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Quacks, Lemons, and Self Regulation: A Welfare Analysis[1]

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Abstract
This paper provides a framework in which suppliers of experience goods may find it in their best interests to provide, and enforce, quality standards. The incentives to form self-regulatory organizations are inversely related to ex-ante monitoring costs of the organization, as well as the number of members. This self-regulatory outcome is compared to statutory price and quality regulation. Without informational asymmetries between market participants and the social planer, self-regulatory outcomes can always be replicated by statutory regulation. Even with asymmetric information, self regulation is socially desirable only if the regulator values firm's profits sufficiently highly.

> "Despite a long standing interest by policy makers,.. the formal analysis of the economics of the self-regulating profession has received little attention from theorists."
>
> (Shaked and Sutton 1981, 217-234)

1. Introduction

More than ten years after Shaked and Sutton's article on the self-regulating profession, little of their assessment has changed (the only exception known to the authors' is Shapiro (1986, 843-862)). This is even more surprising for the concept of self regulation is quite an interesting economic construct. Consider a market in which consumers cannot observe product quality prior to purchase and suppose that firms have an incentive to provide high quality products in order to serve a large clientele. Each firm has different possibilities to signal quality:[2] for example, it can build on reputation effects (see Shapiro (1983, 659-680)), offer warranties (see Cooper and Ross, (1985, 439-449)) or choose a particular sequence of prices (see Bagwell and Riordan (1991, 224-239)). However, signaling maybe extremely

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2 See von Weizsäcker (1980a, Chapter 6) for the efforts to provide quality information.

costly, sometimes not credible, or even excluded in certain markets. In those situations, some or all firms in the market have an incentive to self-regulate the market in the sense to improve jointly their product qualities.

In the present article, we focus on the conditions and implications of self regulation in markets in which firms cannot credibly signal a higher quality of products individually but have an incentive to self-regulate market conduct. In such an environment, a self-regulatory club sets minimum standards on product quality. Of course, the club has to credibly enforce these standards: If one member of the club deviates from the prescribed standard to exploit his superior informational position, all club members lose their credibility.

The following example of the Swiss Regional Bankers Association illustrates the problems which may arise if those requirements are not met: Due to the expansion of the Grossbanken and Cantonal Banks in rural areas, Regional Banks which tend to focus on retail and commercial banking in their local areas [3] founded the Regional Bankers Association in 1971 to maintain their competitive position. The reduction of operating costs via centralization of common services, as well as the improvement of confidence and safety, were two main goals of this Association. However, as Swiss banks generally are regarded as safe banks, the Association failed to institute a supervisory board which would monitor quality standards. Then, in 1991 the Spar- and Leihkasse Thun, a Sfr. one billion regional bank was liquidated and the bank's license was withdrawn by the Federal Banking Commission. [4] The bank's failure damaged the image of Swiss banking, in particular that of the members of the Regional Bankers Association. In order to prevent a repetition of similar developments, a board of examiners was founded to set business standards and audit their compliance. Inadequate conduct of business now is sanctioned by exclusion as a member of the Association.

Our analysis is based on the following model: Firms and consumers are located across isolated islands. Firms produce services or products of a quality which can be observed by consumers only after purchase. Over time, consumers will learn the true qualities. However, between consumption periods, there is a chance that consumers might need to migrate to ex ante unknown locations. In such cases, they loose all their information of former purchases. They have to learn from scratch again. [5] In this environment, both consumers and firms have an incentive to improve on the situation. A self-regulatory club then may credibly enforce its minimum standard because each member has an incentive to detect and exclude from the club any deviant. The deviant will fool some prospective clients, who in turn revise downwards their appreciation of the club. This destroys reputational capital of other club members. Since such revisions of consumer beliefs hurt expected future revenues of the other club members, they have a strong incentive to enforce the quality standard.

The incentives to form such a self-regulatory club depend on the costs the club incurs for monitoring its members' quality, the proportion of migrants, and the number of members. We show that self regulation is more likely as monitoring costs are low, the proportion of migrants is high, or the number of local markets is small, ceteris paribus. This result may help to explain why, in an international banking context, we do observe different attitudes towards self regulation. While self regulation seems to be more prominent in Switzerland,

3 Which are small sized with the largest disposing of assets of around Sfr. 8 billion.

4 The Federal Banking Commission supervises all Swiss banks.

5 Implicitly, we assume that it is too costly or even impossible to verify loosely communicated information perfectly.

it is of less importance in the United States. This accords well to the observation of a larger number of local banking markets in the United States. Furthermore, one may argue that because of institutional advantages (e.g., secrecy laws, tax treatment) Swiss banks enjoy a large international clientele. These customers are very mobile and may easily switch across the Swiss banks. In such an environment, our model predicts strong incentives to self-regulatory agreements.

The welfare aspects of self regulation are particularly interesting. In a first-best world, where the social planner has access to the same information as the firms in the market, there is little scope for self regulation. [6] So any analysis of self regulation has to start from information asymmetries between market participants and the social planner. Assume that the enforcement of statutory regulation is impeded by the fact that the regulator himself may not be privy of other inside information, e.g., those pertaining to the firms' production costs. In such situations the regulator needs to interpret market signals in an attempt to uncover wrong doings. However, he will remain only partially informed in any statutory regime. [7] We show that the regulator may be willing to grant regulatory powers to self-regulatory organizations, provided he places sufficient weight on industry in the social welfare function. This result is even more restrictive when firms are assumed to be local monopolists. So the trade-off between provision of quality and the social costs imposed by barriers to entry is omitted (see von Weizsäcker (1980b)).

