Reverse Auctions for Universal Service Funding?

A Policy White Paper Prepared by

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Executive Summary

While auctions have been successfully applied by the Federal Communications Commission (FCC) to distribute spectrum licenses, there are notable differences associated with funding universal service offerings. These differences indicate that an easy "transplant" of FCC auction methods to address the universal service issue cannot reasonably be expected. Other nations have applied auctions to address the deployment of telecommunications services. However, here too, the experience is less than relevant. "Universal service" auctions held overseas have typically been directed at the deployment of pay telephone service to unserved areas (that did not have *any* telephone service). The lessons offered by the experience overseas are also unlikely to easily transfer to the U.S.

This paper considers the application of an auction mechanism to distribute universal service funding. Some of the key observations that emerge from this review include:

- Universal service auctions require careful definition of (1) the universal service "product"; (2) the maximum price associated with the universal service product; and (3) the service characteristics and quality associated with the universal service product.

- The single most important challenge facing policymakers interested in employing a reverse auction is encouraging entry, i.e., designing an auction that will attract many bidders. Auctions that do not attract many bidders are much less likely to generate substantial benefits.

- Identification of appropriate geographic areas associated with universal service auctions may present challenges, given the ongoing role of incumbent local exchange carriers (ILECs) in the provision of universal service.

- Implementing an auction requires that a reserve price be established. The reserve price is used to identify the maximum bid in a reverse auction. Depending on the number and expected profile of auction bidders, policymakers may need to utilize a cost model to determine an appropriate reserve price. This may increase the time and expense associated with an auction.

- A number of factors suggest that sealed (secret) bid auctions for universal service support may have advantages, as compared to an "outcry" auction where bidders can observe one another's bids.

- The auction process should be "transparent" to participants. The selection of auction winners should be based on rules that are known in advance. The auction rules should minimize the policymakers' application of post-auction discretion.

- Legal impediments may hinder policymakers' desire to implement auction outcomes.

Given the lack of any similar experience, either in the U.S. or abroad, the process of applying auctions to promote universal service plows new ground. This paper hopes to bring issues associated with auctions into the open, and to inspire further discussion, so that policymakers can make reasonable choices regarding the many complex issues surrounding auctions for universal service funding.

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Acknowledgment

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Introduction

Universal service obligations have traditionally been funded based on "cost." The focus on cost originated in the era of rate-of-return regulation. Federal universal service support for smaller telephone companies continues this tradition.[2] For larger telephone companies, however, the FCC has applied cost models to determine funding levels. Cost models associated with universal service funding have been directed at estimating the forward-looking cost of service using circuit-switched wireline technology—the type of technology historically deployed by incumbent local exchange carriers (ILECs). Certainly, the cost-modeling approach has generated substantial controversy when used to generate the answer to the questions "What is the cost of providing service?", and "What amount of subsidy should be provided?"

The advent of new technologies may raise doubts regarding the efficacy of relying on cost modeling to determine the level of universal service funding needed in "high cost" areas. As a result, the initial groundwork is being laid to refocus the efforts of policymakers on the application of "reverse auctions" to determine funding levels for universal service. For example, the FCC has recently released a rulemaking to address reverse auctions as a means to reform universal service support.[3] Similarly, the California Commission is conducting a proceeding that proposes to replace the previous cost-model-based foundation for determining the level of

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[2] See, for example, In the Matter of Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Report and Order, May 8, 1997, ¶295. Smaller telephone companies continue to be strong advocates for the application of embedded cost methodology for universal service funding. See, for example, Comments of NTCA in CC Docket No. 96-45, October 15, 2004. Attachment "The Role of Embedded Cost in Universal Service Funding."

[3] *In the Matter of High-Cost Universal Service Support Federal-State Joint Board on Universal Service,* WC Docket No. 05-337, CC Docket No. 96-45, Federal Communications Commission, Notice of Proposed Rulemaking, January 29, 2008.

See also, *In the Matter of High-Cost Universal Service Support, Federal-State Joint Board on Universal Service,* WC Docket No. 05-337, CC Docket No. 96-45, Recommended Decision, November 20, 2007, ¶¶ 8 & 15.

state subsidy support for high-cost areas with an auction-based approach.[4]

Prospects for Universal Service Auctions

Auctions for universal service support have, like spectrum auctions, been identified as a means of overcoming the asymmetric information that exists between regulators and firms.[5] It is likely that universal service funding programs are subject to a substantial asymmetric information problem. Existing universal service support mechanisms were established when the telephone network provided nothing more than voice services. Subsidies for the provision of basic voice service have persisted in spite of the fact that the provision of basic voice service is likely to be one of many services that a firm may be able to sell to residential consumers. While the scope economies[6] associated with a firm providing basic voice, vertical features, toll, high-speed data, and video services have grown substantially, the demand for basic service subsidies has not declined.[7] This is an irrational economic outcome that would not be expected if markets were competitive. Entry decisions made in competitive markets are based on all potential sources of revenue.

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4 See, *Order Instituting Rulemaking into the Review of the California High Cost Fund B Program,* Rulemaking 06-06-028, Assigned Commissioner's Ruling Regarding the Scoping and Scheduling of Phase II Issues, October 5, 2007.

5 Laffont, J. and Tirole, J. *Competition in Telecommunications*, MIT Press, 2000, p. 243.

6 "Scope economies" arise if the unit cost of production decreases as a firm produces an increasing variety of products or services. For example, if a firm were to sell only basic voice service, the entire cost of the telephone network would need to be recovered from the single service. Alternatively, much of the same network equipment is used to produce vertical features, toll, and DSL services, that would point to scope economies, as shared costs can be recovered from a variety of services.

7 While growth in the level of the federal universal service fund has properly been associated with the expansion of subsidy to competitive eligible telecommunications carriers (CTECs), the universal service payments to wireline carriers increased in the 2000-2003 period, and have been stable since. See, *In the Matter of High Cost Support, Federal-State Joint Board on Universal Service*, WC Docket 05-377, CC Docket 96-45, FCC 07-88. Notice of Proposed Rulemaking, May 14, 2007, Appendix A.

However, there is little evidence that high cost areas are competitive, and the lack of competition has allowed incumbents to collect high levels of subsidy, regardless of the fact that they earn revenues from providing services other than basic voice. As the incumbent's scope economies increased, the economically necessary level of subsidy should have declined. If an auction is properly structured, and if competitive bidding for the subsidy right occurs, the expected outcome may result in reduced costs of universal service funding, as bidders will implicitly disclose the impact of their scope economies (as well as other operational and technological economies) on the cost of providing basic service (among their overall set of services) in a specific market area. Thus, if there is competitive bidding, auctions have the potential to correct the asymmetric information problem with universal service funding.

Policymakers must carefully examine the issues associated with the application of an auction for universal service funding. This report focuses on issues that should be carefully weighed when considering the application of auctions to fund the carrier of last resort (COLR) in its efforts to provide basic voice services. Given the application of auctions by the FCC to assign radio frequency spectrum for use with a variety of wireless telecommunications services, it may appear that auctions can provide a superior means to address universal service funding. However, neither the FCC's use of auctions to distribute spectrum licenses, nor the use of auctions to address universal concerns abroad, is likely to provide an easily transferrable model.

