Attachment A

The Use of Reverse Auctions for Provision of Universal Service

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This paper reviews the theoretical and applied literature on the use of reverse auctions (also called minimum subsidy auctions or competitive auctions) for provision of universal service. It reveals that reverse auctions are feasible, and have met with some success, for provision of new infrastructure/services into previously unserved areas, or for the upgrading of existing infrastructure and/or services. In contrast, the U.S. environment is one in which there are multiple existing service providers, using a diverse set of technologies, in most supported areas. 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). Unfortunately, there is scant empirical evidence on which to determine the feasibility or desirability of reverse auctions relative to alternative methods of providing universal service under these conditions.

The use of auctions to award provision of utility services can be traced back to Demsetz (1968). Demsetz introduced the notion that franchise bidding could replace traditional public utility regulation. Particular use for provision of universal service, or carrier of last resort (COLR) responsibilities, was first explored by Milgrom in his 1996 Nobel lecture in honor of William Vickrey, and was first suggested for examination by the FCC in 1995. Considerable academic and practitioner work has been conducted on auctions since that time, especially in conjunction with the widespread use of auctions for awarding the right to use spectrum resources. In addition, there is a lengthy literature surrounding the

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use of competitive bidding for awarding contracts (e.g., defense department procurements, public works construction, etc.) which are a discrete form of an auction (in which a single project or set of projects is awarded on the basis of a competitive bidding process).

The use of competitive processes has a number of general beneficial properties: they promote incentives for cost-reducing innovation, they mitigate against informational asymmetries between funding entities and entities contracted to provide services on their behalf, auctions can be used to ration scarce resources to those that value them the most, and they can permit market forces to play a role in the determination of the quality of services provided. Competitive contracts are not a panacea, however. Victor Goldberg (1976) points out that competitive procurement and alternative regulatory mechanisms should be compared under realistic conditions related to the nature of the service that is being provided.

Goldberg provides the example of a university food service that might be contracted out on the basis of a competitive bid, or could be provided internally by the university itself. The latter is meant to approximate the conditions under which a regulated utility operates. Regulators must monitor the quality and cost of service provision, and face a number of potential inefficiencies inherent in monopoly provision by an agent with better information than the principal. Competitive bidding reduces only some of these problems, and creates some new issues. Quality of service must still be monitored, and there are administrative costs associated with both the awarding and oversight of contracts.

Goldberg points out that administered contracts, traditional regulation, or any other regulatory mechanism must balance the right of consumers to be served and the right of providers to serve. Universal service is a statement of the public’s right to be served (at comparable rates for comparable services, in high cost and insular areas, and for consumers of low income), and regulators become the agent of these consumers’ rights.

At the same time, providers have the right to an opportunity for a competitive return on their investments.

Goldberg's key insight is that the nature of the service itself, and not the particular way in which contracts are awarded (competitive bidding or regulated monopoly, for example), is what determines the key issues that must be dealt with. Significant investment costs raise issues associated with the need to establish long-term contracts. Volatile operating costs (e.g., fuel costs) would raise issues of risk, regardless of the regulatory mechanism that is adopted.

This principle is pertinent to the use of reverse auctions for provision of universal service. Provision of universal service entails significant investment costs (sunk costs to a degree that depends on the technology deployed) under conditions of continual technological progress. Services are provided to consumers for which the demand falls short of the provisioning costs.[2] In the U.S. there are few unserved areas: instead, there are multiple networks, using different technologies and with different quality attributes, and serving different parts of rural areas. There are also a variety of regulatory restrictions placed on existing rural service providers. The potential use of auctions must be evaluated against a backdrop of these characteristics.

This paper will review the theoretical literature and applied evidence, and is organized according to a number of related issues that must be resolved in order to implement reverse auctions for universal service. These include:

- Definition of the service to be auctioned
- Size of areas to be defined
- Number of COLRs to be subsidized
- Time period for contract awards
- Transition/stranded investment issues

[2] This can either result from consumer unwillingness or inability to pay the full cots of provision, or from public policy that limits their price to be less than these costs. In either case, market provision will be insufficiently forthcoming, absent some form of support.

- Bidder eligibility
- Type of bidding to be conducted (sealed or open, single or multiple round, combinatorial, etc.)
- Basis for determining winning bids
- Pricing and service flexibility accompanying awards
- Monitoring and enforcement issues

Each topic has a number of feasible alternatives. In a comparison of reverse auctions and cost proxy model-based USF, Sorana (1998) states that "it can be easily seen that the two mechanisms cannot be ranked on purely theoretical grounds."[3] Similarly, theory alone cannot determine the desirability of reverse auctions for universal service.