Financial markets are good examples of the model we have in mind, since financial services largely are credence or experience goods rather than search goods (see Mayer and Neven (1989, 112-132)). In the case of credence goods, even ex post, it may be difficult to ascertain product quality, while in the case of search goods the quality can be established immediately on purchase. In fact, clients in financial services cannot easily observe the quality of investment advice or portfolio management. They cannot easily discriminate bad draws of fundamentals of the underlying assets from strategic maneuvering against their interests, such as insider trading or rate cutting for example. Currently, interest in self-regulation features prominently in the regulatory reform of European financial markets. So the Financial Services Act (1986) in the United Kingdom explicitly confers regulatory power to five Self-Regulatory Organizations (SROs) which consist of member firms actively operating in those markets. Direct access to the London financial market requires membership in one of these five clubs.

Our model follows Shapiro (1986, 659-680) quite closely in spirit. The value of reputational capital determines the quality of investments firms undertake initially. Shapiro shows that product licensing and certification can ameliorate the moral hazard problem associated with the provision of high quality products and analyses the differential incentives on quality provision of these two statutory policies. We concentrate on the mechanism of self regulation, which consists of self monitoring and self enforcement, as an alternative mechanism to reduce the moral hazard problem in situations, in which quality is difficult to judge for outsiders. Thus, like Shapiro, we generalize the initial work of Leland (1979, 1328-1346), who considers licensing in the form of minimum standards only. In Shaked and Sutton (1981, 217-234) firms' qualities are exogenously given, and a self-regulatory club determines the minimal quality necessary to enter the market. Their analysis concentrates on the divergence

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6 Here we mean that in such a world statutory regulation could implement self-regulatory outcomes as well.

7 Implicitly, we assume that it is too costly or even impossible to verify inside information perfectly.

of interests between the social planner and the club. However, since qualities are exogenously given, they do not analyze incentives on quality provision. Furthermore, enforcement is automatic, while we concentrate on incentives of club members to enforce club agreements.

The paper is organized as follows. In Section 2 we present the basic economy. Section 3 analyzes the market failure in the absence of a regulatory scheme. Section 4 considers the case in which firms can join a self-regulatory club. Statutory regulation is compared with self regulation in Section 5. The last section concludes with some final remarks.

2. The Basic Model

We consider a segmented market in which firms supply the product only in localized regional markets. The products are non-durable and can be offered in different qualities. Consumption can take place in two periods. The key features of our model are the demographic structure, consumer demand, and the information structure.

Demographic Structure

Consumers are evenly located across N isolated islands. Shopping on other islands is prohibitively expensive so that consumers are constrained to buy products on the very island they inhabit at the given period.

Between the two periods, a fixed proportion $\lambda \in [0, 1]$ of consumers migrates to another island such that the population in each island remains constant. We assume that the migration decision is caused by exogenous events and is unforeseen by the consumers in period 1.

Consumer Demand

In modeling demand for a specific island we follow Shaked and Sutton (1982, 3-13). Consumers are characterized by their income $y \in [0, \bar{y}]$ and by their "reservation quality" $r \in [0, \bar{r}]$. The reservation quality of a given consumer defines his minimal quality satisfaction level in the sense that he derives no utility for products of any lower quality. Consumers demand at most one unit. The utility a consumer with characteristics (y,r) derives from consuming a product of quality q is given by:[8]

$$u(y,r) = \max\{q-r,0\} \cdot y.$$

Income and reservation qualities are uniformly distributed on $[0, \bar{q}]$ and $[0, \bar{r}]$, respectively. Let p denote the price for a product of quality q then market demand reads

$$D(p, q) = \frac{1}{\bar{r}\bar{y}} \int_{q \geq r} \int_{y \geq p} dr\, dy$$

$$= \frac{1}{\bar{r}\bar{y}} q(\bar{y} - p).$$

8 As in Shaked and Sutton (1982, 3-13), consumers trade off product quality against income. In addition, we allow heterogeneity in the marginal rate of substitution by introducing heterogeneous reservation qualities.

Firms and Information Structure

We assume that a firm can supply only a single island. Furthermore, we assume that each firm offers a single product. Products can be offered in different qualities $q \in [0, \overline{q}]$. Production of quality q requires a fixed outlay of $C(q) = q^2$.

Qualities are set before the market opens and cannot be changed during the periods. However, at the beginning of each period a firm can set prices p_1 and p_2 respectively. Prices on a given island are set simultaneously by the competitors.

Product quality is private information of the firms initially. Only after consumption a consumer can learn the quality of a product. This implies that only in period 2 can a consumer be certain of the quality offered by a particular supplier.

We assume that it is not possible to communicate the quality of a product. Hence, in period 2, immigrants in an island cannot inherit the experience of the locals. Moreover, consumption decisions of other consumers are not observable to consumers. So they cannot make inferences from transaction volumes.

Game Structure

Our analysis is based on a non-cooperative game with two consumption periods $t = 1,2$. We consider the following time structure of events:

$t = 0$: Firms choose the quality of their products. Before period $t = 1$ starts, each firm observes the quality set by the other firms.

$t = 1$: Firms set prices for the first consumption period. Thereafter, consumption takes place. At the end of period 1 some consumers migrate across islands.

