

Two Cheers for the FCC's Mobility Fund Reverse Auction

April 1, 2013

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Abstract

The United States held its first competitive bidding, or “reverse auction,” for universal service subsidies in September 2012. While it is far too early to investigate whether this national auction generated improvements in mobile voice and broadband service in underserved areas, it is not too soon to evaluate the auction itself. This paper investigates the outcome of the Mobility Fund Phase 1 Auction (Auction 901) and considers what we could learn from it for universal service and for future planned reverse auctions, such as the upcoming incentive auction, which aims to reallocate spectrum from broadcasters to those who place a higher value on it, and the much larger Mobility Fund Phase 2 Auction.

The analysis, based on data from all auction participants, suggests that this one-time expenditure should be considered a qualified success. Perhaps most importantly, it demonstrated that the FCC can run an effective reverse auction and demonstrated that allocating subsidies based on cost-effectiveness measures has the potential to dramatically increase the bang for the buck we get from universal service expenditures. However, with very few regions receiving multiple bids the auction highlighted the difficulty in generating participation. Additionally, the pay-as-bid feature of the auction may create problems for upcoming auctions because it can create incentives for participants to bid strategically. The FCC should consider employing other auction mechanisms more likely to induce firms to reveal their true estimates of the subsidies necessary to provide service.

¹ I thank Evan Kwerel, Thomas Leonard, Gregory Rosston, Marius Schwartz, and Amy Smorodin for helpful comments, and Corwin Rhyen for excellent research assistance. All mistakes and opinions are my own.

The United States held its first competitive bidding, or “reverse auction,” for universal service funds in September 2012.¹ Put simply, in a reverse auction providers bid the subsidy they believe they require to provide a specified service in a given area, and the regulator funds the firms that ask for the smallest subsidies. Although this sounds sensible, reverse auctions for universal service subsidies can be complicated and the idea has been controversial in the U.S.

Proponents of reverse auctions have advocated for their use in the U.S. for more than a decade,² arguing that reverse auctions would yield more reliable information on the costs of providing service in uneconomical areas and significantly reduce the levels of subsidies given to firms. Other countries have used reverse auctions to fund universal service provision, including India, Australia, and Chile.³ Opponents counter that auctions can fail if the auction does not generate sufficient competition and that competition for service in areas that are often by definition the hardest to reach may be especially difficult to obtain.⁴

While it is far too early to investigate whether this national auction generated improvements in mobile voice and broadband service in underserved areas, it is not too soon to evaluate the design and implementation of the auction itself. This paper investigates the outcome of the Mobility Fund Phase 1 Auction (Auction 901) and considers what lessons can be derived for universal service and future reverse auctions, such as the upcoming broadcast incentive auction.

The Auction

As the FCC explained in its auction description, the Mobility Fund

will offer up to \$300 million in one-time support to carriers that commit to provide advanced mobile voice and broadband services in areas where such services are currently unavailable. Winning bidders will have to deploy third generation (often called “advanced” or “3G”) service within two years or fourth-generation (“4G”) service within three years of the award of support.

This will be the first auction to offer high-cost universal service support through competitive bidding. Using a reverse auction format, bidders will identify a per-road mile support price at which they are willing to meet our requirements to cover the qualifying road miles in a given area. Support will be awarded based on the lowest bid amounts submitted, to at most one provider in a given area. Thus, bidders will compete not only against other carriers that may be bidding for support in the same areas, but against carriers bidding for support in other areas nationwide.

¹ http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=901. The Mobility Auction is included in the Connect America Fund order Federal Communications Commission, *In the Matter of Connect America Fund, A National Broadband Plan for Our Future, Establishing Just and Reasonable Rates for Local Exchange Carriers, High-Cost Universal Service Support Developing an Unified Inter-carrier Compensation Regime, Federal-State Joint Board on Universal Service Lifeline and Link-Up Universal Service Reform – Mobility Fund Report and Order and Further Notice of Proposed Rulemaking* (Washington, DC, November 18, 2011), para. 301, http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db1118/FCC-11-161A1.pdf.

² Paul Milgrom, “Procuring Universal Service: Putting Auction Theory to Work,” in *Lecture at the Royal Swedish Academy* (Canberra, 1996); Dennis Weller, “Auctions for Universal Service Obligations,” *Telecommunications Policy* 23 (1999): 645–674.

³ Scott Wallsten, “Reverse Auctions and Universal Telecommunications Service: Lessons from Global Experience,” *Federal Communications Law Journal* 61, no. 2 (March 2009).

⁴ Dale E. Lehman, *Attachment to NTCA Comments: The Use of Reverse Auctions for Provision of Universal Service*, 2006.

Support will be awarded equal to the per-road mile bid rate multiplied by the number of qualifying road miles that the winning bidder actually covers within the required timeframe.⁵

In other words, the plan called for the FCC to order the bids from lowest (the bidder requesting the smallest subsidy) to highest (the bidder requesting the biggest subsidy) in terms of dollars per road-mile covered and grant awards until it reached its budget constraint of \$300 million. The hard budget of \$300 million is noteworthy. Most universal service funding, unlike nearly every other type of government or private spending, simply provides funding in all eligible areas based on estimated costs.⁶

The Commission used data at the Census Block level to develop a list of 14,245 “biddable items” within the areas deemed underserved. As Table 1 shows, the typical biddable item is small, with a median population of three and 1.6 miles of roads, and a mean population of 125 and 46 miles of roads.⁷

Table 1: Population and Roads in Biddable Items

14,245 Biddable Items	Mean	Median
Population	125	3
Road Miles	46	1.6
Road Miles		
Local neighborhood roads, rural roads, city streets	36.6	0.5
4WD vehicular trails	4.3	0
Secondary roads	2.3	0
Private roads for service vehicles	0.73	0
Services drives	2.1	0
Primary roads	0.03	0
All roads	46.0	1.57

The auction used a single-round sealed bid format, with winners receiving the amount they bid (i.e., pay-as-bid). Several organizations who submitted comments regarding the auction had advocated for a multiple-round mechanism, which the FCC typically uses, but the Commission chose the single-round format “in light of the complications involved in conducting multiple rounds with many thousands of items.”⁸ The FCC took other steps to simplify the auction, such as not allowing package bidding. While package bidding may have created certain efficiencies for some bidders, erring on the side of simplicity seems a prudent approach for the FCC’s first foray into reverse auctions.