FCC Spectrum Auctions and Universal Service Funding Auctions

In light of the experience of the FCC's spectrum auctions, it may be tempting to think that an easy transplant of "success" can be achieved by applying similar auctions to universal service funding. There are a number of reasons why this is not a reasonable expectation. First, with spectrum auctions, the resource that was placed up for bid was newly available. Incumbent cellular telephone providers were not required to bid for the spectrum they already controlled. Thus, there were no inherent conflicts with incumbents over the spectrum that the incumbents

already possessed. In addition, the technology and services associated with the spectrum were defined by the FCC.[8] This "leveled the playing field" with regard to the types of investment that would need to be made by any winning bidder. This characteristic of the spectrum auction led to a third factor—the auctions were likely to exhibit "common values."[9] Finally, the revenue potential associated with winning a license to use the new spectrum, as well as rules that encouraged bidding by smaller entities, made it more likely that there would be multiple bidders, i.e., the auction bidding process was likely to be competitive. As will be discussed in more detail below, it is unlikely that auctions for universal service funding will exhibit similar characteristics. For the reader who is unfamiliar with FCC spectrum auctions, a brief appendix is provided that offers more detail regarding the FCC auctions.

Universal Service Auctions Abroad

Auctions for universal service funding have applied abroad, however, the experience is unlikely to be of much help to U.S. policymakers. Auctions have been used to assist with the deployment of payphone service to previously unserved areas in Latin America.[10] Uganda and Nigeria have pursued similar programs in Africa.[11] The subsidization of the deployment of pay

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8 For example, digital voice and data services.

9 As is discussed further in the Appendix, "common values" arise if the item to be auctioned is likely to have similar value to all bidders, however, prior to the auction the potential bidders are unable to know with certainty what the exact value is. Common value settings are associated with an auction outcome known as the "winner's curse"—the winning bidder is likely to pay more than the item is worth. Because rational bidders are aware of the potential for the winner's curse, bidders will be reluctant to bid up to their anticipated value, resulting in reduced revenues for the seller.

10 See, "Leveraging Telecommunications Policies for Pro-Poor Growth—Universal Access Funds with Minimum-Subsidy Auctions," OECD Document, October 22, 2004, p. 18.

11 *Id.*, and "Federal Republic of Nigeria Request for Proposal to Provide Universal Access Telecommunications Service," May 8, 2006. http://www.ncc.gov.ng/Headlines/RFP-%20UA%20Pilot%20Project%20Phase2.pdf#search=%22Nigeria%20telephone%20subsidy%20bid%22

telephones in unserved areas is a very different proposition than funding a COLR in an area already served by an incumbent. The lessons offered by these "green field" programs are unlikely to be of much use. In fact, auctions held abroad where an incumbent has been present, as was the case in India (for payphone service),[12] and in Australia (for a more general universal service offering), did not fare well. Notably, the Australian regulatory authority identified the presence of the incumbent (Telstra) as the most likely reason for the lack of auction entry in an auction pilot project.[13]

The lack of transferability of auction experience from spectrum auctions, and the lack of relevant experience abroad, both point to a "starting from scratch" approach to universal service auctions in the U.S. The balance of this report identifies and discusses issues that are likely to emerge in such a process.

Key Issues Associated with Designing an Auction for Universal Service

Researchers on the issue of reverse auctions to fund universal service programs note that certain preliminary matters must be addressed:

> [I]mplementing a program of universal service involves first defining "basic telephone service." What services should be included? What additional options should be available? What level of quality should be maintained? Second, an affordable price must be established. Third, a service provider or providers must be identified, and a means must be found of footing the bill.[14]

The design of the Universal Service policy can be divided in three parts: the definition of

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[12] See, Noll, R. and Wallsten, S. "Universal Telecommunications Service in India," AEI-Brookings Joint Center for Regulatory Studies, Related Publication 05-25, October 2005, p. 10. http://aei-brookings.org/admin/authorpdfs/redirect-safely.php?fname=../pdffiles/php97.pdf

[13] "What Rules for Universal Service in an IP-Enabled NGN Environment?", International Telecommunication Union, April 15, 2006, p. 14. http://www.itu.int/osg/csd/ngn/documents/Papers/Xavier-060323-Fin-v1.pdf

[14] Milgrom, P. "Procuring Universal Service: Putting Auction Theory to Work," Lecture at the Royal Swedish Academy of Sciences, December 9, 1996. http://www.econ.au.dk/vip_htm/povergaard/pbohome/webpapers/milgrom-procuring-universal-service.pdf

the Universal Service Obligation (i.e., the set of subsidized "core services" and the "affordable price" at which they must be available), the design of the tax scheme used to finance the Universal Service Fund, and the design of the subsidy scheme that will use those funds to guarantee the satisfaction of the USO (Universal Service Obligation).[15]

Thus, baseline issues which need to be addressed to implement a reverse auction will include the following:[16]

- **The precise definition of the service to be auctioned.** Basic service must be clearly defined. For universal service auctions to be successful, the policymaker conducting the auction must be sure that each bidder is providing a service that satisfies the definition. Prior to the auction both the general service level (e.g., dial-tone availability, trunk blocking, access to repair and customer service representatives), and specific technologies (e.g., access to E911, ability for use for Internet access) must be identified up front. Otherwise the auction bidders will be able self-define "basic service," and the level of subsidy will not be efficiently established as the low bidder may be able to provide a substandard service that does not meet public interest objectives. The policymaker conducting the auction must be prepared to verify compliance with the service level associated with the subsidy award for the life of the COLR contract.

- **Identification of the affordable price for the Universal Service offering.** If the price of the service offering (and the timing and degree of any price changes allowed for the service) is not established up front, then a reverse auction makes little sense as the winning bidder would be able to increase revenues from basic service while collecting subsidy.

- **Identification of high-cost areas eligible for subsidy.** The identification of high-cost areas is best achieved using an objective standard. A cost model could be used to identify the high-cost areas. If a cost model is used, the cost estimates must then be evaluated in relation to a revenue benchmark, i.e., what level of revenue is reasonable to expect when serving consumers in high cost areas.[17] Alternatively, if cost model results

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[15] Sorana, V. "Some Economics of Carrier of Last Resort Auctions," *mimeo,* September 1, 1998, p. 5. http://faculty-gsb.stanford.edu/wilson/archive/E542/classfiles/sorana_tprcpaper98.pdf

[16] This paper does not address the collection of the necessary subsidy dollars.