$t = 2$: Firms set prices for the second period. Then, consumers make their consumption decision.

Strategies and Equilibrium

The strategy for a firm is a triple (q, p_1, p_2), where $q \in [0, \overline{q}]$ is the chosen quality and p_i are the prices set in period $i = 1,2$, respectively. [9]

In period 1, consumers base their purchase decision on their expectation q_1^e of product qualities and the observed prices. [10] In period 2, non-migrant consumers have learned the quality of the supplier whose product they consumed. Migrants, however, have no further information about the qualities of suppliers on their new island and maintain an expectation of q_2^e.

We employ the concept of perfect Bayesian equilibrium Fudenberg and Tirole 1991, 236-260). Let $\pi(q, p_1, p_2, q_1^e, q_2^e)$ denote a firm's revenue function. Then in equilibrium

- a firm's strategy (q^*, p_1^*, p_2^*) has to be an optimal response to their rivals' strategies for given beliefs of the consumers:

$$\pi(q^*, p_1^*, p_2^*, q_1^e, q_2^e) \geq \pi(q, p_1, p_2, q_1^e, q_2^e) \text{ for all } (q, p_1, p_2)$$

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9 We abuse notation and let denote $p_1 = p_1(q)$ and $p_2 = p_2(q,p_1)$ firms' price decisions.

10 Again, we abuse notation and use $q_i e = q_i e(p_i)$ to denote consumers' expectations.

- consumers' beliefs are consistent in the sense that in equilibrium they expect firms to play equilibrium strategies.[11]

$$q_i^e(p_i^*) = q^* \text{ for } i = 1,2.$$

3. The Case of Local Monopolies

Consider a particular island and assume that the local firm has selected a strategy (q, p_1, p_2).

As a reference case, let us consider the situation in which consumers can perfectly observe the quality in both periods. Here the local monopolist faces a straightforward optimization problem. Prices and quality are set such that to maximize his profit function

$$\pi(q, p_1, p_2, q, q) = D(q, p_1)p_1 + D(q, p_2)p_2 - C(q).$$

Result 1 (Full Information)

When consumers can observe the product qualities offered by local monopolists, the optimal choice for local monopolists requires:

$$\hat{q} = \frac{\bar{y}}{4\bar{r}} \text{ and } \hat{p}_1 = \hat{p}_2 = \frac{\bar{y}}{2}.$$

Equilibrium revenues are

$$\pi(\hat{q}, \hat{p}_1, \hat{p}_2, \hat{q}, \hat{q}) = \frac{\bar{y}^2}{16\bar{r}^2}.$$

Proof: see Appendix.

Since market demand is enhanced by higher quality, the monopolist has an incentive to offer high quality products. This incentive is counteracted by the increasing fixed cost of supplying higher quality. In equilibrium, monopolists just balance net revenues and costs.

When consumers cannot observe product quality, monopolists may not capture the full net revenue. Hence, the differential information reduces the incentives to provide high quality products. Therefore, let us now consider the situation in which quality is not observable to consumers before consumption.

Without loss of generality, we concentrate the discussion on equilibria supported by beliefs which accord even with out-of-equilibrium observations of the consumers.[12] In this sense, equilibrium as well as off-equilibrium beliefs should always be of the form $q_1^e(p_1) = \tilde{q}$.[13]

11 Given that production requires fixed costs only, which are sunk at the pricing stage, and given marginal costs are independent of quality, signaling product quality through pricing (Bagwell and Riordan 1991, 224-239) will not occur in equilibrium. In fact, this result will apply even, when marginal costs vary in quality, provided sunk costs are large enough. For that reason, we suppress the dependence of quality expectations on period 1 prices.

12 The stronger equilibrium concept of trembling hand perfect equilibrium would generate such equilibria.

Obviously, $q_1^e = q_2^e = 0$ will support an equilibrium in which all firms offer quality 0. We shall neglect this trivial equilibrium in our further analysis, since in principle the grand coalition of all consumers and the firm could easily improve on this situation.

Given consumers expect quality $q_1^e(p_1)$ to be offered, demand in period 1 is $D(p_1, q_1^e)$. In period 2, the non-migrant consumers will know the true quality on offer. On aggregate, they demand $(1 - \lambda)\, D(p_2, q)$, accordingly. The migrant consumers are uniformed. If they expect quality $q_2^e(p_2)$ to be offered, their aggregate demand is $\lambda D(p_2, q_2^e)$. Accordingly, the firm's revenues $\pi(q, p_1, p_2, q_1^e, q_2^e)$ are

$$\pi(q, p_1, p_2, q_1^e, q_2^e) = D(p_1, q_1^e)p_1 + (\lambda D(p_2, q_2^e) + (1 - \lambda)D(p_2, q))p_2 - C(q).$$

The firm's optimization problem then is to maximize profits over product quality and prices. Equilibrium requires that consumers' expectations about product quality are rational, i.e., $(q_1^e, q_2^e) = (q^*, q^*)$.

Choose (q, p_1, p_2) to maximize

$$\pi(q, p_1, p_2, q_1^e, q_2^e).$$

Result 2 (Asymmetric Information)

In the case of local monopolists, equilibrium is given by

$$q^* = \frac{(1 - \lambda)\,\bar{y}}{8\bar{r}} \text{ and } p_1^* = p_2^* = \frac{\bar{y}}{2}.$$

Monopolistic revenues in equilibrium are

$$\pi(q^*, p_1^*, p_2^*, q^*, q^*) = (1 - \lambda)\frac{\bar{y}^2}{16\bar{r}^2}\left(1 - \frac{1 - \lambda}{4}\right).$$

Proof: see Appendix.

