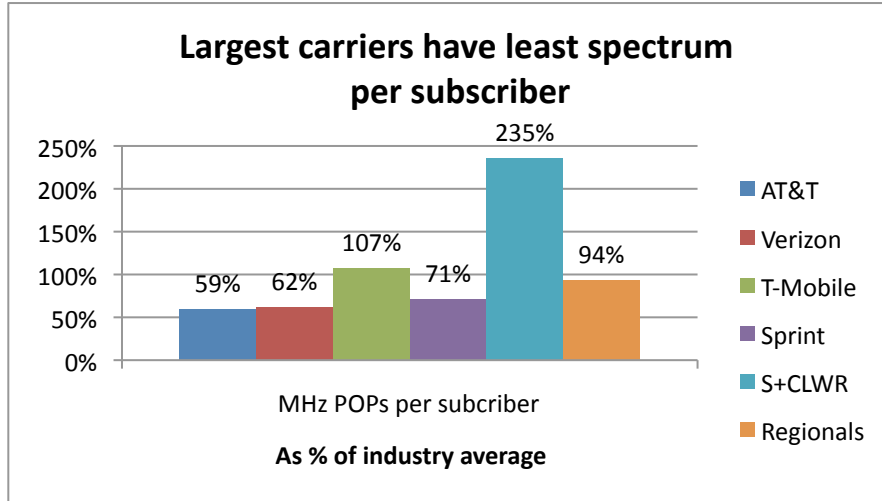
- Auction 73 showed that an auction that is open to all bidders can be very competitive and small bidders can do well. Bidders serving less than 10% of wireless subscribers won 28% of the MHz POPs. However, excluding the largest carriers would have reduced Auction 73 proceeds radically—by at least 50%--and is likely to have the same effect in a future auction.



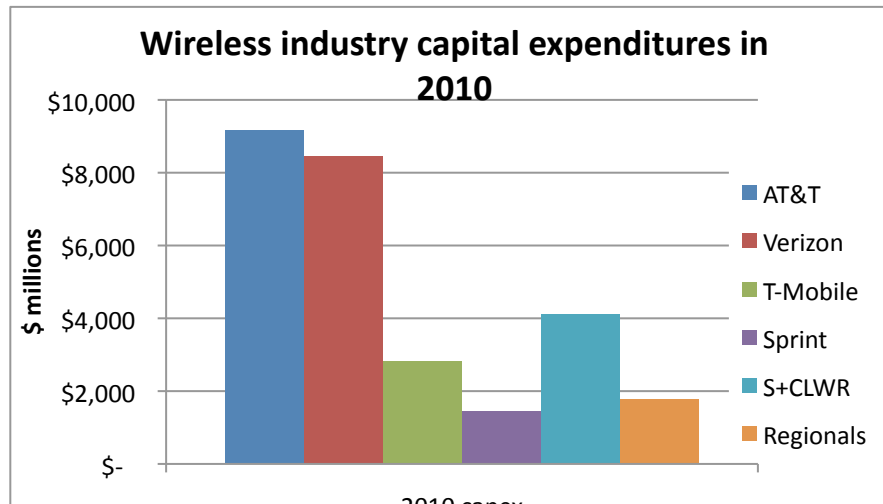
- Given scarce spectrum and explosive demand for wireless broadband, it is in the interest of consumers to ensure that spectrum is available to the carriers they have chosen, that it goes into service rapidly, and is

efficiently utilized. Yet, spectrum distribution is out of sync with subscriber choice. The carriers who have the greatest number of subscribers have the least spectrum per subscriber.

- Even with the spectrum that they won in Auction 73, AT&T and Verizon are spectrum-constrained.



- Carriers are using capital expenditures to compensate for spectrum constraints, as can be seen from the numbers in 2010, the last full year for which all companies have reported financials. AT&T and Verizon accounted for \$18 billion out of the industry total of \$26 billion, as they accelerated spending to deploy LTE, to increase the efficiency of their cell sites via fiber backhaul, and to off-load traffic to various forms of fixed wireless.



