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Franchise Bidding Without Holdups: Utility Regulation with Efficient Pricing and Choice of Provider[1]

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Abstract
The idea of franchise bidding, as a governance structure for regulating natural monopoly, has remained dormant for the last twenty years, during which the technology and regulation of natural monopoly has changed considerably, both in theory and in practice. Meanwhile, auction theory has advanced significantly, independently of regulatory economics, which has moved in a different direction, namely price-cap regulation. We seek to combine the effects of the changes in the technology of network industries and the advances in bidding theory and in regulatory economics toward the development of a rigorous model of franchise bidding. The model presented in this paper, which develops conditions for efficient outcomes, provides a benchmark to begin a reconsideration of the potential of franchise bidding. In particular, for the first time, we complete Demsetz' (1968) proposal by specifying (second-price) rules for bidding and for transfer of assets when the incumbent loses the bid at re-auction. The scheme features one bid determining simultaneously output pricing and asset transfer pricing, to address concerns of hold-up and opportunistic behavior in the event of a change in franchisee.

The regulation of network industries—telecommunications, electricity, gas, postal services—is currently undergoing major changes, the most significant being the entry of competitors and the substitution of price-cap regulation (PCR) for traditional cost-of-service or rate-of-return regulation (ROR). However, the very existence of regulation simultaneously with competition is of concern. Why is regulation necessary at all as competitive entry is normally expected to lead to efficiency? One reason for regulation is that it is facilitating a transition from monopoly to competition. Although technological change has reduced the segments of network industries that are natural monopolies, there is still a residual segment of these industries that is a natural monopoly and is likely to remain so in the foreseeable future. This is the more important justification for some form of continuing regulation. In

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the situation faced today, the entire traditional business of a firm in a network industry is no longer defined as a natural monopoly. Since the problem of access to bottleneck facilities remains, though, the problem of natural monopoly regulation remains, notwithstanding all the changes of this decade.

We contend that recognizing the continued existence of natural monopoly at a production stage within the business of network industries is critical to obtaining the benefits of competition and the potential gains in efficiency that are available. In addressing this issue, PCR is a step forward over ROR (Crew and Kleindorfer 1996). However, PCR is only a partial solution to the problem of residual monopoly. The current situation, we believe, calls for examination of alternatives to PCR; *franchise bidding* is one alternative warranting a re-examination and extension incorporating recent developments in auction theory.[2] While we cannot yet argue that a specific variant of Demsetz (1968,1971) franchise bidding is ready for implementation, we do show that franchise bidding has considerable potential relative to the alternatives.

The paper is comprised of five sections. The first provides background and a motivated introduction to our re-examination of franchise bidding. Section 2 develops the first complete specification of a franchise bidding procedure, our *benchmark* model. This model, in its own right, may be of interest to auction theorists, in that it attains a symmetric equilibrium in what is necessarily an asymmetric situation, as one of the bidders is the incumbent firm. Section 3 examines some of the main criticisms of franchise bidding—transfer of assets, asset maintenance incentives, and robustness—in the light of our model. In section 4, we discuss some extensions to our model and implications for future research and policy. Section 5 is by way of brief concluding comments.

1. Background and Motivation

Franchise bidding, as proposed by Demsetz (1968), had considerable attractions in efficiency terms. It held out the prospect of X-efficiency under monopoly, which no other regulatory mechanism before or since has offered.[3] Despite its attractive efficiency properties, franchise bidding (except for a time with CATV) has failed to gain even a toe-hold as a regulatory mechanism for network industries. This may be because franchise bidding is not attractive to lawmakers and regulators in part because it reduces substantially their flexibility in using the regulatory process to achieve their own "social agenda."[4] Thus, it may not be surprising that, at a time of considerable change in network industries and of regulatory innovation, franchise bidding has been bypassed in favor of PCR (Crew and Kleindorfer 1996; Kridel, Sappington, and Weisman 1996).

In the academic literature, franchise bidding as a governance structure for natural monopoly has effectively been dismissed following Williamson's (1976) condemnation and

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2 Auction mechanisms have recently been applied in the Federal Communication Commission's radio spectrum auction. This elevates the application of auction mechanisms as an instrument of economic policy.

3 Franchise bidding does not offer the guarantee of allocative efficiency, as, given natural monopoly, price cannot be set equal to marginal cost.

4 We would like to acknowledge the anonymous referees for suggesting this reason for the failure of franchise bidding to be embraced by regulators.

Goldberg's (1976) "case against the case against regulation." In particular, their argument that regulatory contracts are necessarily incomplete has been echoed in the recent survey paper by Crocker and Masten (1996). Williamson (1976), Goldberg (1976), and Crocker and Masten (1996) point to regulatory contractual incompleteness as a particular concern for franchise bidding. However, in the model below, compensation to the incumbent for asset transfer to a replacing entrant is moved from a contractual mechanism to a market mechanism, suggesting that the dependence of Demsetz' proposal on contractual means is notably less than these authors were concerned it would be.

Instead, the academic research has come to focus on the theory of revelation mechanisms for regulated monopolies.[5] This theoretical contribution occurred simultaneously with the adoption of PCR, which received support not only of coalitions in industry and regulation but also in the writings of academic economists.[6] It is clear that, in proposing a re-examination of franchise bidding, we are swimming against the tide, not only of applied microeconomic theory, but also practice.[7] It is thus incumbent on us to justify our contrarian position.

Franchise bidding is ostensibly superior to PCR in a number of respects. Its primary benefit is that it has superior efficiency properties, as argued by Demsetz (1968; 1971) and as demonstrated by our benchmark model. PCR cannot achieve this level of efficiency because of the information advantage of the firm over the regulator.[8] The firm always gains a rent from the informational asymmetry. We demonstrate below another important benefit of franchise bidding, obtaining management of assets and production by the lowest-cost supplier. PCR maintains the monopolist in place; there is never any discipline from competitors (in the residual monopoly part of the business).[9] All the discipline has to come

5 This work originated with Baron and Meyerson (1982) and includes several influential contributions, among them McAfee and McMillan (1986; 1987), Riordan and Sappington (1987), Laffont and Tirole (1987; 1988), Sappington and Sibley (1992), and Che (1993). For a recent treatise, see Laffont and Tirole (1993). While some of these papers employ bidding mechanisms, they are by and large focused on different issues and do not address concerns raised here. Issues of transfer of assets from an incumbent to an entrant do not arise. In addition, the models are developed with a view to mathematical convenience. In particular, almost without exception, that literature assumes that the costs rival potential suppliers would face are independent random variables and are known with certainty to each potential supplier.

6 In some ways, the most striking contribution is that of Littlechild (1983); PCR then became the standard in the United Kingdom, and Littlechild the regulator of its electricity industry.

7 Laffont and Tirole (1988) provide a noteworthy exception. Their paper examines the problem of franchise bidding dealing explicitly with a single instance of franchise renewal. Their paper is more wide-ranging in its intentions than ours, dealing with the issue of non-transferable investment, while our paper only deals with transferable investment. However, three aspects limit the usefulness of their results in ways we attempt to address. First, like the models cited in footnote 5, they assume that the incumbent's and the sole entrant's costs are independent random variables, and that neither faces any uncertainty over what its costs or demand will be over the contract period. Second, they treat the regulator as being able to observe costs with certainty and, thus, to be able to assign the franchisee any profit level it wishes, subject to incentive-compatibility constraints. Third, they treat the regulator as being capable of transferring transaction-specific assets from the incumbent to the entrant without compensation, while we require that compensation be determined by the auction to be at least as large as the incumbent's indicated willingness to accept. Fourth, they treat a single occasion as a once-and-for-all option to replace the incumbent with the entrant; we have both incumbent and entrant aware that the winning bidder will assume the role of incumbent in the re-auction at the end of the contract period.

