7

FRANCHISE BIDDING WITH VICKREY AUCTIONS: HOW TO REGULATE UTILITIES?

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"What is *Truth* said jesting Pilate;& would not stay for an answer?" Francis Bacon, *Of Truth*, c 15

At first sight, Demsetz's (1968) proposal to regulate public utilities by means of franchise bidding (FB) is exceedingly attractive to economists. The idea is to allow bidding for the right to be the sole supplier of a product. In Demsetz's example, the monopoly right would be awarded to the bidder that offered to charge the lowest price. Ex ante competition is thus employed to prevent ex post monopolistic behavior. Despite its apparent attractiveness on efficiency grounds, FB was soon criticized by a number of economists, notably Williamson (1976). Moreover, for traditional public utilities, it has certainly not been perceived as a breakthrough or alternative to commission regulation, although it has made some progress in CATV, where it became ubiquitous. Thus, despite the fact that FB has not caught on for traditional public utilities, it still prima facie offers a number of advantages from an efficiency point of view over traditional regulation.[1]

The purpose of this paper is to take a fresh look at FB for public utilities. Despite interest, advocacy, and criticism of FB in the quarter century since Demsetz' proposal, this paper is, to our knowledge, the first attempt to model the bidding that would occur if franchises were put up for bid in terms of the price to be charged to customers. Both the incentives facing bidders and the impact of bidding upon market performance can only be analyzed seriously by modeling the bidding process.

Accordingly, this paper will examine the role of auction theory, including second-price auctions, in applying franchising to the regulation of public utilities. Section 1 will provide some brief background, a statement of the problem and sketch of the approach proposed. Section 2 will develop a second-price auction model for franchising public utilities. Section 3 will sketch the theory and illustrate by means of a numerical example. Section 4 will be by way of conclusion and implications for future research and policy.

1. Franchise Bidding and Utilities: Background and Statement of the Problem

The attraction of Demsetz' FB proposal was its apparent ability to promote economic efficiency. In the presence of everywhere-decreasing costs, Demsetz' proposal would result in price approaching average cost.[2] While it would not lead to the allocatively efficient solution of marginal cost pricing, it did have the advantage of providing incentives for internal efficiency or X-efficiency. As such, it attained *a similar* average pricing result as rate-of-return (ROR) regulation. However, ROR regulation, which sets price based primarily upon cost of service, provides few incentives for cost economy and, therefore, X-efficiency. ROR regulation's poor incentives for cost economy have been employed recently by advocates of price-cap regulation. FB would have the additional efficiency benefit over ROR of attenuating, if not eliminating, incentives for cross subsidy. The superiority of FB on efficiency grounds has been disputed by economists, notably Williamson (1976) and Goldberg (1976), using the transactions-costs arguments of the New Institutional Economics. The provision of utility services involves a long term contract which, because of its complexity, cannot be fully specified ex ante. Goldberg argued that a regulatory commission provided a potentially efficient device for administering such a complex contract over time.

If FB is to be effective as a device to promote ex ante efficiency, it would seem to be necessary to allow periodic re-bidding. However, given the transaction-specific nature of much utility investment, there would be potentially high transactions costs involved in transferring the sunk plant, in the event that an entrant provided the winning bid. Williamson argued, by means of a case study, that such costs are likely, in practice, to be major.

Indeed, the almost complete absence of FB as a regulatory governance structure for public utilities provides strong support for the Williamson critique. According to Williamson, valuation of the transaction-specific investment (TSI) in the event of a change of ownership would seem to present a major problem. When combined with the possibility of "capture" by incumbents, FB's failure to catch on for utilities is not surprising. However, FB's ubiquity in CATV and subsequent detailed study by economists at least raised the question as to whether FB might be applied to utilities.

The current interest in alternatives to ROR regulation for public utilities and actual application of price-cap regulation to AT&T and local exchange carriers (LECs) provide additional reasons for another look at FB for utilities. Indeed, as argued by Crew and Zupan (1990), given the problems of applying price caps to industries such as the LECs where cross subsidies are a significant problem, FB may warrant serious consideration as an alternative to ROR or price-cap regulation.

