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Collective Reputation, Professional Regulation and Franchising

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Abstract

Collective reputation and its associated free-rider problem have been invoked to justify state licensing of professions and to explain the incidence of franchising. We examine the conditions under which it is possible to create a Pareto-improving collective reputation among groups of heterogeneous producers. If the regulator or franchisor cannot credibly commit to high quality then a common reputation can be created only if the groups are not too different and if marginal cost is declining. High cost groups benefit most from forming a common regime.

JEL: L43, L44

Keywords: Quality Regulation, Licensing, Collective Reputation, Reputational Externality, Franchising.

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1 Introduction

Many professions are subject to occupational licensing and quality regulation, with, in many cases, the standards set by the professional groups themselves. A common, perhaps majority, view among economists is that such monopoly licensing arrangements are devices to increase the incomes of the producers at the expense of the consumers. An alternative view is that if there is asymmetric information between producer and consumer then setting minimum standards can bring about a Pareto-improvement by increasing the trust that the client has in the professional: consumers are more willing to buy the service if there is less risk that the provider is incompetent or fraudulent. Evidence that, historically, producer incomes rise when licensing is introduced (see Law and Kim (2005)) is consistent with both hypotheses. An alternative solution might be for producers to develop individual reputations for high quality, but this may be inadequate in the cases of occupations, such as those of physicians or realtors, whose service is purchased infrequently or for which there are serious consequences if something goes wrong.

This still does not establish a case for state-enforced licensing or regulation. Why should the professional groups not form voluntary associations which set standards for their members to adhere to and thereby establish collective reputations[3] for the chosen quality? This private solution allows for the possibility that, alongside a given professional group, other groups ('para-professions') might form parallel associations which establish their own reputations for a different standard of the same, or a similar, service. Why should such groups be denied entry?

One possible answer is that there is a reputational externality: the actions of one group may damage the reputation of another group. Since a given group then does not bear the full cost of its actions, overall welfare is reduced. Partly on these grounds, in the UK, physicians have objected to allowing nurses to perform procedures previously

[3] An Office of Fair Trading report on the UK estate agency (realtor) market remarked: 'Effective codes, those that have high recognition among consumers and are well enforced, should also help to marginalize rogue traders within a sector. Whole sectors of business can suffer through the behavior of the rogue element which can damage consumer confidence.' (OFT (2004), p.112).

reserved for doctors and lawyers have objected to allowing licensed conveyancers to sell house conveyancing services. The collective reputation of a profession is a valuable asset which is endangered by unregulated competitors.[4]

Collective reputation is also thought to be important in the economics of franchising. According to Rubin (2001, p.228),

" we must consider what the franchisee is buying when he buys a franchise. The main item purchased is the trademark of the franchise. This is valuable because the consumers have a good deal of information about price and quality sold by establishments with a given trademark".

Furthermore, this gives rise to a reputational externality and associated free-riding problem. To quote Klein and Saft (1985), who refer to it as "the superhighway problem":

"If each franchisee supplies inputs that significantly influence the quality of the product marketed, and consumers cannot detect the quality of the product before they purchase it, then each franchisee will have the incentive to cut costs and supply less than the desired level of product quality. Because the product is standardized, consumers who receive products of less than anticipated quality will blame the entire group of retailers using the common name. The individual franchisee directly benefits from the sales of the lower-quality product, and the other franchisees share in the losses caused by decreased future demand."

This effect has been suggested as a determinant of a franchisor's choice of whether to franchise a given outlet or to operate it directly. An older literature explained franchise arrangements as a way of raising capital for expansion, but more recent contributions have stressed agency considerations. In a directly-owned outlet the manager must be monitored, whereas a franchisee's incentives are provided by the franchise contract. One would expect to observe franchising when the cost of direct monitor-

[4]A relevant historical case study which is important in the development of state-sponsored auditing requirements is that of the rival associations of credit cooperatives in nineteenth century Germany (see Guinnane (2003)). Another is the case of the nineteenth century US Buildings and Loans Associations and their rival group of savings and loans associations known as the 'nationals' (see Snowden (2003) and Brumbaugh (1988)). In each case one group of institutions argued that problems in another group would harm their reputation and business.

ing is high, when capital requirements are low (otherwise there may be inefficient risk-bearing) and when there is enough repeat-buying (so as to avoid the free-riding problem). The evidence on this point is mixed. Brickley and Dark (1987, p.416) find that firms in industries with relatively little repeat business are more likely to use franchises. But in their study, the economist's favorite proxy for lack of repeat business - placement on a major highway - makes an outlet more likely to be a franchise, when the externality theory predicts the opposite. They are agnostic as to whether the theory is wrong or the proxy is imperfect; placement on a highway may imply that the outlet is expensive to monitor directly (Brickley and Dark (1987, p.418)). In another study, using a better dataset, Lafontaine and Shaw (2005) find that firms with valuable brand names are less likely to use franchising, supporting the theory that franchising creates a shirking problem for the brand.[5]

Similarly, the reputational externality has been used to explain particular features of observed franchise contracts. For example, Klein and Saft (1985) argue that franchise tying contracts (which force the franchisee to buy inputs from the franchisor and have generally been regarded with hostility by US courts) are an efficient device for economizing on quality policing costs which result from the free-riding problem.

The theory of collective reputation has been examined by various authors (see the section below on related literature) but some aspects of it have not been fully explored. Firstly, a possible alternative to state licensing of a profession would be private (or state) *certification*. Each group (profession or para-profession) would be free to provide its own chosen quality of the service and each could distinguish itself from other groups by quality auditing and publicly observable certifying.[6] In that case, why should there be any collective reputation or reputational externality? After all, as long as consumers can observe the fact that you belong to association A, the actions of members of association B should be irrelevant to your reputation. One possible reason is that there is an unobservable *common trait* which is relevant to the

[5]For further discussion of the economics of franchising, see Caves and Murphy (1976), Mathewson and Winter (1985) and Blair and Lafontaine (2005).

[6]Private auditing and certification are observed in a variety of different settings. For example, securities exchanges monitor their members to prevent fraud, universities create organizations that certify their standards, and so on.

choice of quality. In that case, observing quality in one group might tell a consumer something about likely quality in the other group. Hence, an externality might exist even if, say, one group is certified and the other is not. We examine below whether, in this case, a reputational externality can exist and whether it can justify state licensing.

Secondly, we ask the question: under what conditions is it possible to develop a common reputation? Two franchised outlets (e.g., two hotels or two restaurants) may have the same brand name but will not be identical in every way. In many cases they will have different characteristics which are observable to consumers and correlated with factors which are conducive to producing high quality. For example, they may be in different countries,[7] one may be rural, the other urban, they may have different age profiles of staff, etc. It would be rational for consumers to believe that the two outlets will have the same quality only if the franchisor finds it in his interest to enforce the same quality in the two outlets, which may or may not be the case. We aim to isolate factors which are conducive to the development of collective reputation - one would then expect to observe franchises only where such factors are present. The same question applies to state or private regulation of professions: under what conditions would the regulator find it in his interest to enforce a common quality on heterogeneous members of a profession (or a number of related professions) when the heterogeneity is at least partly observable to consumers? Where these conditions do not exist, so that it is not possible to create a Pareto-improving collective reputation, the supposition must be that the purpose of monopoly licensing is to restrict competition.

We develop a stylized model, set out in Section 2, which incorporates the main features common to the above situations. It is a dynamic model, with overlapping generations of consumers and many long-lived small producers divided into two groups which are identifiable to consumers (e.g. group A is a profession and group B a para-profession, or A is rural franchisees, B urban). There is random matching of buyers and sellers, with no repeat buying for a single producer and only limited repeat buying

[7] See Love (1986), pp. 409-410, for an account of difficulties which McDonald's had with a group of its franchises in Paris.

at group level (i.e., a given consumer may buy from A when young and B when old). High quality is costly to achieve and quality is observed by a consumer only after purchase. The groups differ in their cost (c^q) of achieving high quality, which is unobservable by consumers but observable by the regulator/franchisor.