8 This applies even under highly restrictive assumptions, in particular, common knowledge of distributional parameters.

from the regulator setting the price caps. As a substitute for competition, the PC regulator is poorly informed and suboptimally motivated. Because of the nature of the relationship between regulator and firm, PCR faces numerous problems that are well documented in the literature.[10] The incentives for cost economy provided by PCR might not be fully achieved if there is a concern that the regulator will not live up to his agreement. For example, if the firm is highly profitable under PCR, the regulator may be tempted to renege and lower prices. This is the problem of commitment. For PCR to be effective, the regulator must be expected to honor his commitments, at least for a specified period of time. Absent commitment on the part of the regulator, the incentives for cost economy offered by PCR will be attenuated.

While such problems are not eliminated by franchise bidding, we show that they are different in nature and extent. Franchise bidding provides not only stronger competitive discipline than PCR, but it also does not have commitment problems to the same extent as PCR. Under PCR, unexpectedly high profits might send a signal to the regulator to renege and tighten the price cap.[11] Under our benchmark model of franchise bidding, unexpectedly high profits will signal to bidders to bid a lower price and a higher asset value. The incumbent must take this into account in formulating his own bid. The regulator, thus, need be concerned less with high profits, since competition will force prices down while simultaneously compensating the incumbent, absolving the regulator of the need to do so. The incumbent monopolist has an incentive to attempt regulatory capture under PCR that is automatically stymied by franchise bidding.

As Demsetz (1968) originally observed, franchise bidding can achieve competitive prices.[12] While there is no competition in the product market, competition occurs at the bidding stage with the bidder offering to supply output at the lowest price becoming the franchisee. A key attraction of the system is that it offers the opportunity of changing the franchisee. This is a tremendously important source of market discipline and likely to be much more effective than the threat under PCR that the regulator may impose less favorable terms. The prospect of losing the business to a lower bidder is an extremely powerful stick not currently—or ever likely to be—available under PCR.

Since Demsetz first made his proposal, considerable changes have taken place in the technologies of network industries and in the theory of bidding. Indeed, the theory underlying the bidding process that he was advocating did not exist. So of necessity he was somewhat vague on the nature and effects of the process he was proposing. In part because of lack of rigorous analytical foundations, Williamson (1976) was able to attack his scheme as unworkable. His basic argument was that it did not address the problems arising as a result of the need for valuation of transaction-specific assets that would occur if an incumbent were

9 We are referring here solely to the discipline provided by product market product competition. Some discipline results for capital market pressures. However, corporate takeover is attenuated in regulated industries and leaves the regulatory structure in place.

10 For a treatment of the problem and further references to the literature, see Crew and Kleindorfer (1996) and Kridel, Sappington, and Weisman (1996).

11 Tightening the price cap is not the only way that the regulator may "renege." For example, price-cap regulation allows the regulator a considerable amount of freedom to allow entry. See Weisman (1998) for a related discussion of entry issues.

12 Strictly speaking, if there are overwhelming scale economies, economically efficient or Ramsey prices are only approximated by franchise bidding. If there is a single product, price would be set equal to average cost. This point was originally made by Telser (1969).

displaced at franchise renewal. However, in the intervening period, technological change has occurred in the industries. As a result, the nature and extent of the transaction-specific investment have changed, making the problem less severe.

Given the changes in the technology of the industries and the current mood of change in regulation, the time may now be ripe for a re-examination of franchise bidding. This paper provides a rigorous benchmark model of franchise bidding, displaying the efficiency properties claimed by Demsetz. The model requires a number of restrictive assumptions not apparent from Demsetz's original formulations or Williamson's critique. Although the benchmark model naturally is not intended to solve all of the problems involved in the practical implementation of franchise bidding, it does provide clear pointers toward the development of further theoretical models and practical schemes for franchise bidding. It opens avenues for further research on franchise bidding as an alternative governance structure for regulated monopoly.

2. A Benchmark Model of Franchise Bidding

We develop a benchmark model of a franchise-bidding auction to determine the operator of the structural natural-monopoly stage in a network industry. The right to be operator or franchisee is being auctioned for a fixed contract period, with regular re-auctions.

2.1. Bidders, Costs, and Information

Any problems, which are distinct to an initial auction without an incumbent, are ignored here, to focus on a re-auction or other situation in which one of the n bidders is an incumbent (we call the others entrants). All bidders are assumed to be risk-neutral, maximizing expected profit. For simplicity, the demand curve $q(p)$ for the total output of the utility over the contract period is assumed known to all bidders, in order to focus treatment of uncertainty and private information on the cost side of the problem.

Each bidder $i = 1, \ldots, n$ observes a real-valued signal X_i which can essentially be deemed an estimate of the constant marginal cost of supplying output, using the transaction-specific assets in place.[13] This constant marginal cost is assumed inclusive of costs of maintaining the transaction-specific assets in operable condition. There are assumed to be no fixed costs above and beyond those sunk into the transaction-specific assets. A random variable M, not observed by any bidder, represents a mean tendency in marginal cost.

The collection of random variables $\{M, X_1, \ldots, X_n\}$ have a joint distribution F which exhibits strict affiliation (see Milgrom and Weber (1982) for a definition and discussion). Roughly, this means a higher realization for any X_i makes higher realizations for M and for any X_j more likely. For each bidder i, his marginal cost of production is $C_i = \lambda M + (1 - \lambda)X_i$. That is, his marginal cost is a convex combination of the mean tendency in marginal costs (for which he has only an estimate) and his own private information (which he knows). Thus, λ is the measure of commonality of costs: in the special case $\lambda = 1$ (which is called a common-value model in the auction literature), there are no cost differentials

13 Throughout random variables are represented in upper case and realizations of random variables in lower case.

across bidders; in the special case $\lambda = 0$ (which is called a private-values model), no bidder faces any uncertainty over the marginal cost of output supply he would face as franchisee. Crew and Harstad (1992) considered a particular example of the $\lambda = 0$ special case.[14] To the extent that the contract period is long enough for intra-period discounting to be relevant to bidder behavior, we choose to simplify by submersing this effect in the notation already defined. Thus, for any output price p and marginal cost c being considered, $q(p)(p - c)$ will be deemed to denote the present value of the excess of revenue over variable costs during the entire contract period.

This formulation represents via M such common cost uncertainties as the probability that a natural disaster damages equipment or imperfectly foreseen labor market tightness or looseness that affects the wages that must be paid. The impact of X_i upon C_i is designed to allow also for cost uncertainties that are bidder-specific, forming the basis for efficiency consequences of choice of supplier. An example 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. Since it is the comparison of demand and marginal cost curves that determines franchisee profitability, a lower level of X_i is likely a good proxy in this model for a particular firm's differential ability to stimulate demand.

The key assumption is that the joint distribution F of bidders' information exhibits symmetry in the X_i's. This implies that bidders' estimates of M, and hence of C_i, are equally precise. Considerable simplification is obtained as a result. Admittedly, the alternative assumption that the incumbent's estimate of cost is more precise than an entrant's estimate may in some cases be more attractive, but symmetric information precision may be a reasonable approximation in a situation in which all the bidders are large firms that are each an incumbent in several geographic markets, and one of them happens to be incumbent here.