In taking another look at FB with applications to utilities, we are going to consider especially the problem raised by Williamson of transfer of assets in the event of an incumbent's being displaced by an entrant. In such cases, the transfer of assets, according to Williamson (1976), is likely to be exceedingly high in transactions costs. As many of the assets of utilities are literally sunk, they have little or no value in an alternative use. Unlike trucks, automobiles, and aircraft, outside plant, e.g., underground and overhead cables and even telephone central offices and large power plants, have very low value in alternative uses. Thus, a displaced incumbent's bargaining position is likely to be very weak, as he does not have the alternative of taking his investment and selling or using it elsewhere. Thus, he may face potential hold-up by the entrant, who may confidently offer compensation below the value in its existing use. While on the face of it the hold-up potential also applies to the incumbent, in practice this is not the case. The incumbent cannot make a credible threat to take out his plant, given the disruption to service that it will cause. The incumbent's primary recourse would be his constitutional right not to have his property taken, but this kind of litigation is clearly a process likely to be high in transactions costs, providing further support for Williamson's argument.[3]

In view of the potential problems of high transactions costs in the event of displacement of an incumbent and therefore the attenuation of incentives for efficiency, this paper will explore the possibilities of developing a scheme of FB that offers economy in transactions costs, as well as the other efficiency benefits claimed by the supporters of FB.

The approach builds upon the recent literature on auctions (McAfee and McMillan 1987). It takes a different approach from most of the literature on FB, in that it concentrates on the bidding process in much more detail. In addition, it requires a fairly complicated auction procedure. Such complexity is necessary to address the problems involved. The objectives of the exercise are two fold. First, the service should be supplied as efficiently as possible, which implies a low price. For purposes of this initial analysis, we abstract from quality issues. We assume that all bidders offer the same (pre-specified) level of service, and that achieving that level of service is not a problem over the duration of the franchise. Secondly, the assets should be transferred for their value in that use. The idea is to give both incumbents and entrants an incentive to reveal both their willingness to accept payment for service provision and their true valuation of the assets.

Designing an incentive mechanism to reveal asset valuation is a non-trivial problem. The incumbent has the obvious incentive to overstate value of the TSI, while entrants have the reverse incentive. An ordinary (or first-price), sealed-bid auction is not going to provide an incentive to reveal this kind of information.

A Vickrey or second-price, sealed-bid auction offers hope of a better incentive structure (Vickrey 1961). Under a second-price auction, the winner is awarded the price bid by the next lowest bidder, i.e., the price bid by the runner-up. In contrast to a first-price auction, his bid determines not what he pays (or is paid) but only whether he wins.

To understand the promise of the second-price auction, initially consider a situation paralleling Vickrey's analysis, in which bidders face no issue of transfer of transaction-specific assets and are certain of the costs of supplying the service. A bidder's goal is to win the auction whenever the lowest rival bid is above the lowest price at which he is prepared to perform the service and to lose the auction whenever the lowest rival bid is below this reservation price; the bidder accomplishes this by bidding "truthfully" his reservation price. For example, suppose bidder 1 is deciding whether to bid \$50 or \$55. If the lowest rival bid is below \$50, both of his choices lose. If the lowest bid is above \$55, it also does not matter which bid is made, as both win and are paid the same amount: the lowest rival bid. Thus, it only matters whether \$50 or \$55 is bid if the lowest rival bid comes in between. In this case, for bidder 1 to bid above his reservation price is mistaken: if he bids \$55 when he is willing to accept \$50, then a rival has won and will be paid \$55. Similarly, in the only case that matters, bidding below his reservation price is mistaken: if he bids \$50 when he did not want to be paid less than \$55, then the only impact is that he ends up winning to lose: to be paid between \$50 and \$55 when that is where the lowest rival bid falls.

Though for simplicity of exposition, we maintain Vickrey's assumption that no bidder faces any uncertainty over costs of service provision, this is clearly heroic. Auction models have shown quite generally, however, that in a second-price auction, a bidder's best response to rivals' strategies is to bid that price at which he is indifferent between winning and losing. (Milgrom 1981; Levin and Harstad 1986; Bikhchandani and Riley 1991).