- Cisco Visual Networking Index projects that mobile data network traffic will grow 26-fold from 2010 to 2015, a compounded annual growth rate of 92%^{iv}. Even with tremendous investment and network efficiency, carriers can't be expected to keep up with that growth rate without additional spectrum.
- Given their spectrum constraints, already high capital expenditures (capex), and the explosive demand for bandwidth from subscribers, rationing the spectrum available to the largest carriers by excluding them from the proposed incentive auction is likely to degrade their service, raise their cost, and force them to raise their prices. That will hurt their subscribers.
- At the same time, there is no assurance that their competitors' subscribers will benefit. While it is likely that bidders who decide to participate in the auction will be able to purchase spectrum at deep discounts if AT&T and Verizon are excluded, there is no assurance that they will pass that saving on to consumers. For one thing, history has shown that some buyers may not put spectrum into service for considerable periods.
- But even if spectrum is bought by competitors who do put the spectrum into use, they have little incentive to maximize service quality or minimize price as long as the large carriers are spectrum-constrained. Competitors may well choose to take advantage of the large players' forced service deterioration and price increases to maximize their own profitability by underinvesting in service and/or keeping prices up. It is rational for firms to opt to maximize cash flow rather than capital investment and higher margins rather than lower prices, as long as they can engage in that behavior and still gain market share. Depending on the cost curve, it may even be more profitable to engage in behavior that encourages subscribers to stay with the spectrum-starved market leaders, to force them to raise the price umbrella above the industry.

Bottom line: That an incentive auction that imposes conditions and excludes the largest bidders will reduce proceeds to the Treasury is assured. That it will benefit consumers is uncertain, at best.

Discussion

Congress has enormous discretion over the amount of proceeds to be raised by incentive auctions.

Auction 73 showed that the proceeds of a spectrum auction are determined by the conditions that are attached to the spectrum and by the levels of interference that impact the spectrum as well as by the amount of spectrum for sale. Using the range of average valuations for each block in Auction 73, and amounts of spectrum for sale that might potentially vary from 30 megahertz to 120 megahertz, the graph shows that Congress could potentially raise anywhere between \$1.4 billion and \$91.4 billion through the incentive auctions it is now considering.

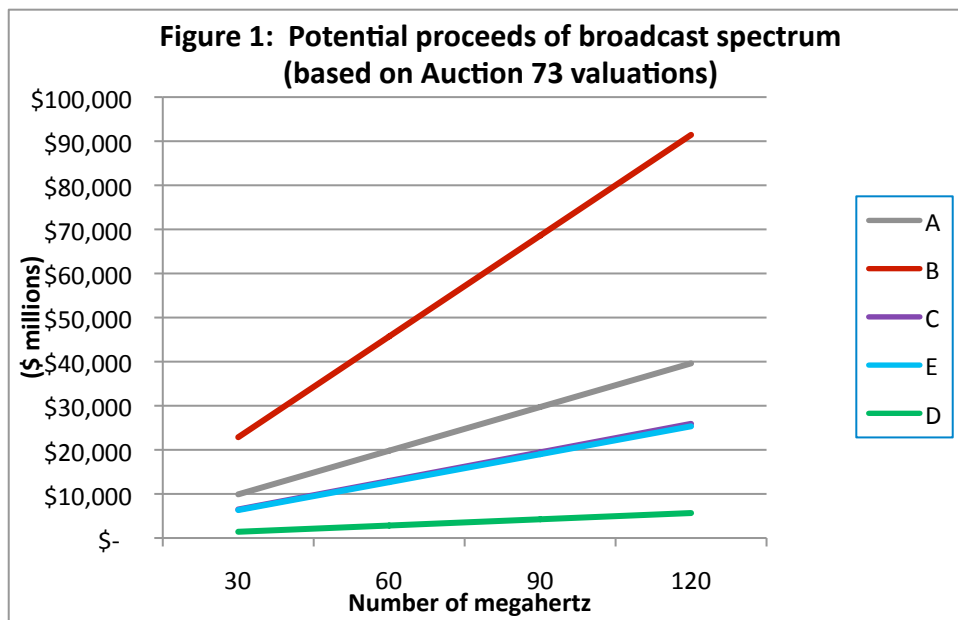


Figure 1^v above shows the potential proceeds from various amounts of 700 MHz spectrum based on the valuations per megahertz per population covered (MHz/POP) achieved by the various blocks in Auction 73.