In Section 3 we address the questions above about whether, in the case of two separately regulated (audited) professions, a reputational externality exists which can justify state licensing. We find that, not surprisingly, if the two groups are heterogeneous, in the sense that their costs of high quality (c^q) are independent random variables, then no reputational externality exists when the two groups are separately regulated - in any equilibrium, a change in the quality of one group has no effect on a consumer's belief about the other group. On the other hand, every equilibrium is inefficient because of the existence of two groups: if there were a single homogeneous group with a single auditor then full efficiency could be achieved. A reputational externality does exist if the groups are homogeneous (the cost of high quality is the same for both groups, i.e., a common trait). Moreover, this gives rise to a worse equilibrium than in the independent costs case if, in addition, marginal *production* costs are declining over the relevant range. On the other hand, there is always an equilibrium in which, because of the reputational externality, quality and profits are *higher* than in the heterogeneous case; furthermore, the bad reputational equilibrium does not exist if marginal production cost is constant. We conclude from this that reputational externality is not a strong argument for common regulation. Even in those cases where it may lead to more inefficiency, the problem could in principle be solved by co-ordinating on a better equilibrium.

In Section 4 we address the question: when is it possible for heterogeneous groups (of potential franchisees or of professionals) to develop, through common regulation, a common reputation for quality? We find that if the regulator/franchisor cannot publicly commit to high quality then it is possible to do so (and, thus, a common auditing framework and common brand can bring about a Pareto-improvement) only if (a) the two groups are not too dissimilar, in the sense that the support of c^q is not too large, and (b) if marginal production costs are declining. Given these conditions, a collective reputation can be created. The reason that marginal production costs must be declining is that, for consumers to believe that, despite heterogeneous cost of quality, the quality is the same in both groups, quality in group A must, given this belief, be a strategic complement for quality in group B. If marginal cost is declining then the fact that quality is high this period in group A, and so, given the consumers' beliefs, demand at group B will be high next period, means that the marginal benefit of setting quality high at B this period (through repeat custom for B-members) is greater than it would be if quality were low at A. Thus, in equilibrium, high quality at one group is associated with high quality at the other, and similarly in the case of low quality.

One case in which declining marginal cost may obtain, and so common regulation is more likely to be appropriate, is the case in which learning-by-doing is important. Suppose that, because of technological progress, producers need to upgrade their skills in every period and that this takes place partly through learning-by-doing. Then, within a given period, marginal cost of producing the first units will be higher than marginal cost of producing subsequent units, at least up to a point.

The implication of the result is that if (a) and (b) above do not obtain, then one would not expect to see the firms belong to the same franchise brand (unless perhaps as a directly-owned outlet), unless there is some commitment device that the franchisor can employ. A possible example of such a commitment device is the franchise tying contract mentioned above.

We also show in Section 4 that if the two groups are very different in size then a common-quality equilibrium does not exist unless the distribution of c^q is such that the larger group, on its own, would have high quality with probability one. This suggests that if a small independent firm joins an existing homogeneous large group of franchisees then unless consumers attach probability one to the event of high quality in the existing group, a common reputation will not be created. On the other hand, a common reputation can be created among a large number of small firms with identically, independently distributed c^q. As long as the support of c^q is not too large, and the distribution puts enough weight at the lower end, an equilibrium exists in which quality is always high - the existence of the low-cost firms creates enough repeat business to make it worthwhile also to set high quality at the high-cost firms.

In Section 5 we ask whether a high quality (in the sense of lower average value of c^q) group benefits more than a low quality group, in the case where common regulation can credibly lead to common standards. We find that in the uniform distribution case a low-quality group benefits more than a high-quality group.

Related Literature

There is a small theoretical literature on professional regulation. Leland (1979) analyzed professional licensing as a policy response to a lemons problem. Shaked and Sutton (1981), in a similar model, analyzed the incentives to form para-professions. Shapiro (1986) studied a moral hazard model in which licensing is viewed as a requirement for prior investment which alters the incentives to produce high quality. This differs from our model in a number of ways; for example, sellers in the Shapiro model are able to build individual reputations. Lizzeri (1999) analyzed the incentives of private intermediaries who certify quality; the focus of his paper is on strategic manipulation of information. Grout, Jewitt and Sonderegger (2007) examine some proposed reforms of the UK legal professions, including various forms of de-licensing. Their analysis is based on a repeated game and relational contracting approach, without asymmetric information. None of these papers is concerned with collective reputation. There are three types of theory of collective reputation in the literature. Firstly, there is a multiple equilibrium theory (e.g., Arrow (1973)). Secondly, some papers (e.g., Benabou and Gertner (1993)) derive collective reputation from the existence of a common trait. Both of these phenomena are present in our analysis below of the case in which the groups have a common value of c^q. Thirdly, Tirole (1996) has a dynamic model, partly adverse selection and partly moral hazard, in which employers can observe an agent's actions only imperfectly and cannot distinguish him from earlier generations of agents. If past generations have been corrupt trust in the agent will be low; this in turn gives the agent the incentive to behave corruptly. In this way, a reputation for corruption can persist through generations. We are concerned here with a somewhat different question: how the reputations of identifiably different groups may interact, and how regulation may create collective reputation.

2 The Model

There are two groups, A and B, each consisting of a continuum of risk-neutral producers of unit measure. Each group is homogeneous internally but, as we will explain below, different from the other group in its cost structure. As outlined above, the two groups should be thought of as two groups of professionals or of potential franchisees. All producers produce the same good, regardless of their group. They are not, however, in direct competition with each other: we model each individual producer as a local monopolist who is able to practice perfect price discrimination. Each producer, in each period, has a continuum of customers, each of whom has inelastic unit demand. It will be convenient to normalize so that the measure of customers (for each firm) is 4.

Cost of Investing in Quality

In each period, a typical producer first chooses its quality of production. Quality can be either high or low; low quality costs zero and high quality costs $c_i^q \geq 0$ where $i \in \{A, B\}$ is the index of the firm's group.[8] The cost of achieving high quality is a fixed investment cost, independent of the scale of production, and it must be paid in each period in which quality is high. For each group $i \in \{A, B\}$, c_i^q is drawn at the beginning of time 1 from an atomless distribution F on $[0, a]$; c_i^q is then fixed forever.[9] The only difference between the two groups is the value of c_i^q. Our assumption for most of the paper is that c_A^q and c_B^q are independent, but we also look, in subsection 3.2, at a model in which c_A^q and c_B^q are correlated, i.e. there is a common trait.

[8] Alternatively, we could assume that investing c_i^q has the effect of shifting, for one period, the cost function for high quality goods downwards, to the level of the cost function for low quality goods (or lower). The results are qualitatively the same.

[9] The model approximates to one in which c^q evolves through time according to a Markov process. See Section 4.

Cost of Production

After selecting quality for the period, the firm produces and sells quantity $y \leq 4$ of the good (storage is not possible, so there can be no value in producing quantity higher than 4). We consider a very simplified cost function: marginal cost is a step function with at most two values. Either there is constant marginal cost or declining marginal cost, and, in the latter case, it is positive over some interval and then drops to zero. Clearly this is a very special type of decreasing marginal cost function, but it simplifies the arguments and the qualitative results would be the same in the case of a more general function. The cost function $c(y)$, common to all firms in both groups, is given by $c(y) = cy$ if $y \leq \lambda'$ and $c(y) = c\lambda'$ if $y > \lambda'$, where $c > 0$ and $\lambda' > 2$. As we will see, it will turn out to be crucial whether λ' is above or below 4. If $\lambda' \geq 4$ then we effectively have constant marginal cost of production; in the other case, where $\lambda' < 4$, marginal cost is decreasing in the relevant range - in particular, cost of production is lower for the second half of total potential production than it is for the first half. It is convenient to define $\lambda = min[\lambda', 4]$. Then $\lambda = \lambda'$ unless we have the constant marginal cost case, in which event $\lambda = 4$.

