Contestable Licensing*

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This Version: November, 2003

Abstract

We analyze a model of repeated franchise bidding for natural monopoly with contestable licensing – a franchisee holds an (exclusive) license to operate a franchise until another firm offers to pay more for it. In a world where quality is observable but not verifiable, the simple regulatory scheme we describe combines market-like incentives with regulatory oversight to generate efficient outcomes.

JEL CLASSIFICATION NUMBERS: D42, D45, L51.

KEYWORDS: franchise bidding, natural monopoly, contestable markets, regulation, quality.

* We are grateful for the suggestions made by Carlos Alos-Ferrer, Zvi Eckstein, Michael Riordan, Curtis Taylor, and seminar audiences at BU, Columbia, Georgetown, Tel-Aviv, Texas Austin, Texas AM, UCL, and Vienna. An editor and three anonymous referees provided useful comments. Gerhard Orosel gratefully acknowledges the support of the Schumpeter Society, Vienna, and the hospitality of the Weatherhead Center for International Affairs at Harvard University.

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1. Introduction

We analyze a model of (repeated) franchise bidding for natural monopoly that relies on contestable licensing – the right to operate the franchise belongs to the party who owns the appropriate license as long as the license is not successfully contested through a process of competitive bidding. In a world where quality is observable but not verifiable, the simple regulatory scheme we describe combines market-like incentives with regulatory oversight to generate efficient outcomes.

Our analysis builds on the "Chicago approach" to regulating a natural monopoly (Demsetz, 1968; Stigler, 1968; and Posner, 1972).[1] We consider a natural monopoly franchise such as cable television, garbage collection, electric power generation, or railroad operation. Every period, the incumbent monopolist (franchisee) may either provide high quality service which yields a "normal" rent, or low quality service, which results in a correspondingly higher per-period rent. We assume that consumers benefit from high quality service, and moreover, providing high quality service is also efficient. The quality of service is observable by the customers, by other firms, and by the relevant regulatory agency, but is not verifiable in court,[2] for example because legal standards of proof are very strict.[3] Because of this non-verifiability, the political economy environment in which the regulator operates makes it difficult for the regulator to credibly commit to transfer the franchise to another firm upon observation of low quality service.

In the case of cable television franchising for example, Viscusi et al. (1995) write that the Cable Communications Act of 1984 "made it more difficult for a local government to fail to renew a cable company's franchise. To do so, the cable company must have violated the franchise agreement and, even in that case, the company had to be given adequate opportunity to rectify the situation" (p. 444). Zupan (1989) reports that out of 3516 cable TV refranchising decisions during the 80s, only 7 resulted in the local government removing the current franchise owner.

We do not model the reason for why it is the case that, in many practical situations, regulators find it difficult to commit to penalize low quality service. The existing literature (e.g., McCubbins, 1985; Calvert, McCubbins, and Weingast, 1989; and Laffont and Tirole, 1994, ch. 15) suggests that lawmakers may want to restrict regulators' discretion in order to align it better with lawmakers' objectives, and to reduce the extent of rent-seeking behavior together with its implied potential for regulatory capture. The franchise bidding scheme we describe facilitates a commitment to penalize low quality service by minimally increasing the discretionary power of the regulator in a way that keeps the potential for abuse by

[1] The idea of franchise bidding dates back at least to Mill (1848) and Chadwick (1859) (Schmalensee, 1979).

[2] If quality is verifiable, then it is possible to obtain the first-best outcome with a standard contract. Even if quality is not verifiable per se, but some other variable that is correlated with it is, then the first best may still be achieved through contracting and renegotiation (Hermalin and Katz, 1991; Edlin and Hermalin, 2001).

[3] Consider for example the issue of conflict of interest. The recent Sarbanes-Oxley law was designed to protect companies' stakeholders from conflict of interest and fraud by board members and executives. The fact that this law does not apply to every type of company and to every type of behavior which might appear to some as involving conflict of interest, plus the fact that the law is so recent (Spring, 2003), illustrates the gap that often exists between corrupt and illegal activities.

opportunistic regulators under check.

At this stage, it is useful to abstract away from considerations of pricing and the ability of the regulator to observe other variables besides quality (such as cost and sales). As will become clearer below, such considerations do not affect the results of our discussion.

We consider a model where in every period a rival firm may contest the (exclusive) right of the incumbent franchisee to operate the franchise by making a bid for the license to operate the franchise. The incumbent franchisee may submit a counter-bid, and whoever made the highest bid wins the right to operate the franchise until the next challenger appears, upon which the whole process is repeated. We describe conditions under which a franchisee who provides low quality service is quickly replaced by another in equilibrium. On the other hand, a franchisee who provides high quality service can expect to hold the license for a long period of time (for ever in our model). Thus, when the incumbent franchisee considers the present value of providing high versus low quality service, the former yields a higher discounted payoff. As a result, franchisees who intend to provide high quality service are also willing to pay more for the license, and they always win the bidding contest against opponents who have the same technological capability but intend to provide low quality service. Furthermore, this is the unique subgame perfect equilibrium in "simple" strategies (to be defined below).

The regulator's role in all of this is important but minimal: First, it must design the franchise contract in a way that allows a franchisee who provides high quality service for a long period of time to earn higher (discounted) expected profits than a franchisee who provides low quality service for a short period of time. Second, if a rival firm is willing to pay more for the license than the incumbent franchisee, then the regulator should grant it the exclusive right to operate the franchise; if the incumbent is willing to pay more than the rival firm, then it should retain the license. Only when the rival firm and the incumbent franchisee are willing to pay equal amounts for the license, is the regulator called to exercise judgement. In this case, the regulator should grant the license to the incumbent franchisee if it provided high quality service in the past, and to the rival firm if the incumbent provided low quality service in the past.

Our analysis gives rise to a number of interesting conclusions. First, the formal separation in the model between the issue of the quality of service on the one hand, and the price and cost of operation on the other hand, allows us to describe a regulatory scheme that permits the combination of assuring high quality service together with the provision of "high-powered" incentives for cost reductions.[4] This is due to the fact that, as we show below, contestable licensing ensures high quality service, and it allows the regulator, in addition, to design an incentive scheme that is highly responsive to the franchisee's cost savings and sales. In contrast, much of the literature has emphasized that when quality is not contractible, high quality performance necessitates the provision of low powered incentives.[5]

Second, unlike Demsetz (1968) and Stigler (1968) who call for awarding the franchise to the firm that offers to supply the service on the best terms, or Posner (1972) that recommends

[4]Incentives are "high powered" if the regulated firm is allowed to capture a large fraction of its cost savings. They are "low powered" if the opposite is true.