This principle will be applied below in a newly complex setting, as the auction will have to determine both the price at which output is sold and the compensation for transaction-specific assets, in the event the incumbent loses the auction. Thus, a bid consists of an ordered pair: an output price, and an asset compensation. The inverse relation between the two will be constrained by the auction rules. Hence, a bidder will know that if his bid is lowest, the lowest rival bid will determine both the output price and the asset compensation he will be committed to pay if he replaces an incumbent. He does not simply bid the lowest output price at which he is willing to provide service, as the lower his bid, the higher his indicated willingness-to-pay for the transaction-specific assets. Nonetheless, his bid will be determined in equilibrium by his indifference between winning and losing.

We limit our scope in this paper to a presentation of the proposed auction, an illustrative numerical example of equilibrium outcomes, and a brief concluding discussion of the approach's potential benefits and shortfalls.

The proposed scheme is illustrated in figure 7.1. A bidder is required to offer a two-dimensional bid consisting of valuation of the transaction-specific assets, t, and the price at which he is prepared to provide service. The role of the regulator is to organize the auction. He provides the bidders with a feasible bid locus which consists of the pairs (t,b), where b is the price at which the bidder is prepared to offer service. In figure 7.1, the entrant, e, outbids the incumbent, i. He offers both a lower price at which he is prepared to provide service and a higher valuation of the transactions-specific investment. Notice that because the auction is second-price, the entrant charges the price b_i ($> b_e$), and the incumbent receives t_e, while

Figure 7.1

the entrant only pays t_i. This creates a problem of how to fund the deficit $t_e - t_i$. In addition, what happens if the regulator offers a different functional form for the bid function, for example, the line parallel to it? These issues are examined later in the paper by means of an illustrative numerical example of equilibrium outcomes. We will argue that the robustness of the results depend on a commitment by the regulator not to change the rules of the game.

2. A Second-Price Auction Model and a Benchmark Equilibrium

We ignore any problems which are specific to the initial bidding for a franchise, to focus on contract renewal problems. While the qualitative results could be extended to several entrants, for simplicity, we illustrate our franchise bidding auction in the case where bidder **1** is the incumbent and bidder **2** is the only rival bidder (the entrant). A more realistic treatment would make the number of entrants an endogenous variable, responding to the expected profitability of competing for the franchise. This would not be a particularly difficult alteration of the model, following techniques in Harstad (1990; 1991), but it would distract from the principal issues which we wish to analyze.

Both bidders submit sealed bids, with the lowest bidder becoming the franchisee, or provider, for the next contract period, and the incumbent in the next auction. If more than one bidder ties for lowest bid, a new franchisee is chosen randomly, equiprobably, among those tied; ties will be a zero probability event in equilibrium. All aspects of the rules are assumed to be common knowledge among the bidders.

As treatment of transaction-specific assets introduces several essential complications, we seek to reduce complications that are not closely related. Thus, we assume both bidders are risk-neutral (symmetric risk aversion would likely only complicate, without qualitative changes). The winning (lowest) bidder is committed to supply output to meet demand at a price equal to the second-lowest bid. If the second-lowest bid is p, then p will be the present price for the contract period. The demand at price p is known to be $Q = A - p$. The key simplification in this demand specification is to assume that bidders have no private information about demand; in particular, the incumbent is not at an informational advantage in estimating demand to prevail over the contract period. If entrants are generally expected to be incumbents in other geographic markets, this may not be unreasonable. Given informational symmetry, stochastic demand would burden notation without serious impact on conclusions. Similarly, allowing for nonlinear demand would introduce only (significant) notational burdens. Finally, given known linear demand, a slope of –1 is simply a convenient normalization of physical units of output.

With demand known, informational asymmetry will be placed on the cost side of the market. Ideally, we would allow for some cost uncertainties that would be common to any bidder should he become the franchisee—for example, imperfectly foreseen labor market tightness or looseness which affects the wages that must be paid—and also cost uncertainties that are bidder-specific and form the basis of potential efficiency gains through changing the franchisee. An example of the latter might be the prospect of innovations in managing billing practices, plant maintenance, or quality control, and the uncertainty over how readily and effectively a large firm can introduce such innovations in each particular market where it is a franchisee.