Matching of Buyers and Sellers

Time is discrete and infinite and labeled $t = 1, 2, ...$ In each period a generation of new identical risk-neutral consumers is born (we model this generation as a continuum of measure 2 for each producer) and lives for two periods. In each of these two periods, a consumer is randomly assigned (with equal probabilities) to a producer; thus, she has equal probability in each period of meeting an A-producer and a B-producer. In each of the two periods she buys and consumes at most one unit of the good. Since arrival of consumers at firms is random, each firm will have, in any period $t \geq 2$, a measure 2 of new-born consumers, a measure 1 of old consumers who were assigned to an A-producer last period, and a measure 1 of old consumers who were assigned to a B-producer last period. Because of our assumption that producers are small the chance of a consumer repeat-purchasing from a given producer is zero. On the other hand, there is repeat purchasing as far as a particular group is concerned (i.e., a particular customer of an A-producer may meet another A-producer later). The formulation is intended to represent a situation in which the good is purchased in a lumpy and infrequent manner, so that repeat purchasing (looked at from the perspective of a group) is present but limited; furthermore there is potential for interaction between firms in one group and firms in the other, because consumers may buy from both groups at different times.

All consumers are identical and in each period they derive utility 0 from a low-quality good and utility $v > 0$ from a high-quality one. We assume that $v > c$, which ensures that there is potentially a positive surplus in any match between a producer and a consumer. A consumer knows the group identity of a producer with whom she is matched, but, at the time of buying, she cannot observe the quality of the good - she discovers this only when she consumes it. The fact that she observes group identity is intended to model a situation in which, as discussed in the Introduction, producers have some observable differentiating characteristic which is correlated with the cost of quality (for example rural versus urban potential franchisees). The quality (after the fact) of her first-period purchase, if any, and the group affiliation of the firm or firms with which she has been matched are the only pieces of information which the consumer has. She cannot observe qualities produced at any firm before she was born, or, after she is born, at firms with whom she is not matched. Nor can she observe the costs, c_A^q and c_B^q, of achieving high quality.

Pricing

For simplicity, we assume, as noted above, that each firm is a perfect-price-discriminating local monopolist. This means that, after choosing quality, the firm observes a given consumer k's willingness-to-pay $v\pi_k$, where $\pi_k \in [0, 1]$ is the consumer's belief that the good will be of high quality. The firm's objective is to maximize the expected present value of its profit stream, discounted by the factor $\delta \in [0, 1)$. Since the firm will not meet its current customers again, it has no interest in charging k less than $v\pi_k$. Equally, it cannot charge more since k will get no surplus in the future, and hence can have no incentive to pay extra in order, say, to learn about quality in the firm's group. Whatever its chosen quality, the firm will therefore sell, at price $v\pi_k$, to any customer k for whom $v\pi_k \geq c$, since these trades are certainly profitable. Let the measure of these customers be y'. The cost of serving the remaining customers is $C(y') = max[(\lambda - y')c, 0]$. The firm will therefore sell to the remaining customers, at their respective valuations, if and only if the resulting revenue is at least $C(y')$. In particular, it will sell to all the remaining customers if $y' \geq \lambda$, so that marginal cost at y' is zero, and to none of them if $\lambda = 4$, which would imply that marginal cost of serving all customers is c.

Auditing

For a given producer at a given period, each of its current customers' beliefs about its quality is independent of the producer's past and current decisions, because it has not served any of these customers before. Therefore its profit is independent of its chosen quality, so it is clear that it will always choose low quality if $c_i^q > 0$. Obviously this outcome is inefficient, and inferior for the producers. A natural response would be for the group to appoint an auditor, or regulator, to maintain a quality standard for the group as a whole. We assume therefore that each group has such an auditor. Our main interest will be in whether heterogeneous groups benefit by having a common regulatory regime, so we examine two cases: (a) the *separate auditors* case, in which each group has its own distinct auditor, and (b) the *single auditor* case in which the two groups have the same auditor. An auditor is able, in each period, to choose the quality level for the whole group. In the single auditor case, the auditor chooses two levels of quality - one for group A and one for group B - which may or may not be the same.[10] In the franchising interpretation of the model the auditor is the franchisor, so 'auditor' should be understood as 'auditor or franchisor'. If it turns out that there is a Pareto-superior equilibrium in which the single auditor chooses uniform quality, that would suggest that it is credible for the franchisor to establish a uniform quality over all his franchisees.

[10] In principle, the auditor might, if it were possible, prefer to choose different qualities for different producers within a given group. However, this would not be in his interest.

In modeling the auditor in this way, what we have in mind is that he is able to announce to the franchisees or members of the association what the required quality is and that he has the ability credibly, at zero cost, to enforce the announced standard, by, for example, random audits and adequate sanctions. There is an issue as to whether the auditor would have the incentive after the fact to carry out the announced punishment of a producer who has been found not to meet the required standard. In this paper, however, we side-step that issue by assuming, in effect, that the auditor has the ability to commit to the sanction in advance (as in Banerjee, Besley and Guinnane (1994)). This does not mean, though, that the auditor is able to commit publicly to choosing a particular quality standard - that is, if he announces to the consumers that the quality is high, he will nevertheless choose high quality only if it is in his (and the producers') interest to do so (in particular, if the cost of high quality is not too high).

The objective of the auditor is to maximize the unweighted sum of the utilities (i.e., long-run discounted profits) of the firms which he is auditing. Since consumers earn zero surplus this is the same objective as a utilitarian social planner would pursue. Like the producers, but unlike the consumers, the auditor of group i knows the cost c_i^q of high quality. An auditor does not observe the quality in a group which he is not auditing. Although the auditor controls the quality of output, he does not control pricing or production decisions. As a result an association does not act as if it were a single firm; in particular, a producer, as noted above, will not offer low introductory prices in order to allow customers to learn about the quality.

The main features of the model set out here are found in a variety of industries. Although subject to some state regulation, professionals usually belong to an association that combines some ability to police quality (in the sense of our auditor) with lobbying, education, and other functions. Lawyers operate this way in the United States, Britain, and some other countries. In some countries, financial institutions have private auditing arrangements that are either stricter than or take the place of state auditing. There are other industries in which producers join a group that provides a common brand and some advertising and sourcing services, but the producers remain independent firms, and, most notably for our purposes, agree to common quality standards and a common dispute resolution procedure. For example, a large automobile parts wholesaler in the U.S. (NAPA, the National Auto Parts Association) forms a relationship with what would otherwise be unrelated local automobile repair shops. In addition to parts, the wholesaler provides common branding and advertising. But the firm stresses that it assures customers that each associated repair shop meets certain standards of quality and also adheres to a common dispute-resolution mechanism.[11]

Strategies

In the separate auditors case, a pure strategy σ_i for the auditor of group i specifies, for each possible cost $c_i^q \in [0, a]$, a function $\sigma_i(c_i^q)$ which maps each history of the form $(q_1^i, q_2^i, ..., q_{t-1}^i)$ to a choice of quality at date t, $q_t^i \in \{h, l\}$. In the single auditor case, a pure strategy σ of the auditor specifies, for each pair $(c_A^q, c_B^q) \in [0, a]^2$, a function $\sigma(c_A^q, c_B^q)$ mapping each history $(q_1^A, q_1^B; q_2^A, q_2^B; ....q_{t-1}^A, q_{t-1}^B)$ to a pair of date-t qualities (q_t^A, q_t^B).