I examine the theoretical guidance and empirical evidence that is available from the applications of reverse auctions in telecommunications (and some limited relevant experiences in other industries). A recurring theme will be that the complexity of these decisions increases significantly in the presence of an existing infrastructure (rather than a "green-field" application), and when competing service providers use different technologies (with different cost and quality characteristics).

Service Definition

The definition of universal service will need to be specific in terms of service quality, coverage, and capabilities. In particular, it will need to specify whether equal access is to be included, appropriate service quality standards (e.g., system reliability), and what data speed is to be supported. This is one area in which auctions may be less desirable than the current USF mechanism.

Under current rules, the delivery of services can outpace the definition of universal service: for example, higher broadband speeds may be available, even while broadband is not included within the definition of universal service. An auction mechanism may not

[3] Sorana (1998) at page 18.

permit this outcome – the carrier's business case will need to support the service delivered. If policymakers want to see faster deployment, then they will need a specific auction for their desired rate of deployment.

Broadband is not part of today's universal service definition, and the FCC's definition of broadband service is relatively slow by today's standards. Many rural carriers provide broadband speeds well in excess of 256k, and often in the absence of sufficient market demand to justify the deployment costs of these higher speeds, on a narrow profitability criterion. The justification for providing these services rests on their economic importance to the rural community served, and the ability to provide these services is facilitated by USF.

It is precisely because of the strong cost-reducing incentives of reverse auctions that the service definition must be precise. This means that regulators must predict service needs at least as far into the future as the time period that the franchise will cover. The need for such regulatory foresight undermines some of the principal theoretical advantages of reverse auctions – that they potentially replace regulatory fiat with market processes.

Coverage is another key part of service definition. It is not feasible to define universal service as availability to 100% of the population. Reduced targets, such as 90%, however, do not sound like *universal* service. For many years, telephone companies have operated under state –specific requirements to provide service to any location within X miles (usually a fairly small number) of their current network facilities. Special construction charges apply to locations that exceed X, with the costs usually borne by the party requesting service. Given that this practice has been built into construction plans, it seems that continuing this practice would be least disruptive to consumers.

<u>Size of Areas</u>

A fundamental principle for an auction to be efficient is that the item being auctioned must be the same for all bidders (their individual valuations may differ, but the item being auctioned must be the same if the bids are to be compared). This means that the coverage area must be the same for all COLR bidders.

Theoretical work also suggests that their may be subtle strategic effects of geographical coverage differs across competing providers. If one provider is obligated to serve all customers at the same price, and the other carrier can serve a subset of customers, the COLR carrier must be reimbursed for reduced profits on the contested part of the market as well as the higher costs of serving the uncontested consumers [Hoernig and Valletti (2003)]. The strategic considerations go further and can "raise the subsidy substantially, and even may leave both firms with higher profits than if they were just serving the urban market."[4] More generally, differential serving areas and COLR obligations create strategic incentives which will influence the level of competition between carriers. Theoretical work has thus far been constrained to the case of an incumbent competing with a new entrant – the case of competing existing COLRs has not been modeled. Strategic considerations and information asymmetries have yet to be analyzed in this environment.

The next question is whether these areas should be large or small. When there are potentially significant cost complementarities (costs depend on the specific combination of areas that a service provider will serve), then there are two options: (i) auction a large enough areas to include most of the significant complementarities; or (ii) auction many smaller areas, but permit for combinatorial bidding so that significant complementarities can be realized. There appears to be some dispute about the feasibility of (ii) [Kelly and Steinberg (1998) claim that complex combinatorial auctions are feasible, but Hultkrantz (2004) cites Kelly and Steinberg's work, but concludes that "the consensus in the economic literature seems to be that combinatorial auctions have several desirable properties but are too difficult to be used;" Sorana (1998) claims "it must be ultimately recognized, however, that the theoretical and experimental properties of multi-unit auctions, combinatorial or otherwise, are not well understood," and Luander and Nilsson

[4] Hoernig and Valletti (2003) at page 91.

(2004) provide experimental evidence that combinatorial auctions may be more efficient and make collusion more difficult than one shot sealed auctions].

Large area auctions would appear to favor larger carriers, or would require smaller carriers to bid jointly in order to compete.[5] Larger areas that make sense from a network perspective may also require a mixture of areas currently served by rural and nonrural carriers. This would exacerbate the complexity of designing joint bids to serve large areas. It may also increase the size of the fund by including high cost areas (currently served by nonrural carriers) that do not presently receive support.

In general, smaller areas should involve more precise and larger universal service funds, *ceteris paribus*. Larger areas involve more averaging of relatively high and relatively low cost customers, tending to decrease the overall fund size, but failing to provide full support for high cost areas [Lehman (2000)]. Smaller areas necessarily involve the complexities of combinatorial bidding.