To keep matters relatively simple, we assume constant marginal costs, given the transaction-specific assets in place. We presume that, in equilibrium, all entrants can anticipate the incentives facing the incumbent and accordingly can anticipate the condition of the transaction-specific assets. (Again, this becomes less heroic to the extent that entrants are themselves incumbents in other geographic markets where the incumbent faces corresponding incentives.) Our numerical example further simplifies to neglect the cost uncertainties in the last paragraph, presuming that bidder $i = 1,2$ has a marginal cost level X_i which is an independent draw from the uniform distribution on [0,1]. Distributional information is common knowledge, but each bidder privately observes his own cost.

As mentioned, there are transaction-specific assets in place which must be transferred to the winning bidder if the incumbent loses the auction. The auction rules envisioned here will specify a precise relationship between the bids and the transfer price of these assets. It is clearly the case that, if the winner is able to sell output to customers without losses, at a lower price, then the transaction-specific assets must be worth more than they would be at a higher break-even price. Accordingly, the regulator, in setting up the auction rules, announces a decreasing function $t(b)$ which can be thought of as an estimate of the transfer value of the transaction-specific assets, under the assumption of willingness to supply output at price b. We comment below about the impact on the procedure of a biased specification of $t(b)$; for the moment, we treat this transfer pricing function as the regulator's best estimate, and temporarily regard as unimportant how good the regulator is at conditional estimation.

The transfer pricing function $t(b)$ is common knowledge among bidders prior to selecting bids. Thus, each bidder knows that, if he bids some amount b, he is simultaneously indicating a willingness to supply output at price b (we will be more precise about how this willingness to supply relates to second-price auction rules momentarily) and a willingness to evaluate the transaction-specific assets at a transfer price $t(b)$. Hence, the key step to handling difficulties in negotiation over transfer of these assets to a new incumbent is automatically included in the auction procedure: it generates pricing both of output and asset transfer; in bidding, both the winning entrant and the incumbent indicate evaluations of the transaction-specific assets. The idea that a single auction could generate a vector of prices is, to our knowledge, due to Michael Rothkopf, and suggested in Rothkopf and Engelbrecht-Wiggans (1989). We believe this paper is the first attempt at an equilibrium analysis of such an auction.

The benchmark set of rules which we emphasize in our analysis will treat both the output price and the transfer price under full second-price rules. That is, the lowest bidder becomes the new franchisee, committed to meet output demand at a price p equal to the second-lowest bid. If this lowest bidder is an entrant, he pays an amount equal to $t(p)$ for transfer of the transaction-specific assets. Thus, an entrant knows that, barring a tie for lowest bid, his bid will not directly determine either output price or his asset transfer payment should he win; both of these prices will be determined by rivals' bids. The incumbent, should he lose, will receive an amount equal to $t(b)$, where b is the winning entrant's bid, in compensation for the transaction-specific assets. The incentives generated correspond to the entrant's incentives: the incumbent's bid does not directly affect either the output price should he remain as franchisee, or the transfer compensation should he lose, as both are based on rivals' bids. For all bidders, their bid directly determines only whether they win or lose, and only via this effect does it influence the terms of trade they face.

This benchmark set of rules generates a budgetary deficit to the regulator in the event that an entrant wins outright (i.e., does not tie). If so, the winning bid b is necessarily lower than p. Since $t(\cdot)$ is a decreasing function, $t(p)$, the amount paid for the assets by the winner, is less than $t(b)$, the compensation received by the losing incumbent. We comment below on alternatives for dealing with this deficit, including alternative procedures which back off from second-price rules in one way or another, and eliminate the deficit. Temporarily, we assume the deficit is not a problem for the regulator.

We proceed to characterize a symmetric equilibrium for this auction under benchmark rules. To be honest, we were quite surprised to discover a symmetric equilibrium, as incumbent and the entrant would seem to face quite asymmetric situations. Nonetheless, the benchmark second-price auction does have a symmetric equilibrium. Asymmetric equilibria may also exist, but we have been unable to characterize any and would view them as less plausible in the presence of a symmetric equilibrium. (Equilibrium per se is of course a questionable assumption, especially if the bidders were to find this two-dimensional auction novel, but we have no sensible alternative to an equilibrium behavioral assumption.)