Beliefs

At the point when a customer has to make her first-period decision whether to buy, a consumer has two possible first-period histories, namely A and B, i.e., all she knows is the group identity of the producer. When she makes her second-period buying decision she has twelve possible second-period histories, denoted by $(i, q; j)$ where $i, j \in \{A, B\}$ and $q \in \{h, l, \phi\}$. For example, $(A, h; B)$ refers to the history

[11]In explaining its services to potential members, its website says: "NAPA knows how important it is for your business to remain independent. We respect that need, and have designed the NAPA AutoCare Program to meet that need. At the same time, consumers continue to become more brand loyal, especially when they know the benefits of a nationally recognized brand name. The NAPA AutoCare Program is not a franchise, nor is it part of a consolidated group... By partnering with NAPA, you gain all the advantages of NAPA's experience, knowledge, and hard-won national reputation. Consumers instantly recognize your business as part of the largest group of top quality repair centers across the country and can visit your facility already prepared to trust you and your work. As with most of NAPA's programs, it is necessary to meet certain requirements. If you, your team and your business meet these standards, there are many benefits to help you become even more successful."

in which she meets an A-producer in her first period, buys a unit and discovers that its quality is high, and then meets a B-producer in her second period. $(A, \phi; B)$ represents a history in which she meets an A-producer in the first period and a B-producer in the second period, and there is no sale in the first period. The beliefs of a consumer who is born in period t are denoted by $\pi_t : \{A, B\} \rightarrow [0, 1]$ and $\widetilde{\pi}_t : H \rightarrow [0, 1]$ where H is the set of second-period histories. $\pi_t(.)$ and $\widetilde{\pi}_t(.)$ give the probability, conditional on the observed history, that if she buys she will get a high quality good. We will focus below on steady-state beliefs, that is, beliefs which are not indexed by t, so that all generations have the same prior belief and the same updating rule.

Equilibrium

We will examine pure-strategy, perfect Bayesian equilibria with steady-state beliefs. In the separate auditors case such an equilibrium is defined in the following way. Each generation of consumers has a common belief system $(\pi(A), \pi(B); \widetilde{\pi}(.))$ and each auditor $i \in \{A, B\}$ has a pure strategy σ_i such that

(i) for each i, each t, each history $(q_1^A, q_1^B; q_2^A, q_2^B; ....q_{t-1}^A, q_{t-1}^B)$ and each $c_i^q \in [0, a]$, the continuation strategy defined by σ_i maximizes i's expected continuation payoff, given σ_j $(j \neq i)$ and the belief system $(\pi(A), \pi(B); \widetilde{\pi}(.))$; and

(ii) the belief system $(\pi(A), \pi(B); \widetilde{\pi}(.))$ gives the true conditional probabilities of high quality if the auditors employ the strategy pair (σ_A, σ_B).

Similarly, in the single auditor case, an equilibrium consists of a steady-state belief system and a pure strategy σ such that, firstly, σ is optimal for the auditor after every history given the beliefs and, secondly, the beliefs are correct given σ. In order to avoid complications associated with knife-edge cases, we assume that, if indifferent, the auditor always chooses high quality.

3 Equilibrium with Separate Auditors

3.1 Independent Costs

Take an arbitrary pure steady-state equilibrium in the separate auditors case, with c_A^q and c_B^q independent, and consider the problem of the auditor of group i at an arbitrary date t. He has to decide, knowing c_i^q, whether or not to set high quality for this period. This decision has no effect on the prices paid this period by the current customers of producers in group i since they do not know the current quality at the time that they buy. Nor will it have any effect on any members of the generations born at date $t+1$ or later, since they do not observe anything dated before their birth, or the behavior of older buyers. Thirdly, since any date-t customer of group j will never observe the current quality in group i, the decision will have no effect on prices paid in the future by these consumers. The only effect will be on i's repeat customers: those consumers born at date t who are customers of group i at date t and will again be customers of group i at date $t+1$.

First, note that old customers of group i who were assigned to the other group (j) in their first period do not believe that there is any correlation between quality at i this period and quality at j last period. This is because the auditor of group i at time t does not observe c_j^q or q_{t-1}^j and c_i^q is independent of c_j^q.[12] That is, $\widetilde{\pi}(j,h;i) = \pi(i)$ and $\widetilde{\pi}(j,l;i) = \pi(i)$. There are two possibilities to consider: either (a) $\widetilde{\pi}(i,h;i) \leq \widetilde{\pi}(i,l;i)$ or (b) $\widetilde{\pi}(i,h;i) > \widetilde{\pi}(i,l;i)$.

In case (a) the price paid at date $t+1$ by the repeat customers will be no higher if they get high quality at date t than if they get low quality at date t. Clearly, then, there can be no gain, and there will be a positive cost, from setting high quality at t. In that case auditor i will set low quality regardless of c_i^q (except possibly if $c_i^q = 0$). Since the beliefs are the same for all generations, in this equilibrium group i always has low quality and no sale is ever made (since the customers always place value zero

[12]Even if he could observe willingness-to-pay of former j-customers (we have assumed that he cannot), the above argument would apply at date 2 if he has to choose quality before observing it. Therefore, by stationarity of beliefs, independence applies at all times.

on the goods produced by i). Even if there is a deviation and group i producers produce and sell high-quality goods, the repeat customers will still expect low quality next period, i.e. $\tilde{\pi}(i, h; i) = \tilde{\pi}(i, l; i) = 0$. It is easy to check that this is indeed an equilibrium.

In case (b) the auditor derives a benefit from the higher price paid by repeat customers next period if he sets high quality this period. He sets this benefit against the cost c_i^q. Clearly there will be a critical value $c_i^* \geq 0$ such that he sets high quality if $c_i^q < c_i^*$ and he sets low quality if $c_i^q > c_i^*$. Since the beliefs are stationary across generations the auditor faces the same problem each period, so the threshold value c_i^* is independent of history. The steady-state belief of new-borns must therefore be that the probability of high quality at group i is given by

$$\pi(i) = F(c_i^*).$$

If $\pi(i)$ is such that there is no possibility of a profitable sale, i.e. if

$$vF(c_i^*) < c,$$

then producers will not sell to new-borns and so there will be no repeat customers. In that case there will be no incentive to choose high quality and so $c_i^* = 0$. This is the same as the equilibrium which we saw in case (a) above.

Suppose, on the other hand, that new customers do buy (so $c_i^* > 0$). The same will be true of old customers who were assigned to the other group in their first period since, as we have seen, they have the same belief about i as new-borns. If a new-born customer observes high quality at i then she deduces that $c_i^q < c_i^*$ and, by Bayes' rule, she must believe that she will again get high quality if assigned to i in her second period; similarly, if she observes low quality then she will expect low quality next period. That is, $\tilde{\pi}(i, h; i) = 1$ and $\tilde{\pi}(i, l; i) = 0$.

Next period there will be a measure 3 of sales made at a representative firm (2 to new-borns and 1 to previous customers of the other group) regardless of this period's quality, and a measure 1 of additional repeat customers (paying v) if and only if quality this period is high. Therefore the benefit of setting high quality is equal to δv if $\lambda \leq 3$ and $\delta(v - c(\lambda - 3))$ if $\lambda > 3$. In the first case marginal cost of production is zero, given the assured sales of 3, so the discounted marginal benefit is δv for each extra unit sold; in the second case, marginal cost is c until sales reach λ. The auditor's strategy in each period must be to set high quality if and only if c_i^q is less than or equal to the discounted marginal benefit. That is,

$$c_i^* = min[\delta v, \delta(v - c(\lambda - 3))].$$

Since $\lambda \leq 4$ and $c < v$, $c_i^* > 0$. If this is to be an equilibrium it must be that new customers place value of at least c on the good. That is,

$$vF(min[\delta v, \delta(v - c(\lambda - 3))]) \geq c. \tag{1}$$

There exist, therefore, two possibilities for each group: either there is zero probability of high quality and the market has collapsed because of low expectations, or else sales are made (at least to three-quarters of potential) and there is positive probability of high quality. In total, there are four possible equilibria since beliefs about the two groups may be asymmetric: e.g., group A may have low quality for sure while group B has positive probability of high quality. In the low-quality case the auditor achieves nothing - the equilibrium is the same as if he did not exist. But, as long as (1) is satisfied, the auditor can improve matters. Our interest will be in equilibria in which both groups have strictly positive probability of high quality: we call these *positive-quality equilibria*.

To summarize, we have the following result.