A-block: \$1.07

B-block: \$2.68

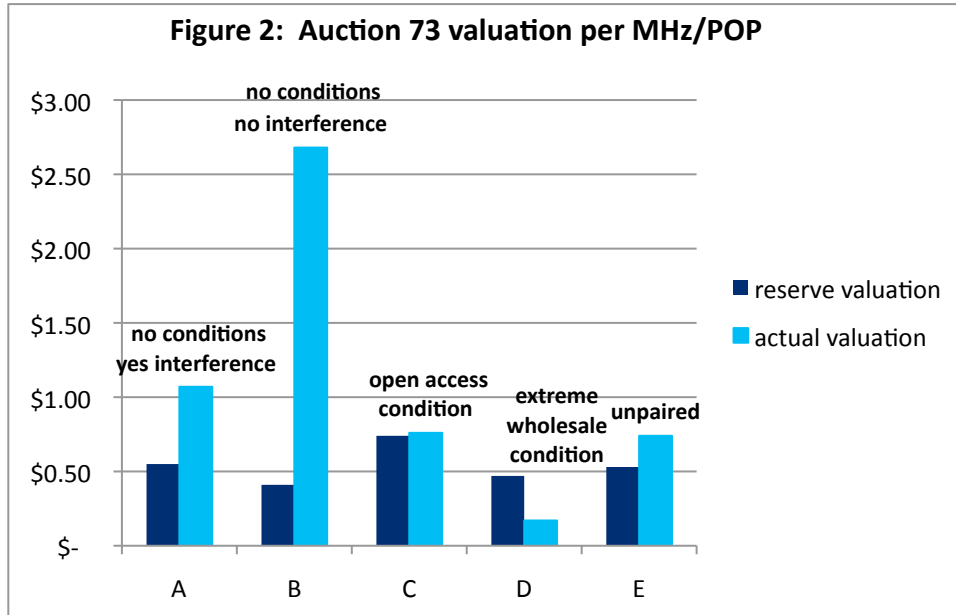
C-block: \$0.76

D-Block: \$0.17

E-block: \$0.74

Auctions held at different times under different circumstances are likely to result in some differences in valuation, but the dampening effect caused by the imposition of conditions is likely to recur.

Valuations are highest if there are no conditions and no restrictions on bidders.



- As Figure 2^{vi} above shows, the highest valuation in Auction 73 at \$2.68 per MHz/POP was achieved by the B-block, which carried no conditions, had no interference issues, attracted the most bidders, and had the greatest number of winners. Indeed, the B-block raised half the proceeds of the auction, although it represented less than a quarter of the spectrum sold.
- The impact of interference is best illustrated by the different valuations of the A- and B-blocks, each of which was a 12 MHz swath of spectrum carrying no conditions. The primary difference between the two is that the A-block suffers from interference and was sold in somewhat larger geographic units. As a result, it enjoyed fewer bidders and a much lower valuation than the B-block. At \$1.07 per MHz/POP the A-block sold for only 40% of the valuation of the B-block.
- The C-block was as free from interference as the B-block and should have been very desirable because it was easy to assemble into a national foot-print. However, it was burdened by an open-access condition. Consequently, it was valued at \$0.76 per MHz/POP, i.e. at only about a quarter of value of the condition-free B-block. In fact, the C-block's highly desirable 22 MHz swath of paired spectrum had a lower valuation than the A-block whose value was reduced by interference issues. The C-block achieved roughly the same valuation per MHz/POP as the E-block which consisted of 6 MHz of unpaired spectrum. The C-block, which constituted roughly 43% of the MHz/POPs sold in the auction, raised only 25% of the auction proceeds.