[5]Laffont and Tirole (1994) for example write "When incentives for noncontractible quality are provided by reputational concerns, low-powered incentives are needed to encourage its provision." (p. 664) See also Laffont and Tirole (1991) and the references therein.

that firms compete for the license through bids that combine terms of service and lump sum payments, we show that the incentives to provide high quality service are better preserved when the franchise is awarded to the firm that is offering to pay the largest lump sum for it. Previous authors emphasized that once a monopolist obtains the exclusive right to operate a franchise through competition, it has an incentive to provide low quality service unless the competition was specifically on the terms of the franchise contract. We highlight a different concern. Namely, especially in those situations where important aspects of the quality of service are non-verifiable, competition over the terms of the franchise service could lead to the selection of operators who promise excellent terms of service, but provide very low quality service once they obtain the license.

Third, following the Chicago approach and unlike Laffont and Tirole (1988), we show that the preservation of dynamic incentives is better served with the imposition of bidding parity between the incumbent franchisee and the rival firm.[6]

Fourth, as a consequence of the fact that, in equilibrium, an incumbent franchisee that provides high quality service remains the incumbent for a long period of time, the "dynamic costs" associated with the fact that incumbent franchisees may under-invest in capital equipment for fear they will not be able to recoup their investment in case they are replaced, need not be large.[7]

Finally, because along the equilibrium path the incumbent franchisee is never challenged, the transaction costs associated with running a series of bidding contests need not be large either.[8]

The analysis presented here relates to the previous theoretical literature on franchise bidding (Laffont and Tirole, 1987; McAfee and McMillan, 1987; and Riordan and Sappington, 1987).[9] This literature has mostly considered once-and-for-all bidding,[10] and focused on the "separation" between the competitive bidding stage and the regulation stage, obtaining the result that the winner of the franchise can be regulated as if the competition stage did not take place. Our focus is different. In contrast to this "mechanism design" inspired literature that studied franchise bidding under asymmetric information but with "complete contracting" ability, we consider a situation with complete information but incomplete contracting.[11] In this environment, we show that allowing for repeated franchise bidding exerts a strong disciplinary pressure on the incumbent franchisee to provide high quality service.

Another related work is that of Klein and Leffler (1981) who studied the issue of whether the market mechanism (repeat-purchase) can be counted on to ensure high quality performance in those circumstances where quality is not directly contractible.[12] The necessary and sufficient condition they identified, namely, that market prices are set high enough so that

[6] Laffont and Tirole (1988) considered a two-period model where distortion away from bidding parity in the second period improves efficiency by affecting the incumbent franchisee's incentives to invest in the first period.

[7] See Williamson (1976) and Laffont and Tirole (1988).

[8] See Williamson (1976).

[9] See also Laffont and Tirole (1994) and the references therein.

[10] However, as mentioned above in footnote 6, Laffont and Tirole (1988) considered the case of twice repeated bidding. Riordan and Sappington (1989) offer related analysis.

[11] For results about the distortions induced by a monopolist who can control the quality of the good it produces see, e.g., Mussa and Rosen (1978) and Gabszewicz and Wauthy (2002).

[12] See also Shapiro (1983).

the discounted stream of rents to the firm with high quality performance is greater than the rents obtained from nonperformance, has a direct analog in our model (Regulator's Rule 1 below). Klein and Leffler ignored the possibility of the existence of multiple equilibria. As we show, in addition to the "good" equilibrium where high quality service is provided in every period, there also exist other ("bad") equilibria where low quality service is provided. Our contribution consists in the identification of plausible conditions (namely, the presumption that firms would rather employ *simple* strategies, defined below), under which the good equilibrium is the unique subgame perfect equilibrium.

Finally, the basic idea of "contestable licensing" shares at least some of its motivation with the idea of "contestable markets" as formulated in Baumol, Panzar, and Willig (1982), and in the references therein. Both approaches rely on the notion of contestability as the threat of competition rather than actual competition to discipline incumbent firms. However, while the contestability literature formulates conditions under which regulatory intervention (except for securing easy entry and exit) is unnecessary, and derives implications with respect to market structure, our goal is to utilize the idea of contestability for the purpose of designing a regulatory scheme that calls for greater regulatory oversight.

The rest of the paper proceeds as follows. In the next section we present the model. In Section 3, we explain our notion of a *simple* strategy and proceed to describe the (unique) subgame perfect equilibrium in simple strategies, as well as a number of other equilibria in which firms do not employ simple strategies. In Section 4, we discuss the robustness of our results to the possibility of regulatory capture (4.1), to the issues of sunk costs, the transferability of investment, and asset specificity (4.2), and to technological progress (4.3). All proofs are relegated to the Appendix.

2. The Model

Let J be a large set of risk-neutral firms that are all potentially capable of operating some natural monopoly franchise. We assume that the firms' per-period opportunity costs are identical and equal to zero, and that all firms have the same technology. Since the procedure that we propose does not conflict with "high-powered" incentives for cost reductions, technological improvement due to the successful implementation of generally known technologies can be incorporated into our approach. However, rather than unnecessarily complicating the model we show this separately in the discussion section below.

Every period, the incumbent franchisee chooses whether to provide high or low quality service. Recall that providing high quality service is assumed to be more efficient. The incumbent's choice of quality in period t is denoted by $q_t \in \{q_L, q_H\}$ where q_L denotes low and q_H denotes high quality service, respectively.[13] For example, a firm can provide low quality service by offering only few or inferior choices (in the case of cable TV), by not installing a sufficiently large capacity to handle emergency situations, by neglecting to provide proper maintenance (in the case of a toll road), etc. We assume that the incumbent franchisee's

[13] In many applications, quality is likely to be multi-dimensional. This does not affect our results as long as there exists a monotone function that maps quality into $\{q_L, q_H\}$. The fact that we only distinguish between high and low quality involves no loss of generality since the "efficient" quality (and higher qualities) can be mapped into q_H, and lower qualities into q_L.

choice of quality is observable by the regulator but not verifiable in court. As explained in the introduction, the fact that courts demand high standards of proof sometimes may imply the existence of a gap between what people generally consider to be of low quality, and what a court might declare to be of low quality. Furthermore, incumbents and their lawyers are not only expected to exploit legal loopholes and take advantage of legal procedures when they have to defend themselves in court, but to also anticipate these possibilities and provide low quality in such a way that with high probability the regulator will fail to establish in court the fact that low quality was provided in spite of the fact that low quality is observable to every interested agent.