Moreover, we assume that the re-auction which will occur at the end of the contract period for this auction will involve a new draw of $\{M, X_1, \ldots, X_n\}$ in accordance with the same distribution function F and that λ will be unchanged. The signals (cost estimates) ξ_i, corresponding to X_i in some previous auction in which i took part or in some auction in another geographic market, are of no value in estimating his C_i in this auction, in that X_i is a sufficient statistic for $\{X_i, \xi_i\}$. Correspondingly, the current X_i is of no help in cost estimation problems for the next auction, in the same sense. In short, for any auction a bidder observes one signal (cost estimate) which is his only source of information.[15]

2.2. Baseline Auction Rules

Our basic proposal is that the auction *simultaneously* determines a price p at which output is supplied to consumers (technically an upper bound on allowable output prices) *and* an amount $t(p)$ that a winning entrant pays to the incumbent for the transfer of ownership of the

14 The mechanism design literature (cf., cites in footnote 3) treats an even more special case, in which $\lambda = 0$ and the random variable M is degenerate.

15 By comparison Laffont and Tirole "...assume that the incumbent's and the entrant's efficiency parameters are drawn from a common distribution; any *ex ante* intrinsic discrepancy in second-period efficiency is attributable only to the non-transferable investment." (1988, 517)

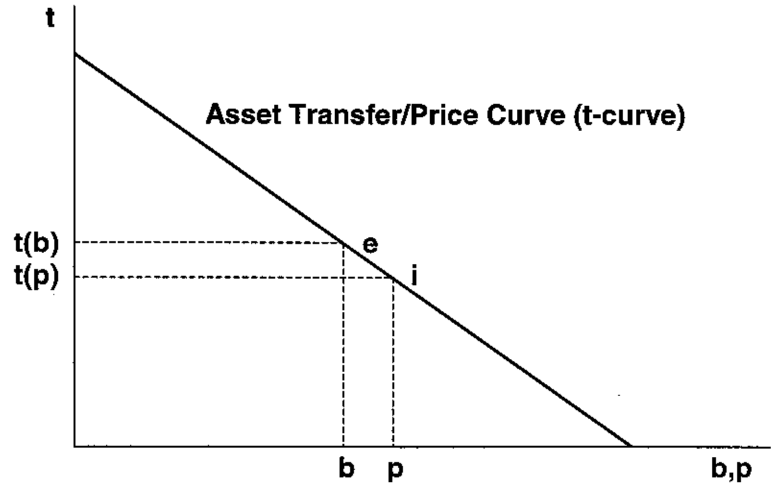

Figure 1

transaction-specific assets. The relationship between output price and transfer price is not determined by the bidders, but specified in advance by the regulator, as what we will call a t-curve, which is illustrated in figure 1. Though the auction simultaneously determines two prices, bidders have only one degree of freedom in selecting bids. Put another way, a bidder is not allowed to exhibit a willingness to supply output at a lower price without simultaneously exhibiting a higher evaluation of the transaction-specific assets that would be used to produce this output, as shown by the negatively sloped t-curve in figure 1.

This feature is the key step in addressing the problem raised by Williamson concerning the valuation of assets transferred. Our auction rules arise from the intuitive notion that capital which allows a firm to supply output more cheaply is more valuable. Thus, an incumbent who is outbid has indicated an evaluation of the assets, but will be turning them over to an entrant who, by bidding to supply output at a lower price, has indicated a larger evaluation of the assets than has the incumbent.

The notion of a single auction with scalar bids simultaneously determining multiple prices originates, to our knowledge, with Michael Rothkopf and is reported in Rothkopf and Engelbrecht-Wiggans (1989). He suggests that mineral lease auctions could in essence have bidders bid an amount to be paid for the rights to drill (the "bonus"), with a prespecified positive relationship between the bonus and other lease variables, such as the royalty rate, land rent, and or seller's profit share. In Crew and Harstad (1992), we present a numerical calculation, in a highly simplified example, of an equilibrium for such a proposal in the franchise bidding context. To our knowledge, this paper is the first to develop any qualitative analysis of equilibrium bidding in a context in which a scalar bid simultaneously affects more than one price.[16]

16 A contrast of some interest is offered by the model of Bushnell and Oren (1994). They consider bidders seeking to supply power to a regulated electric utility and assume that bidders have two degrees of freedom: the fixed base rate of compensation for participating, and the variable unit rate of compensation for power supplied. The scoring function converting ordered-pair bids into scalar-ranked bids is prespecified. It is not at all clear that an analogue of their bidding with two degrees of freedom

In a natural sense, then, the t-curve that the regulator specifies can be interpreted as attempting to specify the value in use of the transaction-specific assets that serve to allow profitable production at the output price bid. We accept this interpretation, but make no assumption that the regulator is at all competent or informed in this specification. Robustness with respect to misspecification is discussed in section 3.2 below. We assume here and examine in section 4 a form of dynamic consistency: the regulator is committed to specifying the same t-curve on the occasions of re-auction for following contract periods.

Given our basic proposal, using an auction in which a single bid serves to identify both an output price and an asset transfer price, there remain a variety of possibilities to complete the specification of the auction rules. One possibility—perhaps the obvious one—which we call *first-price rules* specifies that if b is the lowest bid, then b becomes the output price, and $t(b)$ is both the amount paid and the amount received for transfer of the transaction-specific assets in the event the incumbent loses. Most of our analysis, however, will be focused on what will be called the *baseline rules.* The choice of rules to call a baseline is guided by a desire for incentive compatibility; not coincidentally, this also enhances tractability. The *baseline rules* are thus full second-price rules, as follows. The lowest bidder becomes franchisee for next contract period. Output price is set by the second-lowest bid. Of course, if the incumbent is the lowest bidder, there is no asset transfer, and the second component of the bids has been rendered irrelevant. If an entrant wins, he pays an amount for the transfer of the transaction-specific assets that is determined by the t-curve as evaluated at the second-lowest bid. As in figure 1, if the lowest bid is b and the second-lowest bid p, then consumers obtain the utility's service at price p, and the winning entrant pays $t(p)$ for the transaction-specific assets. In order to maintain the property that neither output nor transfer price is directly influenced by one's own bid, the *baseline* rules require that, when the incumbent loses, the payment he receives for the transaction-specific assets is $t(b)$, derived from the lowest bid. In this way, the payment received does not depend on the incumbent's bid, but is at least as much as the incumbent's indicated willingness to accept. That is, since $b < p$, $t(b) > t(p)$. A consequence of full second-price rules is that, whenever there is a change of franchisee, the mechanism runs a deficit, an issue addressed further in Section 4.

2.3. A Symmetric Equilibrium under Baseline Rules

This section will demonstrate two results, first characterizing a symmetric equilibrium under baseline rules. The symmetry assumption of the last section is of course crucial to this result.[17] However, we also show that second-price rules are crucial, by demonstrating the nonexistence of a symmetric equilibrium under the same symmetry assumptions for first-price rules.

Let p_m be the expected unregulated monopoly price, and π_m the corresponding expected unregulated monopoly profit. To avoid uninteresting pathologies, we invoke the mild assumption that the regulator sets the t-curve at a low enough level that

can be readily introduced into the present context or that the device used here, having a single bid simultaneously determine two prices, would be useful in their context.

17 Recall that the model assumes (1) a symmetric probability distribution. In analyzing a symmetric equilibrium, we add two further uses of symmetry: (2) a monotonically increasing equilibrium bid function, and (3) all bidders using the same bid function.