The averaging effect can be substantial. At the extreme, imagine a single national service area being auctioned off – a subsidy would probably not be required to serve the high cost areas along with the low cost areas. This result, however, is a move away from decades of efforts aimed at increasing competition in the industry. If auctions are designed to accommodate large areas *and* competition within these areas, then the overall fund cost will be driven upwards, as discussed below under the number of COLRs.

Determination of geographical areas to be auctioned is complicated by the presence of multiple existing network infrastructures. For example, suppose that the COLR includes service to 100% of the customers within a current ILEC serving area and that a wireless carrier wishes to bid, but their network only covers 80% of the population in that area.

[5] Current spectrum auctions highlight this issue. Joint bidding is permitted, but the bidders cannot subsequently use the spectrum rights individually, under their separate business identities. Auction design should avoid dictating market structure – it should reveal when joint bidding is most efficient, but it should not force carriers to consolidate operations. Forced consolidation presupposes that regulators know the most efficient market structure to begin with, undermining the potential of auctions to substitute market processes for regulatory processes.

The wireless carrier would be required to arrange to resell the incumbent's service or provide an alternative infrastructure for the 20% of customers that it does not currently reach.

Conversely, suppose the service area is defined as the wireless carrier's service area, and that this extends beyond any single ILEC's service area. This would require several ILECs to combine their bids to match the service area of the wireless carrier. In either case, transactions costs and uncertainty will increase when existing infrastructures do not match.[6]

It is difficult to design an auction that will be technologically neutral under these circumstances. To avoid bias, areas would need to be smaller than anybody's current service area, thereby placing a similar burden on all potential bidders. However, such small areas would greatly increase the complexity of the combinatorial auctions that would be required.

Number of COLRs

Closely related to defining the geographic COLR area is the issue of whether there will be one winning bid or more than one within each area. At a fundamental level, there is a tradeoff between competition *for the market* (favored by a single winning bidder) and competition *within the market* (promoted by multiple winning bidders). A priori, it is not clear which type of competition would lead to greater economic efficiency.

It is clear that total subsidies will be larger with multiple winning bids than single winners. This is evident from the GTE reverse auction proposal submitted to the FCC [Weller (1998)]. Weller proposed that bidders submit two bids – one for sole provision of

[6] The 1999 NPRM cited the use of competitive bids for COLR in Hawaii. The first such award went to TelHawaii. In order to transfer the assets from the previous COLR, GTE Hawaiian Tel, the Public Utilities Commission of Hawaii condemned some of the assets of GTE Hawaiian Tel. Several court battles later, a state court overturned the condemnation as unconstitutional. Rather than continue the legal battles, TelHawaii pulled out of the market after spending millions of dollars attempting to enter [Honolulu Star-Bulletin, July 20, 1999]. Regardless of the ultimate merits of the legal dispute, problems like this are likely to accompany bids that require use of other carrier's facilities in order to satisfy the COLR obligations.

COLR within an area and the other assuming shared provision of COLR responsibilities. Preliminary evidence was that reducing a carrier's market share by 50% would increase unit costs by 52%. This is due to the fact that network investment is not proportional to the number of customers, particularly in sparsely populated areas. Serving half of the customers may entail nearly the same infrastructure as serving all of the customers.

It should be noted that some technologies may be more tolerant than others of multiple winning bidders. Wireless technology does not have the same sunk cost characteristics as wireline technology, so per unit subsidies may not increase as dramatically for wireless carriers. This need not cause a problem as long as the wireline bidder can receive a subsidy adequate to serve a partial market share. If high cost support is capped at current per-subscriber levels, adequate support would be impossible, however. So, it is important that there be no caps on bids if multiple COLRs are to be awarded.

Single COLRs does lead to reduced USF costs in one way – it eliminates the problem of multiple supported services (wireline and wireless) without the administrative problems that accompany proposals to limit individual support to a single service (to households, or locations, etc.).

Sorana (1998b) examines an auction mechanism (based on the 3rd lowest bid) that permits multiple COLRs. He points out that "there could be much higher cost involved if the auction rules are not carefully crafted." This results from the vulnerability to collusion. While careful auction rules can avoid this (by making the number of COLRs dependent on the bid amount) "it may still be unable to generate enough incentives for high-quality service."