⁵ http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=901

⁶ An economists’ letter to the Commission in 2009 also advocated for this type of competition among bidders in different areas. Paul Milgrom et al., *Comments of 71 Concerned Economists: Using Procurement Auctions to Allocate Broadband Stimulus Grants*, 2009.

⁷ These data are available here http://wireless.fcc.gov/auctions/Auction_901_Attachment_A_Sept2012.htm.

“Attachment A,” available at that site, also provides this information by state.

⁸ Federal Communications Commission, *Mobility Fund Phase I Auction Scheduled for September 27, 2012 Notice and Filing Requirements and Other Procedures for Auction 901*, AU Docket No. 12-25, May 2, 2012, para. 129, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-12-641A1.pdf.

Was the Auction Successful?

Ultimately, whether the auction was successful will depend on whether the winning bidders provide service, whether the subsidy itself is responsible for that service being newly offered in an area, and the size of the subsidy relative to the costs of other ways of providing the same service. We cannot answer those questions yet, but we can evaluate the design and implementation of the auction itself as reflected in data on bids and bidders.

The auction resulted in 33 out of 52 qualified bidders receiving a total of \$300 million to cover about 83,500 road miles (Table 2).⁹

Table 2: Total Subsidy and Road Miles Covered by Bidder

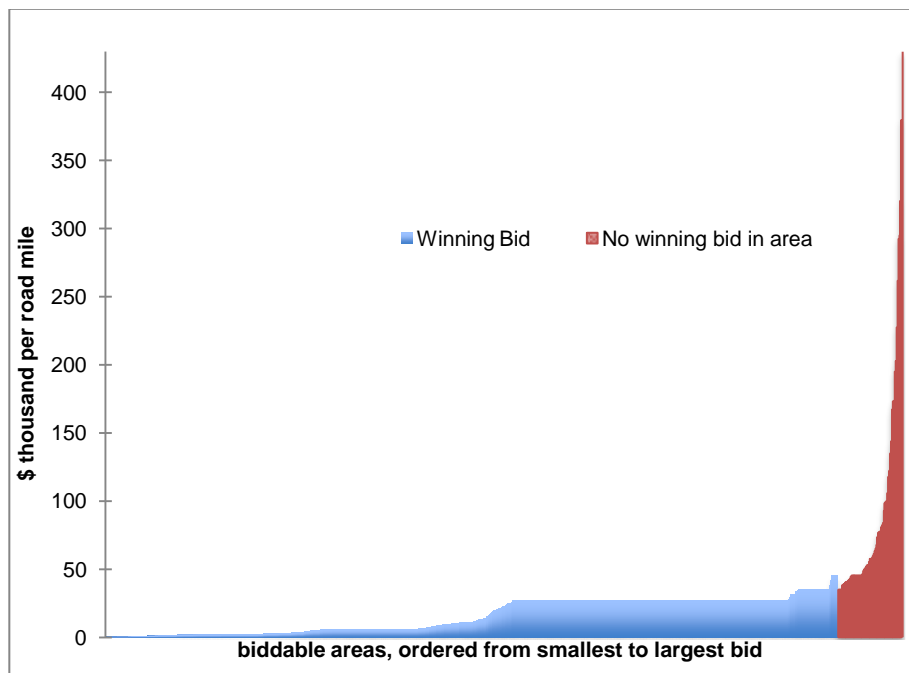
Bidder	Total subsidy (\$ millions)	Road miles covered
Allied Wireless Communications Corporation	45.9	4,417
NE Colorado Cellular, Inc.	40.2	12,079
United States Cellular Corporation	30.9	1,724
Union Telephone Company	22.8	13,577
Commnet of Nevada, LLC	21.1	2,777
Carolina West Wireless, Inc.	20.8	594
T-Mobile West LLC	19.3	10,328
Pine Belt Cellular, Inc.	10.2	1,570
Plateau Telecommunications, Incorporated	9.3	4,933
Leaco Rural Telephone Cooperative, Inc.	6.7	11,282
NEP Cellcorp, Inc.	6.7	838
Texas 10, LLC	6.6	4,818
Hardy Cellular Telephone Company	5.6	194
TexNet 4G, LLC	5.2	3,521
Pine Cellular Phones, Inc.	5.1	965
West Virginia PCS Alliance, L.C.	5.0	152
Powertel/Memphis, Inc.	4.4	361
East Kentucky Network, LLC	4.4	1,307
T-Mobile Northeast LLC	3.7	252
Sagebrush Cellular, Inc.	3.7	1,165
USCOC of Central Illinois, LLC	3.6	251
Central Louisiana Cellular, LLC	3.4	2,128
Standing Rock Telecommunications, Inc.	3.3	1,290
GCI Communication Corp.	3.2	120
VTel Wireless, Inc.	2.1	941
PTI Pacifica Inc.	1.3	332
Georgia RSA 8 Partnership	1.2	212
Cross Wireless, LLC	1.2	64
Oklahoma Western Telephone Company	0.9	102
Wichita Online, Inc.	0.8	98

⁹ Prior to the auction, some worried smaller firms would be at a disadvantage in this auction, but the FCC declined to give special preference to smaller firms (Ibid., n. 72.). As a matter of economics, special preference could only have introduced inefficiencies and resulted in fewer (or, at least, not more) road miles covered for the same amount of money. As it turns out, the concern was unwarranted as small firms appear to be well-represented.