$t(p_m) < \pi_m r/(1 - r)$, where r is the discount factor over the length of the contract period. This amounts to assuming that unregulated monopoly profit would be sufficient to cover interest payments on a consol with face value $t(p_m)$ and assures that bidding the expected monopoly price is a strategy with a nonnegative expected payoff.

We begin by answering what may seem an unrelated question: under what circumstances would an entrant be indifferent over the outcome of a tie-breaking rule, if he were to tie for lowest bidder? If the tie is not broken in his favor, then his expected profit is zero. Suppose he becomes the franchisee; to be indifferent, his expected profit must also be zero. His expected revenue over the contract period, net of variable costs, with output price p and marginal cost c, is $q(p)(p - c)$. To calculate this entrant's expected profit if the tie were to be broken in his favor, expected revenue must be reduced by the amount of the payment for transfer of the transaction-specific assets, $t(p)$, and augmented by the expected present value of the profitability of being the incumbent at the time of the next auction, denoted W.

To formulate W, note that two outcomes can occur in the next upcoming auction: the incumbent then can win again or can be a losing bidder and receive a transfer payment based on the lowest bid. Suppose both this auction and those upcoming exhibit a symmetric equilibrium bid function $b^*(x)$ for any bidder (including the incumbent) observing $X_i = x$. Then $1/n$ is the probability that the incumbent will win.[18] Letting $Y = \min\{X_2, \ldots, X_n\}$, and using symmetry to focus on bidder 1,[19] the expected value of the transfer receipt given that the incumbent's bid loses is

$$S = n\int_{-\infty}^{\infty} t[b^*(x)]\,[1 - F_Y(x \mid x)]\,dF_1(x),$$

where subscripts on F denote the relevant marginal and conditional distributions.

Now W can be specified:

$$W = \left(\frac{1}{n}\right)\frac{W}{\delta} + \frac{(n-1)}{n}\frac{S}{\delta},$$

or

$$W = (n-1)\frac{S}{n\delta - 1},$$

where δ is the real compounded discount factor for the length of the contract period. Note that, while W depends upon the assumed equilibrium bid function, it does not depend upon the private information of bidder i. Also, while we will be assuming the event in which an entrant ties for lowest bid, no similar tie at re-auction is assumed in calculating W (since a tie will be a zero probability event in equilibrium).

Having formulated W, next we define a function v, implicitly as follows:

$$E\{q[v(x,y)]\,[v(x,y) - C_1] - t[v(x,y)] + W \mid X_1 = x,\, Y = y\} = 0. \tag{1}$$

18 Given symmetry, the probability of any particular rank order of the incumbent's bid is $1/n$.

19 We attach the subscript for convenience. Sometimes we refer to the incumbent as bidder 1, while in other instances we refer to the entrant. In symmetric equilibrium, this is a legitimate exercise.

This is simply a particular conditional expectation of profit: expected net revenue less transfer payment plus the expected benefit of incumbency at re-auction. Equation (1) admits the following interpretation. Suppose an entrant is bidder 1 and observes $X_1 = x$. Moreover, suppose that $Y = y$ is the lowest signal observed by any of bidder 1's rivals (including the incumbent). Then $v(x, y)$ is the output price at which bidder 1 would expect zero net profitability from becoming franchisee, adjusting for the cost of obtaining the transaction-specific assets and for the benefits of being incumbent at re-auction.[20] Under the same suppositions, at any higher price $p > v(x, y)$ (but not more than p_m), bidder 1 would expect positive net profitability; in this case, he will be paying less than $t[v(x, y)]$ for asset transfer. Correspondingly, at any price $p < v(x, y)$, bidder 1 would conditionally expect net profitability less than zero.

Then, define $b^*(x) = v(x, x)$. This allows us to answer our initial question: if an entrant had adopted the bid function b^*, then he would be indifferent over the outcome of a tie-breaking rule. Our affiliation assumption on F implies that b^* is increasing.[21]

Theorem 1: Given symmetry in informational precision, $[(b^*(\cdot), \ldots, b^*(\cdot)]$ is a symmetric equilibrium under baseline rules.

Proof: A. By construction, if an entrant ties for lowest bid, having bid $b^*(x)$, he is indifferent between winning and losing the tie-breaker. The first step is to show that the same characterization applies to the incumbent. Reworking the definition of v:

$$E\{q[v(x, y)]\,[v(x, y) - C_1] + W \mid X_1 = x, Y = y\}$$
$$- E\{t[v(x, y)] \mid X_1 = x, Y = y\} = 0. \tag{2}$$

Given that the incumbent observes $X_1 = x$, and $Y = y$ is the lowest signal observed by an entrant, the first term in (2) is the expected profitability of the incumbent if he obtains the franchise again, and the second term is his expected profitability if, in this event, he is replaced and receives a transfer based on $v(x, y)$. Thus, as in the case of the entrant, the incumbent prefers to win the auction at a price above $v(x, y)$ (then losing would provide a lower transfer payment) and to lose at a price below $v(x, y)$ (receiving more for the asset transfer).

B. Next, suppose bidders 2, ..., n use the b^* bid function, bidder 1 observes $X_1 = x$, and consider bidder 1's choice between bidding $b = b^*(x)$ and any positive alternative $b' < b$. Initially suppose bidder 1 is an entrant. Let the lowest rival bid (including the incumbent's) be a random variable $p = b^*(Y) = v(Y, Y)$. If $p < b'$,

20 To see that $v(x,y)$ is well-defined, fix x and y and let $a(v)$ be the left-hand side of equation (1). By assumption, $a(p_m) > 0$. For $v < p_m$, a lower v both reduces the expected net revenue term and raises $t(v)$; reducing v thus continuously lowers $a(v)$. As $a(0) < 0$ trivially, there must be some v that satisfies $a(v) = 0$.

21 See Milgrom and Weber (1982, Theorem 5); we maintain throughout their nondegeneracy assumption.

then both bids lose, attaining zero profit. If $p > b$, then both bids win, identically attaining the expected profitability associated with output price p and transfer price $t(p)$. Thus, it only matters whether the entrant bids b or b' in the event $A = b' < p < b$, in which case b loses to attain zero profit, while b' wins to attain expected profit:

$$E\{q[p]\,[p - C_1] - t[p] + W \mid X_1 = x, A\}$$
$$= E\{q[v(Y, Y)]\,[v(Y, Y) - C_1] - t[v(Y, Y)] + W \mid X_1 = x, Y < x\}$$
$$< E\{q[v(Y, Y)][v(Y, Y) - C_1] - t[v(Y, Y)] + W \mid X_1 = Y < x\} = 0. \quad (3)$$

The inequality in (3) stems from affiliation, which implies that $E[C_1 \mid X_1 = x]$ is increasing in x. The final equality in (3) repeats (1). We conclude that, when rivals use the bid function $b^*(x)$, an entrant does not wish to deviate to any bid $b' < b^*(x)$.

C. Next, we claim that the argument of part B applies to the incumbent as well. Suppose he is considering the choice between $b = b^*(x)$ and $b' < b$. Again the profitability will be identical if the lowest rival bid $p > b$, with output price p and no asset transfer, independent of his bid. If $p < b'$, both bids lose, and the incumbent is paid the same $t(p)$, whichever bid he made. So again, the only event that matters is A. Then removing t into a separate expectation, as shown in (2), is applied to (3).

D. It remains to show that deviations $b' > b^*(x)$ are unprofitable. This is a completely corresponding argument, with the event A defined via reversed inequalities, so that only bid b wins. But then $Y > x$, reversing the inequality in (3), yielding the desired conclusion.