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13 Of course, if we would drop this assumption, different belief structures would support multiple equilibria due to the lack of specification of consumers' out-of-equilibrium beliefs. So, for example, suppose that all consumers on a particular island expect a quality $q \in (0, \bar{q}]$ before their first period consumption to be offered by the firm. Moreover, in period two each consumer expects zero quality if the offered product quality did not meet q, that is

$$q_1^e(p_1) = q \text{ for } q \in (0, \bar{q}] \text{ and } q_2^e(p_2, \tilde{q}) = \begin{cases} 0 & \text{if } \tilde{q} \neq q, \\ q & \text{otherwise.} \end{cases}$$

Given this belief structure, a firm chooses product quality q in equilibrium as long as $q \leq \bar{y}/4\bar{r}$. To see this, note that firm's profit when deviating from the excepted q is $q\bar{y}/4\bar{r}$ at its maximum (if it chooses $\tilde{q} = 0$), whereas it's profits are $q\bar{y}/4\bar{y} - q^2$ if it offers quality q. Hence, the firm's behavior, given consumers' beliefs, supports an equilibrium if the expected quality is lower than the full information quality. Here, consumers' out-of-equilibrium beliefs force the firm to behave as supposed. However, these equilibria are inconsistent in the sense that if a firm deviates from equilibrium and offers some quality $\tilde{q}$, consumers' belief are no longer rational.

Note that in equilibrium the quality offered is below the full information quality. This is due to the informational advantage of the monopolists. In period 1, quality is not observed by consumers. Hence monopolists have an incentive to under provide quality (relative to the full information quality). The only incentive to provide quality above the minimal level derives from the segment of informed consumers (non-migrants) in period 2. Indeed, when all consumers migrate in the second period ($\lambda = 1$), the monopolist provides minimal quality.

Consequently, the reservation utilities of less consumers are met and market demand is lower in the case of informational asymmetries. Since equilibrium prices are identical in both situations, consumer welfare is strictly higher in the full information case.

Furthermore, note that even in the case when no migration takes place, i.e., $\lambda = 0$, the first best level of quality is not offered due to the informational asymmetry in period 1.

Revenues are lower when qualities are not observable. In fact, equilibrium revenues are decreasing in λ.[14] This is due to a reputation effect for the monopolist: the more consumers in period 2 can evaluate the quality of his products the larger are his incentives to provide high quality. Hence, in principle monopolists prefer to commit to high quality. However, when quality is not observed by consumers, firms cannot commit not to underprovide quality. These information costs are expressed in lower than full information revenues.

The discussion demonstrates that with asymmetric information both consumers and firms are worse off relative to the full information case. This implies that consumers as well as producers have an incentive to improve on this situation.

Producers have a strong incentive to self-regulate the market in the sense to commit to high quality. Since all producers enjoy superior information about product quality, a commitment mechanism can be implemented as follows: before date 0 local firms gather in a club and impose a minimum product quality as a membership requirement. In order to credibly impose these minimum standards for club members, a non-complying firm needs to be punished. Indeed, each member firm has an incentive to monitor other members and to punish non-compliance. If a non-complying firm were not punished, a fraction of the period 2 clientele would no longer believe in the standards. This reduces profits of complying firms, since some of those betrayed consumers will migrate and form part of the demand of complying firms.

Consumers would like an independent authority to impose some kind of regulation on producers. This is the case of statutory regulation. Here the government could enact price, quantity, or quality regulation. While price and quantity regulation are easily feasible, the regulation of qualities by imposing a minimum standard meets the difficulty that the government cannot directly observe the qualities provided.

4. Self Regulation

Consider a situation in which local monopolists can join a club to commit to some minimum standard $q_{SR} > 0$ before period 0. The club can monitor firms' activities ex ante at a cost of $k > 0$ per firm. This is precisely the membership fee a given firm has to contribute to the club. After the club agreements have been decided, consumers can observe membership to the club. However, as before, they cannot observe the actual quality selected before consump-

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$$\frac{\partial \pi}{\partial \lambda} = -\frac{\bar{y}^2}{16\bar{r}^2}\left(1 + \frac{1-\lambda}{2}\right) < 0.$$

tion. Again, second period consumption depends on observed product quality. In this situation, consumers maintain beliefs about club products. That is, consumers will value the products of all club members identically. Consequently, if a consumer migrates from an island served by a club member to another island also served by a club member, he expects the same product quality as in the first consumption period.

Note that firms have no incentive to provide qualities higher than the standard, since they cannot commit on their own to higher quality. So they are not rewarded for increased costs. On the other hand, if a club member deviates, without being excluded from the club, it behaves like the monopolist in the asymmetric information case and selects quality q^*. The non-compliant's decision is driven by the trade-off between the revenues from non-migrant consumers, knowing precisely the quality in period 2, and the costs for providing quality, just as in the monopoly case.

Assume that consumers trust the club agreements. This means when purchasing from club members they expect products of at least minimum quality, i.e., $q^e \geq q_{SR}$. If first-period consumption reveals that, in fact, quality is less than the standard, $q^e < q_{SR}$, the club agreement is no longer credible, and consumers revise their perceptions. In this case, they believe that all firms behave as local monopolists, and quality q^* is offered by all club members.