Commnet Four Corners, LLC	0.6	28
Pinpoint Wireless, Inc.	0.6	133
Eagle Telephone System, Inc.	0.1	946.8
TOTAL	\$300	82,547

Figure 1 shows both the winning bids and the bids in areas in which no provider was awarded funds. A total of 865 out of the 14,274 biddable areas received at least one bid, and of those 795 areas received subsidies. Winning bids ranged from as little as \$130 per road mile to \$35,000 per road mile, while bids in areas in which nobody won ranged from \$35,000 up to \$430,000 per road mile.¹⁰

Figure 1: Bids Ordered by Least to Most \$/Road Mile¹¹



An auction that yields winners and losers does not, of course, mean that the auction achieved its objectives. A reverse auction for universal service is intended create a mechanism that induces firms to reveal the subsidy they truly believe is necessary to make service provision viable rather than rely on cost models. Cost models are subject to significant error as well as strategic game playing since much of the data used in the models come from subsidy recipients who have little incentive to provide evidence of low costs. While reverse auctions do not face those problems, they face other inherent difficulties. For example, it may be difficult to generate multiple bids, which is typically a hallmark of successful auctions. Some reverse auctions for universal service

¹⁰ The \$430,000 bid was by U.S. Cellular for 10.52 miles in Sevier County, Tennessee.

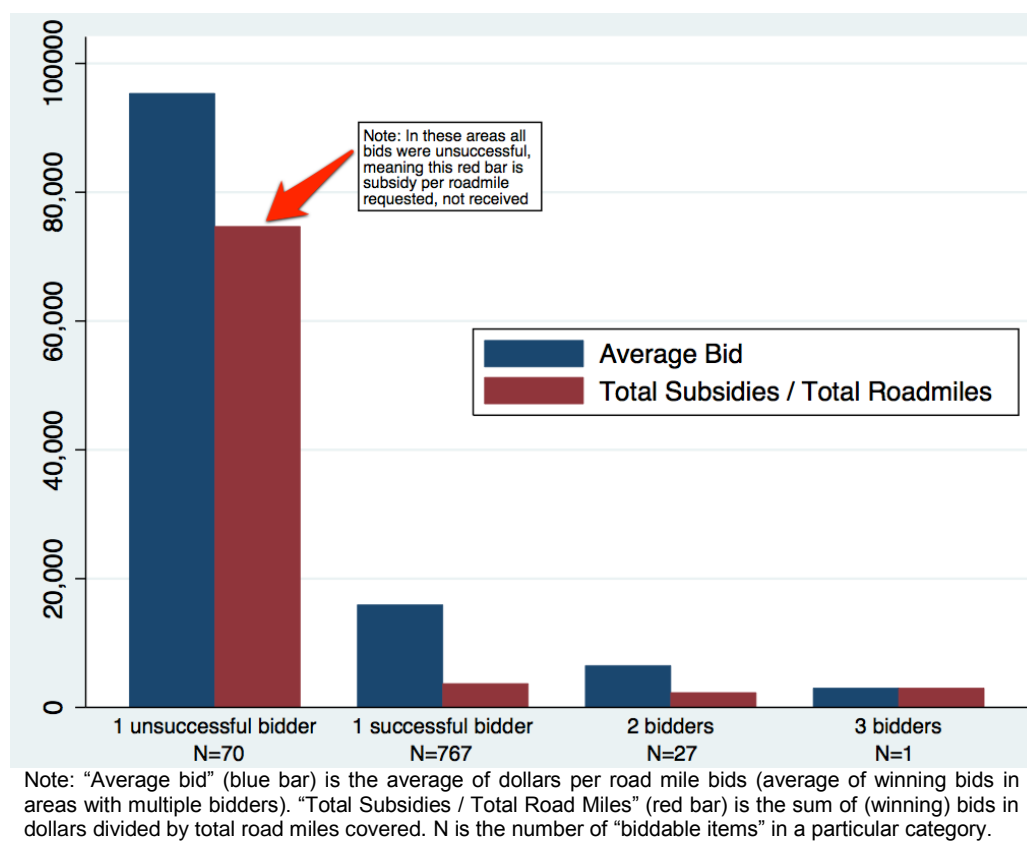
¹¹ Note that a few winning bids are higher than bids in some areas that received no funding. This at first seemingly strange result is simply an expected consequence of the budget constraint. A bidder's total subsidy requested is (\$/road mile) x (number of road miles), and as the total amount won approached the budget constraint some bids were too large in terms of total dollars requested to fund without exceeding the budget so had to be skipped.

provision in other countries had that problem, resulting in the incumbent telecommunications provider being the only bidder and bidding exactly the regulator's reserve price.¹²

The FCC recognized this challenge and handled the potential problem of few bidders for any given area by comparing bids across all areas and funding them in order of cost-effectiveness until the budget was exhausted, as discussed above. On the one hand, this approach created an incentive for bidders not to ask for too high a subsidy for a biddable area regardless of its expected competition for fear of bidding too high relative to bids in other areas. On the other hand, the pay-as-bid feature of the auction was more likely to create strategic bidding than, say, a uniform price auction.

Figure 2 provides summary data on bids by number of bidders for each biddable area. Perhaps not surprisingly, especially given the large number of biddable items in a single round, the auction generated little direct competition (i.e., multiple bids for a given biddable item). Out of the 865 areas that received bids, 837 (97%) received only a single bid. However, unlike some reverse auctions elsewhere, 70 of the 837 lone bidders received no subsidies at all because their bids were too high relative to others' bids in other geographic areas. Of the 795 areas that won subsidies, 767 had only a single bidder, 27 had two bidders, and only 1 had three bidders. The FCC's strategy of considering each bid relative to all the other bids appears to have been successful, as evidenced by the large difference between unsuccessful bids and winning bids.