Suppose an indivisible asset is sold by second-price auction. Consider, for each bidder, the mathematical function which yields his conditional expectation of asset value under the assumption that this bidder's private estimate of asset value is tied for highest estimate. (A tie is a zero probability event, but may nonetheless be assumed, and the resulting function is well-defined.) If this is the same function for every bidder, then it is a symmetric equilibrium bid function (Matthews 1977; Milgrom 1981; Milgrom and Weber 1982). The proof that it is the unique symmetric equilibrium, in Levin and Harstad (1986), also offers the best explanation as to why it is an equilibrium. In essence, if a bidder were to tie for winner, equilibrium requires that he be indifferent between having the tie broken in his favor, or against him (otherwise, he would wish to vary his bid slightly to avoid the tie). Had his bid matched the expected asset value, given a tie, he would be indifferent. If he loses, he does not regret losing: some rival observed a higher asset value estimate and outbid him; to win, he would have had to pay the amount the winner bid, which was the expected asset value, assuming that two estimates were as high as this rival observed; the asset is not worth that much. If he wins, the price he pays is what the asset would be worth were the two highest estimates equal to the highest rival estimate; since the winner's estimate is higher, winning yields positive expected profit, and with it no regret.

In general, results for auctions where bidders compete to buy have natural, complete counterparts for auctions where bidders compete to supply. In this case, it is a symmetric equilibrium for each bidder to bid the price at which he would be indifferent between winning and losing, should he tie (and assuming this is the same mathematical function of private information for all bidders). The fact that the bid also determines a transfer price leads bidders to alter the price at which they are indifferent between winning and losing, but does not alter the basic equilibrium analysis.

We first specify when the entrant will be indifferent between winning and losing and follow by showing that the same description applies to the incumbent. Denote the entrant i, and let him observe the cost estimate $X_i = x$. Let Y be his rival's cost, a random variable. As we are postulating a symmetric equilibrium in which lower cost estimates lead to lower bids, the event in which i ties for winning bidder is $\{Y = x\}$. If this tie were to be broken (by coin flip) against the entrant, his resulting profit would be 0: no franchisee revenues, no operating costs, no transfer payment. So indifference over how a tie is broken requires that i's expected profit when the tie is broken in his favor also be 0.

If he wins, expected net revenue as franchisee over the contract period is

$$[A - b^*(x)]\,[b^*(x) - x]$$

Here, the first term in brackets is output, and the second is profit per unit. To calculate expected profit, expected net revenue must first be reduced by the payment for transfer of transaction-specific assets, $t(b^*(Y))$, and then augmented by the discounted expected benefit of being the incumbent at the time of the next auction, denoted Z. This incumbency benefit at re-auction is equal to: the equilibrium probability that the incumbent loses, times the discounted expectation of the transfer payment for transaction-specific assets at that time, S; plus the equilibrium probability that the incumbent wins, times the discounted expected profitability of being an incumbent during the second upcoming contract period. Note that the presumption of a tie for winning in this auction still entails estimating Z without assuming a tie upon re-auction. Also, realize that Z is formulated envisioning dynamic consistency on the part of the regulator: the same $t(b)$ function is assumed to be part of the rules at re-auction. The critical part of dynamic consistency is anonymity: if the regulator does not impose the same $t(b)$ function at re-auction, at least the compensation function chosen then must not depend on the identity of the incumbent; otherwise, the symmetry sought will be destroyed. With two bidders, and discount factor r[4],

$$Z = \left(\frac{1}{2}\right)\frac{Z}{r} + \left(\frac{1}{2}\right)\frac{S}{r},$$

so $2rZ = Z + S$, so $Z = gS$, where $g = 1/(2r - 1)$. Now

$$S = \int_0^1 t[b^*(z)]\,(1 - z)\,dz,$$

for the expected compensation if the incumbent loses in the next auction. We will further simplify by assuming a linear compensation schedule: $t(b) = h - sb$.