PROPOSITION 1: *If there are separate auditors and independent costs, then a positive-quality equilibrium exists only if* (1) *is satisfied. In that case, there is a unique such equilibrium. In this equilibrium, in every period, quality in group i is high if and only if $c_i^q \leq c_i^*$.*

Clearly a zero-quality equilibrium is highly inefficient. The positive-quality equilibrium, however, will also be inefficient. In the first-best, high quality will be produced in steady-state as long as

$$4v - \lambda c > c_i^q \tag{2}$$

since the left side of this inequality is the total surplus (gross of c_i^q) in the event of high quality, and there is zero surplus if low quality is produced. In equilibrium, there is high quality only if

$$min[\delta v, \delta(v - c(\lambda - 3))] \geq c_i^q \tag{3}$$

The left side of (3) is lower than that of (2) for all $\delta \in (0, 1]$ since $v > c$. Therefore quality is too low in equilibrium. Notice that this inefficiency is not caused by any reputational externality. Since the two groups are independent, and since the customers are able to distinguish one group from the other, a change in the actions of group A, say, has no effect on the payoffs of group B, since it has no effect on the beliefs of any customers about the quality of group B. If there is little discounting, the inefficiency is caused instead by the fact that only a proportion of customers of a given group will be repeat customers of that group: clearly, if there were a single group with a single auditor, the auditor, in a positive-quality equilibrium, would set high quality if and only if (2) were satisfied.

3.2 Common Costs

We assumed above that the cost of high quality in one group is independent of the cost in the other group and that an auditor does not observe quality in the other group. As a result there is no reputational externality. We suppose now that the two costs c_A^q and c_B^q are correlated and we ask two questions: (i) is there a reputational externality in this case (i.e., in equilibrium, would an increase in quality at one group increase the revenue at the other)? and (ii) if so, is such an equilibrium necessarily worse than the equilibrium in the independent costs case - in particular, can inefficiency in this model be traced to the reputational externality? In this case it is plausible that the externality would be present because observing quality at group A would tell you something about c_A^q which in turn would give you some information about c_B^q and so about likely quality at group B. That is, the two groups have a common trait, namely the common component of c_A^q and c_B^q. See Benabou and Gertner (1993) for an application of a similar idea in macro-economics.

The answer to (i) will be that there are indeed equilibria in which the externality is present. In particular, if marginal cost is decreasing, there is an equilibrium in which average quality is lower than in the positive-quality equilibrium in the independent case: each association has an incentive to lower quality, damaging the interest of the other group, and reducing the incentive of the other group to invest in high quality. This lends some plausibility to the claims, referred to in the Introduction, that considerations of reputation can cause inefficiency which needs to be tackled by enforcement of industry-wide standards. On the other hand, the answer to (ii) above is that the reputation effect is not intrinsically bad, because there is another equilibrium (also exhibiting a reputational externality) in which both groups use the same cut-off strategies as in the independent cost case. In that equilibrium, therefore, average quality is the same as it would be without any externality; moreover, profits are higher than in the independent cost case. Thus reputational externality is not the main issue, in the sense that even in the cases in which the externality may give rise to a bad equilibrium, the problem could be solved, at least in principle, by co-ordinating on a good equilibrium (and since the zero-quality equilibrium always exists, some reliance on co-ordination is necessary in any case).

For simplicity, we look at the polar case in which there is complete correlation, i.e., $c_A^q = c_B^q = c^q$. Again, c^q is assumed to be distributed according to F on $[0, a]$. We also assume that $\lambda = 3$, so that in the independent costs case the critical value $c^* = \delta v$. As before, we assume that an auditor cannot observe past quality at the other group, so that equilibria derived from repeated-game considerations (enforcing high quality by using punishments for low quality) are not feasible.[13]

[13] One might ask why the auditor cannot deduce what the other group's quality was by observing the willingness-to-pay of customers who have previously bought from that group. Our assumption is that only the producers, not the auditor, observe willingness-to-pay.

Proposition 2: *Suppose that there are separate auditors and common costs,* $\lambda = 3$ *and*

$$vF(\delta(v-c)) \geq c. \tag{4}$$

Then there are two positive-quality equilibria. In one equilibrium both groups use cut-off $c^* = \delta v$ *and in the other they use cut-off* $\delta(v-c)$*. The first equilibrium Pareto-dominates the second and also Pareto-dominates the positive-quality equilibrium in the independent costs case. If there are constant marginal costs* ($\lambda = 4$)*, or if* (1) *holds but not* (4)*, then only the first of the two equilibria exists.*

Note that since, in this case, (1) is $vF(\delta v) \geq c$, (4) implies (1).

First, we set out the Pareto-inferior equilibrium; in this equilibrium the reputation effect leads to low average quality. The strategy of each auditor is to set high quality if and only if $c^q \leq \delta(v-c)$. New-born consumers all buy at price $vF(\delta(v-c))$. ((4) guarantees that it is profitable to sell to them). A consumer who observes high (low) quality at one group expects high (low) quality next period at both groups, hence is willing to pay v (zero). Clearly the beliefs are correct given the strategies because in equilibrium each group always has the same quality as the other. If $c^q \leq \delta(v-c)$ then i knows that his group will sell at least 3 units for c or more at a representative firm next period regardless of whether he sets high or low quality this period (2 to new-borns and 1 to previous j-customers). Marginal production cost will therefore be zero, so the benefit of high quality is δv, which exceeds c^q, hence it is optimal to set high quality. If, on the other hand, $c^q > \delta(v-c)$ then i knows that j's quality is low and that current customers of j will therefore not buy from i next period. Therefore, since i's repeat customers, if any, will take production next period from 2 to 3, the marginal benefit of high quality this period is only $\delta(v-c)$, which is less than c^q, so it is optimal to set low quality. Hence, the auditor's strategy is optimal. This establishes that this is an equilibrium.

However, since (1) is satisfied, there is also an equilibrium in which both groups use the cut-off strategy defined by $c^* = \delta v$, i.e. the same one as in the independent costs case. In this equilibrium too, after observing the quality in one group, a consumer attaches probability one to the event that the other group produces the same quality. Thus, if $c^q \leq c^*$ an auditor knows that next period there will be sales of 3 to new-borns and former j-customers plus, if and only if quality is high this period, repeat purchases of 1. Therefore the benefit of high quality is c^*, which outweighs the cost. If $c^q > c^*$ then the benefit is less, so it is optimal to set low quality. As in the previous equilibrium, a reduction in quality at one group will reduce the payoff at the other, so the externality is present. However, average quality is the same as in the positive-quality equilibrium of the previous section. Moreover, average profit is higher. If costs are independent, the expected trading profit of a producer in group i (excluding investment cost) is

$$4v\pi^I - 3c$$

where $\pi^I = F(\delta v)$ is the probability of high quality in the independent case. This is because demand from new-borns and former j-customers totals 3, paying $v\pi^I$, and, with probability π^I, there will be 1 unit of repeat purchases, paying v. In the common costs case, the corresponding profit is

$$4v\pi^I - c(2 + \pi^I).$$

As above, demand from new-borns will be 2, paying $v\pi^I$, and, with probability π^I, demand from repeat customers will be 1, paying v. In this case, however, previous j-customers will only be served with probability π^I, though their expected payment will be the same ($v\pi^I$). Expected profit is therefore higher in the common costs case because of the saving on production cost when quality is low (expected investment cost is of course the same in the two cases). The remainder of the proof of Proposition 2 is in the Appendix.

It is clear that the zero-quality equilibrium which we saw above will also still exist in this setting: if each customer always believes that quality will be low then there can be no incentive to set high quality. Similarly, there are asymmetric equilibria in which one group uses the c^* cut-off strategy and the other always produces low quality, for all c^q, (after a deviation in which a consumer buys from a firm in a group which in equilibrium always produces low quality, but observes high quality, assume that he continues to believe that c^q obeys law F).