Q.E.D.

In fact, the equilibrium is the unique symmetric equilibrium; we omit the tedious demonstration, which closely parallels the uniqueness theorem in Levin and Harstad (1986).

In general, entrant and incumbent are not in symmetric situations, but symmetry of informational precision (which plays a crucial role in the proof) suffices for existence of a symmetric equilibrium when the rules are incentive compatible. Incentive compatibility plays an essential role, as the following result shows.

Theorem 2: Even given symmetry in informational precision, there does not exist a symmetric equilibrium under first-price rules.

Proof: Suppose $b(x)$ were a symmetric equilibrium bid function for a franchise bidding auction under first-price rules. Then for both an entrant and the incumbent, a unilateral incremental change in his bid, $db < 0$, would have no effect on expected profit. For an entrant, this yields the equation:

$$0 = f_Y(x \mid x)g(x) + [1 - F_Y(x \mid x)]t'[b(x)] - [1 - F_Y(x \mid x)]q[b(x)] - b(x)q'[b(x)], \quad (4)$$

where $g(x)$ is the expected increment to profit that would result in the event a bidder bid $b(x)$ and found a tie broken in his favor (this function is the same for entrant and incumbent). For the incumbent, the corresponding equation is

$$0 = f_Y(x \mid x)g(x) - [1 - F_Y(x \mid x)]q[b(x)] - b(x)q'[b(x)]. \quad (5)$$

In both equations, the term involving $g(x)$ reflects the differential change in the probability of winning, while the rest of the equation reflects the impact of bidding less in those events where the bidder would already have won. For both bidders, an incrementally lower bid incrementally reduces output price and consequent profitability in the output market. For the entrant, a lower bid also incrementally increases the transfer payment (the middle term in (4)). However, events in which the incumbent would already have won are events in which no asset transfer takes place. Of course, no function $b(x)$ can simultaneously satisfy (4) and (5).

Q.E.D.

Vickrey (1961) introduced second-price auctions in a simplified, one-dimensional setting and obtained the well-known characterization that bids truthfully reveal the bidders' values. It bears emphasis that, in general, no similar inference can be drawn from bids in the more complicated two-dimensional franchise-bidding auction under baseline rules. The bid reflects a tradeoff between profitability in the output market and profitability of being incumbent at re-auction.[22]

A relationship between expected prices in equilibrium and marginal costs can be discerned for the special case in which average cost is constant (given the assets in place, and including optimal asset maintenance expenditures). Then marginal cost is equal in expectation to the bid that the lowest bidder would make if he knew the cost estimate of the second-lowest bidder. The winning equilibrium bid is below marginal cost, on average, as the winner incorporated an assumed tie in his bid. The mean equilibrium price is above expected marginal cost, as the price-setter incorporated an assumption that the lowest rival cost estimate equaled his.[23]

2.4 Efficiency

The model incorporates uncertainty over the cost of supplying output, and yet allows for cost differentials across providers. ROR and PCR have no intrinsic mechanism for replacing a supplier with more productive management, something that is accomplished via decentralized bid selection in franchise bidding.

Proposition 1: Symmetric equilibrium under baseline rules is allocatively efficient in choice of supplier; moreover, given the output price determined by competitive bidding and the resultant quantity of output, this supplier's choice of production technique is efficient.

Proof: As b^* is increasing, $b^*(x_i) < b^*(x_j)$ if and only if $x_i < x_j$ if and only if $C_i < C_j$, yielding efficiency in the choice of supplier. Supplier's efficient choice of production

22 Indeed, it is possible to construct parameters yielding a positive probability of information being observed which leads a bidder to foresee a sufficiently sizable capital gain upon attaining incumbency and then losing at re-auction to yield a bid below the Bayesian estimate of C_i (this possibility is clearly present in (1) and arises in the example calculated in Crew and Harstad (1992)) in the special case of $\lambda = 1$.

23 There is another reason why the equilibrium price exceeds marginal cost in expectation for the constant-average-cost case: the price setter is a less efficient producer than the winning bidder and has a somewhat higher marginal cost.

technique has been attained directly by making him the residual claimant over the contract period.

Q.E.D.

Subject to the supplier's earning at least a competitively determined rate of return, the output market is efficient. Naturally, our interpretation of a competitive rate of return is a rate of return determined in non-cooperative equilibrium. If ROR or PCR were to accomplish a lower price than the expected output price in equilibrium of franchise bidding under baseline rules, this could only occur by regulatory barriers to exit being constraining (cf., equation (2) above). Presumably, output price under ROR or PCR would lie between the expected franchise bidding equilibrium price and the unregulated monopoly price.

3. Critique of the Critique of Franchise Bidding

One consequence of the benchmark model, in providing a rigorous model of franchise bidding, is that we are in a position to provide stronger arguments in support of franchise bidding relative to the current alternatives, including PCR. Another advantage of the benchmark model is that it enables us to respond incisively to critics of franchise bidding. While we cannot yet provide all the answers to the critics, as a result of the benchmark model we now have clearer and more promising directions in which to proceed.

The major concern of Williamson was the problem of asset transfer problems when the incumbent failed to win renewal. These include the adverse effect on incentives to maintain assets and the consequential increase in transactions costs. We will therefore concentrate on determining the basis for asset transfer; in our model, this is why the *t*-curve is specified. We also examine the robustness of our results to the misspecification of the *t*-curve. Finally, we examine some implications for asset maintenance.

3.1. Determining a Transfer Function

So far, little has been said about how the transfer function, or *t*-curve, gets determined, other than that it is specified by the regulator in advance of the auction. The most important notion in its determination is that the willingness of a bidder to supply output at a lower price implies a greater productive, i.e., cost-saving, value of assets in place. Hence, the absolute value of the slope of the *t*-curve will ideally be proportional to the inverse of the value of marginal product (VMP) of these assets.[24] The task of measuring this VMP as a *function* of

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24 To focus and simplify, let the production function be represented as $f(k, m)$, where k is the market value (in dollars) of the transaction-specific assets and m aggregates all other inputs. Then profit, gross of the cost of the transaction-specific assets, is

$$\pi = p\, f(k, m) - m, \qquad (6)$$

where p is the output price.

With this setup, consider an increase in the productivity of the transaction-specific assets that is sufficient to support a small reduction Δp in output price without a reduction in gross profit. A first-order Taylor series expansion of (6) yields:

$$\Delta\pi = p\, f_k \Delta k - \Delta p\, f(k, m),$$

Setting $\Delta\pi = 0$ yields

$$\Delta k = \Delta p\, f(k, m) \,/\, (p\, f_k).$$

The denominator is the value of the marginal product of the transaction-specific assets.

the marginal willingness-to-supply does not even theoretically have a useful specification. In practice, presumably nothing more than estimating an appropriate slope for a linear t-curve would be attempted. Estimating VMP is a familiar exercise in the literature on empirical production functions.

Ideally, estimating VMP serves to determine the transfer function, up to a constant, but this remains critical. The constant term in the t-curve specification implies a rate of return on the assets in place at re-auction: augmenting this constant simply increases the return to the firm who is incumbent when the augmentation occurs and to the capitalized value of the assets if the constant once augmented is maintained. How to estimate an appropriate constant to use, in order that the initial incumbent (i.e., the incumbent firm when franchise bidding is first instituted) neither be unjustly enriched nor deprived of assets without due compensation is a major problem. Setting the constant is based upon establishing an appropriate balance between a regulator's estimate of the market value of the assets in place and the estimate of W, the expected present value of the profitability of being the incumbent at the time of the next auction. But estimating W necessitates estimating the expected equilibrium level of the winning bid, which in turn depends upon the constant in the t-curve. This is not completely circular, in that it is straightforward to demonstrate contractibility, compactness, and continuity for the existence of a fixed point, but it is admittedly a computational problem that exceeds most economists' perception of the capabilities of regulators.