Figure 2: Average subsidy per road mile by number of bidders



¹² Wallsten, "Reverse Auctions and Universal Telecommunications Service: Lessons from Global Experience."

Figure 2 highlights two points.

First, the results demonstrate how much more of a “bang for the buck” it is possible to get when subsidies are ordered by cost-effectiveness rather than simply provided in all possible eligible areas. By ordering subsidies in terms of cost-effectiveness, \$300 million covered 83,500 road miles. Based on bids received in areas that were ultimately not awarded funding, covering the next 1,924 miles would have required an additional \$144 million in subsidies. Similarly, in areas that received bids but were not awarded funds, firms bid an average of about \$95,000 per road mile (about \$75,000 when evaluating total subsidies requested by total road miles that would have been covered). By contrast, areas that received subsidies averaged \$16,000 per road mile and less (\$9,000 when considering the overall dollars per road mile).

To be sure, this outcome is the result of funding areas based on estimated cost-effectiveness, not the result of an auction, *per se*. The advantage of an auction mechanism is that it has the potential to induce firms to ask only for the subsidy they truly need. Thus, and second, the figure highlights how competition can reduce subsidies. Based on total dollars awarded and total road miles covered, subsidies in areas that received only one bid were about \$500 per road mile more than in areas with two bidders.

Only one area—in Latimer County, Oklahoma—received three bids, making it impossible to generalize about the benefits of more than two competitors. Nevertheless, it provides a nice mini-case study highlighting why allocating funds via cost models can lead to subsidies higher than necessary and why competition for subsidies can be so useful. In this auction, the lowest bidder asked for less than one-third the amount the highest bidder requested (Table 3). The three bidders presumably all had information at least as good as any cost model a regulator would have used, yet the three estimated very different subsidies necessary to cover the 38.5 miles of eligible roads in that county. A cost model might have resulted in spending close to an additional \$250,000 in this one area alone.

Table 3: Bids for Subsidies in Latimer County, Oklahoma

Bidder	\$/road mile	Total bid (subsidy requested)
Pine Cellular Phones, Inc.	3,000	\$114,750
Cross Wireless, LLC	7,726	\$295,520
Oklahoma Western Telephone Company	9,849	\$376,724

Similarly, consider how much larger the subsidies would have been if a cost model had yielded estimates closer to the amounts submitted by the losing bidder in areas that received two bids. As Table 4 shows, subsidies requested by the losing bidder averaged \$5,340 per road mile more than subsidies requested by the winning bidder. Subsidies based on information from the losing bidders would have resulted in an additional \$33 million—more than three times as much as it did, in fact, spend—to cover the same 12,400 miles.

Table 4: Bids and Total Subsidy Requested by Winning and Losing Bidders in Areas that Received Two Bids

	Average \$/road mile	Total subsidy requested
Winning bidders	\$2,291	\$14.2 million
Losing bidders	\$7,631	\$47.3 million

More intense competition for the subsidy is the most obvious explanation for lower subsidies in areas with more bidders, but it is not the only possible explanation. Another possibility is that potentially more profitable areas, which inherently require fewer subsidies, attract more bidders. Under that explanation, it is not the bidding competition, *per se*, that led to reduced subsidies, but rather that more firms were interested in those areas because they require less government help to be profitable. It is also possible that both are true: areas that are expected to be more profitable attract more firms who bid for less government assistance both because they expect to earn more in these areas than in others and because they expect other firms to bid, as well.

If multiple bidders are attracted to particular characteristics and those characteristics alone are responsible for low bids then we would expect to see all bids in those areas to be low. Table 4 above, however, lends some weight to the hypothesis that competition matters. In particular, the table shows a large spread between the winning and losing bids in areas with two bidders. This observation does not mean that *only* bidder competition matters in determining price, however.

If only bidder competition mattered in determining the magnitude of the subsidy then we would expect to see few differences, on average, in features of the biddable items. In other words, we expect to see no significant differences in average population and miles of roads in areas that received no bids, 1 unsuccessful bid, 1 successful bid, 2 bids, and 3 bids. Similarly, if only the characteristics of the biddable item matters then we would expect to see stark differences in those characteristics across the regions varying with the auction outcome.

The Appendix investigates these questions more rigorously, but summary figures suggest that the characteristics of the biddable items matter in determining the size of the requested subsidy. Figure 3 provides information on population in the biddable items by outcome (whether the subsidy was awarded). The figure shows some stark differences in population by outcome, lending support for the hypothesis that the characteristics of the biddable item affect the number of bidders, but not ruling out the hypothesis that the number of bidders also matters. In particular, the typical area that received no bids tends to have the fewest people—a median of only two people, although with a large range. By contrast, areas that received two and three bids had the largest populations. However, areas with only one bidder that were successful typically had much lower populations than areas with one bidder that received no subsidies.