To ensure compliance with the club agreement, members need to monitor each other and to punish non-compliance. Punishment means that, after the quality decision in stage 0, a non-compliant firm is excluded from the club before the market game starts. Since consumers observe this decision, excluded members are posed in the same position as any other local monopolist.

As a consequence of migration, $\lambda > 0$, each club member has an incentive to actually punish deviations from club agreements. In period 2, each club member expects a fraction of λ/N of the non-compliant's consumers. The club commitment is no longer credible for these consumers, and hence they expect quality $q^* < q_{SR}$ to be offered. This reduces local revenues by:

If club members are correctly perceived to offer quality q_{SR}, equilibrium prices are identical in both periods and revenues amount to

$$2D(p, q_{SR}) - C(q_{SR}) - k.$$

Result 3 (Self Regulation)

Let $\bar{\lambda} = \sqrt{32Nk\frac{\bar{r}^2}{\bar{y}^2} + \frac{1}{4}} - \frac{1}{2}$. For $\lambda > \bar{\lambda}$, the full information allocation can be implemented by the coalition of all local firms. This coalition imposes the full information quality level as a membership requirement. Non-compliance is credibly deterred by exclusion from the coalition:

$$p^*_{SR1} = p^*_{SR2} = \frac{\bar{y}}{2}, \quad q^*_{SR} = \frac{\bar{y}}{4\bar{r}}.$$

For $\lambda \leq \bar{\lambda}$, self regulation is not viable and firms behave as local monopolists in the case of asymmetric information (result 2).

Proof: see Appendix.

The critical $\bar{\lambda}$ is determined by substitution of the equilibrium qualities and prices into the credibility constraint:

$$\frac{\lambda}{N}\left[D(p_2^*,q_{SR})) - D(p_2^*,q^*)\right]p_2^* - k > 0.$$

If this inequality is satisfied, the club agreement can be implemented. The gain from monitoring consists in larger period 2 demand. In period 2, any member firm expects to get λ/N consumers from any other club member. So a complying club member would expect to get the same portion of consumers from a deviator. Since betrayed consumers distrust the club agreement, their demand is $D(p_2^*, q^*)$, where q^* is the quality level individual firms would choose independently (see result 2). Consumers who did observe the announced club quality q_{SR} will trust the club agreement to hold good and demand $D(p_2^*, q_{SR})$.

Besides the distributional parameters $\bar{r}$ and $\bar{y}$, the critical $\bar{\lambda}$ is determined by the club's monitoring costs k and the number of members N. Monitoring costs reduce the gains from club membership. But also, as the number of members increases, the club looses attractiveness, since the individual incentives to monitor are reduced for club members. This is true, since each complying club member will receive a smaller share of betrayed consumers.

The result shows that self regulation is viable in environments with sufficient mobility relative to monitoring costs and the number of local markets. In a fragmented environment with many local markets, self regulation is less likely. On the other hand, more mobile environments tend to increase the possibilities for club formation.

Observe that self regulation enhances welfare of each individual player relative to the non-commitment case, since better qualities are offered at the same prices and market demand is thus enhanced. Indeed, the solution is identical to the situation of full information (result 1).

5. Welfare Analysis

We now investigate the question of whether a benevolent social dictator, called "the regulator," should use statutory regulation (price or quality regulation) to maximize social welfare or whether he should promote self regulation by local monopolists. We are particularly interested in situations in which the regulator may actually prefer to implement a self-regulatory scheme.[15] This pre-supposes that self regulation is viable, that is $\lambda > \bar{\lambda}$. In the following discussion, we concentrate on this case.

We assume that social welfare is based on both consumer surplus CS, industry gross profits Π, and costs of production C. All islands and both periods carry equal weight. Let $\alpha \in [0, 1]$ be the weight the regulator attaches to consumer surplus. If product quality and prices are (q, p_1, p_2), social welfare reads [16]

15 In the present analysis, we abstract from monitoring costs of the regulator. If they were positive, the statutory regulator would incorporate those in his decision, and in turn self regulation would be more likely.

$$W(q, p_1, p_2) = \alpha CS(q, p_1, p_2) + (1 - \alpha)\,\Pi(q, p_1, p_2) - C(q),$$

$$\text{where } CS(q, p_1, p_2) = \frac{N}{4\overline{ry}}\, q^2(\bar{y} - p_1)^2 + \frac{N}{4\overline{ry}}\, q^2(\bar{y} - p_2)^2$$

$$\text{and } \Pi(q, p_1, p_2) = \frac{N}{\overline{ry}}\, q(\bar{y} - p_1)\, p_1 + \frac{N}{\overline{ry}}\, q(\bar{y} - p_2)\, p_2 .$$

Of course, the regulator prefers to regulate markets by prices or qualities, if the social weight attached to consumers is high. To see this, consider the social welfare in the case in which the regulator builds on self regulation by firms. Using result 3, social welfare reads:

$$W_{SR} = \frac{N\bar{y}^2}{16\bar{r}^2}\left[1 + \alpha\left(\frac{\bar{y}}{8\bar{r}} - 2\right)\right].$$

The term in brackets becomes negative if α exceeds some critical value. Hence, social welfare becomes negative if local monopolists regulate themselves, but social welfare is mostly determined by consumer surplus.