4 Equilibrium with a Single Auditor

In this section we return to the model with independent costs and consider the case in which there is a single auditor or franchisor who, in each period, chooses a pair of qualities (q^A, q^B). All the equilibria that we found in the separate auditors case will exist in this game too. To see this, notice that if the consumers have a belief system which assumes that the quality in group i is set entirely as a function of c_i^q and so is independent of the quality in group j, then the auditor cannot gain by setting quality in any other way. A change in the quality in group i will have no effect on the profits of group-j producers; therefore the auditor must set i's quality to maximize i's profits, and so he faces the same problem as a separate auditor would. If there are constant marginal costs then these are the only equilibria, as the next Proposition shows.

PROPOSITION 3: *Suppose that there is a single auditor, independent costs of investment, and constant marginal costs. Then the set of equilibria is the same as in the separate auditors case.*

PROOF: Consider an arbitrary equilibrium and arbitrary date t. There is a measure 1 of customers of group i who will again be customers of group i next period, giving a profit next period of $max[v\tilde{\pi}(i,.;i)-c,0]$, where $\tilde{\pi}(.)$ are beliefs corresponding to the equilibrium. There is also a measure 1 of i-customers who will be customers of group j next period, giving a profit next period of $max[v\tilde{\pi}(i,.;j)-c,0]$. These are the only consumers whose behavior will be affected by the quality in group i at t. Therefore the auditor's expected payoff if he sets high quality at group i at t differs from his expected payoff if he sets low quality by the amount

$$\delta[max[v\widetilde{\pi}(i,h;i)-c,0]+max[v\widetilde{\pi}(i,h;j)-c,0]-max[v\widetilde{\pi}(i,l;i)-c,0]$$

$$-max[v\widetilde{\pi}(i,l;j)-c,0]]-c_i^q.$$

He sets high quality if and only if this expression is non-negative. But, since the expression is independent of quality in group j, the beliefs $\widetilde{\pi}(.)$ must assume independence, and the equilibrium must be one of the separate-auditors equilibria. QED.

In other words, regardless of the quality in group j, and regardless of the inference that consumers draw from observing this quality, the marginal cost of production will be the same (c) and hence the net benefit gained, via repeat customers, from investing in high quality will be the same. Therefore the trade-off between high and low quality in group i is independent of quality in group j. But that means that consumers must believe that there is no correlation between the qualities in the two groups. Even though there is only one auditor/franchisor setting quality for all the producers he cannot credibly announce that there is a common standard for everyone.

If, on the other hand, there are decreasing marginal costs ($\lambda < 4$) then a complementarity may endogenously arise between q^A and q^B. For simplicity, we will consider the case[14] $\lambda = 3$. If group A's quality is high and if, as a result, group A's customers are willing to trade in their second period with group B producers, then B producers have more to gain from high quality (δv) than they would if A's quality were low and so demand for B's products were lower (the benefit then would be $\delta(v-c)$). So, if consumers believe that the qualities are correlated, it will be profitable to make them so, which in turn justifies the belief.

We will assume that the following two inequalities apply:

$$v \geq 2c \tag{5}$$

[14]For other values of λ, qualitatively similar equilibria will obtain, for different ranges of parameter values.

and

$$2\delta v \geq a. \tag{6}$$

If (5) and (6) are satisfied then there exists an equilibrium in which, for every pair (c_A^q, c_B^q) there is a common standard for the two groups.

PROPOSITION 4: *Suppose that there is a single auditor, independent costs of investment, and* $\lambda = 3$, *hence marginal costs are decreasing. Suppose also that* (1), (5) *and* (6) *hold. Then there is an equilibrium in which both groups always have the same quality: quality is high if and only if*

$$\frac{c_A^q + c_B^q}{2} \leq \delta(2v - c). \tag{7}$$

This equilibrium Pareto-dominates the c^**-cutoff equilibrium and has higher average quality.*

PROOF: In the equilibrium, the auditor sets high quality in both groups if average cost of investment is below $\delta(2v - c)$ and otherwise sets low quality in both. Let the probability of the event of high quality be denoted by $\hat{\pi}$. Each new generation has belief $\pi(A) = \pi(B) = \hat{\pi}$. The beliefs of old generations are given by

$$\widetilde{\pi}(i, h; i) = \widetilde{\pi}(i, h; j) = 1$$

and

$$\widetilde{\pi}(i, l; i) = \widetilde{\pi}(i, l; j) = 0$$

for $i, j \in \{A, B\}$. That is, if a consumer observes high quality she believes that next period the quality at both groups will be high; similarly, if she observes low quality she believes it will be low next period at both groups. Clearly the beliefs are correct, given the auditor's strategy.

Each new-born generation buys, since $v\hat{\pi} \geq c$. To see this, note that if $c_A^q < 2\delta(v - c)$ then, since, by (6), $c_B^q \leq 2\delta v$, it must be that (7) is satisfied and so quality is high. Therefore

$$\hat{\pi} \geq pr(c_A^q \leq 2\delta(v - c))$$

and so

$$\hat{\pi} \geq F(2\delta(v - c).$$

By (1), $vF(\delta v) \geq c$. Combining with (5) gives $v\hat{\pi} \geq c$. This also establishes that $\hat{\pi} > F(c^*)$, so that quality is higher in the common-quality equilibrium.

It remains to check that the auditor's strategy is optimal given the consumers' beliefs. Clearly the auditor's maximization problem is stationary and it suffices to consider the effect of changing quality in one period on the profits in the following period. Let the difference between next period's discounted profit and the current cost of quality be denoted by $\mu(q^A, q^B)$. The auditor has four possible choices for (q^A, q^B): (h, h), (h, l), (l, h) and (l, l). μ is given as follows.

$$\mu(h, h) = -c_A^q - c_B^q + 2\delta[2v + 2v\hat{\pi} - 3c],$$

$$\mu(h, l) = -c_A^q + 2\delta[v + 2v\hat{\pi} - 3c],$$

$$\mu(l, h) = -c_B^q + 2\delta[v + 2v\hat{\pi} - 3c],$$

$$\mu(l, l) = 2\delta[2v\hat{\pi} - 2c].$$

For example, if quality is high at both groups, each firm will make $2v$ from second period consumers, and $2v\hat{\pi}$ from first-period consumers. If quality is high only at A, then each firm will make $2v\hat{\pi}$ from first-period consumers and v from consumers who bought at A in their first period. If (7) is satisfied then (h, h) is better than (l, l), and vice versa if (7) is not satisfied. (l, h) is optimal only if

$$c_A^q \geq 2\delta v,$$

which violates (6). Therefore (l, h) is never optimal. Similarly, neither is (h, l). This shows that the auditor's strategy is optimal given the beliefs of consumers.

To show that the common-quality equilibrium is Pareto-superior to the c^*-cutoff equilibrium, we consider the event that the auditor deviates by playing the c^*-cutoff strategy and we show that this deviation gives him a higher expected payoff than the c^*-cutoff equilibrium does. Since the deviation by definition is inferior to the equilibrium strategy, this shows that the auditor is better off in the former equilibrium, and hence that it is Pareto-superior. If he deviates, his expected investment cost is the same as in the c^*-cutoff equilibrium and his expected revenue from a repeat customer is also the same ($vF(c^*)$). Like a repeat customer, an old customer who has switched groups will pay v with probability $F(c^*)$ and zero with probability $1 - F(c^*)$, giving the same expected revenue as in the c^*-cutoff equilibrium (when she pays $vF(c^*)$ for sure). The only differences are (i) that in the c^*-cutoff equilibrium, customers of the latter type are served for sure rather than with probability $F(c^*)$ hence expected production cost is higher, and (ii) new-borns pay $vF(c^*)$ rather than $v\hat{\pi} > vF(c^*)$. Hence the c^*-cutoff equilibrium gives lower expected payoff to the auditor. QED.