Laffont and Tirole (2000) provide an extended theoretical analysis of reverse auctions, focused principally on the issue of multiple COLRs. They conclude:

> "We are unaware of formal analyses of universal service auctions with endogenous market structure. We have tried to provide a framework within which analysis of such auctions can begin. The first insights thus

> gleaned do not build as strong a case for the introduction of competition as we had expected."[7]

One salient point is that endogenous market structure increases uncertainty for bidders, thereby requiring an extra risk premium in their bids. Laffont and Tiorle also echo the complexities raised by existing infrastructure in high cost areas,

> "Much of the discussion on universal service auctions proceeds as if all competitors were building their network from scratch. This may be a fine assumption for newly settled areas or when substantial network upgradings are contemplated. In practice, however, many high-cost areas are already partly covered by a wire-based incumbent operator able to provide the supported services with its existing technology. While the incumbent operator's network may have been very costly to build, once in place it has a low (short-term) marginal cost. And so facilities-based entrants (e.g., offering wireless services) may find it hard to compete with the incumbent. In our view, more attention should be devoted to this aspect of universal service provision."[8]

In the U.S. environment, the issue is doubly complex since there is existing wireless infrastructure in many high cost areas. The theoretical performance of auctions has not yet been studied under these circumstances. Nor is there much empirical evidence to provide guidance.

<u>Duration</u>

There is a tradeoff between long and short duration of COLR franchises. Short time periods enhance the ability of universal service costs to adjust to changes in technology or changes in service definition. However, this comes at the cost of inhibiting investments that have longer time horizons.

It is notable that cable franchise awards (where competitive bidding is used) are quite long – typically 8-15 years. It is difficult to reject a renewal application upon expiration. Federal law places the burden of proof for failing to renew a cable franchise on the community – they must show that the carrier is either unable to continue providing the

[7] Laffont and Tirole (2000) at pages 254, 260.
[8] Laffont and Tirole (2000) at page 260. This point was also made by Milgrom (1996).

service or will be unable to provide the service that the community requires in the future [Kramer (2003)]. In fact, in the 1980s, only 7 out of 3516 cable refranchising decisions resulted in replacement of the existing franchise owner [Zupan (1989)].

There is a relationship between contract duration and the number of winners. Even with single auction winners, issues arise concerning whether the incumbent winners should have any special treatment in subsequent auctions, or whether there are benefits to opening future auctions to carriers other than the prior winners. Laffont and Tirole (2000, page 261) reach the conclusion that

> "the incumbent may be shut out of the market. The transfer of the incumbent's capital to winning entrants (either through rentals or through an acquisition) may give rise to the usual concerns about the impact of "second sourcing" on the incumbent's incentives to invest in the quality of its network."

Previous work by Laffont and Tirole (1988) explored the case where incumbent's investments are observable (i.e., where they can be acquired by others – an example of unobservable investment is the buildup of knowledge within the human capital of the firm's managers: it seems that most rural incumbent investment is observable, such as the physical capital of the infrastructure). They reach "a relatively pessimistic assessment of the virtues of second-sourcing (or takeover) when substantial investments are at stake." (page 532) This is due to the potential that some of the value of the incumbent's investment may flow to future auction winners. This externality causes the incumbent to under-invest, and calls for future auctions to be stacked in the incumbent's favor. Indeed, this is a rationale behind the burden of proof in cable refranchising that falls on those that do not want a franchise renewed.

Universal Service minimum subsidy auctions in South America have typically used lump-sum payments with 5 year exclusive franchises [ITU (2002)]. The subsidy is paid in stages, according to established milestones (e.g., upon installation of half of the required payphones), but it is not a recurring payment. That is, the subsidy is geared to recover the full cost of the investment (unless the bidder is willing to bid for only partial recovery during the 5 year period). Carriers can decide how much risk they wish to bear by bidding for less than full recovery during the 5 year period. Given that these South American auctions (and new ones proposed in Africa) take place in green-field environments, there is often a business case for ultimate expansion into these unserved areas, so bidders may be willing to accept less than full cost recovery from the subsidy mechanism. It is unclear how relevant these circumstances are to the U.S. rural environment (where many rural areas are not growing).

Sorana (1998) points out that "sufficiency" of USF is not assured by good auction design, and neither is voluntary provision of universal service. He constructs a model to compare reverse auctions with cost-proxy models, finding that auctions may involve lower subsidies than accurate cost proxy models, but his model *assumes* that the funds from the auction are sufficient for the intended purposes. He notes that this is not assured.

Competitive bidding is used in the Essential Air Service program, but with only a 2 year horizon. Airplanes, however, are quite mobile, unlike telecommunications infrastructure. These examples suggest that the time periods would have to be relatively long, if there is to be sufficient incentive to invest in telecommunications infrastructure.

Transition

Existing infrastructure complicates the picture. Suppose the incumbent loses the auction but has investment that was prudently incurred, but has not yet been fully recovered. It is possible that the winning bidder may want to purchase this infrastructure.[9] This creates legal and policy issues, but it also impacts economic efficiency. If regulators establish a precedent for truncating recovery of prudent past investments, then future investment will be affected. It is unlikely many investments will take place with payoff periods longer than the duration of the franchise.