Thus, the social planner will be inclined to favor self regulation only when the social weight attached to consumers is not too large. However, note that even when the regulator cares about firms' profits only, he can implement the self regulation solution and maximize social welfare. He simply sets the product quality standard q_{QR} equal to the product quality $\hat{q}$ in the self regulation situation. Hence, there is no need for self regulation in the context of our basic model. Basically, in equilibrium the regulator will always be as well informed as the firms. Firms have no real informational advantage, and hence statutory regulation can always mimic self regulatory actions.

This argument no longer applies when the regulator faces some kind of uncertainty. When qualities, for example, also depend on some technological variables which are unknown [17] to the regulator, it may be impossible for him to discover, and appropriately punish, misconduct. In such situations, even in equilibrium, the regulator will only be partially informed. Hence, even in equilibrium, firms maintain an informational advantage, and it is precisely for that reason that self regulation may give firms more flexibility. Consequently, when the regulator cares sufficiently about firms' performance, he may have no alternative but resort to self regulation.

In order to make specific this argument, we will assume that the regulator is not completely informed about the monopolists' production costs. Asymmetric information is introduced in form of a production parameter, which is private information of the local monopolists. The regulator knows the corresponding probability distribution only. He maximizes social welfare and selects the regulatory framework solely on the basis of his expectations concerning production costs.

We modify our basic model in the following way. If a monopolist supplies product of quality $q \in [0, \bar{q}]$, the production of quality requires fixed costs $C(q) = b\,\hat{q}^2$, where

16 Note that consumer surplus in one period with product quality and price (q,p) is

$$\frac{N}{\overline{ry}} \int_{q \geq r} \int_{y \geq p_1} (q - r)\,(y - p_1)\, dr\, dy.$$

17 This essentially is a short hand for saying that such variables are costly to observe for the regulator.

$b \in [\underline{b}, \bar{b}]$ denotes the production parameter. For simplicity, we assume that the production parameter b is distributed on $[\underline{b}, \bar{b}]$ and its realization is identical for all firms. The regulator only knows the expected value of the production parameter $E[b]$.[18]

Result 4 (Self Regulation versus Statutory Regulation)

If $\lambda > \bar{\lambda}$ and if the regulator's uncertainty about the production parameter b varies over a sufficiently large range and if he weighs firms' profits sufficiently high in social welfare, he strictly prefers self regulation to statutory price or quality regulation.

The argument is as follows. The regulator has three regulation possibilities available: He can either use price or quality regulation instruments or he promotes self regulation. In the first two cases, the regulator maximizes social welfare about expected production costs and expected product qualities. In the third case, the regulator builds expectations about the social welfare achieved by self regulation. In the following, we first derive the regulator's optimal choice of price or quality regulation. Second, we compare social welfare under statutory regulation or self regulation.

Let $W_{PR}(E[b])$, $W_{QR}(E[b])$, $E[W_{SR}]$ denote the corresponding social welfare and consider the extreme situation in which social welfare is determined by firms' profits only, i.e., $\alpha = 0$.

Price Regulation

Suppose that the regulator sets prices (p_1, p_2). Given these prices, local monopolists select profit-maximizing product qualities q_{PR}. Their choices are given by

$$\pi(q_{PR}, p_1, p_2, q_1^e, q_2^e) \geq \pi(q, p_1, p_2, q_1^e, q_2^e) \text{ for all } q,$$

Hence, the optimal product quality depends on second period prices only,

$$\$q_{PR} = \frac{1-\lambda}{2\bar{r}\bar{y}} (\bar{y} - p_2)\, p_2 ,$$

and first period prices can be set by the regulator in a way to redistribute consumer surplus and gross profits. For $\alpha = 0$, the regulator's optimization problem is then to choose prices (p_{PR1}^*, p_{PR2}^*) to maximize social welfare

$$W(p_1, p_2 \mid E[b]) = \frac{N}{r\bar{y}} q_{PR}(\bar{y} - p_1)\, p_1 + \frac{N}{r\bar{y}} q_{PR}(\bar{y} - p_2)\, p_2 - q_{PR}^2 E[b] N$$

$$\text{subject to } \pi(q_{PR}, p_{PR1}^*, p_{PR2}^*, q_{PR}, q_{PR}) \geq 0.$$

Thus, price regulation is characterized by $p_{PR1}^* = p_{PR2}^* = \bar{y}/2$, $q_{PR}^* = [(1-\lambda)\bar{y}]/8\bar{r}E[b]$ and social welfare reads

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18 Our previous result on the optimal product quality under self regulation then is $q_{SR}^* = \bar{y}/4\bar{b}r$.

$$W_{PR}(E[b]) = \frac{N(1-\lambda)\bar{y}^2}{16\bar{r}^2 E[b]}\left[1 - \frac{1-\lambda}{4}\right].$$

Quality Regulation

Consider now the effect of quality regulation on social welfare and suppose that the regulator fixed product quality standard at a level q_{QR}. If the monopolists comply with the desired product standard, they choose prices (p_1, p_2) to maximize their profits $\pi(q_{QR}, p_1, p_2, q_{QR}, q_{QR})$. Optimality then requires

$$q_{QR}(\bar{y} - 2p_1) = 0, \quad q_{QR}(\bar{y} - 2p_2) = 0.$$

Hence, $p_1 = p_2 = \bar{y}/2$.