The conclusion is that, even though there is no reputational externality when the groups are separately audited, it is possible to maintain higher quality and higher expected payoff if the groups merge into a single association as long as two conditions are satisfied: firstly, there is some element of fixed cost in production and, secondly, the potential difference between the two groups is not too great (a is not too high, as guaranteed by inequality (6)). The two conditions are required because it has to be credible that the auditor will set a common standard. This cannot be credible if the two groups are too different from each other or if there is no complementarity between the two qualities, given the belief that there is a common standard. Intuitively, the reason that the common-standard equilibrium is superior to the separate-auditors equilibrium is that, assuming that the common standard is credible, the market reach of the association is larger and, as a result, the degree of potential repeat purchasing is increased. This improves incentives to set high quality.

If (6) is not satisfied ($a > 2\delta v$) then the common-quality equilibrium cannot exist. Suppose that the consumers believe that quality is always the same at the two groups. If $c_A^q > 2\delta v$ and $c_B^q < 2\delta(v-c)$ then the auditor will want to set high quality at B since $\mu(h,h) > \mu(h,l)$ and $\mu(l,h) > \mu(l,l)$, and low quality at A, since $\mu(l,h) > \mu(h,h)$

and $\mu(l,l) > \mu(h,l)$. Therefore there can be no equilibrium of this kind. There may, however, still be a c^*-cutoff equilibrium. Suppose that $2\delta v < a < \delta v^2/c$ ((5) ensures that this interval is non-empty). Suppose also that $F(.)$ is the uniform distribution. In that case inequality (1) is $\delta v^2/a \geq c$, which is satisfied, so the c^*-cutoff equilibrium exists by Proposition 1.

We have assumed that the quality cost c^q is fixed forever at the initial period, while our welfare analysis has implicitly assumed that assessments are made before c^q is chosen. What we have in mind is that the model above is an approximation to one in which c^q evolves slowly while the discount factor is high. Suppose that each c_i^q independently follows a Markov process - in each period there is a small probability of a new draw from F. It can be shown that in that case the equilibria will be close to those of the model set out above. In a common-standard equilibrium a consumer's willingness-to-pay in her second period after buying a high-quality good in her first period will be slightly less than v because of the possibility of a drop in the average value of c^q; therefore the marginal benefit of setting high quality is slightly changed, which in turn brings about a small change in the critical value. In other respects the equilibrium is unchanged. In such a model, with a high degree of patience, it is appropriate to use *ex ante* assessments to evaluate, e.g., whether it is in the interest of two groups to merge, even if they know their current values of c^q.

Asymmetric Group Sizes

Until now we have assumed there are two equal-sized groups. Now we consider the case in which one group is much larger than the other. Suppose, for example, that a franchisor with an existing homogeneous group of franchisees is considering whether to admit a new, independent, firm, or small group of firms, to the organization. Would a common standard then be credible? It turns out that the answer is no, unless the existing group is certain to have high quality. The reason is that in the event that the small group has a very low cost of quality, but the large one does not (i.e., would have low quality without the new members), the franchisor would choose high quality for the small group and low for the large one, which implies that a belief in a common quality is not sustainable.

We assume, as above, that (1), (5) and (6) hold and that $\lambda = 3$. The two groups have the same distribution of investment cost c_i^q, with support $[0, a]$. Group A now consists of a continuum of firms of measure $\alpha < 0.5$, instead of measure 1; group B has a continuum of firms of measure $1 - \alpha$. As before, each firm has, in each period, a continuum of new customers of measure 2; of these, 2α go in their second period to a firm in group A and $2(1-\alpha)$ go to a firm in group B. Thus, if α is close to zero (as we will assume) most customers, whether at group A or group B in their first period, will go to group B in their second.

Consider first the case in which the two groups are separately audited. In a positive-quality equilibrium, A's demand in the absence of repeat purchasers would be $2 + 2(1-\alpha) > \lambda$, so marginal cost would be zero. Therefore A optimally sets high quality if $c_A^q \leq 2\alpha\delta v$. B's demand in the absence of repeat purchasers is $2 + 2\alpha < \lambda$ and he sets high quality if $c_B^q \leq \delta[2(1-\alpha)v - (\lambda - 2(1-\alpha))c] = \delta[2(1-\alpha)v - (1-2\alpha)c]$. If α is close to zero, then A's critical value $2\alpha\delta v$ is also close to zero, so this cannot be an equilibrium (new customers would not pay enough to cover production cost). Therefore the only equilibrium is the zero-quality one, in which A producers earn zero profit. In group B, the critical value is approximately $\delta(2v - c)$; by (1), new customers will be willing to pay more than c, so the positive-quality equilibrium does exist for this group. When α is close to zero this equilibrium is approximately the same, for B, as the positive-quality equilibrium of B on its own.

Suppose now that the two groups form a single association. Assuming that consumers believe quality is the same at the two groups, and defining $\mu(.,.)$ as above, we have

$$\mu(h,h) = -\alpha c_A^q - (1-\alpha)c_B^q + \delta[2v\hat{\pi} - 2c + 2v - c],$$

$$\mu(h,l) = -\alpha c_A^q + \delta[2v\hat{\pi} - 2c + 2\alpha v - 2\alpha c],$$

$$\mu(l,h) = -(1-\alpha)c_B^q + \delta[2v\hat{\pi} - 2c + 2(1-\alpha)v - c],$$

$$\mu(l,l) = \delta[2v\hat{\pi} - 2c].$$

By (6), $c_A^q < 2\delta v$, so (l, h) is inferior to (h, h). Suppose that $c_A^q < 2\delta(v - c)$ and $c_B^q > \delta(2v - c)$. Then, for small α, $\mu(h, h) < \mu(h, l)$ and $\mu(h, l) > \mu(l, l)$. Therefore (h, l) is optimal, contradicting the consumers' belief in a common quality. This shows that the common-standard equilibrium cannot exist unless $a \leq \delta(2v - c)$, in which case group B is certain to set high quality in the separate auditors case. This therefore gives a second sense in which the franchisees have to be similar for a collective reputation to develop: they should not be both independent and unbalanced in importance.

PROPOSITION 5: *Suppose that there is a single auditor, independent costs of investment, $\lambda = 3$, and that (1), (5) and (6) hold. Suppose also that the sizes of A and B are respectively α and $1 - \alpha$. If $a \leq \delta(2v - c)$ then, for any sufficiently small α, there is an equilibrium in which both groups always have high quality; if $a > \delta(2v - c)$ then, for any sufficiently small α, no common-quality equilibrium exists.*

Many Small Groups

Suppose now that the organization consists of many small firms of the same size and with identical, independent distributions of quality cost. There are k firms, each of measure α, with $k\alpha = 1$. For comparability with the analysis above, we continue to assume that the measure of new customers at each firm is 2, so that for any $\{i, j\}_{i,j=1}^k$ firm i has 2α old customers who were customers of firm j in the previous period. As before, let $\lambda = 3$.

Suppose that the consumers believe that quality is the same at all firms. Suppose also that the auditor sets quality high at at least half of the k firms and consider his decision at one of the remaining firms, i. The cost of high quality is αc_i^q. Next period, since at least half of second-period customers at a typical firm will choose to buy, marginal cost of serving a previous customer of i will be zero. Therefore the marginal benefit of setting quality high at i is $2\alpha\delta v$. By (6), $c_i^q < 2\delta v$, so high quality is optimal. Therefore, if the auditor sets quality high at half of the firms then he must also set quality high at the other half.

If fewer than half of the firms have high quality then the marginal benefit of high quality at i is $2\alpha\delta(v-c)$, so high quality is optimal at i if $c_i^q < 2\delta(v-c)$. For the limiting case as α goes to zero, what matters therefore is whether $F[2\delta(v-c)]$ is above or below 0.5. If $F[2\delta(v-c)] < 0.5$ then no common-quality equilibrium can exist, since it would be optimal to set high quality at a proportion $F[2\delta(v-c)]$ of firms, but not at any others. If $F[2\delta(v-c)] > 0.5$ then a common-quality equilibrium does exist; moreover, quality is always high in this equilibrium. The existence of a critical measure of low-cost firms has the effect, via the decreasing marginal cost, of dragging up the quality of all the other firms.