The social welfare generated by the incumbent franchisee in period t (which we identify with the regulator's per-period objective function) is given by $w_t = w_t(q_t)$. We assume that for every $t \geq 1$, an incumbent franchisee that provides high rather than low quality service generates a higher per-period social welfare. The function w_t should thus be interpreted as a "reduced form" of a more general social welfare function that depends, among other things, on consumers surplus and producer surplus.

The payoff to the incumbent franchisee in period t depends on the terms of the license to operate the franchise in period t (which are determined by the regulator) and on the incumbent franchisee's choice of quality. It may include a transfer to or from the regulator that depends on the cost incurred by the franchisee,[14] the revenue collected by the franchisee, etc.[15] We denote the per-period profit to the incumbent franchisee in period t by $\pi_t(q_t)$ and assume that for every $t \geq 1$, the per-period profit $\pi_t(\cdot)$ is decreasing in the quality of service whatever the terms of the license may be. This combines two assumptions. First, although demand may be increasing with the quality of service, the incumbent franchisee's additional revenues when providing high quality service are assumed to be lower than the additional cost. The reason for this assumption is that this is the (only) case we are interested in. If high quality service generates higher profit, then the franchisee has sufficient incentive to provide high quality without any regulatory intervention. Second, the regulator cannot influence the franchisee's per-period profit in such a way that higher quality results in a higher profit. This is a consequence of the fact that quality is not verifiable. As much as it would like to, the regulator cannot reward the franchisee for providing high quality service or penalize it for providing low quality service. Consequently, ceteris paribus, an incumbent franchisee that provides low rather than high quality service obtains a higher per-period payoff.

We assume that the firms discount all future per-period payoffs according to the commonly known (real) interest rate, $r > 0$.

We do not specify the terms of the franchise contract that are independent of the franchisee's choice of quality. However, we do assume that every such term can be enforced. In the discussion section below we show that our mechanism does not conflict with providing the incumbent franchisee with high-powered incentives to update its technology to the most

[14] This cost does not include possibly large, but infrequently incurred, set-up costs. These are discussed seperately in Section 4.2 below.

[15] For example, consider a franchise to operate a toll bridge where demand is inelastic with respect to the quality of service. The regulator may control the incumbent franchisee's profit by specifying toll charges. Other things equal, an incumbent franchisee that provides lower quality service obtains higher per-period profit.

current generally known standard.

The game proceeds as follows. In every period $t \geq 1$:

1. The incumbent franchisee decides whether or not to provide high quality service. Its decision is observed by the regulator, and by all its potential rivals.[16]

2. At the end of the period, the payoff to the incumbent franchisee and social welfare to society are realized.

3. Next, a rival firm appears. The rival firm may bid for the license to operate the franchise. We denote its bid by $b_t^R \geq 0$. We assume that preparing and submitting the bid requires the rival firm to incur a small cost, μb_t^R, where $\mu > 0$, which is proportional to its bid. Finally, the challenger's bid is constrained to be an integer multiple of some bid increment $m > 0$.[17]

4. The incumbent franchisee observes the challenger's bid and may respond by making a counter-bid $b_t^I \geq 0$ at a cost μb_t^I.[18] The counter-bid b_t^I is constrained to be an integer multiple of the bid increment m.

5. The regulator awards the franchise to the highest bidder, provided (exactly) one exists. The highest bidder pays the regulatory agency an amount equal to its bid. The regulator's action in case the bids are tied is specified below in the second regulator's rule.

It is understood that the right to operate the franchise belongs to the incumbent franchisee as long as the terms of the franchise contract are satisfied, and the regulator did not award the right to operate the franchise to another firm through competitive bidding as specified above.

The description of the game above corresponds to a situation where several different firms provide the same franchise service in close but different geographical locations. Every such firm is eager to expand its franchise service to additional areas.

3. Equilibrium Analysis

The regulatory design has to overcome the moral hazard problem that the incumbent franchisee may provide only low quality service. We present two rules that, if followed by the

[16] The analysis remains qualitatively unchanged if the regulator and rivals only observe a (non-verifiable) signal about the incumbent franchisee's decision, provided this signal is not too noisy. The two rules RR1 and RR2 below have to be modified in the following way. In RR2 the regulator's decision depends on a "cutoff" realization of the signal, and in RR1 the regulator has to provide rents that take account of the fact that the signal is only imperfectly informative (consequently the rents are higher the noisier the signal). The signal is non-verifiable whenever courts do not regard it as sufficient evidence that would justify a decision against the incumbent franchisee.

[17] The auction design is part of the regulatory design and can include a minimum bid increment. Moreover, imposition of minimum bid increments is standard in many empirically observed auctions.

[18] The assumption that the cost of bidding is proportional to the submitted bid is not necessary for our results to hold. It could be replaced, for example, by the assumption that submitting any positive bid requires bidders to incure a small fixed cost.

regulator, guarantee that providing high quality service is a subgame perfect equilibrium outcome of the game above. The equilibrium is such that a franchisee that provides low quality service, while earning a higher per-period payoff, can only expect to remain the incumbent franchisee for one period. On the other hand, an incumbent franchisee that provides high quality service (and earns a lower per-period payoff), can expect to remain the incumbent franchisee forever. The first rule is:

Regulator's Rule 1 (RR1). *The regulator sets the terms of the franchise contract such that the payoff to the franchisee from providing low quality service for one period is lower than the discounted sum of benefits associated with providing high quality service forever. Or, for every* $t \geq 1$,

$$\sum_{\tau=1}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} \pi_{t+\tau}\left(q_H\right) > \left(\frac{1}{1+r}\right) \pi_{t+1}\left(q_L\right). \qquad (*)$$

It is important to observe that the rule above can be easily followed. Suppose, for example, that the regulator sets exactly the same franchise contract every period, and that this contract generates per-period profits of $\overline{\pi}$ and $\underline{\pi} < \overline{\pi}$ to the franchisee if it provides low or high quality service, respectively. In this case $(*)$ reduces to

$$\frac{1}{r} \cdot \underline{\pi} > \frac{1}{1+r} \cdot \overline{\pi},$$

which is satisfied whenever the interest rate r is low enough. In case the interest rate is not sufficiently low, the regulator can still ensure that $(*)$ is satisfied by increasing the per-period profit of the incumbent franchisee by some constant C. The fact that on the left-hand-side of the inequality above C is divided by r while on the right-hand-side it is divided by $1+r$ implies that the inequality holds provided C is sufficiently large.[19] However, it may not always be possible to pay the franchisee a constant subsidy C. In such cases, depending on the context, the regulator may have, in addition, other instruments available for achieving the purpose of satisfying $(*)$. For example, when the regulator controls prices, then $(*)$ can be satisfied by allowing the franchisee to charge higher prices, as the following illustration shows.