To enforce the quality standard q_{QR}, we assume that the regulator can verify product qualities produced by local monopolists and that he can make his information about produced qualities publicly available. Thus, after the verification of product qualities, all consumers are perfectly informed about the quality of the products. Since social welfare is assumed to be industry net profits, the regulator faces the same situation as a monopolist in the full information case (see Result 1). Hence optimal quality regulation implies $q^*_{QR} = = \bar{y}/8\bar{r}E[b]$ and social welfare is

$$W_{QR}(E[b]) = \frac{N\bar{y}^2}{8\bar{r}^2 E[b]}.$$

Of course, if the regulator is able to verify produced product qualities before the first period consumption, all information is common knowledge in the economy. Hence, local monopolists have no incentive to deviate from the quality standard q^*_{QR}. If, however, we assume that the regulator cannot verify product quality before the market opens but before the second period consumption, a monopolist can benefit from his private information on his actual produced product quality in the first period. Taking advantage of consumers' incorrect first period quality expectations, a monopolist chooses a quality $\hat{q} = \bar{y}/8\bar{r}$ to maximize second period gross profits minus production costs (see Result 2 for $\lambda = 0$). To enforce the quality standard q^*_{QR}, the regulator then has to impose a penalty $P > (q^*_{QR} - \hat{q})^2 = \bar{y}^2/64\bar{r}^2$ on a monopolist, if a verification reveals that he did deviate from the quality standard.

Welfare Comparison

Note that, in a situation in which the regulator promotes self regulation, social welfare is determined by

$$E[W_{SR}] = \frac{N\bar{y}^2}{16\bar{r}^2} E\left[\frac{1}{b}\right].$$

Comparing social welfare, we immediately see that

$$W_{PR}(E[b]) = W_{QR}(E[b]) \text{ and}$$

$$W_{QR}(E[b]) \leq E[W_{SR}] \quad \frac{1}{E[b]} \leq E\left[\frac{1}{b}\right].$$

By Jensen's inequality, this property holds for any distribution of b.[19]

Consequently, the regulator will prefer self-regulatory regimes whenever he values firms' profits highly and when the potential costs of false statutory regulation have a significant impact on firms' profits. Obviously, for a very small support of b, the consequences of regulatory errors will not affect the regulator's objective function dramatically, and the case for self regulation is weak. When the support of b is large, however, the regulator may wish to grant more authority to self regulating authorities.

6. Concluding Remarks

This essay discusses self regulation in a context where all members of a self regulatory club can observe each others products perfectly well. Migration of customers creates a strong incentive for all club members to monitor and especially to enforce the club standards.

Self regulation is of potential social value whenever the club members have better access to information about rivals' product qualities. On one hand, such firms can perform the monitoring task more cost efficiently, and on the other hand, it gives members of the club greater flexibility to adjust to unforeseen (cost) shocks.

The costs of self regulation are the standard costs associated with some degree of monopoly power conferred to the club. Therefore, it comes of little surprise that a social planner will enact self regulation only when he is quite lenient to industries' needs and when the costs of false statutory regulatory action may have serious consequences for firm revenues.

The above analysis can be extended in several ways. First, an interesting question would be to allow competition between firms. Given that quality provision is not observable in the first period, firms appear as identical competitors, and price competition tends to reduce first period revenues. In the case of unregulated firms, incentives to quality provision by firms are determined by the marginal contribution to revenues of the captive clientele in period 2 and marginal costs of quality production (see result 2). This implies that under competition product quality will be lower than in the case of a local monopolist: firms' market shares in period 2 depend on consumers' information about quality of products, which they did not consume in period 1. In the best case, a single firm can expect all the non-migrant consumers. Accordingly, in the case of local monopolies firms incentives to provide quality are highest.

Consequently, market failure is more severe in the competitive case. Therefore, the statutory regulator will have a larger interest in regulation. But also the interests in self-regulation by firms are larger. In this situation, we would expect the co-existence of several clubs, which differ (vertically) in their quality agreements: when clubs can credibly commit to quality standards, consumers will be informed about product quality on each island. Following the arguments of Shaked and Sutton (1982, 3-13), one would expect that more than one club would form. Therefore, on each island two firms may enter and join the respective club. The high quality firm will join the high quality club and sell its product at a higher margin, while the low quality firm will join the low quality club and sell at a lower margin.

19 If we assume that the production parameter is uniformly distributed on the interval $[\underline{b},\bar{b}]$, we infer that $1/E[b] = 2/(\underline{b} + \bar{b})$ and $E[1/b] = 1/\bar{b}\underline{b}\, E[b]$. Hence, the second inequality is strictly satisfied.

Another interesting question is to pursue the analysis in situations where firms' quality decisions are imperfectly observed by other club members. Suppose, for example, that monitoring the product quality of a given firm provides a noisy quality signal. In this situation, a low signal can arise through observation errors as well as through low quality provision by the observed firm. As is known from the literature (e.g., Green, Porter (1984, 87-100)) on cartel formation with imperfect observation, the club can enforce its quality standards using the following trigger strategy: if the observed quality falls short off a certain threshold level, the club will infer low quality provision and exclude this firm. Now, typically, the club's equilibrium quality level will depend on the signal-to-noise ratio of members' observations. The lower this ratio, the lower are the returns from monitoring for club members, and the lower is the likelihood of viability of a self-regulatory regime. If the ratio is sufficiently high, however, in equilibrium individual members will provide the mandated quality. Nevertheless, some members may be excluded because of observational errors of the club.