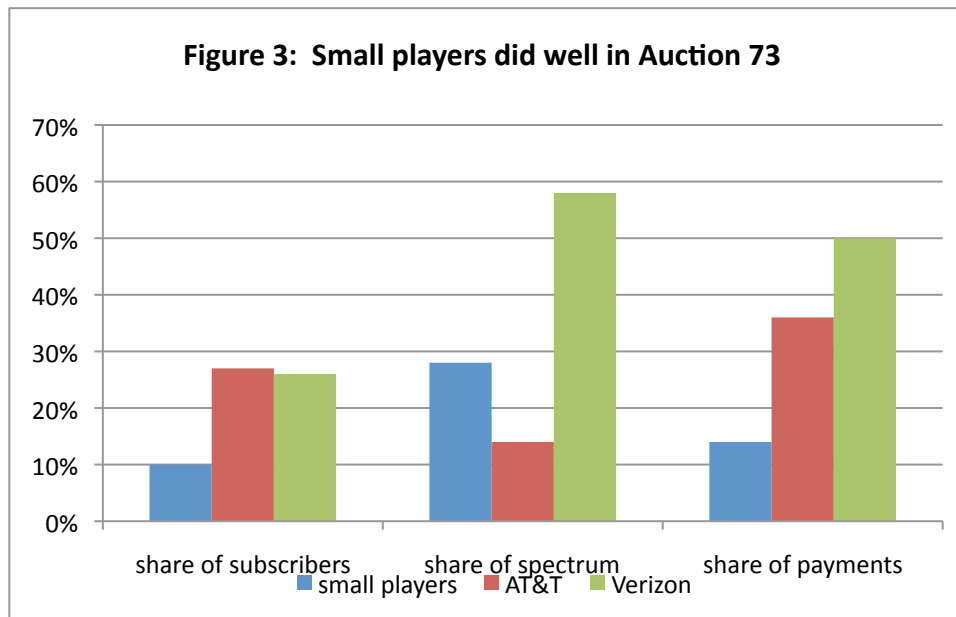
- The lowest valuation was achieved by the D-block which was the most onerously-conditioned spectrum. It carried an extremely complex version of a wholesaling requirement that would have made its buyer a partner of public safety and created uncertainty about the availability of the spectrum to the D-block's buyer during emergencies. While that arrangement made sense from the perspective of public safety, it was so commercially unappealing that the D-block attracted only one bidder, Qualcomm, whose \$472 million bid did not meet the reserve price of \$1.33 billion and so did not win the block. The D-block's valuation of \$0.17 per MHz/POP was a mere 6% of the valuation of the B-block. Less extreme wholesaling conditions might result in less of a discount, but what Auction 73 makes clear is that some discount should be expected.
- The auction was a great success in that it raised a total of \$19 billion, more than any prior auction. But the impact of conditions—and lack of conditions--on spectrum valuation was not anticipated by the Federal Communications Commission (FCC) despite its enormous expertise in running spectrum auctions. As figure 2 shows, actual valuations were radically different from those anticipated by the reserve prices set by the FCC. The agency valued all of the spectrum, regardless of interference or conditions, within a very tight range per MHz/POP between \$0.41 and \$0.74. The FCC placed the highest valuation per MHz/POP on the C-block at \$0.74 and the lowest on the B-block at \$0.41, and valued the A-block, despite interference, at \$0.55, and the unpaired E-block at \$0.53, both above the B-block. It valued the highly-conditioned D-block \$0.47, also above the B-block. In fact, the condition-free B-block sold at 250% of A, 355% of C, 1576% of D, and 362% of E.
- Bottom line, Auction 73 raised nearly twice the \$10 billion that was expected, but did so primarily because of the super-high valuation paid for the condition-free B-block which exceeded its reserve price by nearly \$8 billion and, thus, raised half the auction proceeds instead of the mere 14% it was expected to raise.

An auction that is inclusive, i.e. open to all bidders, is competitive: Small players can walk away with a disproportionately high share of the spectrum at a good price. Conversely, the largest carriers don't necessarily do best in an auction, nor do they crowd out small bidders. In Auction 73, bidders collectively representing less than 10% of the industry's subscribers won 28% of all the MHz POPs, twice as much as AT&T won.

As Figure 3 shows^{vii}, another lesson of Auction 73 was that an auction that is open to all bidders can be a competitive success. Aside from the usual discounts for designated entities, Auction 73 did not attempt to directly impact auction participation. The auction was open to any bidders who could meet the usual financial and operational qualifications and provide the usual up-front payment—i.e., those who could demonstrate that they would be able to fund and operate the spectrum if they won it. However, the conditions imposed on some blocks did, in effect, discourage bidding and lower the proceeds from those blocks relative to proceeds from blocks without conditions.

- Auction 73 was open to all bidders.
- There were 214 qualified bidders and 101 winners in Auction 73.

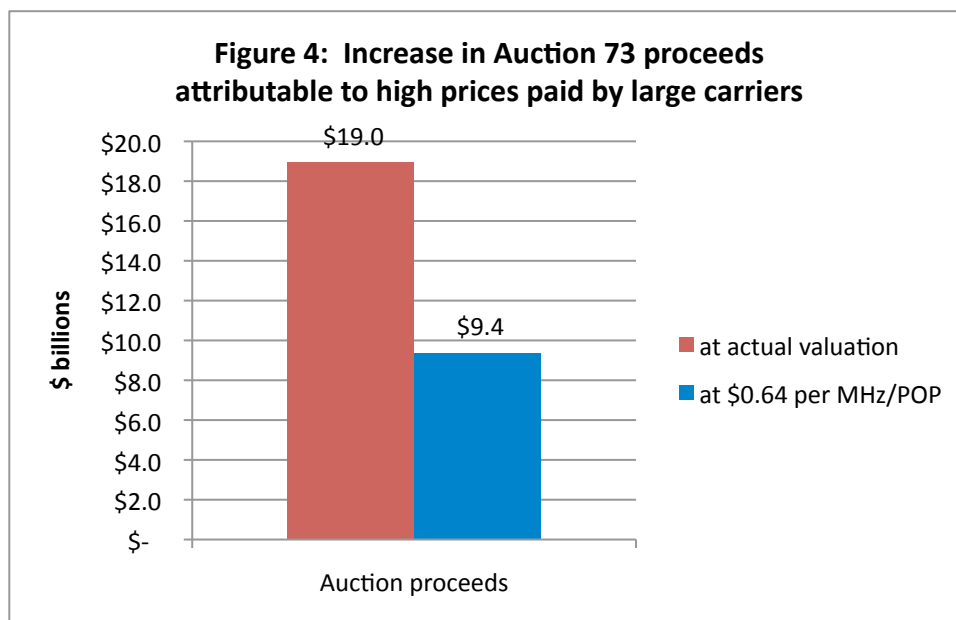
- Of the 101 winners, 99 represented in total less than 10% share of industry subscribers, and provided 14% of auction proceeds in exchange for 28% of MHz POPs. These winners included regional wireless operators such as MetroPCS, Cellular South, and Cincinnati Bell, various small phone companies and cable companies, various designated entities, as well as equipment manufacturers, who collectively represented well below 10% market share in the wireless market at the time. Their winnings included a variety of markets, urban as well as rural. They won 4.1 billion MHz POPs for \$2.6 billion, an average price of \$0.64 per MHz POP.