Figure 3: Population By Number of Bidders / Outcome

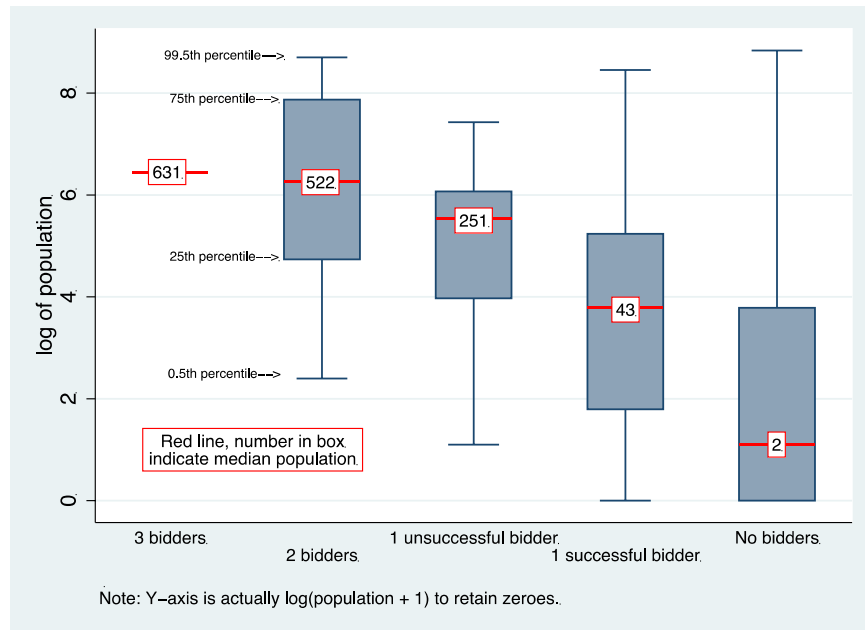
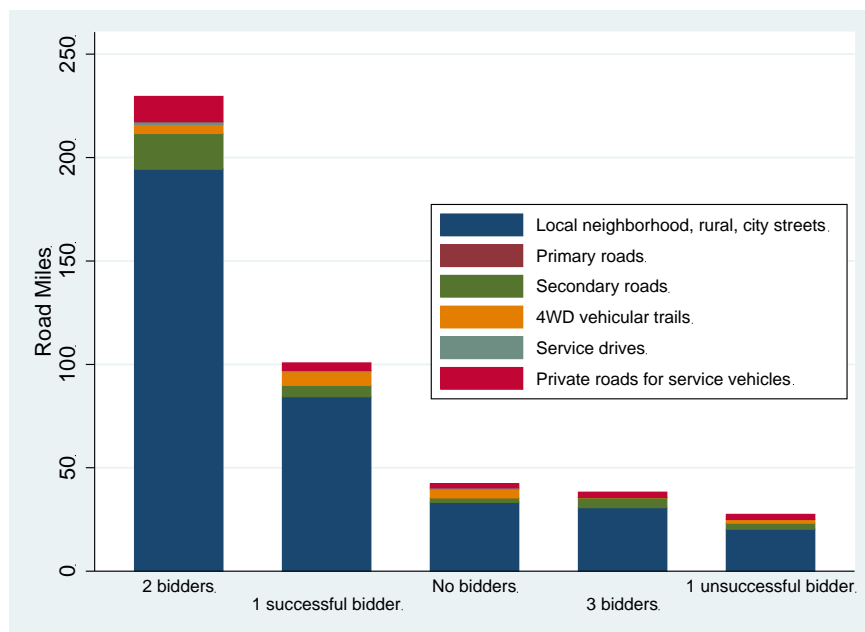


Figure 4 presents information on the number of miles by type of road by the number of bidders. Again, this figure shows that the characteristics of the biddable item matter in determining requested subsidy size. The figure shows that areas with two bidders had far more miles of road than areas with only one successful bidder. On the other hand, areas with no bidders had more miles of road, on average, than areas in which firms bid but no subsidies were awarded. The area with three bidders also had relatively few road miles, but with only one biddable item receiving three bidders it is not possible to draw any general conclusions.

Figure 4: Road Miles by Number of Bidders / Outcome



The evidence suggests that both hypotheses discussed above are true. Areas likely to be more profitable were more likely to receive multiple bids, but the bidding competition itself also resulted in lower subsidies.

Discussion and Conclusion

Overall, the FCC is to be commended on a designing and running a reverse auction that succeeded in many ways. In particular, the evidence suggests that the auction mechanism managed to distribute funds at a lower cost per road mile, and therefore provide more new coverage, than would have been possible without an auction.

Additionally, concerns expressed by opponents prior to the auction proved to be unwarranted. The Blooston Rural Carriers, for example, were “concerned that the specific ‘lowest per-unit bids across all areas’ selection mechanism” would “ensure that AT&T, Verizon, and Sprint Nextel will receive virtually all the Mobility Fund support they want that is awarded by reverse auction.”¹³ As shown in Table 2 above, none of those companies received any subsidies in the reverse auction, suggesting that the auction did not create an advantage for large over small carriers.

The auction was not perfect, of course, and several issues require additional thought.

Evaluating Bids

The FCC used miles of roads as the relevant unit of measure for evaluating bids because, it explained,

[it]...implicitly will take into account many of the other factors that commenters argue are important – such as business locations, recreation areas, and work sites – since roads are used to access those areas....Because bidders are likely to take potential roaming and subscriber revenues into account when deciding where to bid...we believe that support will tend to be disbursed to areas where there is greater traffic, even without our factoring traffic into the number of road mile units.¹⁴