Consider the case in which the franchisee's production function is subject to increasing returns to scale and thus to decreasing average cost. Let $x_H(p)$ and $x_L(p)$ denote demand at price p for the good produced by the franchisee if quality is high and low, respectively. Suppose that $x_H(p)$ and $x_L(p)$ are constant over time, decreasing in p, and for every price p, $x_H(p) > x_L(p)$. Let $c_H(q)$ and $c_L(q)$ denote the average cost of producing quantity q of high and low quality, respectively, and suppose that $c_H(q)$ and $c_L(q)$ are decreasing. It follows that $c_H(x_H(p))$ and $c_L(x_L(p))$ are increasing in p. Suppose further that the regulator wishes to ensure that the incumbent franchisee produces high quality goods. Let $p_H(q)$ and $p_L(q)$ denote the inverse demand functions and define social welfare as the sum of consumers' plus producers' rent.[20] The production of high quality maximizes social welfare if (but not only if)

[19] Thus, as in Klein and Leffler (1981), it is necessary to let the incumbent franchisee capture a positive rent to ensure high quality performance.

[20] The sum of consumers' plus producers' rent equals consumers' aggregate willingness to pay (the area below the demand function) minus total production cost.

for every quantity $x \geq 0$, social welfare from producing high quality, or $\int_0^x p_H(q)\,dq - xc_H(x)$, is larger or equal than social welfare from producing low quality, $\int_0^x p_L(q)\,dq - xc_L(x)$.

The regulator can ensure that RR1 is satisfied by fixing an appropriate price p for the good that is produced by the franchisee. Note that if the regulator sets the price p, then the profit to the franchisee from producing high and low quality is given by $\pi_H(p) \equiv [p - c_H(x_H(p))]\,x_H(p)$ and $\pi_L(p) \equiv [p - c_L(x_L(p))]\,x_L(p)$, respectively. If at the price p^* that is chosen by the regulator $c_H(x_H(p^*)) \leq c_L(x_L(p^*))$ and $c_H(x_H(p^*)) \leq p^*$, then the incumbent franchisee will always produce high quality (since in this case, $\pi_H(p^*) \geq \pi_L(p^*)$) and the regulator need not do anything. Suppose then that at the price p^* that the regulator would ideally want to set, $\pi_H(p^*) < \pi_L(p^*)$.

A regulator who cannot pay lump sum subsidies to the incumbent franchisee has to ensure that the incumbent franchisee breaks even, which implies that the price, p, has to be larger or equal to $c_H(x_H(p))$. Given this constraint, a regulator who is concerned about social welfare may ideally want to set the price such that $p = c_H(x_H(p))$, and if that is not possible may want to minimize $p - c_H(x_H(p)) \geq 0$.[21] However, because $\pi_H(p) \geq \pi_L(p)$ if and only if

$$p \geq c_H(x_H(p)) + \frac{[c_H(x_H(p)) - c_L(x_L(p))]\,x_L(p)}{x_H(p) - x_L(p)}$$

the regulator cannot set the price p too close to $c_H(x_H(p))$ without giving the incumbent franchisee an incentive to produce low quality. The incentive scheme that is described here takes advantage of the fact that $\frac{\pi_H(p)}{r} > \frac{\pi_L(p)}{1+r}$, if and only if

$$p > c_H(x_H(p)) + \frac{[c_H(x_H(p)) - c_L(x_L(p))]\,x_L(p)}{x_H(p) - x_L(p) + \frac{x_H(p)}{r}},$$

to relax the incumbent franchisee's incentive constraint. Any price p that satisfies

$$\frac{[c_H(x_H(p)) - c_L(x_L(p))]\,x_L(p)}{x_H(p) - x_L(p) + \frac{x_H(p)}{r}} < p - c_H(x_H(p)) < \frac{[c_H(x_H(p)) - c_L(x_L(p))]\,x_L(p)}{x_H(p) - x_L(p)}$$

provides the incumbent franchisee with an incentive to produce high quality. Note that the smaller is r, the bigger is the present value of continuing to hold the franchise, and the closer the regulator can get to a price p that is equal to $c_H(x_H(p))$.

Of course, demand must be sufficiently inelastic so that the efficiency loss from pricing farther above marginal cost is smaller than the resulting gain from the provision of high quality service.[22] In any case, since regulation determines the incumbent franchisee's per-period rent, the relevant regulatory agency can always make sure that condition $(*)$ is satisfied. Finally, note also that the regulator would typically want to set the left-hand-side of $(*)$ as low as possible in order to minimize the rent captured by the incumbent franchisee.

[21] Assume, for this illustration, that the equation $p = c_H(x_H(p))$ has a unique solution p^* and that p^* is indeed (constrained) welfare maximizing. Since $x_H(\cdot) > x_L(\cdot)$, the assumption that $\pi_H(p^*) < \pi_L(p^*)$ implies $c_H(x_H(p^*)) > c_L(x_L(p^*))$, and continuity implies that $c_H(x_H(p)) > c_L(x_L(p))$ at least in a neighborhood of p^*.

[22] If the efficiency loss from increasing the price is larger than the efficiency loss from raising taxes, rather than allowing the franchisee to charge a price above marginal cost the regulator should pay a subsidy to the franchisee that is financed by taxes.

The next rule further constrains the regulator's behavior. Recall that if either the incumbent franchisee or its rival make a higher bid for the license to operate the franchise, then the regulator awards it with the license. It is possible however, that they bid exactly the same amount. In this case we assume that the regulator awards the license to the rival firm if the incumbent franchisee provided low quality service in the last period, but it lets the incumbent franchisee retain the license if the incumbent provided high quality service in the last period. In an environment where quality is non-verifiable and hence not directly contractible, this provides an easily justifiable way for the regulator to discipline the incumbent franchisee.

Regulator's Rule 2 (RR2, "Tie-Breaking Rule"). *If at (the end of) any period t the rival firm and the incumbent franchisee bid the same amount $b_t^I = b_t^R$ for the license, then the regulator awards the license to the incumbent if it provided high quality service in period t, and to the rival firm if the incumbent provided low quality service in period t.*

Together, RR1 and RR2 ensure that providing high quality service is an equilibrium of the game.