- There were 25 winners of A-block licenses, 52 winners of B-block licenses, 3 winners of C-block licenses, no winners of the D-block license (since the reserve price was not met), and 5 winners of E-block licenses.
- Because of the difficult financial conditions in late 2007-early 2008, at least one bidder who had indicated great interest in the D-block, Frontline Wireless LLC, withdrew before actual bidding began.
- Sprint and T-Mobile, which together represented 32% of the wireless industry's share of subscribers, as well as some smaller carriers elected not to participate in the auction.
- As a result, bidders in the auction represented only about 63% of the industry's share of subscribers.
- AT&T, which had 27% share of subscribers at the time, won only 14% of the MHz POPs but paid 36% of the auction proceeds.

- Largely due to the C-block's reduced appeal, Verizon, which had 26% market share at the time, was able to win 58% of the MHz POPs in exchange for 50% of the proceeds.
- For the A, B, and E blocks, which collectively constituted 8.4 billion MHz/POPs, there were a total of 82 winners. Bidders representing less than 10% subscriber share won 48% of the MHz POPs represented by these licenses.
- Not surprisingly given the economics of supply and demand, the block that had the most bidders raised the highest proceeds per MHz/POP. That was the B-block, which was not encumbered by either heavy interference issues like the A-block or heavy conditions like the C and D blocks.

The Treasury benefited disproportionately from the large carriers' participation. Had AT&T and Verizon been excluded from Auction 73, the auction's proceeds would have been reduced drastically. Even in the unlikely event that all of the spectrum could have been sold to the small players at the \$0.64 per MHz/POP average paid by the small players in the actual auction, the auctions proceeds would have been cut by \$9 billion.



- Sprint and T-Mobile as well as some small carriers did not participate in the auction at all.
- Small players who did participate were, in some cases, budget constrained. Several dropped out of C-block bidding, for example, at levels well below those that would have allowed the block to meet the reserve price.
- On average, AT&T paid \$3.15 per MHz/POP for its B-block wins, Verizon paid \$1.10 per MHz/POP as an average of \$0.77 for the C-block and \$1.45 for the A-block and \$3.69 for the B-block spectrum, while the

rest of the winners paid an average of \$0.64 per MHz POP for a combination of A- B- and E-block spectrum.

- As Figure 4 shows^{viii}, had all of the spectrum sold in the auction been sold at the price paid by the small players, the auction would have raised \$9.4 billion instead of \$19 billion. It is, however, likely given the budget constraints of the small players that in the absence of AT&T and Verizon not all the spectrum would have been sold, or that it would have sold for a much lower price per MHz/POP, resulting in even lower auction proceeds.
- In other words, AT&T and Verizon's participation in Auction 73 doubled--or more than doubled--auction proceeds. Based on Auction 73's results, it appears likely that if AT&T and Verizon were excluded from bidding in the proposed incentive auctions, the CBO's estimate of auction proceeds would have to be revised down radically.
- Quite simply, because they need the spectrum to satisfy their subscribers' appetite for high bandwidth at a low price, the largest carriers are the most willing to pay for spectrum.

The proposed incentive auction is unlikely to attract new major players to the industry.