[17] While the availability of basic service at affordable rates may be the objective of the auction process, it is reasonable to include expected revenues from services other than basic service in the revenue benchmark. For example, suppose that the affordable basic service rate is $12 per month; expected average revenue per customer is $35 per month, and the cost of service is determined to be $50 per month. These facts suggest a shortfall of $15 per month, the difference between the cost of service and the average revenue. Unless one is willing to allocate the shared costs of service (e.g., wireline or wireless "local loops") among the various service families that share the facilities used to provide basic service, it is

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are not available, it may be sufficient to conduct auctions based on the fact that an area is currently receiving subsidy. As will be discussed further below, some situations are more likely to require the application of cost models, and this may be a very complex addition to the process of establishing an auction.

- **Consideration of who might be the "service provider or providers" that will participate in an auction**. Is it reasonable to expect a large number of potential auction entrants, or is it more likely that there will be few serious bidders? As will be discussed further below, the answer to this question will have a substantial impact on how the auction is designed.

Once these foundational issues have been examined, then other details of the auction process can be addressed, some of which are discussed below.

Defining Geographic Areas

The definition of geographic areas associated with auctions may be complicated, in light of the legacy geography associated with ILEC service areas. Given that existing subscribers are likely to be served by the ILEC, its service area may be an attractive choice for the areas associated with the universal service auction. However, this geographic area may be large, and may not be consistent with the reasonable deployment of alternative technologies. In general, larger geographic areas may deter auction entry. Other alternatives could include subsets of the ILEC's service areas, such as wire centers, or "technology neutral" geographies, such as Census Blocks. However, complexities could be introduced if the ILEC's service area were not associated with the geography. For example, what would happen if Census Blocks were used to define the bidding areas, but the ILEC lost the bid for several in its service area? Would the loss of subsidy in some of its service area lead the ILEC to claim that its ability to continue to serve in other areas was compromised? Striking a balance between a definition that encourages entry and limits post-auction problems should be a priority in establishing geographic areas.

[17](...continued)
inappropriate to consider the revenues from the basic service rate in isolation when establishing the revenue benchmark.

Eligibility Standards for Auction Participants

Eligibility standards should be focused on the ability of the candidate bidder to meet service quality standards, given the pricing constraints on the basic service offering. The technical capabilities associated with the basic service offering and the level of service quality must be clearly identified. Each bidder, as part of the qualification process, should be required to file a brief overview of the technology that they will deploy should they win the auction, and how that technology satisfies the relevant criteria.

It also makes sense, as part of the qualification process, to assess the financial fitness of the bidder. The auction process must have provisions that limit the potential for "hold up," i.e., if a bidder wins the auction through a low bid, becomes the COLR, and later announces that it cannot meet its obligation at the rates implicit in the winning bid, and demands higher rates, with the threat to exit the market. This problem has occurred in some auctions conducted in Latin America.[18] Presentation of the bidders financial qualifications are a reasonable pre-qualification. Given the problems experienced in the FCC's spectrum auctions associated with winning bidder bankruptcies, it makes sense to take steps to limit possible legal entanglements due to bidder insolvency.[19]

Setting the Reserve Price

The reserve price, set by the seller, is the price that bidders must beat. Reserve prices can play an important role in influencing auction outcomes, and, if properly set, may prevent

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[18] "Leveraging Telecommunications Policies for Pro-Poor Growth—Universal Access Funds with Minimum-Subsidy Auctions," OECD Document, October 22, 2004, p. 18. Available at: http://docstore.ingenta.com/cgi-bin/ds_deliver/1/u/d/ISIS/40251420.1/oecd/16091914/2005/00000005/00000001/0205011ec001/1140E0397A647A871193428151E088CFC8C3A8CC6C.pdf?link=http://www.ingentaconnect.com/error/delivery&format=pdf

[19] Further discussion is provided in the Appendix.

predation (powerful bidders driving weaker bidders out), or collusion.[20] In the case of universal service auctions, the reserve price is a level of subsidy that the policymaker asks the bidders to beat. The following example illustrates a simplified illustration of how a reserve price might be set. Under this approach, two critical data points are utilized—the expected revenue per customer in the service area, and the expected cost of service. If the expected average revenue per customer is $35 per month, and the cost of service is determined to be $50 per month, these facts suggest a shortfall of $15 per month, the difference between the cost of service and the average revenue. This shortfall could be used as a reserve price for the subsidy level. Note that with this approach to setting the reserve price, the concept of "cost" has crept into the auction process. But which cost to use? The ILEC's embedded cost? The cost associated with a cost model, that estimates the "forward-looking" costs of a wireline network? Or the costs expected with the "least-cost" network deployment, allowing the least-cost technology to be selected (i.e., technology other than wireline)?

The reserve price appears to present a potentially complex area for consideration. However, it is also important to note that the reserve price will have a short "shelf life" if the auction process is successful. If there is competitive auction entry by firms that can employ new technologies or that have superior cost structures to that of the incumbent, the bidding process should result in the reserve price being undercut (and regulators will learn something about the true cost of service in the "high cost" area).

An assessment of the expected auction environment may assist with determining how much effort should be placed in developing reserve prices:

- If a policymaker expects the auction bidders will include the ILEC and few other bidders, or if a policymaker's ultimate decision regarding the characteristics of the universal service offering make it more likely that bidders must use conventional wireline technology, then applying or updating a cost model to assist with the development of the

[20] Klemperer, Paul. *Auctions: Theory and Practice.* Princeton University Press, 2004, p. 109.

reserve price is more important to the ultimate result. If the ILEC is likely to be the main bidder, and other rivals are weak or absent, then a cost-based reserve price based on "fresh" data will be more likely to generate positive results.

- On the other hand, if a policymaker expects the auction will be competitive (i.e., that there will be new entrants participating in the auction process), and that these new entrants will be bringing new technologies into play (e.g., fixed wireless or fiber optics), then updating or applying cost models will be less urgent. If the auction is expected to be competitive, then a less rigorous basis for a reserve price could be utilized—for example, use of the existing subsidy level, or perhaps application of cost data that a policymaker has on hand.

In summary, the reserve price presents a difficult issue, and may reintroduce the complexity of cost modeling into the auction process. If the policymaker expects a competitive auction, then two expeditious alternatives could be applied when establishing a reserve price: use of existing subsidy levels (perhaps modified by a set percentage), or use of available cost information. It should be recalled that publicly-available cost model results from the FCC's Synthesis Model are available on the FCC's web site.[21] Alternatively a policymaker could apply some other cost model if one was readily available, or attempt to update the FCC's cost results.

Single Winners or Multiple Winners?

Another decision associated with establishing a reverse auction is whether there will be a single winner, or multiple winners. The resolution of this issue also influences whether auction bidders should be compensated based on the number of customers to which they provide the qualifying service, or compensated a fixed amount regardless of the number of subscribers who take the qualifying service.