5 Asymmetric Cost Distributions

In this section we examine what happens if the distribution of investment costs differs between the two groups. The main question we ask is: who benefits most from forming a merged association, a relatively high quality group (i.e., one with a low expected cost of achieving high quality) or a relatively low quality group? One theory might be that the high quality group gains most because, when the two groups are separately audited, the low quality group exploits the reputation of the high quality group, damaging the latter's interest. We have seen, however, that, if costs are independent, there is no collective reputation phenomenon, so this argument cannot apply. A second theory would be that the high quality group gains most because, when the two groups are jointly audited, the low quality group is burdened with excessive cost of investment. We show that, on the contrary, if the cost distributions are uniform, the low quality group benefits most from merger.

First, we consider general distributions of cost and show that, in the separate auditors case, the high quality group has higher expected profit. More precisely, if the distribution of B's cost first-order stochastically dominates the distribution of A's cost, then A's expected equilibrium profit is higher.

Suppose that c_A^q is distributed according to c.d.f. $F_A(.)$ on the interval $[0, a]$ and c_B^q is distributed according to $F_B(.)$ on $[0, b]$. c_A^q and c_B^q are independent. Suppose also that $F_B(.)$ first-order stochastically dominates $F_A(.)$, that is, $b \geq a$ and $F_B(x) \leq$

$F_A(x)$ for all $x \in [0, b]$. Thus, B is a relatively low quality group in the sense that its cost of obtaining high quality tends to be higher.

We consider, for simplicity, the case $\lambda \leq 3$ and we suppose that parameters are such that the positive-quality equilibrium exists in the separate-auditors case. That is, $vF_i(\delta v) \geq c$ for $i = A, B$. We assume also that $a > \delta v$, so that, in equilibrium, there is strictly positive probability of low quality in each group. In this equilibrium, auditor $i = A, B$ sets high quality if and only if $c_i^q \leq \delta v$. The expected payoff in each period of group i (in ex ante terms, i.e. before c_i^q is known), denoted Γ_i^S, is

$$\Gamma_i^S = 4vF_i(\delta v) - \lambda c - \int_0^{\delta v} c^q dF_i(c^q).$$

Therefore group A's payoff exceeds group B's payoff if and only if

$$4v(F_A(\delta v) - F_B(\delta v)) > \int_0^{\delta v} c^q dF_A(c^q) - \int_0^{\delta v} c^q dF_B(c^q). \tag{8}$$

PROPOSITION 6: *If there are separate auditors and independent costs of investment, and $F_B(.)$ first-order stochastically dominates $F_A(.)$, then A has a higher ex ante expected payoff in the positive-quality equilibrium than B.*

PROOF: Using integration by parts,

$$\int_0^{\delta v} c^q dF(c^q) = \delta v F(c^q) - \int_0^{\delta v} F(c^q) dc^q.$$

Therefore (8) is true if and only if

$$(4 - \delta)v[F_A(\delta v) - F_B(\delta v)] > \int_0^{\delta v} [F_B(c^q) - F_A(c^q)] dc^q.$$

By first-order stochastic dominance, the left-hand-side of this inequality is positive and the right-hand-side is negative. QED.

Now we consider the common-quality equilibrium when there is a single auditor. As in section 4 we limit ourselves to the case $\lambda = 3$, and we assume that (1) and (5) hold and that (6) holds for both distributions: that is, $2\delta v \geq b$. Denoting $2\delta(2v - c)$ by z, the quality is high in both groups if and only if $c_A^q + c_B^q \leq z$.

In this equilibrium, both groups have the same expected revenue and the same expected cost of production. Therefore expected payoff differs only inasmuch as expected investment cost differs. Let Γ_i^J denote the per-period payoff for group i in this equilibrium (J standing for 'joint'). Then the difference between the two groups' expected payoffs is given by

$$\Gamma_A^J - \Gamma_B^J = \left(\int_0^{z-a} c^q dF_B(c^q) + \int_{z-a}^{b} c^q F_A(z - c^q) dF_B(c^q)\right) -$$

$$\left(\int_0^{z-b} c^q dF_A(c^q) + \int_{z-b}^{a} c^q F_B(z - c^q) dF_A(c^q)\right)$$

since, for example, given cost realization c^q, B will incur cost c^q for sure if $c^q < z - a$ and will incur it with probability $F_A(z - c^q)$ otherwise.

Suppose now that $F_A(.)$ is the uniform distribution on $[0, a]$ and $F_B(.)$ the uniform distribution on $[0, b]$. Then, after some calculation, we have

$$\Gamma_A^J - \Gamma_B^J = \frac{(a - b)[(a + b - z)^2 - ab]}{2ab}$$

and

$$\Gamma_A^S - \Gamma_B^S = \frac{\delta v^2 (b - a)(8 - \delta)}{2ab}.$$

Group B, the inefficient group, benefits more than group A from merger if $\Gamma_A^J - \Gamma_B^J < \Gamma_A^S - \Gamma_B^S$. Since $a < b$, $(\Gamma_A^J - \Gamma_B^J) - (\Gamma_A^S - \Gamma_B^S)$ has the opposite sign to

$$(a + b - z)^2 - ab + \delta v^2 (8 - \delta),$$

which, since $\delta v > b/2$ and $a < 2\delta v$, is positive. This establishes

Proposition 7: *A low-quality group has most to gain from common auditing. That is, if $F_A(.)$ and $F_B(.)$ are independently uniform on $[0, a]$ and $[0, b]$ respectively, where $a < b$, then B gains more from merging than A does, assuming the merged association has the common quality equilibrium.*

6 Concluding Remarks

There are many settings in which disparate producers may want to establish a common reputation. We have shown in this paper that the possibility of doing so depends on certain factors, including the nature of the production function, in ways which have not previously been noted in the literature. These factors in turn can be expected to be relevant to the explanation of, for example, the extent and composition of franchise organizations and professional groups.

One common complaint about self-regulating professions is that they do not actually enforce properly their proclaimed standards. If so, that may be because an auditor who identifies with and is drawn from the profession may not, after an abuse, have the incentive to carry out the required punishment. This issue did not arise in this paper because we assumed that an auditor can commit to enforce his chosen quality. Suppose, however, that the auditor lacks this commitment power. This would raise questions about the optimal balance between self-regulation and state regulation which we hope to address in subsequent work.

Appendix

Proof of Proposition 2: First we show that the two equilibria described are the only positive-quality equilibria. If, in some equilibrium, there is positive probability of high quality at both groups then new-borns must buy at both groups (otherwise there would be no incentive to set high quality). If c^q is such that previous customers of group j will buy from group i then i's optimal cut-off is δv, while, if not, it is $\delta(v - c)$. Therefore there are only two possible equilibrium cut-offs. To see that both groups must use the same cut-off, suppose, for definiteness, that A uses δv and B uses $\delta(v - c)$. New-borns must be willing to buy from B (for the reason above). Thus, if A's quality is high, A-customers must be willing to buy in their second period from B because they have a higher expectation of B's quality than new-borns, their conditional expectation of c^q being lower. So, if $c^q \leq \delta v$, B's demand without repeat customers is 3, which means that B's benefit of setting high quality is δv, which is a contradiction.

If (4) does not hold then clearly the $\delta(v-c)$ cut-off strategies do not form an equilibrium. If there are constant marginal costs then the marginal profit is always $\delta(v-c)$ so the δv cut-off equilibrium does not exist.

Finally, we need to show that the δv cut-off equilibrium Pareto-dominates the $\delta(v-c)$ cut-off equilibrium. If, in the δv equilibrium, one auditor unilaterally deviates and chooses cut-off $\delta(v-c)$, his expected payoff is

$$3vF(\delta v) + vF(\delta(v-c)) - 2c - F(\delta v)c - E(c^q | c^q \leq \delta(v-c)). \tag{9}$$

His expected payoff in the $\delta(v-c)$ cut-off equilibrium is

$$4vF(\delta(v-c)) - 2c - F(\delta(v-c))c - E(c^q | c^q \leq \delta(v-c)). \tag{10}$$

Since (10) exceeds (11), the Proposition is proved. QED.

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