Combining, the equation defining indifference for entrant i as to how a tie is broken is

$$E\{[A - b^*(Y)]\,[b^*(Y) - x] - sb^*(Y) \mid X_i = Y = x\} - h$$
$$+ g[h - s\int_0^1 b^*(z)\,(1 - z)\,dz] = 0. \tag{7.1}$$

This equation serves to define implicitly the function $b^*(x)$.

Now switch perspectives to the incumbent, letting $X_1 = x$ be the incumbent's cost estimate, and Y be the lowest of entrants' cost estimates. If the incumbent wins, he calculates expected net revenue in precisely the same fashion, and adds Z to determine the expected profitability of having a tie broken in his favor. If it is broken against him, given the tied assumption $Y = x$, the incumbent's profitability of losing is $t(b^*(x))$, the compensation for the transaction-specific assets. (Of course, the incumbent gives up ownership of these assets, but that factor is subsumed in Z.) Thus, the equation defining indifference for the incumbent as to how a tie is broken is obtained by adding $h - sb^*(y)$ to both sides of the entrant's indifference equation above, as the incumbent does not pay the compensation if he wins, but does receive it if he loses.

Next, we obtain a numerical approximation to the bid function characterized as an equilibrium in (7.1). It solves the differential equation

$$b^*(x) - A + b^{*\prime}(x)[A + s + x - 2b^*(x)] = 0, \qquad (7.2)$$

obtained by differentiating (7.1). This is an exact differential equation. A solution is

$$b^*(x) = \frac{1}{2}\,[x + A + s \pm \sqrt{A^2 + 2As + s^2 - 2Ax + x^2}\,] + k, \qquad (7.3)$$

where k must be set to satisfy (7.1), in lieu of an initial condition.

3. A Numerical Example

We set $g = 7/4$, which is an interest rate of just under 5%, for a contract period of 5 years. For many sets of parameters, (7.2) yields a bid function which is very close to linear on [0,1], so let us work with a linear approximation. Setting $A = 24$, and $s = 2$, the slope of (7.2) is 0.076923 at $x = 0$, and rises slowly, and more rapidly as x approaches 1, finally reaching 0.082662. The unweighted average of the slope of (7.2) at points in [0,1] which are a multiple of 0.01 is 0.079354. So we will use $b^*(x) = 0.079354x + k$ as an approximate equilibrium bid function. The initial condition for $h = 2.34838$ is satisfied at $k = 0.25$ to an acceptable approximation.

Thus, if either the incumbent or the entrant adopts the bid function approximated by $b^*(x) = 0.079354x + 0.25$, this is the best response for the other bidder. For both to bid it forms a symmetric equilibrium. (Note that the unusual nature of the initial condition prevents a guarantee that the equilibrium so found is the unique symmetric equilibrium.)

It deserves mention that the asset compensation function chosen, $t(b) = 2.34838 - 2b$, was not derived from any underlying production technology to correspond to the marginal productivity of the transaction-specific assets. In this sense, misspecification of the $t(b)$ function may well have been imitated by the choices made in this exercise. Equilibrium outcomes are qualitatively unaffected by such misspecifications: the resulting behavior is still symmetric, with the incumbent retaining the franchise half the time. Linearity of the function was chose for simplicity, as was setting $s = 2$. Higher values of s lead to steeper bid functions; the h parameter affects only the intercept of the bid function, as it does not appear in the differential equation above.

Perhaps the most important property of this equilibrium is that it is allocatively efficient: because both bidders use the same increasing function of cost to determine their bids, the entrant will replace the incumbent as franchisee if and only if the entrant has a cost advantage. The entrant wins half the time. Beyond the sophist argument that incumbency per se lends incumbents efficiency advantages, we know of no alternative method of natural monopoly regulation that can yield a similar efficiency advantage.