While policymakers have spent much time and effort trying to introduce competition *into* local exchange markets, an auction process creates *competition for the COLR right*. Competition "for the market" will generate efficiency benefits, and as has been noted by researchers, use of an auction to try to promote competition *after the auction*, through the support of multiple

[21] The data available from the FCC web site is dated, but might be modified or used to benchmark reserve prices.

subsidy recipients ("in-market competition") can be problematic:

> The policy discussions of auctions for universal service often take the benefits of in-market competition for granted. The environments in which these auctions will possibly be implemented, however, are not traditional environments, since they are substantially regulated. One should, therefore, not rely on the economist's gut feeling that competition is *a priori* good for the consumer, and one should rather investigate the nature of the benefits in this specific environment. It is useful in this respect to distinguish between two types of services: supported services, and non-supported or complementary services.[22]

These researchers apply a theoretical model to explore the potential benefits of in-market competition. The key element of their modeling is that auction participants will offer both the basic supported service, and complementary services (e.g., vertical, toll, data). If there are multiple COLR auction winners, the fact that they will face competition for both the *basic* and *non-basic* services due to supporting multiple COLRs has negative consequences:

> The first key insight of this analysis is that *in-market competition is a mixed blessing,* for a reason that was analyzed earlier: *Competition* lowers profits on the complementary segment, and therefore *raises the equilibrium subsidy that is demanded by the bidders.* In a sense there is no free lunch. In-market competition is desirable if the deadweight loss associated with the absence of competition in the complementary segment exceeds the increase (associated with the increase in the subsidy) in the deadweight loss on other telecommunications segments financing the universal service plan.[23]

Thus, in-market competition does not necessarily lead to a superior outcome for consumers, and the promotion of in-market competition through allowing multiple auction winners may lead to higher subsidy payments. Other researchers have also analyzed the impact of in-market competition and reached unfavorable conclusions for slightly different reasons—pointing to the increased likelihood of collusion associated with auctions that support in-market competition:

> . . .COLR auctions for per-subscriber subsidies are more vulnerable to collusion than standard procurement auctions and COLR auctions for lump-sum subsidies. Moreover, the problem is exacerbated if the auction appoints more than one COLR. *The source of the problem is precisely in the added scope for competition "in the market"*: Defectors

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[22] Laffont, J. and Tirole, J. *Competition in Telecommunications,* MIT Press, 2000, p. 251.

[23] Laffont, J. and Tirole, J. *Competition in Telecommunications,* MIT Press, 2000, p. 254. Emphasis in the original.

> from collusive agreement in COLR auctions for per-subscriber subsidies can be punished by charging low prices in the market immediately after the auction where a defection occurred. . . .[24]

These analyses suggest that using auctions to support competition may be undesirable in the context of COLR auctions. A benefit identified associated with subsidies supporting multiple providers is the potential positive impact of competition on service quality.[25] However, given that the level of service quality following the auction period must be monitored to ensure that the winning bidder is providing a service consistent with the policymaker's definition, the gains from competition on service quality, should they result in a service level higher than the service quality standards established by the policymaker, are likely to be small. Thus, given the nature of the service areas likely to be up for bid (i.e., rural and high-costs areas where evidence shows very little competitive activity in the first place), increasing subsidy levels to support in-market competition may not be advisable. Rather, the benefits of competition *for the COLR right* will improve efficiency in the distribution of universal service subsidies. This approach would also simplify the process by specifying a lump-sum subsidy award to a single COLR, rather than a per-customer approach that might make more sense with multiple COLRs.

Bidding Structure

Auctions can take on a number of forms. For example, sealed bid auctions require the submission of secret bids, and typically have only a single bidding round. Alternatively, "open outcry" auctions are possible, where various bidders can see what others are bidding. When considering universal service funding, the auction process will produce a low bidder. Thus, if an

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[24] Sorana, V. "Auctions for Universal Service Subsidies," *mimeo*, November 24, 1998, p. 18. Emphasis in the original. http://faculty-gsb.stanford.edu/wilson/archive/E542/classfiles/Sorana_JMP.pdf

[25] See, for example, Milgrom, P. "Auctions for Universal Service," Presentation at the Universal Service Conference sponsored by the Progress & Freedom Foundation, March 1, 2007. http://www.pff.org/events/eventpowerpoints/030107usfreverseauction/Auctions%20for%20Universal%20Service.pdf

open outcry approach were to be utilized, the auction would have a descending bid design. Furthermore, auctions can be structured to have "first price" or "second price" characteristics. In a first price auction, the high (or low) bidder wins,[26] and pays the price associated with the winning bid. In a second price auction the high (or low) bidder wins, but pays the second place bid. Thus, the structure of an auction can be complex, and determining which auction form is best for a particular situation requires careful consideration.

To answer the question of what type of auction structure should be applied, a number of factors must be considered. Foremost among these factors is the level of entry that can reasonably be expected with an auction. How may bidders will participate in the auction? An auction with many bidders is likely to exhibit fundamentally different outcomes than an auction with few bidders. As noted by Paul Klemperer, a highly regarded expert on auctions, in addition to the number of bidders, the relative position of the bidders will also influence auction outcomes:

> The received theory described above takes the number of bidders as given. But the profitability of an auction depends crucially on the number of bidders who participate, and different auctions vary enormously in their attractiveness to entry; participating in an auction can be a costly exercise that bidders will only undertake if they feel they have realistic chances of winning. In an ascending auction a stronger bidder can always top any bid that a weaker bidder makes, and knowing this the weaker bidder may not enter the auction in the first place – which may then allow the stronger bidder to win at a very low price. In a first-price sealed-bid auction, by contrast, a weaker bidder may win at a price that the stronger bidder could have beaten, but didn't because the stronger bidder may risk trying to win at a lower price and can't change his bid later. So more bidders may enter a first-price sealed-bid auction.[27]

While Professor Klemperer frames this discussion in terms of an ascending bid auction that is generating revenue for the seller, the moral of the story applies equally to a descending bid

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[26] COLR auctions are more similar to procurement auctions, thus the low bidder will be the winning bidder, assuming that they otherwise satisfy the requirements specified by the policymaker.

[27] Klemperer, Paul, "Using and Abusing Economic Theory," *2002 Alfred Marshall Lecture to the European Economic Association*, p. 9. http://www.nuff.ox.ac.uk/economics/papers/2003/W2/usingandabusing.pdf

auction. In the context of a descending bid auction, a stronger bidder (say an ILEC) can always undercut a weaker bidder, and this may deter entry from occurring in a descending bid auction, which may result in the incumbent facing little competitive pressure as few (or no) other firms may enter the auction, thus resulting in an auction outcome where subsidy payments are higher than necessary.