- There are no obvious new entrants on the horizon that can be expected to build out networks in competition with all the current wireless carriers. Companies who are well funded and operate in related areas should be the most logical candidates. But, Auction 73 gives little grounds for hope of new entrants who will actually buy spectrum and operate networks.
 - Having lobbied for the open-access condition on the C-block, Google bid for the C-block, but only until it triggered the reserve price. Funding a spectrum purchase would not have been a problem for Google which had \$15 billion in cash and equivalents (cash) at the time.
 - Microsoft, like Google a player at the application layer, had \$26 billion in cash on its balance sheet at the time, but showed no interest whatsoever in the auction.
 - There is little indication that they would have a greater interest now. However, if either of these companies now decided to build a wireless network, it could certainly afford to buy spectrum at full market price. Google now has \$45 billion in cash on its balance sheet and Microsoft has \$53 billion.
- Given their expertise at running networks, cable companies might also be logical candidates for entry, but a consortium of cable companies is in the process of selling spectrum to Verizon right now. Having owned the spectrum for several years without building it out, they have determined that they could not make a viable business if they entered the market. Similarly, Qualcomm which has expertise in the wireless arena has just sold spectrum to AT&T for the same reason.

- Thus, there is no evidence at this point that serious new players who would quickly build out the spectrum to compete with current wireless carriers exist.
- There may be others out there who might want to bid for spectrum sold at deep discount, since that could make for great speculative profits in the future. But such financial speculation is hardly beneficial from either the Treasury's or consumers' perspectives. To the extent that happened, there would be a massive wealth transfer from the U.S. Treasury—i.e. taxpayers—to the speculators. At the same time, consumers would suffer because that spectrum would not be used during the holding period to improve their broadband service.

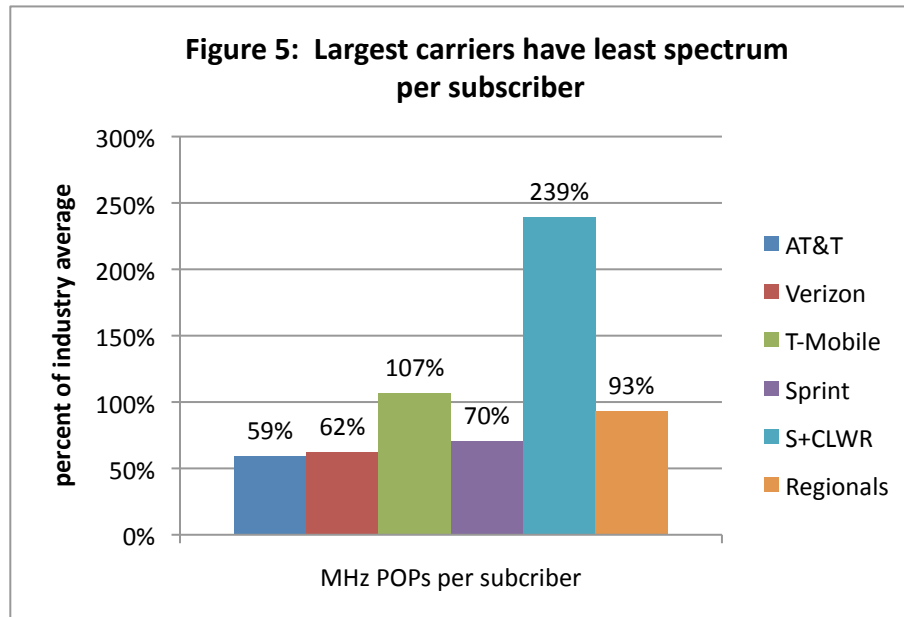
Were AT&T and Verizon excluded, what role might current competitors play?

- Thus, the relevant question is whether the spectrum should be sold at deep discount—far below the normal designated entity discount—to current wireless competitors, via an auction that excludes AT&T and Verizon. One problem is that it is not clear how much spectrum the rest of the industry would (a) buy and (b) build out.
- As we indicated earlier, Sprint did not choose to participate in Auction 73. In 2008, Sprint divested massive amounts of spectrum to Clearwire, while retaining control. It cut its own capital expenditures radically and used Clearwire for its WIMAX-based 4G strategy. In 2011, Sprint lowered its voting interest in Clearwire just below 50%, but its WIMAX customers remain on Clearwire. Sprint has indicated that it will shift to a strategy based on LTE and based on its own spectrum as well as on network sharing. However, analysts have expressed varying degrees of confidence—ranging from outright skepticism to enthusiasm—in Sprint's ability to execute its new strategy.
- T-Mobile, the fourth major player in the U.S. wireless market, is controlled by Deutsche Telekom, which has made it abundantly clear that it has no intention of investing in the U.S. Even assuming that the \$3 billion that AT&T just paid to Deutsche Telekom is all invested in T-Mobile in the U.S. rather than going to the parent for other uses, it's unlikely that there is more to come from the parent. Bottom line, it's not clear how much T-Mobile will be able to invest in either spectrum or infrastructure in the U.S.
- There are a number of smaller regional players, and we expect them to buy spectrum at relatively low prices in quantities that will enable them to deploy 4G and compete effectively in the market. The lesson of Auction 73 is that large numbers of competitors do buy large amounts of spectrum at much lower prices, on average, than the market leaders.
- But even if one were to assume that all of these players find the will and capital to buy massive amounts of spectrum at deep discount and to build it out, there is still no assurance that the result will be a net benefit to consumers, relative to an auction that allows all qualified bidders to participate.