3.2. Robustness

It is qualitatively unimportant to the analyst (though quantitatively critical to a losing incumbent) whether the regulator is capable of computing and instituting an appropriate t-curve.

The equilibrium position places minimal demands on this regulatory specification, particularly on the constant incorporated. It does assume commitment on the part of the regulator; we discuss the implications in section 4.

Proposition 2: Efficiency in choice of supplier is robust to misspecification of the t-curve by the regulator.

Proof: The proof of Proposition 1 did not employ any assumption that the specified t-curve bore any relation to the value in use of the transaction-specific assets.

Q.E.D.

It bears comment that, while a t-curve more onerous than justified by asset value in use may seem to be a barrier to serious competition by entrants, the regulator's dynamic consistency creates a counterbalance: becoming the incumbent now will yield a correspondingly more lucrative position at re-auction. It is precisely this counterbalance which undercuts the incentive of an incumbent to attempt regulatory capture, an incentive that represents a serious problem in any form of regulation that preserves incumbency indefinitely, such as ROR or PCR.

3.3. Asset Maintenance Incentives

While we have explicitly responded to the principal claim of Williamson: that transfer of the franchise is subject to hold-ups, our approach is limited in that it shows how auction theory allows some latitude in addressing this problem. In particular, we proffer no claim that our franchise bidding rules are ready for prime time. High on the list of issues that would need to be researched further are the incumbent's incentives to maintain in operable condition assets that he may no longer own after the next auction.

Recall that we had subsumed asset-maintenance expenditures in the marginal cost formulation. In principle, explicit allowance for these expenditures can be incorporated, and the key results extended; the resultant notational complexities would, however, exceed the value added. This is because the issue of the incumbent's incentives to spend on asset-maintenance projects, at a level that would correspond to a social planning optimum, would remain unaddressed by the model of equilibrium bidding.

Note that this is a normative basis for what expenditures ought (socially) to be made, but not an appropriate basis for comparison with other forms of regulation. It is a mistake to assume that PCR and ROR are themselves free from asset-maintenance concerns. For example, under PCR a firm may have an incentive for excess expenditure on capacity and asset maintenance in order to hide profits or shift profits intertemporally. Similarly, when a regulator had failed to honor his commitments, the optimal response on the part of the firm may include less-than-efficient asset maintenance efforts. Nonetheless, to what extent does an incumbent in a franchise-bidding mechanism have an incentive to spend on asset-maintenance projects? Notice that this question could not sensibly be addressed before a benchmark model made explicit the relation between the output price proposed by a successful entrant and the resultant specification of asset transfer terms.

At least well before the end of the contract period, allowing assets to deteriorate uneconomically will increase supply costs, and the incumbent cannot pass on the increased costs, not even with a regulatory lag. By itself, this incentive would yield insufficient spending on any asset-maintenance projects for which benefits persist into the next contract period.

However, the incumbent during the period τ cannot ignore the state of assets at the time of the $\tau + 1$ contract renewal, because he may also be (the next) incumbent at $\tau + 1$. In the symmetric equilibrium of Theorem 1, there is 1 chance in n of remaining incumbent; the odds are presumably greater in more realistic asymmetric situations.[25] Because we are talking about a socially optimal level of asset-maintenance expenditures as our benchmark, falling short of this will be costly in terms of the present value (as of τ) of extra asset-maintenance expenditures in $\tau + 1$ should this incumbent win.

Entrants will inspect assets in place as part of their bid-determination process. Poorer quality assets will imply that they raise their bids in the $\tau + 1$ auction, because it will be more costly for them to serve customers in $\tau + 1$, and hence the τ incumbent will receive a lower transfer payment for the assets if he loses.

For this reason, it is important to set the slope of the t-curve close to the inverse of the VMP of the transaction-specific assets. If that is done, and entrants who inspected the assets are nearly as well informed about their condition as is incumbent, then franchise bidding has come close to supplying the incumbent with the asset-maintenance expenditure incentives he would have if he were to be residual claimant in the industry over its entire technological

25 It is straightforward to envision situations in which the incumbent has asymmetrically superior information precision. This may lead to equilibria in which the incumbent's chances of remaining continue to exceed one-half as the number of bidders is increased to the limit implied by nonnegativity of an entrant's expected profit (cf., Harstad (1990, 1993)).

horizon. This ought actually to compare favorably with the asset-maintenance expenditure incentives offered by any other scheme of regulation.

It might be thought that franchise bidding has given incumbent τ very low incentives for asset-maintenance expenditures. By foregoing these expenditures, it would appear that he can increase his profit during the rest of the τ contract, while driving down the value of the asset base at $\tau + 1$, implying that $\tau + 1$ entrants who do not want to overpay for the assets cannot risk a low bid against him, in which case he can win the $\tau + 1$ auction while still bidding to supply output at a high price during the $\tau + 1$ contract period. The logic is spurious, though, as it ignores the impact that being the incumbent for the $\tau + 2$ auction has on the equilibrium bidding in the $\tau + 1$ auction. Suppose the incumbent behaves as postulated. Then a $\tau + 1$ entrant can respond by bidding higher than the equilibrium bid function (that would have applied in the $\tau + 1$ auction if the τ incumbent had followed the asset-maintenance expenditures pattern subsumed in the symmetric equilibrium), but slightly lower than the τ incumbent was counting on when he deliberately diminished asset value. Now the entrant stands to profit from the incumbent's deviation, winning the $\tau + 1$ auction with a higher probability, charging consumers in $\tau + 1$ a fairly high price when he wins, incurring additional costs during $\tau + 1$ of restoring assets to the condition called for, but (and this is the aspect missed in the scenario) reaping a reward for those expenditures: a large capital gain from the enhanced value of being the $\tau + 1$ incumbent in the $\tau + 2$ auction, and having the $\tau + 2$ bidders then realize that the assets will be in better shape than they were when the $\tau + 1$ incumbent (currently the entrant) acquired them.

Imperfect inspecting of asset condition by entrants may not diminish much the force of the previous argument. Especially to the extent that entering bidders are themselves incumbents in other markets, they may well understand the incentives facing an incumbent. They can know what the equilibrium behavior is like, what the sensible under-maintaining defection from equilibrium would entail, and simply look for the key inspection features that would distinguish between what they themselves would do if following equilibrium or defecting behavior, in terms of asset-maintenance expenditures in their own markets.

This leaves a diminished window for opportunistic asset deterioration untouched by the above arguments. Once an incumbent feels that the forces which will determine the lowest rival bid have finished operating, his incentives to incur asset-maintenance expenditures drop significantly, and they disappear once he learns he has been unseated. The time between asset inspection and bidding can be shortened by the entrants, but it is up to the regulator to institute a prompt turnover of asset-maintenance responsibility once an incumbent loses. In principle, different dimensions of franchisee turnover could occur with different lags, so that maintenance responsibility did not have to wait for all aspects of the transfer to be finalized. For example, a departing incumbent no longer employing the repairmen could still be responsible for resolving billing inquiries over ensuing weeks or months. Nonetheless, spreading out franchisee turnover across months is likely to create new incentive problems just as fast as it solves old ones. As mentioned, details of the proposal at this level have not been worked out, or even thought through. For a prime-time proposal, they would have to be: if the devil is not in the details, at least the ammunition for the devil's advocate is.