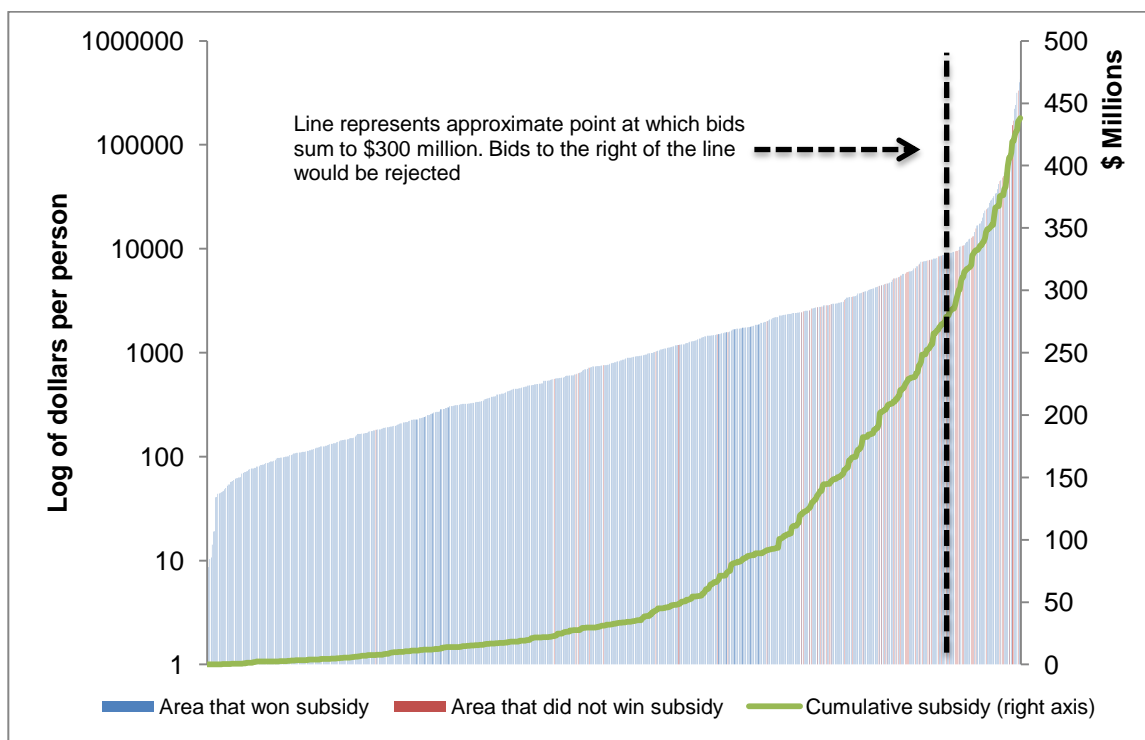
But subsidy per road mile may not be the right way to evaluate bids, especially given the types of roads in these areas. In particular, as Table 1 above showed, about 80 percent of the roads in areas that won subsidies were local neighborhood, rural, and city streets. A distant second was 4WD trails, representing about 9.3 percent of roads. Because local streets and trails are probably not used primarily for long-distance travel, perhaps other factors like population or number of workers might have been a better evaluation measurement than road miles.

¹³ Blooston Rural Carriers, *Comments of the Blooston Rural Carriers In the Matter of Universal Service Reform Mobility Fund*, December 16, 2010, 6–7.

¹⁴ Federal Communications Commission, *In the Matter of Connect America Fund, A National Broadband Plan for Our Future, Establishing Just and Reasonable Rates for Local Exchange Carriers, High-Cost Universal Service Support Developing an Unified Intercarrier Compensation Regime, Federal-State Joint Board on Universal Service Lifeline and Link-Up Universal Service Reform – Mobility Fund*, para. 351.

Consider an alternative mechanism that awarded subsidies on the basis of dollar per person covered. Figure 5 shows how the bids would have been ordered under this scenario. The figure shows that using population instead of road miles would have resulted in a different ordering of cost-effectiveness, and that some bids that won when based on road miles would not have been awarded subsidies, and vice versa. To be sure, using different criteria for evaluating bids would have led to different bidding behavior, so it would be inappropriate to assume the figure shows the precise outcome that would have occurred if population was used. Nevertheless, it demonstrates how the evaluation mechanism matters to the outcome.

Figure 5: Subsidies if Awarded by Population Instead of Road Mile



Because the auction results will differ based on the evaluation mechanism, and because it is not clear that subsidy per road miles is the best measure of cost-effectiveness, the FCC may want to reconsider this particular metric. To be clear, this discussion does not demonstrate that dollars per person is a better measure than dollars per road mile, only that the question is worth investigating in more detail.

Converting Bids to Subsidies

This auction used a pay-as-bid approach, in which winning bidders received the subsidy for which they bid as opposed to, for example, a Vickrey auction, in which winning bidders receive the bid submitted by the second-place bidder. In a pay-as-bid auction bidders do not necessarily face incentives to bid their true value and base their bid, at least in part, on how much they expect others to bid. We do not know the extent to which companies engaged in strategic bidding in this auction, but we do know that the winning bids ranged from \$130 per road mile to \$35,000

per road mile. It is not difficult to imagine the winner of the \$130 subsidy kicking himself for not bidding for a subsidy of at least an order of magnitude larger.

If this auction were a one-time only event this would not be a major issue. However, the FCC may run a second reverse auction for the Mobility Fund Phase II, which will award \$500 million annually.¹⁵ Not only are the stakes higher, making strategic bidding potentially more valuable, bidders know the results of the first auction, and in a pay-as-bid system are likely to try to avoid being the lowest bidder.

Competition and Auction Participation

As discussed earlier, very few biddable items received multiple bids. This outcome did not take the FCC by surprise, and the Commission dealt with the issue adroitly through the auction mechanism, which compared each bid to all the other bids. Nevertheless, the lack of head-to-head competition is concerning since competition is crucial to an auction's success. It is therefore worth considering whether any changeable policy factors artificially reduced participation and whether the FCC could increase participation in future auctions.

For example, after identifying all the areas eligible to be auctioned based on the current level of service, the FCC removed some areas from consideration based on existing commitments by firms to provide service in the future. The Mobility Fund order notes,

Pursuant to the USF/ICC Transformation Order, we will also make ineligible for support census blocks for which, notwithstanding the absence of 3G service, any provider has made a regulatory commitment to provide 3G or better wireless service, or has received a funding commitment from a federal executive department or agency in response to the carrier's commitment to provide 3G or better wireless service.¹⁶

The USF/ICC Transformation Order provides more information about this requirement:

To implement this decision, we will require that all wireless competitive ETCs that receive USF high cost support, under either legacy or reformed programs, as well as all parties that seek Mobility Fund support, review the list of areas eligible for Mobility Fund support when published by the Commission and identify any areas with respect to which they have made a regulatory commitment to provide 3G or better wireless service or received a federal executive department or agency funding commitment in exchange for their commitment to provide 3G or better wireless service. We recognize that a regulatory commitment ultimately may not result in service to the area in question. Nevertheless, given the limited resources provided for Mobility Fund Phase I and the fact that the commitments were made in the absence of any

¹⁵ Federal Communications Commission, *Further Inquiry Into Issues Related to Mobility Fund Phase II*, November 27, 2012, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-12-1853A1.pdf.