The sealed bid approach may also be superior for universal service auctions if the best-case scenario regarding the number of participants suggests that there will be relatively few bidders. Sealed bid auctions reduce the ability of bidders to signal one another about their intentions or desired auction outcomes. Given the status of the local exchange market today, where even in high-density low-cost areas consumers have few choices of a service provider, it seems a reasonable expectation that there will not be large numbers of bidders in many universal service auctions. Auctions with small numbers of bidders are more susceptible to collusion, and an "open" bidding process such as that associated with an outcry auction is more likely to encourage collusion. Returning to Professor Klemperer on the issue of small numbers and collusion:

> Another elegant example of bidders' ability to "collude" is provided by the 1999 German DCS-1800 auction in which ten blocks of spectrum were sold by ascending auction, with the rule that any new bid on a block had to exceed the previous high bid by at least 10 percent. There were just two credible bidders, the two largest German mobile-phone companies T-Mobil and Mannesman, and Mannesman's first bids were 18.18 million deutschmarks per megahertz on blocks 1-5 and 20 million deutschmarks per MHz on blocks 6-10. T-Mobil – who bid even less in the first round – later said "There were no agreements with Mannesman. But [we] interpreted Mannesman's first bid as an offer." The point is that 18.18 plus a 10 percent raise equals 20.00. It seems T-Mobil understood that if it bid 20 million deutschmarks per MHz on blocks 1-5, but did not bid again on blocks 6-10, the two companies would then live and let live with neither company challenging the other on the other's half. Exactly that happened. So the auction closed after just two rounds with each of the bidders acquiring half the blocks for the same low price, which was a small fraction of the valuations that the bidders actually placed on the blocks.[28]

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[28] Klemperer, Paul, "Using and Abusing Economic Theory," *2002 Alfred Marshall Lecture to the European Economic Association*, p. 13, footnotes omitted.

(continued...)

There is no *a priori* reason to expect that an open outcry auction for a universal service subsidy, if characterized by a small number of bidders, would not result in collusion, leading to a higher-than-necessary subsidy payment.

COLR Auctions are Less Likely to Exhibit "Common Values"

Other factors may weigh in favor of sealed bid auctions. As discussed earlier, when common values are present, an open outcry auction is more likely to generate a better outcome for the seller (i.e., higher revenues in the event of an ascending bid process, or lower expenditures in the event of a descending bid process). However, in the case of universal service subsidies, there is a lower likelihood that common values exist. The amount of subsidy needed by various carriers that might consider entering the auction will depend on the technology upon which each carrier relies. A fixed wireless operator or municipal broadband provider will have a very different cost structure than an incumbent ILEC, thus there is no reason to expect that a fixed wireless carrier or municipal broadband provider would gain any useful information regarding the formulation of its bid by observing the bids of an incumbent wireline carrier.[29] For example, suppose a fixed wireless carrier could offer the qualified basic service at a substantially lower cost than the incumbent. An outcry auction would allow the fixed wireless provider to observe an incumbent's bids, and if the incumbent's bids exhibited a reluctance to decline, this could easily result in the fixed wireless carrier winning the auction with an unnecessarily high subsidy margin above its costs.

Sealed Bid Auctions and Incumbent Decisions Regarding Sunk Costs

In addition, a sealed bid auction may encourage incumbents to behave rationally regarding their sunk costs. In a competitive market, rational firms ignore sunk costs in forward-

[28](...continued)
http://www.nuff.ox.ac.uk/economics/papers/2003/W2/usingandabusing.pdf

[29] I.e., useful from the seller's point of view.

looking decision-making.[30] If incumbent providers rationally ignore sunk costs when competing for the right to remain the COLR, the need for subsidy will be reduced. Thus, the auction should be carefully structured to encourage this result, and a sealed bid approach may be best. If the incumbent faces intermodal providers with lower cost structures, the incumbent will be more likely to bid rationally, and ignore sunk costs, if bids are secret.

First Price or Second Price?

Second price auctions would award the lowest bidder the COLR right, but allow them to receive the second lowest bid subsidy level. For example, if bidder "A" submitted a bid of $1,000 for a specific area, and bidder "B" submitted a bid of $1,200, bidder "A" would win the COLR right, and receive subsidy of $1,200. This auction structure has generated very poor outcomes when applied in auctions for spectrum where few bidders participated. For example, in New Zealand spectrum auctions, some licenses where the high bid was $100,000 were sold for $6.[31] A small number of bidders, each having disparate resources resulted in the winners taking spectrum licenses while providing very little revenue to the government. If few bidders are expected in the COLR auction, similar problems could emerge, which would argue for use of a first-price auction.

Summary on Bidding Structure

On both entry grounds, and on collusion grounds, it may be that an open outcry descending bidding process will generate an inferior outcome to that of a sealed bid.[32] It is

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30 As noted in a standard managerial economics text: "Principle: Irrelevance of Sunk Costs—A decision maker should ignore sunk costs to maximize profits or minimize losses." Baye, M. *Managerial Economics and Business Strategy*, 3rd ed. Irwin McGraw-Hill, 2000, p. 182.

31 McMillan, J. "Selling Spectrum Rights," *Journal of Economic Perspectives,* Vol. 8, No. 3, Summer, 1994.

32 GTE, both in proposals made to the California Public Utilities Commission in 1997, and in other early venues, proposed that a sealed bid auction process be utilized to distribute universal service funds. See: Comments of GTE Submitted

(continued...)

important to keep in mind that the optimal structure is likely to be influenced by the expected number of bidders, and their relative strength in the market. If many strong bidders are expected, then the risk associated with outcry auctions may be mitigated. However, as demonstrated by the FCC experience with spectrum auctions, open outcry auctions can be susceptible to collusion, even when the number of bidders is large.[33] Given the likelihood that relatively few bidders will participate in COLR auctions, a first-price sealed bid approach may hold the most promise.

Combinatorial Bids

One aspect of the FCC's spectrum auctions was the ability of bidders to use "package bidding," or combinatorial bids. In the spectrum auction framework, package bidding served a useful purpose as the winning bidder would use the licenses to offer a new service, and thus would have to invest after gaining its licenses. Combinatorial bidding in the spectrum auctions allowed the bidder to incorporate into their bid formulation the economies of scale, and economies of marketing, that they anticipated by gaining a group of licenses. For example, if spectrum licenses were available for several contiguous market areas, gaining a license in each market area would allow the carrier to exploit economies of scale in construction of its network,

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[32](...continued)
to the California Public Utilities Commission Auction Proposals for Universal Service, June 20, 1997. See also: "Auctions for Universal Service Obligations," Dennis Weller, GTE Chief Economist. Presentation at the 12th Biennial Conference of the ITS, Stockholm, June 1998, p. 16.

Verizon, GTE's successor, now appears to support a multiple round outcry approach, that begins with reserve prices based on existing (capped) subsidy levels, and pays a lump-sum subsidy to a single auction winner. See, Dennis Weller, Chief Economist, Verizon. "Modernizing Universal Service: Meeting America's Universal Service Goals in a Challenging Future," Progress & Freedom Foundation, March 1, 2007. http://www.pff.org/events/eventpowerpoints/030107usfreverseauction/WELLERAuction%20slides%20Weller%20PFF.ppt

[33] See discussion in Appendix A.

and to also enable the carrier to offer consumers a more valuable product (a wider coverage area). If the carrier did not win the necessary licenses, it would face higher unit investment costs, as it would not have the ability to exploit economies of scale (nor would it be able to offer the broader coverage to its customers).

With COLR auctions, new investment may be less likely, as existing ILECs and wireless firms are likely to have facilities deployed. Thus, unless these bidders will be expanding their operations through new investment should they win the auction, *they will enjoy similar economies of scale whether or not they win the auction.* As a result, combinatorial bidding may be of less importance to the bidders in a COLR auction.