The World Bank (2000, pages 6-26) cites competitive bidding as a feature of a good universality fund, but "As previously discussed, the process is more difficult where an

[9] Although this may entail problems such as those encountered in the Hawaii case discussed above.

incumbent is already providing the designated universal services." The embedded network may provide the incumbent with an advantage bidding against new entrants (as was the case in India and Australia, discussed below), or may force the incumbent to fail to recover its past investments, despite regulatory oversight deeming those investments to be prudent.

Despite these complications, the World Bank does claim that auctions are still possible – they cite transfer of assets to the lowest bidder, subcontracting, joint ventures, etc. as mechanisms that can deal with embedded infrastructure. While such developments can enhance efficiency, there are costs associated with each of these avenues (as demonstrated in the Hawaii case in footnote 6).

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. It is not surprising that the most successful reverse auctions (Chile, Peru, Guatemala, Columbia, and the Dominican Republic) involved previously unserved areas or significant upgrades to the existing infrastructure within these areas [ITU (2004)].

The need to address stranded investment is well-recognized in the area of electricity deregulation. The Congressional Budget Office (1998) reviewed the stranded cost issue, concluding

> "For reasons of fairness and political reality, utilities are likely to be compensated for some or all of their losses. Determining the correct figure for stranded costs, deciding how much of them to compensate, and figuring out how that compensation should be paid are difficult issues, which are slowing progress toward restructuring in many states."

Volumes have been written and disputes continue over measurement and recovery of stranded electric generating costs, but it is an issue faced by all attempts at deregulation.

For example, in Texas, there is a provision for "true-up" charges:

> "These 'true-up' proceedings are designed to provide commission authorization for an electric utility to begin recovery of its costs for power

> plants built to meet customer demand for electricity prior to the start of retail competition, which cannot be recovered in the competitive marketplace. These costs are said to be 'stranded.'" [10]

Reverse auctions potentially render the incumbent's network less valuable (if they lose the bid or forego full cost recovery in order to win the bid). Given that these were prudent investments undertaken precisely to fulfill the COLR, there is a strong case for recovery of these stranded costs. To the extent that new technologies (e.g., wireless) cause this decrease in value, the case for recovery is strengthened (since the investments were prudent at the time they were made, and were often recovered through overly long depreciation schedules). Resolution of this issue is of political, legal, and economic importance (the latter through its affect on future investment incentives).

Eligibility

Bidders must be financially and operationally capable of fulfilling their COLR responsibilities. The FCC has considerable experience with ensuring bidder eligibility, although there have been problems, particularly with small bidders. The goal should be to have enough bidders to ensure a competitive bidding process, while limiting future problems with failure to deliver the required services.

The 1999 Peru auctions illustrate this problem [ITU (2004)]. The winning bid was 20% of the available subsidy, but the winning company then could not meet its targets. The ITU presents this an example of excessively low bidding and points out that most Latin American auctions have attracted bidders without much operational experience, and have failed to attract large international operators or incumbents.

[10] Described at http://www.aep.com/newsroom/resources/docs/TrueUp.pdf#search=%22stranded%20investment%20auctions%22

Summary on Geography, Size, Numbers, and Eligibility

The discussion thus far can be summarized as a spectrum of choices that would govern the intensity of competition for the COLR subsidy. International experience can be placed on a continuum from lack of competition to healthy competition. The Latin American examples [World Bank (2000), ITU (2002), ITU (2004), Intelecon (2005), Scherf (2006)] appear to have had truly competitive bidding in their reverse auctions. Savings of 50% (compared with the maximum potential subsidy level) are commonly cited, but these "savings" are based on comparison with a cost proxy model of unknown accuracy. There is no evidence concerning the relative costs of reverse auctions and other universal service mechanisms in any of these countries. Still, the auctions were administratively feasible and resulted in multiple bidders for the COLR.

The extreme example of a lack of competition for the market is India [Malik and Silva (2005), Noll and Wallsten (2005)]. Reverse auctions were held for infrastructure upgrades to a number of rural areas. The incumbent, BSNL, won almost all of the bids and bid the maximum subsidy available in each case. Critics of the Indian auction point out that the eligibility rules essentially predetermined this outcome. Only providers with current infrastructure in these regions could bid; technologies were limited to wireline and fixed wireless, and bidders were required to install infrastructure to reach everyone within these regions but without any wholesale regulation of the incumbent to provide for interconnection, unbundling, or resale. As a result, in 19 of the 20 areas, there was only a single bidder (BSNL) and they bid the maximum subsidy available. The rules were designed to promote neither entry nor efficiency.