Proposition 1. *Suppose that the regulator follows RR1-RR2. There exists a subgame perfect equilibrium in which the incumbent franchisee always provides high quality service (and is never replaced).*

The strategies that support this subgame perfect equilibrium are as follows: The incumbent franchisee provides high quality service in every period. Whenever it is challenged, it matches any bid that is equal or below the discounted sum of per-period payoffs from providing high quality service taking the cost of bidding into account. If a higher bid is submitted, the incumbent declines to bid. Rivals' strategies are as follows. If at any period the incumbent franchisee provided low quality service, then the next rival firm bids an amount equal to the discounted sum of per-period payoffs from providing high quality service taking the cost of bidding into account. Rival firms decline to bid otherwise. Along the equilibrium path, the incumbent franchisee always provides high quality service and is never replaced.

It is easy to verify that this is indeed a subgame perfect equilibrium. If the incumbent franchisee provides low quality service, then the next rival firm will bid for the license and win since it is favored by the regulator's tie-breaking rule. RR1 then implies that the maximum profit that the incumbent franchisee can achieve by providing low quality service for one period is lower than the sum of discounted profits if it continues to provide high quality service forever.

However, as the next two examples show, this is not the only equilibrium of the game. In both examples it is assumed that the regulator sets the same franchise contract in every period. The statement "bid B" should be interpreted as "bid the highest integer multiple of the bid increment m that is smaller or equal to B." We denote the (stationary) per-period payoff of an incumbent franchisee that provides low quality by $\overline{\pi}$, and of an incumbent franchisee that provides high quality service by $\underline{\pi}$. By assumption, $\overline{\pi} > \underline{\pi} > 0$.

The next example illustrates the significance of focusing on subgame perfect as opposed to Nash equilibria.

Example 1 (Subgame perfect vs. Nash equilibrium). Consider the following profile of strategies: The strategy of every rival firm is to always challenge the incumbent franchisee by

bidding $\frac{\overline{\pi}}{(1+\mu)(1+r)}$. The strategy of every incumbent franchisee is to provide low quality service after any history. When challenged, every incumbent franchisee bids the smallest possible amount that ensures its victory, but not more than $\frac{\overline{\pi}}{(1+\mu)(1+r)}$, after any bid that is strictly lower than $\frac{\overline{\pi}}{(1+\mu)(1+r)}$. It declines to bid otherwise. Note that this is a Nash equilibrium of the game in which each incumbent franchisee holds the franchise for exactly one period after which it is challenged and replaced. Since the incumbent franchisee is challenged regardless of its choice of quality, its best response is to provide low quality service. However, this equilibrium is not subgame perfect. If the incumbent franchisee provides high quality service (and matches any bid up to $\frac{\underline{\pi}}{(1+\mu)r}$ if challenged), the next rival would be better off not bidding against it since it will incur the cost of submitting a bid but because of the tie-breaking rule will lose.[23] But if the next rival firm declines to bid, providing high quality service is better than providing low quality service and the equilibrium unravels.[24]

The next example demonstrates the problem that may arise when rival firms' strategies depend on the incumbent franchisee's identity.

Example 2 (The importance of Anonymity). Consider the following profile of strategies: The incumbent franchisee at time 1, i_1, provides low quality service as long as it remains the incumbent. Whenever challenged, it matches any bid that is smaller than the discounted sum of per-period payoffs from continuing to provide low quality service, unchallenged, taking the cost of bidding into account, i.e., it matches any bid that is smaller than $\frac{\overline{\pi}}{(1+\mu)r}$, and declines to bid otherwise. The strategy of a rival firm that appears in any period $t \geq 1$ is to decline to challenge the incumbent franchisee if it is i_1; and, when facing any other incumbent franchisee, to decline to bid if the incumbent franchisee provided high quality service, and to bid $\frac{\underline{\pi}}{(1+\mu)r}$ if the incumbent franchisee provided low quality service. While it holds the license to operate the franchise, the rival firm always provides high quality service and matches any bid that is smaller or equal to $\frac{\underline{\pi}}{(1+\mu)r}$. Along the equilibrium path, the first incumbent franchisee provides low quality service in every period and is never challenged. The equilibrium is sustained because future rival firms treat i_1 differently from any other incumbent franchisee. They "allow" the first incumbent franchisee to provide low quality service but "demand" high quality service from any other incumbent franchisee. Since the payoff to an incumbent franchisee who provides high quality service in every period is lower than the payoff to an incumbent franchisee who provides low quality service (and retains the franchise) forever, the first incumbent franchisee can never be defeated.

Example 2 demonstrates the significance of anonymity.[25] It is important to emphasize that while Example 2 violates anonymity in that the incumbent's "name" matters, it is straightforward to modify the example so that strategies do not depend on names, and yet a similar equilibrium in which low quality is produced in every period exists. This can be

[23] $\frac{\underline{\pi}}{(1+\mu)r}$ is the discounted sum of payoffs from continuing to provide high quality service forever, taking the cost of bidding into account.

[24] Note also that the fact that $\overline{\pi} > \underline{\pi}$ implies that the bids paid are higher than they would be if high quality was produced, but that because bids are transfer payments, this does not affect social welfare (except, perhaps, to the extent that distortionary taxes can be reduced). Moreover, along the equilibrium path no bids are actually made.

[25] Anonymity may be interpreted as "competitiveness" of the underlying economic environment. See the discussion in Osborne and Rubinstein (1990), and Rubinstein and Wolinsky (1990).

done, for example, by "identifying" firms according to the duration of time they held the license. If, in every period t, rival firms strategies may depend on whether the incumbent franchisee held the license for t or for fewer periods, then the initial incumbent may be treated differently from later incumbents. Thus, anonymity may be violated even if agents have no "proper" names. However, true anonymity, or at least a kind of anonymity that guarantees that the "good" equilibrium described in Proposition 1 is the unique subgame perfect equilibrium, can be achieved by restricting attention only to those equilibria where firms employ *simple* strategies as follows.

Definition. *A firm's strategy is called* ***simple*** *if it satisfies the following two restrictions:*

S1 Rival firms care only about the performance of the incumbent franchisee. *When bidding for the license, rival firms' decisions about how much to bid depend only on what has happened since the current incumbent franchisee began operating the franchise and are independent of the incumbent's identity.*

S2 Firms have bounded recall. *Firms do not remember what happened more than k periods ago for some finite $k \geq 1$.*

Thus, a rival firm that employs a simple strategy bids the same against different incumbent franchisees who have the exact same history of actions. Furthermore, it also ignores everything that has happened before the current incumbent franchisee has started operating the franchise. The requirement that rival firms' bids do not depend on the incumbent franchisee's identity should be interpreted as an assumption about the competitiveness of the underlying environment. We view competition as implying that rival firms do not condition their bids on "irrelevant" aspects of the history of play such as the incumbent franchisee's identity. Otherwise, some incumbent franchisees may be free from the threat of a challenge which implies that competition is, in some sense, inhibited. S2 or bounded recall is a standard "bounded rationality" type assumption. Here, it excludes implausible strategies that, in effect, eliminate competition by giving special treatment to particular incumbent franchisees (e.g., as explained above, to the first incumbent franchisee by conditioning challengers' bids on its tenure). This requirement is weak in that the length of firms' recall, k, can be arbitrarily large.