The efficient outcome obtained in this example does not depend upon a single entrant, or upon the particular simplistic representations of cost and demand conditions used for demonstration. It does, however, depend upon ex ante informational symmetry; if the incumbent has an advantage in the precision of his information about demand, costs, or the condition of the transaction-specific assets, changes of franchise operator will not coincide precisely with efficiency gains. An approximation to efficiency may be obtained when the incumbent's informational advantages are slight. Moreover, with more than one entrant bidding, efficiency depends on use of second-price rules: even with informational symmetry, first-price rules for the determination either of the output price or of the asset compensation level render the equilibrium asymmetric. Accordingly, at least some outcomes would be inefficient.

In the second-price equilibrium studied, when the entrant wins, on average, he bids 0.276578 and pays 1.74207 for the transaction-specific assets; when the incumbents loses, on average he bids 0.303157 and receives 1.79522 as compensation for these assets. Whenever the incumbent loses (excepting the zero probability case of a tie), the mechanism runs a deficit; with the parameters of this illustration, the deficit is small. Ex ante, the expected deficit is one half of the difference between expected payment and receipts, or 0.026578. For this example, the deficit can readily be made up by an entry fee in that amount, as entrant's ex ante expected profit from participating in the auction is 0.42919, and the requisite entry fee is only 6.19% of that. With such an entry fee, the regulation would sometimes have to inject funds beyond the entry fee, and at other times would find the entry fee larger than the deficit; on average, the mechanism would be budget-balanced.

As a crude indication of efficiency, we calculate the sum of consumers' and producers' surplus in the output market under the assumption that marginal costs associated with upkeep for the transaction-specific assets are unaffected by the institution used to determine pricing and incumbency. Then, for simplicity, these costs are set to zero (alternatively, some appropriate number for these costs, which are unaffected by whether franchise bidding is used, could be subtracted form producers' and total surplus calculations below). For the above parameters, we obtain:

	Consumer's Surplus	Producers' Surplus	Total Surplus
Unconstrained Monopoly Profit Max	69.04	138.08	207.12
Franchise Bidding Equilibrium Outcome	280.77	-0.36	280.41
Imposed Marginal Cost Pricing	280.06	0.00	280.06

In general, we expect this second-price franchise bidding auction to be quite an efficient mechanism. However, the numbers above are an aberration due to some of the simplifying assumptions used. In part, they stem from lower marginal costs than under imposed marginal cost pricing, as on average, the wining bidder has a marginal cost of 1/3, while the monopolist evaluated alone has a marginal cost averaging 1/2.

A major part of the apparent efficiency in this numerical example is due to the insignificance of mean cost differentials between the two bidders. As a result, they compete over the profitability of being the incumbent on the next auction and are willing to incur a small loss in the output market on the current contract in order to be paid the benefits of incumbency in the next auction. Unless his cost is extremely low, the entrant expects, should he become incumbent in this auction, to receive more in present value for the transaction-specific assets should he lose the next auction than he has to pay for them now. This is because, whenever there is a change of franchisee, the entrant's payment for the assets is based upon their value for the losing bidder, while the incumbent's receipt for the assets is based on the higher value to the winning bidder.

As a result, for high realizations of marginal cost, bids are below marginal cost. If the entrant observes a cost below 0.27166, he bids above marginal cost, guaranteeing himself a profit in the output market should he win this auction. Also, as output price is set by the losing bid, whenever the two bidders' costs are slightly further apart than on average (i.e., more than 1/3), the winning bidder makes a profit in the output market. Bear in mind that bids are not so low as to remove the expected profitability of taking part in the auction (even in the presence of a budget-balancing entry fee).

The feature of bids below marginal costs is presumably eliminated by having more than one entrant and introducing the sorts of cost uncertainties that were mentioned early in section 2. With such cost uncertainties, each bidder rationally increases his bid to take into account the fact that losing bidders would estimate his own costs to be higher than he expects them to be; failure to take such adverse selection forces into account results in what is called the "winner's curse." There are no such forces in the simple example calculated here.

4. Conclusions and Implications

There are a number of questions raised by this analysis, which warrant further research. Some of these are of a theoretical nature and include generalizing the result to deal with issues of the robustness of the regulator's bid function. Others are of a more practical nature. However, it appears that the approach is worthy of some consideration as an alternative to traditional cost-of-service regulation or even recent innovations, such as price caps. For the moment, let us briefly review some of the issues remaining.