The other end of the spectrum can be envisioned as the U.S. While competitive bidding has not been utilized, support on a predetermined per line basis (i.e., without uniform coverage requirements) has been offered to multiple ETCs. The fact that many rural areas have witnessed multiple carriers willing to accept the offered support level, suggests that there would be multiple bidders if the auction were conducted on a per-line subsidy level, and without requirements to serve everybody within the same service areas with the same quality characteristics. In this sense, the current rules for the high cost fund are designed to promote entry, but not efficiency.[11]

Australia provides an interesting data point [Department of Communications, Information Technology and the Arts, Australia (2004), ITU (2006)]. Two pilot regions were selected for reverse auctions. These included the most remote 80% of Australia, and $150 million was available for introducing unlimited local calling with these areas. The goal was to find “a simpler way of determining a reasonable level of subsidy de-linked from a calculation of costs.”[12] The auction was designed for a single winner. No competitive tenders were received. In fact, since 1991, carriers other than the incumbent (Telstra) have been free to apply to be COLR, but none have applied. The ITU report concluded “However, while the experiences with designating universal service providers on the basis of competitive tendering in some countries has been encouraging (e.g., Chile and Peru), there has been some less positive experience in Australia.”

Australian regulators did follow-up analysis to determine the causes for lack of competitive interest. Major factors cited were: difficulty competing with Telstra, meeting the obligation to serve all customers, and difficulty identifying other revenue opportunities to help support COLR responsibilities. It is also possible that the investment climate at the time of the pilots was unfavorable. The regulator concluded that higher subsidies might induce entry, but they were not worth the significant increase in costs. They recommended preserving the reverse auction option, but not continuing it at this time. One benefit they cite from the pilots is the determination that Telstra was not being overcompensated for COLR at current subsidy levels.

Another example is provided by electricity deregulation in Maine [Maine Public Utilities Commission (2002)]. Maine claims to have the most robust retail competition for

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[11] Parties differ in the source of inefficiency that they see, but virtually all agree it is inefficient. Some parties point to the support of multiple carriers based on incumbent costs as leading to unnecessary duplication of infrastructure and unnecessary support for CETCs. Others believe the waste is caused by the cost plus nature of determining support levels. In any case, nobody claims the current environment is particularly efficient.

[12] ITU (2006) at page 14.

electricity customers in the nation. Significant competition (more than half of the market) has developed for large customers. Virtually no retail competition has developed for small residential and business customers (with the single of exception of a small area in Northern Maine, which the Commission discounts for a number of region-specific reasons).

State legislation eliminated the obligation to serve, with “standard offer service” available for those who could not find a suitable competitive supplier. The Commission was instructed to strive for at least 3 suppliers of standard offer service in every areas, “but only if multiple suppliers would not cause rates to be significantly higher.”

Early attempts to solicit competitive bids for standard offer service did not result in retail suppliers for all customer classes. Later attempts were somewhat more successful. Still, the Commission notes that “there is virtually no retail competition for residential and small commercial customers, either in Maine or elsewhere.” Their research concludes that prices should not be increased in the hope of attracting suppliers (consumer input was strongly against paying higher prices in exchange for increased competition). Standard offer service does extend some of the benefits of competition to individual small customers through the aggregation inherent in a standard offer available throughout the state. In the telecommunications context, this is akin to requiring geographical averaging of retail prices across broad geographic regions. This is closer to the old system of implicit support in which lower cost customers pay higher prices in order to support lower prices for the high cost customers. Such a system is not feasible in a truly competitive environment.

What these examples reveal is that regulators have wide discretion in determining the extent of competition for the market that results from a reverse auction. They can design auctions that preclude entry (such as in India) or they can promote entry, regardless of attendant inefficiencies (the U.S.). It appears to be feasible to get reasonable entry and efficiency in a green-field environment. This is what the Latin American examples show. It is more elusive in environments with existing providers.

The political economy of regulatory policy must be considered when evaluating reverse auctions. In the absence of strong policy direction, it will be difficult to design a reverse auction that does not either deny CETCs their current support or deny rural ILECs recovery of their existing investments. The result could well be a *managed* competitive reverse auction, with few of the benefits that reverse auctions potentially offer.

To avoid a managed outcome, regulators must set a clear goal in terms of how much entry they want, and what efficiency cost they are willing to bear. A concrete example is the choice of serving area. Very small geographical areas can promote entry (per-subscriber subsidy bids is the extreme example), but jeopardize the ability to realize cost complementarities and at the risk of unnecessary duplication of support. The trouble is that regulators must know a great deal about what is most efficient before they can design the reverse auction (for example, they must know how many COLRs are efficient, and which technologies are most efficient, and how to define universal service over the length of the franchise contract). It is the absence of such knowledge that is one of the major benefits of using reverse auctions to begin with – the market is supposed to provide these answers.