It is straightforward to verify that the equilibrium that is described in Proposition 1 is in simple strategies. The next proposition establishes the uniqueness of such an equilibrium.

Proposition 2. *Suppose that the regulator follows RR1 and RR2. Then, the game described above has a (generically) unique subgame perfect equilibrium in simple strategies. In this equilibrium, the incumbent franchisee always provides high quality service and is never replaced.*[26]

The uniqueness of the equilibrium in simple strategies that is described in Proposition 1 is by no means obvious. For example, one may wonder whether the incumbent franchisee can provide low quality service but the next rival firm may be wary of challenging it because the

[26] We use the term "generically" in the following sense: the franchisee's payoff $\pi_t(\cdot)$ is generically not equal to some integer multiple of the bid increment m.

rival firm believes that if it becomes the incumbent franchisee itself, it would be challenged by future rival firms and has to pay to keep its license whereas the incumbent franchisee would not. As a consequence, the rival firm would be willing to pay less for the license and since bidding is costly, would not attempt to bid for the license. The proof of Proposition 2 shows that such wariness on the part of rival firms is incompatible with the logic of subgame perfect equilibrium in simple strategies.

Because firms have bounded recall, the rival firm that appears in period t, call it j, knows that if it survives k periods as the incumbent franchisee (i.e., if it is the incumbent franchisee at $t+k+1$), it will be treated thereafter exactly as the present incumbent franchisee, call it i, would. Therefore, k periods into the future (i.e., in period $t+k$), j would be willing to pay the same amount the incumbent franchisee i would for the right to operate the franchise in period $t+k+1$. S1 implies that the rival firm that will appear in period $t+k$ (challenging the incumbent franchisee of period $t+k$ for the license in period $t+k+1$ onwards) will only be judged according to its own performance. It will therefore be indifferent between challenging firm j or the incumbent franchisee i and will therefore treat both identically. Realizing this, firm j would also realize that it faces the exact same future as the incumbent franchisee i, k rather than $k+1$ periods into the future. The same argument can be repeated to show that firm j would be treated exactly as the incumbent franchisee also $k-1$ periods into the future. Repeating this argument $k-2$ more times implies that the rival firm j and the incumbent franchisee can expect to be treated in the same way by all future rival firms. But, in this case, the regulator's tie-breaking rule implies that an incumbent franchisee who chooses to provide low quality service gives up its advantage as the incumbent and is surely going to be defeated by the next rival firm. On the other hand, if it chooses to provide high quality service, it can count on the regulator's "support" and will win every future contest by matching rival firms' bids. All rival firms realize this and therefore, since bidding is costly, decline to bid against incumbent franchisees that provide high quality service.

At a more general level, the intuition for Proposition 2 is that competition works. Restricting our attention to equilibria in *simple* strategies implies that competition for the franchise contract is not inhibited by "special treatment" of specific incumbent franchisees which shields them from competition. Every incumbent franchisee is subject to the threat of being successfully challenged if it ever provides low quality service. Because of this threat, every incumbent provides high quality service in every period. Thus, if the market for the franchise contract is competitive enough and firms employ *simple* strategies, then contestable licensing leads to the efficient outcome.

Proposition 2 may thus be interpreted as a refinement. Namely, the infinite game we described has many equilibria, but only one equilibrium that relies on strategies that satisfy the "attractive properties" captured by our notion of a *simple* strategy.[27]

[27] The proposition may also be interpreted as establishing the uniqueness of a Markov Perfect Equilibrium where states are defined as histories of length smaller or equal to k since the incumbent obtained the license.

4. Discussion

4.1. Regulator Malleability

Under the current regulatory regime, it is difficult if not impossible for a regulatory agency to commit to an action that is based on non-verifiable information and is against the interest of regulated industry. Even if such commitment is possible, the associated legal costs that arise when the regulator's decision is challenged in court are likely to be prohibitive. Consequently, it is very difficult for regulatory agencies to pressure regulated industries into providing high non-contractible quality. The franchise bidding scheme described in this paper increases the regulator's discretion so that such commitment is made possible. This additional discretionary power is minimal – the regulator should still be able to justify its decisions in court, but should be held to weaker standards of proof. The regulator is called to exercise judgement only in the unlikely event where two firms have submitted identical bids. The rarity of such situations promises that they will focus the public's attention on the regulator's decision which will further constrain it from behaving opportunistically. Furthermore, various consumer groups may act as watchdogs and, upon observation of low quality service, apply pressure on the regulator to make it commonly known that it will henceforth resolve ties in favor of rival firms.[28] To a benevolent regulator, this added discretion facilitates an easily justifiable way of dismissing incumbent franchisees who provided low quality service. After all, even if it is not verifiable, the fact that the incumbent franchisee provided low quality service is observable, and a rival firm who is willing to operate the franchise under the same conditions and is willing to pay for this right as much as the incumbent is, is readily available.

Under so-called "direct" or "command and control" regulation, increasing the regulator's discretion so that it can dismiss the franchisee at will is not likely to be as robust against regulatory capture. Suppose for example that as formulated, the details of the franchise contract promote efficiency (i.e., RR1 is satisfied) but the incumbent regulator may be subject to regulatory capture. It may fail to dismiss the incumbent franchisee upon observation of low quality service with a certain, commonly known, probability $0 < p < 1$.[29] Under direct regulation, a high enough p implies that incumbent franchisees will provide low quality service. However, under the franchise bidding scheme we propose, if consumer groups are willing to cover the bidding costs of a rival firm, a rival firm who notices that low quality service is provided by the incumbent franchisee may still challenge the incumbent for the right to operate the license.[30] Even if a tie occurs and the regulator resolves the tie in

[28] The evidence presented in Besley and Coate (2003) that showed that electricity prices are on average lower in states where regulators stand for public election than in states where they are appointed suggests that the public may well act as an effective "watchdog" against regulatory capture.

[29] This distinction between the efficiency of the rules on the one hand and the effectiveness of rule enforcement on the other is standard in the literature. Perhaps because verifying a document (the rules), may be easier than verifying the state of the world (enforcement), the literature typically assumes that the efficiency of rules may be easier to ensure than effective enforcement. See Laffont and Tirole (1994, ch. 15) and the references therein.