¹⁶ Federal Communications Commission, *Mobility Fund Phase I Auction Scheduled for September 27, 2012 Notice and Filing Requirements and Other Procedures for Auction 901*, AU Docket No. 12-25, para. 11.

support from the Mobility Fund, we conclude that it would not be an appropriate use of available resources to utilize Mobility Fund support in such areas.¹⁷

Excluding areas in which subsidized support either already exists or a provider expects to launch subsidized service is sensible in principle. After all, subsidizing areas in which someone has already agreed to build seems wasteful. If the goal of the auction was to maximize new road coverage subject to the budget constraint, then the FCC's decision to exclude certain areas was correct. In fact, the FCC notes that maximizing new coverage *was* the objective: "Support will be allocated to maximize the road miles covered by new mobile services without exceeding the budget of \$300 million."¹⁸

A key question given the FCC's maximand is whether the criteria for removing biddable areas from consideration were appropriate. The rules may have given incumbent providers a *de facto* right of first refusal since they were not required to actually be providing service yet, and, as the FCC said, "a regulatory commitment ultimately may not result in service."¹⁹

More rigorous standards for excluding otherwise eligible biddable areas may have increased participation by including more desirable but still underserved areas in the auction and may also have induced firms to participate that were instead given a *de facto* right to receive a subsidy.

Additionally, the lack of participation by the largest providers is puzzling. As the Blooston Rural Carriers note,

AT&T, Verizon, Sprint Nextel and other large national and regional wireless carriers have the size and purchasing power to negotiate the most favorable and least expensive per-unit terms possible for construction contracts and bulk equipment purchases. In addition, these large carriers enjoy substantial economies of scale that can further reduce the per-unit costs of their planning, overhead and other capital expenditures.²⁰

Given that the universal service program should strive to meet its goals at the lowest possible cost to telecom users, who pay for the program through taxes on telecom service, Blooston's comments suggest that the largest carriers would be best positioned to deliver cost-effective service. Perhaps Blooston is wrong and smaller carriers have innate advantages in areas such as those included in the mobility fund auction. But if Blooston is correct, the FCC might investigate why the largest carriers mostly avoided the auction since their participation would have provided additional competition and probably increased the coverage obtained for the fixed amount of money.

¹⁷ Federal Communications Commission, *In the Matter of Connect America Fund, A National Broadband Plan for Our Future, Establishing Just and Reasonable Rates for Local Exchange Carriers, High-Cost Universal Service Support Developing an Unified Intercarrier Compensation Regime, Federal-State Joint Board on Universal Service Lifeline and Link-Up Universal Service Reform – Mobility Fund*, para. 342.

¹⁸ Federal Communications Commission, *Mobility Fund Phase I Auction Scheduled for September 27, 2012 Notice and Filing Requirements and Other Procedures for Auction 901, AU Docket No. 12-25*, para. 2.

¹⁹ *Ibid.*, para. 342.

²⁰ *Ibid.*, 6.

Finally, the FCC should consider barriers to participation in the auction that cannot be addressed through auction design, but must engage other parts of the Commission and areas of regulation. Specifically, firms could not participate in this auction unless they had access to spectrum:

Applicants are required to provide a description of the spectrum access that the applicant will use to meet its obligations in areas for which it is the winning bidder, including whether the applicant currently holds a license for or leases the spectrum.²¹

Thus, FCC decisions affecting how well secondary spectrum markets work and the availability of spectrum that licensees make available for wholesale use might have a large effect on the pool of potential entrants into the auction. For example, Lightsquared had planned on providing wholesale wireless access, but the FCC's decision to deny the company the right to launch its network meant that its spectrum was not available for potential retail providers.²²

Given the recent timing of the Lightsquared decision it is conceivable that its spectrum or network would not have been available in time for this auction. Additionally, publicly-available information does not make it possible to determine whether access to spectrum was, in fact, a barrier to entry in this auction. Nevertheless, the point is that when considering potential auction participation, it is worth evaluating how seemingly unrelated rules and regulations might affect participation.

Conclusion and Implications for Future Auctions

The universal service program remains an impressive example of inefficiency and inequity,²³ and the reforms associated with the Connect America Fund do remarkably little to address underlying problems. In that context, spending an *additional* \$300 million is inherently egregious.

Nevertheless, this one-time expenditure should be considered a qualified success, although only time will tell whether it achieved its ultimate goal of bringing service to new areas. While this exercise demonstrated that the FCC can run an effective reverse auction, it also yields certain lessons. Most notably, the auction highlighted the potential difficulty in generating participation. The FCC handled this problem well, but must continue to think hard about how to encourage participation in upcoming reverse auctions, most notably on the broadcaster side of the Incentive Auctions. For example, while the Incentive Auction enabling legislation limits the FCC's ability

²¹ Federal Communications Commission, *Mobility Fund Phase I Auction Scheduled for September 27, 2012 Notice and Filing Requirements and Other Procedures for Auction 901*, AU Docket No. 12-25, para. 167.

²² See, for example, <http://money.cnn.com/2012/04/05/technology/lightsquared/index.htm>.