It is the existence of current infrastructures that complicates this design. Rules cannot be chosen that will satisfy all interests, so the regulator is required to know what the efficient outcome looks like before the auction can be designed. In a green-field environment, by definition the COLR that is being auctioned is one that the market has not found profitable – hence, there are fewer interests at stake in the creation of the reverse auction mechanism. The evidence supports this conclusion: green-field reverse auctions have been fairly successful, while there are no clear examples of competitive bidding in more developed settings.

Auction Mechanics

There are a number of subsidiary design questions that deal with the mechanics of how a reverse auction would actually operate.

Type of Bidding

Most reverse auctions have utilized simple one-shot sealed auctions. Most spectrum auction design has been multiple-round, open, combinatorial auctions. The underlying issues concern the importance of cost/value complementarities, bidder risks, and opportunities for collusion. These have been extensively studied in the general auction literature. A few particular considerations apply in a universal service setting. Cost complementarities are potentially important, so the auction must either be combinatorial or involve fairly large geographical areas. Both pose problems. In addition, in an environment in which there are existing infrastructure providers, sealed bidding would appear to impede much necessary negotiation about joint bids, outsourcing arrangements, etc. Some research suggests that sealed bidding may actually facilitate collusion [(Luander and Nilsson (2004)]. On balance, it would appear that combinatorial bidding is more appropriate in the U.S. environment, but the feasibility and complexity of the required auction is in some dispute.

Determination of Winner(s)

It is clear that more than price must be considered in determining winning bids. None of the international examples (or domestic examples from other industries) entail a price-only selection. What the literature does say, however, is that the rules for determining winners must be specified precisely and unambiguously in advance [ITU (2002), World Bank (2000)]. That is, the process must avoid subjectivity. This is the same problem encountered in many procurement contracts – the rules must be clear and objective.

Current costs, under the U.S. high cost fund, are controlled via a number of oversight mechanisms, the lack of full cost recovery (high cost funding only supports a percentage of the costs above the national average), and competitive pressure from other services (e.g., VOIP, wireless usage substituting for wireline usage, etc.). The high cost fund, itself, is not designed to necessarily minimize costs. It does not contain cost-reducing incentives as strong as would an auction mechanism. While this can lead to inefficiency in terms of costs, it also permits more flexibility in terms of services offered (e.g., broadband speeds). This flexibility has value – particularly, if regulators do not have sufficient information to project universal service definitions into the future.

Post-award flexibility

Reverse auctions in developing countries have relied on additional service revenues to reduce the cost of public subsidies. Permitting COLRs to market value-added services, in addition to the contracted COLR, can result in their bids being less than the cost of providing solely the COLR. Some countries have specifically permitted retail prices in rural areas to exceed those in urban areas by predetermined amounts. In some auctions (e.g., the Essential Air Service Program) there are no restrictions on post-award pricing at all.

It is clear that bidders will bid lower in a reverse auction to the degree that they have post-award flexibility. However, flexibility endangers the concept of universal service. Once again, there is a tradeoff. The more flexibility that is provided, the lower the expected subsidy required, but the less assurance there is that universal service objectives will be met.

It is also worth noting that the “successful” Latin American reverse auctions rely, in part, on asymmetric interconnection fees to support rural providers. For example, the largest Chilean rural operator gets 60% of its total revenues from such charges; Columbia has recently introduced asymmetric fees, and Peru plans to [ITU (2004)]. They also permit higher rural prices and lower license fees in rural areas. Uganda has recently introduced a reverse auction for service to 154 communities that no operators were willing to serve, and part of the mechanism was permitting voice service rates in rural areas to be up to 50% above rates in Kampala (as well as higher termination fees in rural areas) [Intelecon (2005)].

Monitoring and Enforcement

Performance under the franchise award must be monitored. Most countries have specific penalties for failure of winning bidders to meet their performance targets. Removal of a COLR, either through failure to perform adequately or through carrier bankruptcy, poses particular problems for reverse auctions for universal service. How is service to be guaranteed for rural customers in the event that their winning bidder does not (or is unable to) meet its obligations? Scherf (2006) cites this as a weakness in the build-out requirements that accompany licenses in many developing countries: it is cheaper to pay the penalties than fulfill the requirements.

Bankruptcy risks are somewhat mitigated under the current USF by the historic regulatory compact in which rural ILECs have been able to recover their past investments. When cost recovery becomes more uncertain, and when awards are based on low subsidy bids, these risks increase.

Scherf (2006) says that "the regulatory environment has to be credible and sustainable to the eyes of investors," (page 12) and discusses issues associated with enforcement mechanisms, particularly in developing countries. He cites problems in Peru, where some very low bids had been submitted, with subsequent renegotiation under the threat of carrier bankruptcy. He also mentions Uganda, where the regulator has not even asked for the performance data it would need to monitor performance. These concerns are more pronounced in countries with less developed political institutions, but they also arise in the U.S. In addition, we have the issue of the appropriate jurisdictional responsibility for monitoring and enforcement.