[30] Moreover, if the cost of bidding is small relative to the bidding increment, so that the net gain from obtaining the license taking into account the price paid and the probability of winning is larger than the cost of bidding, rival firms will be willing to bid against the incumbent franchisee even if their costs are not covered by consumer groups.

favor of the incumbent franchisee, the incumbent franchisee still has to pay, whereas under direct regulation it would not. Furthermore, anticipating this, the incumbent franchisee may provide high quality service in order to prevent such challenges from occurring in the first place.

The previous argument in favor of contestable licensing can be easily "formalized" and incorporated into the model. The next argument, while perhaps not any less important, is more difficult to explicitly formalize without introducing significant changes to the model. Due to free-rider problems, it is difficult for consumers, as a group, to supervise regulators that abuse their discretionary power. The advantage of contestable licensing compared to direct regulation is that under the former, the rival firm can help organize consumer resistance so as to mitigate the free-rider problem mentioned above. In addition, the presence of a clear alternative may make resistance more effective relative to the case where no such alternative exists as is the case under direct regulation.

4.2. Sunk Costs, the Transferability of Investment, and Asset Specificity

Williamson's (1976) main criticism of the "Chicago School approach" to franchise bidding concerns what he claimed was its facile dismissal of the related issues of sunk costs, the incentives to invest, the transferability of investment, and asset specificity. The basic problem is as follows. Suppose that the incumbent franchisee has to incur a large irreversible cost in order to operate the franchise. This gives the incumbent franchisee a clear advantage over its rivals since in the bidding stage, potential rival firms have to consider their future per-period profits as well as the required irreversible costs, whereas the incumbent franchisee, for whom these costs are sunk, only has to consider its future per-period profits. This asymmetry between the incumbent and its rival may give rise to several types of inefficiencies: First, the presence of sunk costs biases the bidding in favor of the incumbent franchisee, which enables it to outbid any rival, and consequently deter potential challengers. Second, incumbent franchisees may under-invest in capital equipment for fear they will not be able to recapture their investment when they are replaced. And third, the sunk costs may have to be incurred again and again as the incumbent franchisee is replaced, which is socially wasteful.

Regarding the first problem, it is possible to restore the bidding parity between the incumbent franchisee and rival firms by compensating firms for their capital investments. A way to do this is to require the successful rival to pay the defeated incumbent an amount equal to the estimated value of the capital stock involved. Such a measure has two effects: (1) since the incumbent gets exactly what the rival pays, it reduces both their bids by the same amount, so our formal analysis is still valid. The rival reduces its bid by this amount because it has to pay this amount to the incumbent if it wins, and the incumbent reduces its bid by this amount because it will receive this amount if it loses. (2) Because firms are assumed to be risk-neutral, investments by incumbents are not distorted provided incumbents expect the estimate of the size of their capital stock to be unbiased. Thus, play along the equilibrium path will not change except that the values of the bids will be lower by the estimated value of the capital stock.

Alternatively, in many cases the state is or can be made the owner of all capital equipment.[31] Yet another possibility is to let a separate (regulated) private company own all

[31] See Schmalensee (1979) and the references therein for descriptions of cases where this was done in

equipment and require it to lease the equipment to the franchisee that provides the good or service in question.[32]

Demsetz (1968) and Posner (1972) anticipated the second point above by describing various ways according to which incumbent franchisees can be compensated for their capital investments, and the third point by remarking that incumbent franchisee's capital investments can be transferred from one incumbent franchisee to the next to minimize social inefficiency. However, Williamson (1976) pointed to the difficulties associated with these schemes especially when capital investments are highly specific.[33] He concluded that in those industries where assets are generally less specific such as local service airlines, postal delivery, and trucking, franchise bidding may be a satisfactory solution, but in other industries such as utility services (gas, water, electricity, telephone), direct regulation is likely to perform at least as well as franchise bidding.

Finally, in some cases, the problems caused by sunk costs or asset specificity may be so overwhelming that our approach may not be applicable. However, we believe that in many cases, contestable licensing will generate efficient outcomes as long as the basic argument made here is appropriately modified to fit the particular circumstances of every case.

4.3. Technological Improvements

In the formal model we assumed for simplicity that all firms have the same constant technology. However, the procedure described here is consistent with providing the incumbent franchisee with "high-powered" incentives for cost reductions due to the implementation of the most advanced generally known technology. Provision of such incentives requires that the incumbent franchisee be allowed to capture a share of the cost savings generated as a consequence of the implied technological improvements. This can be done, for example, by maintaining the price of the franchisee's good or service at its current level or by reducing it only after a sufficiently long time lag. Such incentives would increase the incumbent franchisee's per-period profits and thus would make it even easier for the regulator to satisfy Regulator's Rule 1. This observation stands in contrast to other approaches (e.g., Laffont and Tirole, 1991, 1994) that emphasize that if quality is non-verifiable then high powered incentives cannot be provided.

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practice.

[32] Examples of such an arrangement are companies that own distribution networks for telephone, gas or electricity, and companies that own rail infrastructure. Of course, the problem of assuring high quality may appear at this level as well, as illustrated by the example of British Rail.

[33] Williamson (1976) also elaborated on the difficulties of correctly measuring capital invesments. These concerns pose less of a problem if firms are approximately risk neutral and the regulator observes an approximately unbiased signal about the franchisee's capital investment.

Appendix

Proof of Proposition 1. Recall that the statement "bid b" should be interpreted as "bid the highest integer multiple of m smaller or equal to b." Consider the following profile of strategies: The incumbent franchisee provides high quality service in every period. Whenever challenged, an incumbent franchisee that has always provided high quality service matches any bid that is equal or below the discounted sum of per-period payoffs from providing high quality service taking the cost of bidding into account, or

$$\frac{1}{1+\mu}\sum_{\tau=1}^{\infty}\left(\frac{1}{1+r}\right)^{\tau}\pi_{t+\tau}\left(q_H\right).$$

In case a higher bid is submitted, the incumbent franchisee declines to bid. An incumbent franchisee that has provided low quality service in the last period responds to any challenge that is equal or below the highest integer multiple of m equal or below

$$\frac{1}{1+\mu}\sum_{\tau=1}^{\infty}\left(\frac{1}{1+r}\right)^{\tau}\pi_{t+\tau}\left(q_H\right)-m$$

by bidding the smallest integer multiple of m above it, and declines to respond to higher bids. Rival firms' strategies are as follows. If the incumbent franchisee provided low quality service in any period t, then the rival firm that appears at the end of period t bids an amount that is equal to the discounted sum of per-period payoffs from providing high quality service taking the cost of bidding into account. Rival firms decline to bid otherwise. Note that along the equilibrium path, incumbent franchisees always provide high quality service and are never challenged.