Here again, the expected profile of auction participants is important. If the auction bidders are expected to be the "usual suspects," i.e., existing ILECs and wireless carriers that have already made the necessary investments, combinatorial bidding is likely to be less important to the auction outcome. Alternatively, if new firms that will make new investments are expected, then combinatorial bidding may be more important.

Combinatorial bidding has been successfully applied in a complex sealed-bid auction process. The London Regional Transport (LRT) authority holds a sealed-bid auction for the rights to serve London bus routes. The auction is designed to allow bidders to automatically create combinatorial bids:

> As in the standard combinatorial first price auction, bidders in the LRT auction can submit bids on any number of routes and route packages. There is no restriction on the number of bids placed, nor is there an obligation to bid on some routes or route packages. In particular, a bidder can submit a bid on a package without submitting a bid on the individual routes that make up that package.
>
> The distinctive feature of the LRT auction is that each bid is a firm but non-exclusive commitment of resources. This means that two bids on different routes implicitly define a bid for the package of these routes. An important consequence of this rule is that bidders are not allowed to bid more for a package than the sum of the bids on any partition of that package. In particular, this rules out bids expressing diseconomies of scale or scope. The original motivation for this rule was the expectation that the market was mainly characterized by economies of scale and scope, and that by allowing bidders to express

such synergies, LRT would lower its procurement costs and improve efficiency.[34] It is likely that the assumption adopted by the LRT—that bidders are unlikely to experience diseconomies of scale and scope—is one that could reasonably be expected to transfer to basic telephone service. The approach applied by the LRT—applying a rule that prevents package bids from exceeding the sum of a portion of a package, simplifies the package bidding approach, and could be part of COLR auction rules.

Lump-Sum or Per-Customer/Per-Household Payments?

Payment distribution must be addressed in the auction design process. As discussed above, using auctions to "subsidize competition" through the funding of multiple COLRs is a less desirable alternative. Lump-sum subsidy payments are a natural match for an auction environment where there is a single winner, and is likely to be the most administratively efficient approach. If multiple COLRs are allowed by the auction process, lump-sum subsidies do not make sense, as the multiple COLRs could free-ride on their distribution regardless of the number of customers receiving the basic service offering. Thus, multiple COLRs require a "per-unit" design. Per-customer subsidies present an interesting dilemma, as wireless COLRs could provide service to several individuals in a household. Per-customer subsidies could dramatically increase the total subsidy needed. Per-household subsidy limits may be appropriate if multiple COLRs are permitted.[35]

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[34] Cantillon, E. and Pesendorfer, M., "Auctioning Bus Routes: The London Experience," Chapter 22 in Cramton, P., Shoham, Y., and Steinberg, R. *eds.*, *Combinatorial Auctions*, MIT Press, 2006.

[35] The impact of wireless service on the availability of basic service in a household is a vexing issue. Providing a household with a single wireless phone does not ensure that household members have *any* access to telephone service. With wireline service, telephone service is available to all household members. Wireless phones, as they are mobility products, are easily removed from the household.

For What Duration Should the COLR Right be Assigned?

The answer to this question may turn, in part, on whether the auction allows multiple winners in market areas. If multiple winners are allowed in a market, then it may make more sense to increase the term associated with an area's exemption from a reauction.

However, as was discussed above, the advantages of multiple auction winners is less than certain. If a single auction winner is specified, the length of the term may reasonably depend on expectations regarding the rate of technological change, and to reasonable recovery periods for the new COLR's investment. As a suggested starting point for the COLR contract term, after an auction is held, there should be an auction moratorium for a period of five (5) years if the COLR relies on existing facilities. After this term expires, the area is again open to challenge, i.e., entrants could request the right to bid on the ability to provide COLR services in the geographic area. If the new COLR builds new facilities, a longer term may be appropriate, perhaps seven to ten years following service initiation.

Policymakers should consider what will happen if an auction is initiated and no bidders materialize. One way to deal with this is to specify that the existing COLR will continue those responsibilities should the auction process fail to generate competition for the market. In addition, auction areas that do not attract initial entry should be made available for bidding, either on the request of new entrants, or on a periodic basis.

Auction Transparency and Bid Evaluation

The success of the FCC auctions has been credited to the "transparency" of the process—bidders are fully aware of the rules and how the process works, and how the winning bid is selected.[36] Achieving similar transparency with a COLR reverse auction may be more challenging due to the fact that there is a potentially greater downside if the winning bidder fails

[36] See, for example, Crampton, P. and Schwartz, J. "Collusive Bidding: Lessons from the FCC Spectrum Auctions," *Journal of Regulatory Economics*, Volume 17, Number 3, May 2000 , pp. 229-252.

to deliver. Unlike CLEC entry under the terms of the Telecommunications Act, should a new COLR fail, and if the ILEC has curtailed its operations following the elimination of its subsidy, service disruption could result.[37] Thus, if care is not taken in developing the auction qualification process, the low bid may not always be viewed by the policymaker as the best alternative, and the policymaker may be faced with the prospect of culling winning bidders after the auction is complete based on perceptions that the winning bidder will not provide adequate service. Researchers studying the competitive tender process associated with London bus routes note:

> After verification that the bids satisfy the technical requirements of the auctioned contracts, LRT awards the contracts to the bidder-allocation that delivers the best economic value. In practice, this means that the contract is awarded to the low bidder but deviations at the margin are possible to account for operator quality, for example.[38]

Another researcher studying the route-tendering process for bus routes in London notes, "there is a real difficulty for the tendering authority in choosing between bids where there is more than one dimension to consider, such as bidders, offering a range of products. . . or different price-quality combinations. In such cases, *the value judgements of the decisions-makers rule*, not the market."[39] Careful development of the definition of the basic service offering, and qualification of the bidders can minimize the use of judgement when evaluating bids, but may not eliminate the application of policymakers' value judgements. It may be necessary that criteria other than the "low bid" influence the final decision regarding the auction winner. Should it be needed, however, the application of the policymaker's judgement should, however, be as transparent as possible.

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[37] Regulatory commissions typically glossed over the potential problem of CLEC bankruptcy by noting that the ILEC would provide the necessary fallback.

[38] Cantillon, E. and Pesendorfer, M., "Auctioning Bus Routes: The London Experience," Chapter 22 in Cramton, P., Shoham, Y., and Steinberg, R. *eds.*, *Combinatorial Auctions*, MIT Press, 2006.

[39] Toner, J.P. "The London Bus Tendering Regime—Principles and Practice," Institute for Transport Studies, University of Leeds, June 2001, emphasis added.