Conclusions

In a definitive work on the theory and practice of auctions, Klemperer (2004) concludes

> "In conclusion, the most important features of an auction are its robustness against collusion and its attractiveness to potential bidders. Failure to attend to these issues can lead to disaster. And anyone setting up an

> auction would be foolish to blindly follow past successful designs: auction design is *not* "one size fits all." …In the practical design of auctions, local circumstances matter and the devil is in the details."[13]

Auctions have a number of desirable properties. The ITU states that

> "The use of well-designed competitive tenders can (in certain circumstances) help to generate incentives to contain costs, innovate, and reveal the true cost of delivering universal service (thus helping to minimize the subsidy required."[14]

We have seen that auctions can be feasible and effective for provision of universal service in unserved areas, if they are properly designed. Their success depends on an appropriate definition of the objective for universal service. Reverse auctions have been most successful where the objective can be clearly defined and does not require long-range forecasting: e.g., provide payphone service in specified rural villages (Chile, Peru, Columbia, Guatemala).

Reverse auctions in the U.S. are a different matter. There are multiple existing infrastructures, utilizing different technologies, providing different services, and with different serving areas. Universal service is an evolving set of service requirements that is difficult to forecast. The performance of auctions in this setting is theoretically and empirically untested. The limited evidence suggests that these are difficult problems.

Auction design will need to address competition within the market as well as for the market, potentially large cost complementarities between high cost areas as well as between high cost and low cost areas, and provide for investment incentives with significant sunk costs and technological uncertainty.

Much of the theoretical appeal of reverse auctions is dissipated under the actual conditions under which universal service will be provided. Regulators will need more foresight than they would like. They will need to specify universal service requirements far enough into the future to allow for the required investment incentives. They will need

[13] Klemperer (2004) at page 122.
[14] ITU (2006) at page 25.

to know more about the most efficient market structure (single COLR, multiple, which technology, etc.) than they would like. Auctions are supposed to permit the market to make these determinations, not regulators. But, this benefit can be illusive. Can the market pick the technology if the auction design cannot put different technological platforms on an equal footing?

One clear beneficiary of a reverse auction system is the economics profession. Their expertise lies in auction design and the devilish details contain plenty of interesting work. How consumers of universal service and providers will fare, is less clear.

The Joint Board Discussion Proposal

The Discussion Proposal (The *Proposal*) provided with the Joint Board Public Notice provides a good illustration of the difficulties of applying reverse auctions in a non-greenfield environment. The *Proposal* does not appear to be derived from any theoretical efficiency properties, nor does it follow the reverse auctions that have been implemented elsewhere. Instead, it seems to be driven by the need to accommodate the fact that we are currently supporting multiple networks using multiple technologies in rural areas.

Separate support for broadband and mobility services in rural areas for 10 year periods, takes a particularly static view of technology. It provides support to two sets of services, neither of which are included in the current definition of universal service – mobility and broadband. The *Proposal* does attempt to address the transition issue by offering an initial phase-in whereby rural ILECs can elect to receive support (at current levels plus inflation) for the first 10 year period for broadband service. This is recognition that past prudently incurred investments need to be recovered.

But, what happens after 10 years? What will govern future network investment? Here, the *Proposal* is silent on the details that will ultimately determine future universal service in rural America. The *Proposal* says that ETCs would be required to relinquish essential facilities at “fair market value” at the end of the contract term. After 10 years of trying to determine “fair market value” for unbundled network elements under the Telecommunications Act of 1996, the task of determining “fair market value” for essential rural network facilities will be daunting.

The *Proposal* defines geographical coverage as 90% or more of the households, without specifying how ETCs would acquire the services needed to reach the remainder of the households (echoing some of the problems in the Australian and Indian reverse auctions discussed above). Basic geographical units would be counties, with the exception of rural ILECs, and counties could be bid on in bundles or separately. This does not address the complexity of the combinatorial auction that would be required (the U.S. Census Bureau lists 3141 counties or county-equivalent administrative units), nor does it address the issue of whether the mobility support would extend to all counties, including those served by nonrural ILECs. There is the potential for a significant growth in the fund, if it includes currently unsupported areas.

Upon review of the past “successes” with reverse auctions, they appear to deliver tangible benefits when used to support delivery of services where current infrastructure is not in place. While many rural areas see significant competition among wireless carriers, there is still a need for more extensive build-out of rural networks. The mobility USF could be aimed at this goal, by tying support to specific infrastructure targets.

The *Proposal* illustrates the complexity of applying reverse auctions in the existing mixed technology infrastructure of the United States. The devil is in the details, but the details are not in the *Proposal*.

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