4. Extensions of the Benchmark Model and Directions for Future Research

It is inevitable that the model's applicability is subject to a number of qualifications. However, the construction of a benchmark model provides insight into the design of franchise bidding practices that previously have been absent. From the benchmark model, we are able to see what assumptions need to be modified and the directions in which these changes lead. This in itself is a step forward from the previous situation, where absent a benchmark model, it was not clear in which direction to proceed, especially in the light of Williamson's criticisms. Absence of a benchmark model may be one reason why little progress has been made in the intervening period with franchise bidding, while PCR has blossomed with the advances in benchmark models of the economics of information. Because of the likely potential of franchise bidding relative to the alternatives, we think a re-examination is long overdue. Accordingly, we provide a brief discussion of some of the ways in which the benchmark model might be extended, principal concerns still to be addressed, and a brief review of some potential applications to network industries.

Once the notion of a scalar bid being used simultaneously to obtain multiple prices in an auction is considered, there is no need to stop at two prices. Hence, this model could readily be extended to franchise bidding for utilities that supply multiple classes of service, as in basic and premium CATV service or plain old telephone service and more sophisticated offerings.[26] Potential franchisees would again submit a scalar bid b, which would be interpreted as a price at which they were willing to supply basic service. In addition to specifying a t-curve, the regulator would specify an m-curve, and a bid b would imply a willingness to provide premium service at or below an upper constraint price $m(b)$. Ideally, a Ramsey pricing rule would be used to specify the m-curve, taking into account that $m(b)$ is an upper bound. Efficiency in choice of supplier still obtains and is robust to misspecification.

The assumption of a fixed number of bidders is unrealistic: the number of bidders is naturally going to respond to the expected profitability of participating. Harstad (1990; 1993) provides techniques to endogenize this response of the rate of participation to profitability. The current paper could readily be adapted to those techniques, though perhaps at some loss of focus. Characterizations would carry over, and the competitive rate of return would be determined more sharply: in equilibrium, each participating bidder's expected profit would just compensate for the resource costs expended to divert attention from other profit opportunities, to gather information, and to bid in this market.

4.1. Addressing the Deficit

Under baseline (second-price) rules a deficit attends incumbent replacement, which results from an entrant paying for asset transfer based upon the lowest losing bid, while the incumbent receives compensation based upon the winning bid. As it is unrealistic to expect that the deficit will be covered by general taxation, other alternatives must be sought. Because bidding offers significant efficiency benefits relative to unregulated monopoly or

26 If a measure of quality could be specified, written into contracts, and subsequently verified by the regulator at low cost, then this measure of quality could be an additional dimension determined in a franchise bidding auction.

ROR or PCR, there will be several avenues to acquire the funds needed to cover such a deficit, for example, changes in the baseline rules, taxes levied on the utility itself, its customers or on bidders.

A few alternatives adjust the baseline rules so that the deficit can be covered in expected value. The mathematics of the baseline rules are altered least if an entry fee, that is, a fixed charge for the right to bid, is imposed upon entrants. If the entry fee is less than the expected profitability of competing, which is positive when no entry fee is charged, the entrants still rationally choose to compete. Crew and Harstad (1992) work through a simplified one-entrant, uniform distribution, $\lambda = 0$ example, and find that an entry fee sufficient to cover the deficit on average would amount to but 6% of the entrant's expected profit. Such an entry fee has the advantage that it is sunk by the time bids are tendered, and it then does not affect the equilibrium bid function or anticipated output prices for consumers of the network facility.[27]

A franchise fee, that is a fixed sum payable to the regulator (to cover the expected deficit, and perhaps, the regulator's budget) at the close of each auction by the winner (incumbent or entrant), carries most of the benefits of the entry fee. In particular, a symmetric equilibrium in the benchmark model is preserved. However, a franchise fee would shift the equilibrium bid function up, and thus lead to higher prices in the output market. A two-part tariff, i. e., a license fee on potential consumers to exercise the right to purchase from the franchisee over the contract period, payable to the regulator and fixed by the regulator prior to the auction, would raise revenue while impacting demand only through income effects, and could still leave consumers better off relative to other regulatory regimes. In contrast, an excise tax would directly undo the efficiency advantages as it raised revenue. When income effects are negligible, the two-part tariff would have an impact on the benchmark model comparable to the entry fee; when income effects are significant, its impact compares to the franchise fee.

However, covering the deficit *on average* may not be sufficient to make franchise bidding politically palatable. Particularly, creating the fund for the first auction could present a problem, as could the possibility that the deficit fund goes insolvent at some point. More fundamentally, raising an entry fee or a franchise fee would realistically serve to decrease the number of bidders participating, undercutting the revenue source and the scale of advantages attained by efficient choice of supplier. If avenues of the sorts discussed cannot resolve the deficit problem, alternatives to the baseline rules next enter the discussion.

4.2. Informational Advantages of Incumbents

While the tractability of the deficit problem under second-price rules is encouraging, the full efficiency properties presented depend critically on an assumption of symmetric bidder information precision that will rarely if ever be achieved in practice. However, it may be approximated in varying degrees. The question is to what extent are the first-best results,

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27 This assumes that the incumbent is allowed to bid without paying an entry fee. Calculations of the expected profitability of being incumbent next time are otherwise altered. A sufficiently large entry fee might attract a smaller number of bidders. In this model, all bidders are symmetric, and the probability of losing significant efficiency gains due to fewer bidders rapidly becomes negligible. More realistically, entrants may not be symmetric in the technologies they bring to the auction; it is perhaps most plausible that a bidder with a superior technology is less likely to be dissuaded by an entry fee.

relative to the current alternatives—ROR and PCR—affected by relaxation of the symmetry assumptions.

If an incumbent's advantage in informational precision about cost and demand conditions is sufficient to render the benchmark model inapt, there will not be a symmetric equilibrium and may be no significant advantage to baseline rules. The smallest rule change would specify that the second-lowest bid determine the incumbent's receipt of payment for asset transfer whenever the incumbent submits neither of the two lowest bids, thus limiting a deficit to the case when the incumbent's bid is exactly second-lowest. Even this smallest change undoes the symmetric equilibrium, yielding a slightly lower bid function for the incumbent than for entrants. That asymmetry implies that an entrant must surpass some nonzero threshold in terms of attaining a lower expected marginal cost than the incumbent attains before he will replace the incumbent in equilibrium. The next smallest change in the rules would always base asset transfer on the second-lowest bid, so that the mechanism always broke even. This would increase the gap between the incumbent's and entrants' bid functions and increase the threshold below which efficiency in the choice of supplier did not occur. The same qualitative movement away from complete symmetry would be furthered by switching to first-price rules.

It bears emphasis, however, that all the variants of franchise bidding mentioned will result in competitively determined output prices and in changeover of management whenever a substantial improvement in supplier efficiency is available. No alternative form of regulation offered in models in the literature accomplishes these goals.

4.3. Regulatory Commitment

In common with ROR and PCR, franchise bidding is dependent upon commitment on the part of the regulator. Indeed, the particular formulation presented is dependent upon regulatory commitment, in that the expected profitability of incumbency at re-auction is calculated assuming the same equilibrium bid functions, which in turn assumes the regulator will specify the same t-curve. If, as one naturally suspects, the t-curve used will turn out to be a poor estimate of the value in use of the transaction-specific assets, there will be a natural temptation to improve the specification next time.