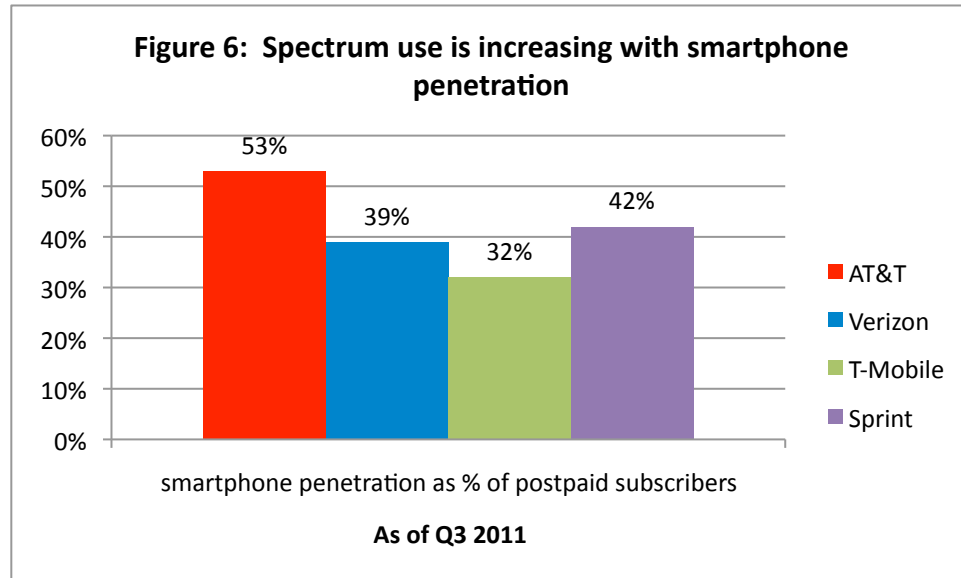
- In any scenario that excludes Verizon and AT&T from bidding, the wealth transfer from the Treasury to the buyers of spectrum would be certain. But the potential benefit to consumers is not at all certain. In some scenarios, consumers might be worse off. That is clearly the case if spectrum is allowed to get into the hands of speculators. It might also be the case if the spectrum is bought by wireless carriers who use the advantage given them by regulators to enhance their own profits and cash flow rather than to improve service and prices for consumers.

Despite their Auction 73 purchases, AT&T and Verizon have the lowest spectrum per subscriber in the industry.

- As Figure 5 shows^{ix}, AT&T has only 258 MHz POPs per subscriber and Verizon has 270, while T-Mobile has 467 and Sprint combined with Clearwire, which it uses for its WIMAX subscribers, has 1024 (calculated after spectrum transfer to AT&T from Qualcomm and to T-Mobile from AT&T).



- As Figure 6 shows^x, AT&T is particularly constrained, with bandwidth-hungry smartphones as 53% of its postpaid devices as of the end of the third quarter of 2011.



- Demand for mobile wireless bandwidth is expected to grow explosively. Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update 2010-2015, February 2011 white paper projected that mobile data network traffic would grow 26-fold from 2010 to 2015, at a compounded annual growth rate of 92%. Mobile video is expected to double every year. Key drivers will be the proliferation of smartphones, tablets, and M2M.
- When the FCC's National Broadband Plan forecast a spectrum crunch for the wireless industry as a whole, it considered not just current demand for and supply of spectrum, but the expected rate of growth of mobile traffic, the extent to which supply might be increased by deploying capital to upgrade infrastructure, and the multi-year time-lag between legislation authorizing an auction and the actual availability of cleared spectrum.
- Similarly, the spectrum capacity of each carrier must also be considered dynamically, recognizing that subscribers' demand will continue to grow explosively. An amount of spectrum per subscriber that may provide an acceptable level of bandwidth today is likely to be grossly inadequate in a few years, despite enormous investment to enhance capacity. That means that rationing the spectrum available to a carrier will force it to ration the spectrum it makes available to its subscribers over time, resulting in degradation of service and/or higher prices.
- Some advocate rationing spectrum to the largest carriers. One option that has been raised would exclude them from the proposed incentive auctions. That would also have the effect of providing spectrum to their competitors or to potential new entrants at artificially low prices. A potential result would be a redistribution of market share from the largest carriers to their competitors. Would this benefit consumers?