(i) The numerical parameters chosen for illustration had the property that the resulting deficit was sufficiently small as to be readily handled by an entry fee. This seems to us a likely result, particularly if the $t(b)$ function is relatively flat, which serves to keep the size of the deficit under control. If this is not sufficient, in that the amount of deficit which cannot be handled by a suitable entry fee is a significant political problem, there are alternatives that involve moving away from the benchmark second-price rules that we have considered. A first-price auction institution would produce a surplus rather than a deficit, which seems not to be a political problem. A second-price auction could also be used to determine output price, but then one of the bids, perhaps the second-lowest, could be used to determine both the amount the winning entrant pays for the assets and the identical amount the incumbent receives. All of these alternatives involve some departure from the allocative efficiency characterization obtained in our example above: the realizations of random variables that yield a change of franchisee will not be precisely those which efficiency would dictate.

(ii) The rate of return implicit in the equilibrium performance of FB is a rate set by economic forces, oligopolistic competition, rather than the clearly politicized deliberations of a rate-making commission. There are good reasons to believe that the FB rate of return will compare favorably with commission-set rates: to the extent that entering into FB competitions yields an opportunity to earn above-market returns, an increase in the competitiveness of FB auctions can be predicted. No similar force necessarily holds down commission-set rates. Moreover, to the extent that commission-set rates would yield prices below those attained by FB, there must exist barriers to exit, partly commission-influenced, which work to inhibit efficient flow of capital. In a model which reaches the level of behavioral detail presented here, there is no obvious alternative to FB that seems likely to attain a comparable level of allocative efficiency.

(iii) In the simplified example presented here, the problem of the regulator choosing the wrong bid function, for example, a line that is too high, h_2 in figure 7.1, does not present a major problem, as long as the regulator, having once determined the bid function, does not change his mind. As in other instances where transactions-specific investments are involved, the parties need protection from hold-up. In this case, the protection derives from commitment on the part of the regulator.

(iv) Other problems that may arise include what happens where there is only one bidder or where there are two bidders who both bid very low, in which event the winning bidder would walk away from the deal. The first of these problems could be handled by means of a reserve price, while the second might be resolved by escrow of a performance bond that would not be refundable in such cases. In any event, we think that both of these events are likely to be rather rare. The two low bidders, while an interesting possibility, will occur only where bidders are attempting to damage other bidders, as it is otherwise not in a bidder's interest to reveal a value lower than his true value.

Our bottom line is that second-price auctions when coupled with franchise bidding would seem to warrant at least a second look as an alternative to existing schemes for franchise bidding, traditional, and price-cap or incentive regulation. We plan on producing a theoretical paper that generalizes and extends the results of this analysis. This is all a far cry from practical application to utility regulation.

Notes

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1. For example, see Crew and Zupan (1990, 185): "At least relative to traditional ROR regulation...FB offers a means of harnessing better the invisible hand of market forces to assist in the pursuit of efficiency in utility markets."

2. Note price would not approach marginal cost, as noted by Demsetz (1968, 57), "If the number of bidders is large or if, for other reasons, collusion among them is impractical, the contracted price can be close to per-unit production cost." Thus, Demsetz treats franchise bidding as a mechanism which yields pricing of utilities' outputs at average costs. An explicit model of the bidding process only attains prices as low as average costs in the limit, as the number of bidders approaches infinity. Realistically, franchise bidding will surely be competition among the few, particularly at the recontracting point where one of the bidders is the incumbent monopolist. Since the act of preparing and submitting a bid is itself done as a conscious pursuit of a profitable opportunity, a potential bidder must rationally expect, ex ante, a positive probability of obtaining the franchise for a price in excess of average cost, and with a sufficiently low payment for the transaction-specific assets.

3. The CATV experience according to Zupan (1989) did not reveal the type or degree of problems raised by Williamson. However, the instances in which assets were transferred were somewhat rare. It is conceivable that the transactions costs of impending litigation were sufficient to make the incumbent's threat credible.

4. Note that the discount factor applies to the entire period and not annually. (The discount rate associated with the discount factor is constant for the entire period.)

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