If the likelihood and resultant nature of such a change is unpredictable and anonymous and if expectations of changes are symmetric, the qualitative conclusions are unaffected. The assumption of an unchanged t-curve at re-auction simplified notation above; beyond that, its only role was to incorporate functionally identical expectations about the profitability of being incumbent at re-auction into the incumbent's and the entrants' bid functions. In view of the robustness of results to misspecification, dynamic consistency may have a lot to recommend it as a policy even in the face of evidence of misspecification. While there is no way of avoiding commitment in regulation, it is likely that franchise bidding will do at least as well in the dimension of regulatory commitment as the current alternatives of PCR and ROR. It bears emphasis that in those forms of regulation, there will typically be pressure exerted by the monopolist to bend regulators away from commitments in the monopolist's favor, and the only countervailing source of pressure would be consumers, who are typically less organized. In franchise bidding, pressure on regulators by incumbent is likely to be balanced by entrants.

4.4. Potential Applications

Providing an answer to this question of the benefits of bidding relative to the current alternatives is potentially important not just in economic theory but also in practice. There are a number of instances currently where the existing system of regulation is encountering major problems in opening up the market to competition. In three such cases, we examine briefly the potential for franchise bidding relative to the current alternatives and suggest directions that research might take.

The first case involves telecommunications. With the rapid technological change following AT&T's divestiture of its local operating companies, several parts of the industry have become increasing competitive. The competition, however, is incomplete, and likely always will be incomplete, because of the existence of local telephone monopolies. The Telecommunications Act of 1996 attempts to address this problem. In so doing, it recognizes that parts of the industry are still bottlenecks or monopolies. These occur primarily in the local service provided by the local exchange carriers (LECs). By and large the LECs have close to a one-hundred-percent market share (in terms of provision to consumers and to resellers) in all basic local services they provide. The Telecommunications Act allows them into the long-distance business but only when they have competitors for local service. The idea is that the suppliers of telephone service will be full-service providers. This arrangement, also known as one-stop shopping, is not widely available at this writing. Its availability requires that some long-distance carriers can buy local service from the LECs and resell it to their customers. Before this can happen, the LECs and the long-distance carriers have to finalize agreements on the resale price of bottleneck services. Setting the discount that long-distance carriers receive when they buy local service for resale is currently the subject of negotiations, arbitrations, and lawsuits between the LECs and the long-distance carriers. It is rapidly becoming a highly contentious process. Absent a competitive market mechanism, setting the discount is inevitably judgmental and much is at stake. If the discount is set too deep, the LECs will be insufficiently compensated. This is serious both in that their incentives to maintain the network infrastructure will be attenuated, and the other carriers will have reduced incentives to build their own facilities.

Franchise bidding would seem to offer an attractive alternative to the current arrangement, which promises to be contentious and unproductive, likely to dissipate many of the benefits of competition, at least initially, in delays and legal expenses. We are currently examining how to apply franchise bidding to this problem. It does seem to make sense to consider having the bottleneck facility run by whomever is willing to charge companies using it the smallest price.

It is not just the present situation in telecommunications that might benefit from franchise bidding. Postal service and electricity are current notable examples of industries that might benefit from franchise bidding. In both of these industries, local distribution is the source of the residual natural monopoly. In electricity, transmission grids are also sources of natural monopolies. Thus, it would be the transmission grids and the distribution systems of the electric utilities and the local delivery networks in postal service that would constitute the principal part of the business subject to regulation. Here there would be a potential for the application of franchise bidding. In postal service, the potential for genuine competition would appear to be considerable, because of the low value of transaction specific or sunk assets. The delivery network is not hard-wired as in the case of the other network industries. The trucks, vans, and personnel all potentially have similar values in their next best alternative. In addition, buildings can be sold or leased for alternative uses. Postal service promises to be an extremely fruitful application of franchise bidding.[28]

While water appears ostensibly to have been untouched by the competitive forces that have been unleashed in other industries, it has not been completely exempt. Water companies have become involved in non-water businesses. Since privatization, water in the United Kingdom has always been subject to PCR. Application of PCR in this case has been no panacea, placing a heavy responsibility on the regulator (Sawkins 1996). There have been several issues of maintenance of infrastructure and the role of unregulated ventures. Franchise bidding might have some potential even in the last old-line utility in both the United Kingdom and the United States. Indeed, there seems to be some movement in that direction with the recent development of investor-owned water companies bidding for contracts to manage municipally owned systems.[29]

5. Concluding Comments

Our benchmark model has shown how second-price rules can achieve the efficiencies claimed by Demsetz. The model has also shown the nature of the restrictive conditions under which a first-best result is guaranteed. To achieve fully Demsetz' purported benefits requires quite restrictive assumptions, much more than was apparent from his informal model. While this is ostensibly discouraging, it has nonetheless provided much clearer guideposts on how to proceed in making franchise bidding a practical regulatory alternative. The effort in doing so would seem to offer considerable potential rewards in terms of efficiency gains.

With the increased interest in competition in the traditional monopoly network industries—telecommunications, postal service, electricity, gas, water—franchise bidding offers an alternative to the existing institutions of PCR and ROR. Unfortunately, despite the attractions of PCR, it still results in a monopolist who effectively cannot be replaced.[30] This is a major weakness; it implies that the regulator under PCR still carries a heavy burden of providing a replacement for the discipline of the market. Franchise bidding not only offers changes in supplier on franchise renewal, but also promises a reduced role for the regulator at least in the provision of market discipline. A further advantage of franchise bidding is that it is less likely to be subject to regulatory capture by the industry than existing forms of regulation. For example, if the incumbent succeeded in persuading the regulator to provide a favorable t-curve, this would result in entrants' perceiving the advantages of incumbency at re-auction that much more attractive.

28 Bidding as in Demsetz' notion amounts to establishing a price, say annually, at which rural residents obtain the right to have mail delivered to them. Of course, this is the sort of pricing that allocative efficiency requires, but it is a politically explosive notion in several nations. It appears worthwhile to examine the alternative of privatizing rural delivery by having the firm willing to cover some specified collection of routes for the lowest fixed annual payment from the postal service.

29 United Water's CEO, Donald Correll in a speech at Rutgers University, May 3, 1996, briefly described his Company's role in such contracts. Note that the bidding envisaged in this development is concession bidding, in that the bid variable is the amount to be paid to the authority for the right to run the system and collect revenues from consumers, subject to some pricing constraints. Concession bidding presumably attains approximate efficiency in choice of supplier, but does not attempt to attain the advantages of competitively determined output prices.

30 It is true that the capital market does provide some discipline on regulated industries in that takeover is possible. However, regulation attenuates the effectiveness of the threat of takeover, in that the regulator may deny the merger, and in any event remains in place following it. In addition, the potential gains to shareholders are typically less in regulated industries than they are elsewhere. Under franchise bidding even relatively small gains would be sufficient to result in change of supplier.

Further research may make the process of setting the t-curve more accurate and acceptable. One approach may be to use the property that the slope of the t-curve is equal to the inverse of the VMP. The regulatory process might be used to derive a "benchmark" value for VMP that would then be used to produce the t-curve. Such a process could allow for periodic reviews. Ideally, this review should be an independent assessment to avoid the problems of commitment and capture described above. However, the details are beyond the scope of this paper. In our opinion, franchise bidding is ripe for reconsideration in the current increasingly competitive environment driven by technological change but in which some residual monopoly remains involving companies that operate in both competitive and monopoly markets.

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