Post-Auction Compliance

Regulatory compliance should be focused on ensuring that the build-out meets the technical standards and time-benchmarks, that minimum quality standards are satisfied, and that prices charged for basic service do not exceed those specified in the initial auction design. Follow-up and audit is a natural part of the use of reverse auctions. For example, reverse auctions held in Peru for the deployment of payphone deployments in unserved areas linked the payment of subsidy monies over time with the satisfaction of government-established performance standards.[40] Audit processes necessary to ensure compliance may include evaluation of network deployment and the ability of all households in the specified area to utilize the supported service. Service quality reporting should be sufficient to ensure that the minimum quality standards are being met, and could address issues such as 911 performance, dial-tone availability, trunk blocking, access to repair and customer service representatives, and out-of-service repair times.

Legal Questions Associated with Reverse Auctions

It is likely that implementing an auction that assigned universal service subsidies to carriers other than existing ILECs could face substantial legal hurdles. One critical issue that may emerge following an auction is what happens if the ILEC does not win the auction? Should the ILEC not win, there are multiple complexities that should be considered up-front. For example, a new COLR might use an alternative technology, but, possibly due to a build-out period, would not be able to serve all subscribers for some period of time. During that build-out period, subscribers will need to continue to rely on the existing ILEC's facilities. Would the ILEC, if it was no longer the COLR have a continuing obligation to serve? Would the subsidy level paid to the existing ILEC be based on the winning bid or the pre-existing level? Would the

[40] Cannock, G. "Telecom Subsidies: Output-Based Contracts for Rural Services in Peru," World Bank Note Number 234, June 2001. http://rru.worldbank.org/Documents/PapersLinks/Peru-605.pdf

ILEC, if it was no longer the COLR, have any obligation, other than the existing obligations under the 1996 Act, to make its facilities available to the new COLR? Does the policymaker have the necessary authority to compel the ILEC to make facilities available to the new COLR on a transitional basis if this action was necessary?

Unlike the “green field” auctions for pay telephone service that have been held in South America, the areas associated with potential universal service auctions in the U.S. are already served. Given the experience of the past twelve years, it is not reasonable to expect that a favorable appellate review of a policymaker’s decision to require ILECs to make their facilities available, beyond what is currently specified by the 1996 Act’s framework, to new COLRs will be a “slam dunk.” There has already been one experience with a court review of a COLR bidding process in the U.S. that did not withstand judicial review:

> In 1995, the Hawaii legislature enacted a statute authorizing its PUC to select, via a competitive bidding process, single carriers of last resort to receive universal service funds for serving designated local exchange service areas. Under the statute, once the PUC determines the level of support that is appropriate for each local exchange area, it must invite telecommunications providers to bid on these areas for providing service. The successful bidder becomes the COLR for the local exchange service area for "a period of time and upon conditions set by the commission." In choosing the successful bidder, the PUC is required to take into account "the level of service to be provided, the investment commitment, and the length of the agreement, in addition to the other qualifications of the bidder." The PUC requires that bidders' proposals contain projected rates for the initial ten-year period and expected subsidies and loans that will lower the rates for consumers, but selection of the new provider need not be made entirely on the basis of who submits the lowest bid; rather it may reflect a weighing of multiple factors, i.e., "internal and external strengths."
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> The first rural area in which the PUC authorized carriers to compete with the incumbent LEC, GTE Hawaiian Tel, was the Ka'u area on the island of Hawaii. In April 1996, the PUC issued a Request for Proposal (RFP), specifying the technical, engineering, financial, and other requirements for bidders. The RFP also articulated specific "internal strengths," "external strengths," and "miscellaneous indicia of fitness and ability" on which bidders would be evaluated.
>
> The PUC selected TelHawaii, Inc. to be the COLR for the Ka'u area, but TelHawaii and GTE Hawaiian Tel thus far have been unable to conclude an agreement for the transfer or lease of GTE Hawaiian Tel's assets to TelHawaii for serving this area. GTE Hawaiian Tel sought reconsideration of the decision selecting TelHawaii as COLR, but the PUC subsequently held that it was necessary and in the public interest to condemn GTE Hawaiian Tel's assets and to allow TelHawaii to use these condemned assets in its

> operations as a public utility. GTE Hawaiian Tel's appeal of this decision is now pending in the Hawaii Supreme Court.[41]

It is important to note that TelHawaii, the winning bidder in the Hawaii Commission's COLR bidding process, abandoned its efforts to act upon the authority granted it by the Hawaii PUC, after unfavorable court rulings.[42] Thus, GTE was able to use the legal review process to undermine the Hawaii Legislature's directive, and the Hawaii PUC's attempt to carry out that directive.

Alternatively, should the auction process select a new COLR that did not rely on the existing facilities of the ILEC in any way, the ILEC could easily claim that it has not recovered all of its "prudently incurred" investments, and demand compensation, that would potentially raise the costs of funding substantially. The issue of stranded investment has been raised in comments solicited by the Joint Board on the issues of auctions and universal service funding:

> Existing infrastructure requires (i) a transition mechanism to recover past prudent investments made to serve high cost areas, and (ii) increases the difficulty of creating an auction that is not biased in favor of any set of current infrastructure providers (particularly if they utilize different technologies). . . .
>
> The only way to avoid bias either for or against incumbent networks is to fully recover the incumbent's investment prior to enacting the reverse auction. [43]

Given that there is "existing infrastructure" in virtually all of the service areas that could be auctioned, it is reasonable to expect that the issue of compensation for past investments will

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41 *In the Matter of Federal-State Joint Board on Universal Service: Promoting Deployment and Subscribership in Unserved and Underserved Areas, Including Tribal and Insular Areas*, CC Docket No. 96-45, Further Notice of Proposed Rulemaking, September 3, 1999, ¶¶178-180.

42 See, "GST seeks callers, TelHawaii unplugs," *Pacific Business News*, July 30, 1999. http://pacific.bizjournals.com/pacific/stories/1999/08/02/story1.html?t=printable

43 Comments of the National Telecommunications Cooperative Association *In the Matter of Federal-State Joint Board on Universal Service Seeks Comment on the Merits of Using Auctions to Determine High-Cost Universal Service Support*, WC Docket No. 05-337, Attachment A, "The Use of Reverse Auctions for Provision of Universal Service," Dale E. Lehman, October 10, 2006, p. 1 and p. 13.

arise. While it may be the case that a policymaker has the authority to conduct an auction for the distribution of universal service funding, it is not at all clear whether the policymaker can prevail on the critical post-auction issues that are likely to arise in the transition away from the ILEC as COLR to a new entrant taking over the COLR responsibilities.

Conclusion

Reverse auctions for universal service do not present the clean slate that characterized the FCC's spectrum auctions, or payphone auctions in less-developed nations. Outside of the careful definition of basic service, and the expected service quality associated with that offering, the key issue that policymakers must consider is the likelihood of entry should an auction be held. If entrants are numerous, then the benefits of holding an auction are more likely to be substantial. Competition among bidders could drive down subsidy levels and result in the delivery of the needed services at least cost to the ratepayers who fund the subsidy. If few bidders are expected, then the benefits of auctions are more difficult to envision. With few bidders, setting the proper reserve price becomes imperative, and this may require the application of a cost model. Cost modeling is a controversial and time-consuming process which, if applied, adds to the complexity of the overall auction process. Policymakers should do the necessary preliminary evaluation to determine whether the time and effort associated with an auction process is likely to generate the expected benefits. The key marker of potential success is the number of potential entrants capable of delivering basic service with the desired level of service quality. If the expected number of entrants is low, the auction process is less likely to deliver outcomes that would be viewed as superior from the ratepayers perspective.