It is easy to verify that this is indeed a subgame perfect equilibrium. The tie-breaking rule employed by the regulator implies that the incumbent franchisee is immediately replaced if it ever provides low quality service. RR1 implies that the incumbent franchisee is sufficiently forward looking to prefer the discounted sum of per-period payoffs associated with continuing to provide high quality service to the payoff it could get by deviating and providing low quality service. It is straightforward to verify that rival firms' strategies are optimal as well. ■

Proof of Proposition 2. The proof follows immediately from the next two lemmas.

Lemma 1. *Generically, in every subgame perfect equilibrium in simple strategies, an incumbent franchisee is successfully challenged and replaced at the end of any period in which it provided low quality service.*

Proof. Fix a subgame perfect equilibrium in simple strategies (SPESS). Suppose that at some period t, the incumbent franchisee, denoted i, provided low quality service. Denote the rival firm that appears at the end of the period by j. Denote the SPESS discounted sum of per-period payoffs the incumbent franchisee expects to get from period $t+1$ onwards if it succeeds in deterring or defeating the challenger in period t by π^i_{t+1}. Similarly, let π^j_{t+1} denote the SPESS discounted sum of per-period payoffs that the rival firm in period t expects

to get from period $t+1$ onwards if it succeeds in winning the license. Note that since the incumbent franchisee in period $t+1$ can always provide low quality service in period $t+1$ and decline to respond to challenges thereafter, both $\pi^i_{t+1}, \pi^j_{t+1} > 0$.

We show that $\pi^j_{t+1} \geq \pi^i_{t+1}$. Note that in this case, since the regulator's tie-breaking rule favors the rival firm j, this implies that j can defeat the incumbent franchisee by bidding no more than the highest integer multiple of m smaller or equal to $\frac{1}{1+\mu}\pi^i_{t+1}$ and generically obtain a positive payoff. Therefore, if $\pi^j_{t+1} \geq \pi^i_{t+1}$, then j will successfully challenge and replace the incumbent franchisee i in the SPESS.

We show that there is a strategy for j under which $\pi^j_{t+1} \geq \pi^i_{t+1}$. In a SPESS, since bidding is costly, if a bid is submitted, then it is successful. We can therefore distinguish between the following two cases: (1) There exists some period $T \geq t$ where along the SPESS path, i is outbidden and loses the franchise, and (2) i is never outbidden on the SPESS path after and including period t.

Consider case (1) first. Since if $T = t$, then along the SPESS path j outbids i at t, we may assume that $T > t$. Now, j knows that if it retains the license up to period $T-1$, then starting from period T onwards, it can expect a larger or equal future discounted sum of per-period payoffs than i because it can provide the same quality service as i does in period T and it may retain the license after T as well. Therefore, if challenged at the end of period $T-1$, j would be willing to bid at least as much as i would in order to retain the license. According to S1 the rival firm that appears in period $T-1$ expects a future discounted payoff that depends only on how it itself performs while it holds the franchise. In particular, it is indifferent between bidding against i or j. Consequently, the rival firm that appears in period $T-1$ will (successfully) outbid j only if it will also successfully outbid i. Therefore, it must be the case that $\pi^j_{T-1} \geq \pi^i_{T-1}$. Repeating the same argument for period $T-2$ implies that $\pi^j_{T-2} \geq \pi^i_{T-2}$. Repeating the same argument $T-t-3$ more times, implies that it must also be the case that $\pi^j_{t+1} \geq \pi^i_{t+1}$.

Consider now case (2). By assumption, i is not outbidden along the SPESS path. In particular, on the SPESS path, i holds the franchise in period $t+k+1$. Suppose now that j outbids i in period t and then adopts the same strategy that i uses from time $t+1$ onwards. If j survives unchallenged to period $t+k+1$, then since it adopted i's strategy, the players' bounded recall implies that j will be treated thereafter no worse than i would, and thus $\pi^j_{t+k+1} = \pi^i_{t+k+1}$. The backwards induction argument presented in case (1) above can be then re-applied to imply that $\pi^j_{t+1} = \pi^i_{t+1}$. Therefore, to complete the proof of the lemma, we must show that j will indeed not be challenged between periods $t+1$ and $t+k$. This too is shown by backwards induction. Consider period $t+k$, and suppose that j has not been challenged between periods $t+1$ and $t+k-1$. If j defeats the rival firm at $t+k$, then, because of the players' bounded recall, it can expect to be treated no worse than i would thereafter, and thus $\pi^j_{t+k+1} = \pi^i_{t+k+1}$. Firm j would therefore be willing to bid as much as i would in order to defeat the rival firm at $t+k$. According to S1 the rival firm that appears in period $t+k$ expects a future discounted payoff that depends only on how it itself performs while operating the franchise. In particular, it is indifferent between bidding against i or j. By assumption, on the SPESS path, the rival firm at $t+k$ refrained from bidding against i, therefore, it must also refrain from bidding against j. But this implies that j and i expect the same future discounted payoff starting from period $t+k$, and thus

$\pi^j_{t+k} = \pi^i_{t+k}$. Repeating the same argument $k-1$ more times implies that j would not be challenged anytime between periods $t+1$ and $t+k$.[34] ■

Lemma 2. *Generically, in every subgame perfect equilibrium in simple strategies, an incumbent franchisee is not challenged (or replaced) at the end of a period in which it provided high quality service.*

Proof. The proof is similar to the proof of the previous lemma. Fix a subgame perfect equilibrium in simple strategies (SPESS) and a time t. Recall the definitions of π^i_{t+1} and π^j_{t+1} from the proof of the previous lemma. Suppose that contrary to what is claimed, the incumbent franchisee i at t is successfully challenged and replaced by a rival firm j at the end of a period where it provided high quality service. By assumption, the incumbent franchisee at t is favored by the regulator's tie-breaking rule. Therefore the fact that i is successfully challenged implies that it must be the case that $\pi^j_{t+1} > \pi^i_{t+1}$. We show that this cannot be and obtain a contradiction. The proof is identical to the one given in the previous lemma with the roles of i and j reversed. ■

[34] The argument bears a superficial resemblance to Jéhiel (1995) and Jéhiel and Moldovanu (1995). However, our argument is different. Among other things, the assumption of bounded recall, by itself, is not sufficient for our result, and, while in Jéhiel (1995) and Jéhiel and Moldovanu (1995) the players' forecasts or behavior strategies, respectively, are history-independent, this is obviously not the case here.

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