Appendix

Proof of Result 1:

When consumers can observe product quality q, firms have to solve the following optimization problem:

Choose (q, p_1, p_2) to maximize

$$\frac{1}{ry} q(\bar{y} - p_1)\, p_1 + \frac{1}{ry} q(\bar{y} - p_2)\, p_2 - q^2.$$

The first-order conditions are

$$\frac{\partial}{\partial p_1} : \frac{1}{ry} q(\bar{y} - 2p_1) = 0 \tag{1}$$

$$\frac{\partial}{\partial p_2} : \frac{1}{ry} q(\bar{y} - 2p_2) = 0 \tag{2}$$

$$\frac{\partial}{\partial q} : \frac{1}{ry} (\bar{y} - p_1)\, p_1 + \frac{1}{ry} (\bar{y} - p_2)\, p_2 - 2q = 0. \tag{3}$$

Now, (1) implies $p_1 = \bar{y}/2$ and (2) implies $p_2 = \bar{y}/2$. Substituting these into (3) yields $q = \bar{y}/4\bar{r}$. Since the profit function is concave (quadratic), the interior solution is global indeed. Equilibrium profits result from straightforward substitution of the equilibrium values into the profit function.

Q.E.D.

Proof of Result 2:

When consumers cannot observe product quality q, firms have to solve the following optimization problem:

Choose (q, p_1, p_2) to maximize

$$\frac{1}{ry} q_1^e(\bar{y} - p_1)\, p_1 + \frac{\lambda}{ry} q_2^e(\bar{y} - p_2)\, p_2 + \frac{1-\lambda}{ry} q(\bar{y} - p_2)\, p_2 - q^2.$$

The first-order conditions are

$$\frac{\partial}{\partial p_1}: \frac{1}{\overline{\overline{ry}}} q(\bar{y} - 2p_1) = 0 \tag{1}$$

$$\frac{\partial}{\partial p_2}: \frac{1}{\overline{\overline{ry}}} q(\bar{y} - 2p_2) = 0 \tag{2}$$

$$\frac{\partial}{\partial q}: \frac{1-\lambda}{\overline{\overline{ry}}} (\bar{y} - p_2)\, p_2 - 2q = 0. \tag{3}$$

Equations (1) and (2) imply $p_1 = p_2 = \bar{y}/2$. Therefore, (3) can be written

$$\frac{1-\lambda}{4} \frac{\bar{y}}{\bar{r}} = 2q,$$

which yields the desired $q = (1 - \lambda)/8\ (\bar{y}/\bar{r})$. Since the profit function is concave (quadratic), the interior solution is global indeed. Equilibrium profits result from straightforward substitution of the equilibrium values into the profit function.

Q.E.D.

Proof of Result 3:

The proof is done in three steps:

(i) Suppose all firms adhere to the club agreements and suppose the club has decided on a quality level q_{SR}. Then firms select prices in order to maximize profits:

Choose (p_1, p_2) to maximize

$$\frac{1}{\overline{\overline{ry}}} q_{SR}(\bar{y} - p_1)\, p_1 + \frac{1}{\overline{\overline{ry}}} q_{SR}(\bar{y} - p_2)\, p_2 - q_{SR}^2 - k.$$

The firms' optimal price choices are $p_1 = p_2 = \bar{y}/2$, independently of q_{SR}.

(ii) Still suppose, firms adhere to the club agreement. Then the club chooses its quality standard q_{SR} to maximize members' profits:

Choose (q_{SR}) to maximize

$$\frac{1}{\overline{\overline{ry}}} q_{SR} \left(\frac{\bar{y}}{2}\right)^2 + \frac{1}{\overline{\overline{ry}}} q_{SR} \left(\frac{\bar{y}}{2}\right)^2 - q_{SR}^2 - k.$$

The first-order condition implies that q_{SR} is the full information quality level, i.e., $q_{SR} = \bar{y}/4\bar{r}$.

(iii) Finally, the club agreement can be implemented only as long as club members do enjoy a sincere interest in monitoring and sanctioning deviations. The gain from monitoring consists in larger period 2 demand. In period 2, any member firm expects to get λ/N consumers from any other club member. So a complying club member would expect to get the same portion of consumers from a deviator. Since betrayed consumers distrust the club agreement, their demand is $D(p_2^*, q^*)$, where q^* is the quality level individual firms would choose independently (see result 2). Consumers who did observe the announced club quality q_{SR} will trust the club agreement to hold good and demand $D(p_2^*, q_{SR})$.

So there will be an incentive to monitor, whenever

$$\frac{\lambda}{N}\left[D(p_2^*, q_{SR})) - D(p_2^*, q^*)\right]p_2^* - k =$$

$$\frac{\lambda}{N}\left(\frac{1}{ry}\frac{\bar{y}}{4r}\left(\frac{\bar{y}}{2}\right)^2 + \frac{1}{ry}\frac{\bar{y}}{4r}\left(\frac{\bar{y}}{2}\right)^2\right) =$$

$$\frac{1}{32}\frac{\lambda}{N}\frac{\bar{y}^2}{r^2}\lambda(1+\lambda) - k \geq 0.$$

For $\lambda = \bar{\lambda}$, the above relation becomes an identity.

Q.E.D.

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