²³ See, for example, David Kaserman and John Mayo, "The Quest for Universal Telephone Service: The Misfortunes of a Misshapen Policy," in *Telecommunications Policy: Have Regulators Dialed the Wrong Number?* (Praeger Publishers, 1997); Robert Crandall and Leonard Waverman, *Who Pays for Universal Service? When Telephone Subsidies Become Transparent* (Washington, DC: Brookings Institution, 2000); Thomas Hazlett, "Universal Service" Telephone Subsidies: What Does \$7 Billion Buy?, 2006; Gregory L. Rosston and Scott Wallsten, "The Path to Universal Broadband: Why We Should Grant Low-Income Subsidies and Use Experiments and Auctions to Determine the Specifics," *The Economists' Voice* 8, no. 1 (April 2011).

to determine which broadcasters are eligible to participate,²⁴ the FCC retains some discretion and should use that discretion to broaden the pool of potential participants as much as possible.

Additionally, the pay-as-bid feature of the auction may be problematic, especially in the much larger upcoming Mobility Fund Phase II. The FCC should consider employing other mechanisms more likely to induce firms to reveal their true estimates of the subsidies necessary to provide service.

Perhaps most importantly, the auction demonstrated that allocating subsidies based on cost-effectiveness measures has the potential to dramatically increase the bang for the buck we get from universal service expenditures. Refining the auction mechanism to create stronger incentives for bidders to reveal truthful estimates of necessary subsidies could simultaneously reduce universal service expenditures.

Hopefully, this experience with reverse auctions will signal to the FCC the waste inherent in traditional funding mechanisms and spur additional novel approaches to bring more rational funding mechanisms to the program.

²⁴ Federal Communications Commission, *Expanding the Economic and Innovation Opportunities Through Incentive Auctions* Notice of Proposed Rulemaking, October 12, 2012, para. 73, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-118A1.pdf.

Appendix: Regression Analysis

This appendix examines in more detail the characteristics of the biddable items that attract bidders and how direct bidding competition affects winning bids.

First, consider which characteristics cause bidders to enter the competition. In principle, providers will participate if their expected revenues plus the subsidy make service economically viable. Data from the FCC includes population, miles of road by type, geographic size of the biddable item, cellular market area (CMA), state and county. Each of those may affect the desirability of a given biddable item, although in a reduced-form model it is not obvious whether each makes an area more or less attractive.

I estimate a least-squares regression in which the number of bids an area receives is the dependent variable, ranging from zero to three, where an observation, i , is a biddable item:

$$\text{number of bids}_i = f(\text{population}_i, \text{road miles}_i, \text{area}_i, \text{CMA}_i, \text{State}_i)$$

Population increases the desirability of a given area because it signals higher potential demand for service. Higher population may also be correlated with the presence of existing service in adjacent areas and therefore possibly competition, even if not in that small biddable area. Miles of road can have a similar effect: more road miles may indicate higher demand if miles correlates with the length of time road users might use your service, but more roads might also mean higher total costs. CMA fixed effects will control for factors unique to that market, and state fixed effects will control for factors like state-level regulations that affect demand and supply.

Table 5 shows the results of estimating this regression.

Table 5: Characteristics of Biddable Items Correlated with Number of Bids

Dependent Variable = Number of Bids	
Population	6.80e-05*** (6.80)
Area	-2.01e-05*** (3.87)
Primary roads	-0.0031 (1.09)
Secondary roads	0.0011* (1.84)
Local neighborhood, rural, city streets	2.80e-05 (1.19)
Miles	
4WD vehicular trails	-0.00014*** (2.69)
Services drives	1.30e-05 (0.18)
Private roads for service vehicles	-0.00031 (1.32)
Constant	-.0018*** (6.90)
Observations	14,263

R-squared	0.44
Robust t-statistics in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	
State and CMA fixed effects included but not shown.	

The table shows that population is positively and statistically significantly correlated with the number of bids, suggesting that expected demand affects entry into the bidding market. The magnitude of the coefficient, however, is small. The coefficient suggests that each additional 14,700 people in a biddable item is correlated with an additional bidder. Given that the mean population of a biddable item is 125 this effect seems negligible.

The size of the area is negatively and statistically significantly correlated with the number of bids, suggesting that larger areas are more costly to serve. As with population, though, the magnitude is tiny. Each additional 50,000 square miles is correlated with one fewer bidders, but the mean is just 59 square miles

Certain types of roads also appear to affect bidder participation. Miles of secondary roads is positively and statistically significantly correlated with bidder participation while miles of 4WD trails is negatively and significantly correlated with bidder participation. Again, the magnitudes of these coefficients are small.

Second, we evaluate how the number of bidders affects the subsidy levels in areas receiving at least one bid:

$$bid_i = f\left(\begin{matrix} number\ bids_i, winning\ bid_i, population_i, road\ miles_i, area_i, CMA_i, State_i \\ | number\ bids_i \geq 1 \end{matrix}\right)$$

where bid_i is dollars per road mile, $number\ bids_i$ is the number of bids received for item i , $winning\ bid_i$ is a dummy variable indicating whether the bid ultimately was accepted, and the other variables are as described above. Table 6 shows the results of estimating this regression.

Table 6: Bids and Bidders

Dependent variable = \$/road mile (mean = \$21,975)			
Number of bids		-14,481*** (3.15)	
Winning bid?		-35,738*** (5.16)	
Population		-4.906*** (3.08)	
Area		3.660 (0.87)	
Miles of...	Primary roads	-768.9 (1.53)	
	Secondary roads	19.72 (0.37)	
	Local neighborhood, rural, city streets	-2.579 (1.08)	
	4WD vehicular trails	-18.35 (1.23)	
	Services drives	-3.657 (0.49)	
	Private roads for service vehicles	-28.39 (0.74)	
	Constant	74,134*** (16.38)	
	Observations		884
	R-squared		0.661
Robust absolute t-statistics in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			
CMA and state fixed effects included but not shown.			

The table shows, most importantly, that competition matters. Each additional bidder is correlated with about \$14,500 less in subsidies, even controlling for characteristics of the biddable item. These results highlight the, albeit not surprising, point that auctions require competition to be successful.