- Rationing spectrum to the large carriers will force them to degrade their service (defined as bandwidth per subscriber) and/or raise prices. Limiting their key input in the face of explosively growing demand removes their ability to improve or even maintain service. It also removes their motivation for lowering price, since they can no longer serve all of their subscribers. Indeed, by raising their costs, it may force them to raise price.
- The theory behind rationing spectrum to the largest carriers by excluding them from the spectrum auction is that their competitors—employing abundant deep-discount spectrum—will provide better service and lower prices. That will induce some of the large carriers’ subscribers to move to their competitors. The resulting shift in customers, according to the theory, will result in a more equal distribution of subscribers among carriers and better service and prices for all subscribers.
- An equally credible theory holds that competitors will not unnecessarily lower price or spend capital. Given the lower service standard forced on the large carriers, their competitors can afford to make less than optimal use of their spectrum by underinvesting in infrastructure. Given higher prices from the large carriers, their competitors can also afford to raise prices to retain their usual relative discount to the large carriers’ prices.
- Having saved cash by buying spectrum at deep discount does not automatically mean that competitors will pass those savings on to consumers, or invest them to make the most intensive use of their spectrum. Instead, given the price and service umbrella provided by the spectrum-constrained large carriers, the competitors can be expected to use their abundant spectrum to maximize profits and cash flow rather than to optimize service and pricing for subscribers. Such behavior, while not beneficial to consumers, would be the rational response to the opportunity presented by a spectrum auction that excludes the largest carriers.
- Thus, even if the new equilibrium after an exclusionary auction results in a somewhat more equal distribution of market share in the industry, it does not have to result in better service and/or lower prices.
- While a policy of rationing spectrum to the carriers who have the most subscribers is likely to provide below-market-value spectrum to their competitors, there is no assurance that it will benefit consumers.
- Indeed, a new paper by the Phoenix Center, *Wireless Competition under Spectrum Exhaust*,^{xi} argues that “under a binding spectrum constraint, a market characterized by few firms (rather than a large number of firms) is more likely to produce lower prices.”

Of course, rationing spectrum to competitors by foreclosing their participation in the incentive auctions would not be helpful to consumers either. The point is not to exclude any bidder, at least not any bidder who is likely to actually make use of the spectrum. But as we showed earlier, one of the key lessons of Auction 73 is that allowing all bidders who wish to participate to do so results in a

competitive auction that does not crowd out the smaller players. Indeed, in Auction 73, the smaller bidders won a disproportionate share of the spectrum, at prices substantially below those paid by the largest carriers. The large carriers, in turn, doubled the proceeds of the auction from what could have been expected from the small players. More important, however, from the perspective of consumers is that they have placed the spectrum they bought into use and have invested heavily to use it efficiently.

ⁱ Congressional Budget Office, scoring of S.911 on July 20, 2011.

ⁱⁱ Coleman Bazelon, *Expected Receipts From Proposed Spectrum Auctions*, The Brattle Group, July 28, 2011, Table 3 on page 25.

ⁱⁱⁱ John W. Mayo, *The (Not-so) Dismal Science and the Super Committee: The Spectrum Option*, Economic Policy Vignette, Georgetown University Center for Business and Public Policy, November 1, 2011.

^{iv} Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010-2015, February 1, 2011, page 1.

^v Figure 1 sources: Calculations based on FCC Auction 73 data available on FCC website.

^{vi} Figure 2 sources: Calculations based on FCC Auction 73 data available on FCC website.

^{vii} Figure 3 sources: Calculations based on FCC Auction 73 data available on FCC website.

^{viii} Figure 4 sources: Calculations based on FCC Auction 73 data available on FCC website.

^{ix} Figure 5 sources: Calculations based on FCC spectrum dashboard data available on FCC website. Company reports. Brett Feldman et al, *Coping with the Spectrum Crunch: Part 1*, Deutsche Bank, U.S. Wireless Services, September 29, 2011, page 13. Philip Cusick et al, *AT&T Spectrum Update Following Recent FCC Spectrum License Transfer Filings*, J. P. Morgan, Telecom Services and Towers, January 25, 2012.

^x Figure 6 sources: Jonathan Chaplin, *3Q Wireless Trends Review*, Credit Suisse, CS Telecom Services, November 22, 2011, p. 12.

^{xi} T. Randolph Beard, George S. Ford, Lawrence J. Spiwak, and Michael Stern, *Wireless Competition under Spectrum Exhaust*, Phoenix Center Policy Paper Series #43, February 2012, page 1.