Appendix: A (Very) Brief Review of FCC Spectrum Auctions

Given the apparent success of FCC spectrum auctions, it may be tempting to think that the experience of spectrum auctions could easily be transferred to reverse auctions for universal service funding. As discussed in the body of this report, this may not be the case. Auctions for universal service raise new issues that were not present with the spectrum auctions conducted by the FCC.

Spectrum Auctions Helped the FCC Determine the Value of a New Resource

Every market transaction is based on *information.* The price at which an object is bought and sold depends on the information available to the buyer and seller. With regard to the newly available spectrum which the FCC was charged with selling, there was a distinct asymmetry of information between the seller (the FCC) and potential buyers (companies interested in providing wireless services). The FCC wanted to generate revenues from the sale of spectrum rights,[44] obviously, the potential buyers wanted to pay as little as possible.

Spectrum rights, within the context of FCC auctions, have an interesting economic characteristic. Unlike an object of art or piece of sports memorabilia, that may have a unique personal value to the purchaser, spectrum rights are likely to provide a similar value to any purchaser. This situation is known, in the economics of information, as "common values." For example, suppose that the FCC was to auction five new licenses to provide a new digital wireless service to the Boston, Massachusetts market area. Because the service is new, *ex ante,* no firm knows the exact value of these licenses. For any firm winning a license, however, it is likely that

[44] The legislation which enabled spectrum auctions, the *Omnibus Budget Reconciliation Act of 1993*, specified that one of the objectives of the FCC was to design auctions which led to the "recovery for the public of a portion of the value of the public spectrum resource made available for commercial use and avoidance of unjust enrichment through the methods employed to award uses of that resource."

the potential profits associated from providing the service will be similar.[45] In formulating a bidding strategy for a license, each bidder estimates the costs and revenues expected if the license were to be won. Once this calculation is completed, the bidder will have an estimate of the highest bid that they are willing to make. While it is likely that the various bidders will come up with similar valuations of the licenses, it is unlikely that the valuations would be identical. There will be some "random" variation in the valuations.

Common Values and the "Winner's Curse"

The situation described above results in a potential risk to any prospective spectrum bidder. If common values are present, then the high bidder in any auction is likely to be the party which has experienced a random variation in calculating the expected value of the license on the *high side*. Thus, the winner will likely pay too much for the license. This outcome has been dubbed the "winner's curse."[46] Of course, potential bidders are aware of the winner's curse, thus any rational bidder will follow a bidding strategy that leads them to "shave their bid," i.e., to not bid as much as they think the license is actually worth. From the seller's perspective, the winner's curse will lead to lower auction revenues, as buyers will not be willing to bid up to their true valuation of the object. This aspect of the auction process presented a challenge to the FCC—could the FCC design an auction that mitigated the winner's curse, and thus would generate higher revenues?

Compounding the challenge facing the FCC when designing its auctions was the complexity of the objects to be auctioned. Policy objectives of promoting competition in the provision of wireless services, and also promoting small-business participation in the auction

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[45] It is important to note that the FCC auction structure typically specifies the type of technology that must be used with a spectrum license. This tends to "level the playing field," as investment choices will be constrained by the technology specified by the FCC.

[46] Klemperer, P. *Auctions: Theory and Practice*, Princeton University Press, 2004, p. 14.

process,[47] were assisted by the FCC's decision to create numerous market areas.[48] For the PCS auctions, a total of 493 market areas (know as "Basic Trading Areas") were used, and multiple licenses were available within each Basic Trading Area. This led to more than 2,500 licenses being available.[49] A potential bidder could be very concerned about the complementary and substitute relationships of licenses, and faced a complex and risky environment.

Electronic Simultaneous Multiple Round Auctions

To solve these problems, the FCC developed electronic auctions, that allow users to participate over the Internet or by telephone. When the FCC applies a simultaneous multiple round auction, all licenses are made available for bidding during the entire auction period, thus creating the "simultaneous" nature of the auctions. The auction is conducted in rounds, each having a set duration. At the end of each round, the bids are posted on a web site for review by the bidders.

The FCC's approach also allows bidders to place combinatorial (or "package bids"), where the participant can place bids on groups of licenses. Package bidding is particularly important where complementary relationships between licenses exist, and new investments must be made. For example, a firm planning on offering service on a regional basis might want to purchase licenses in two or three (or hundreds of) Basic Trading Areas. With the package bidding approach, the firm could place bids on the entire group of licenses in which it was interested. The ability to place package bids has important implications for the bidder, as the FCC auctions, because they were for new services, required that entrants make new investments

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47 *In the Matter of FCC Report to Congress on Spectrum Auctions*, WT Docket No. 97-150, October 9, 1997, p. 3.

48 *Where do We Go From Here? The FCC Auctions and the Future of RadioSpectrum Management.* Congressional Budget Office, April 1997, p. 19.

49 Kykowsky, M. M., Cull, R. J., & Ledyard, J. O. (2000). "Mutually Destructive Bidding: The FCC Auction Design Problem." *Journal of Regulatory Economics*, Vol. 17, 205-228.

to offer service. Auction participants would need to bid aggressively for the package of licenses they desired to ensure that they could benefit from economies of scale when building their networks. Furthermore, the open-outcry format allows bidders to evaluate the bids placed by other participants, which had a positive impact on the bidder's perceptions regarding the winner's curse.[50]

Problem Areas

The FCC spectrum auctions, while generating substantial revenues for the government, and generally delivering the spectrum resource quickly for use, have not been immune from problems. Some auctions were characterized by collusion—bidders signaled one another regarding bidding strategies.[51] However, a much bigger problem emerged surrounding the property rights associated with auction winners. Some winning bidders eventually went bankrupt, and the judicial review process, culminating in a U.S. Supreme Court decision,[52] determined that auction winners did not have to return licenses to the FCC, which was the FCC's position. This provides a very important lesson for policymakers regarding the distribution of subsidy using an auction process. If a subsidy recipient were to file for bankruptcy, other courts with competent jurisdiction could become involved, and it is possible that the regulatory agency administering the subsidy would lose control over the subsidy, just as the FCC lost control over some of its licenses.

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50 *In the Matter of FCC Report to Congress on Spectrum Auctions,* WT Docket No. 97-150, October 9, 1997, p. 18.

51 See, Crampton, P. and Schwartz, J. "Collusive Bidding: Lessons from the FCC Spectrum Auctions," *Journal of Regulatory Economics,* Volume 17, Number 3, May 2000 , pp. 229-252.

52 Supreme Court of the United States, *Federal Communications Commission, v. Nextwave Personal Communications, Inc., et al.* January 27, 2003. http://www.supremecourtus.gov/opinions/02pdf/01-653.pdf