Competitive pressure and incentives in the quality game: The reputational mechanism*

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Abstract

We examine the incentives for the production of the high quality variety of an experience good in a Walrasian market where firms may freely change their names, i.e., they may erase their past at will. Our interest is to analyze how a change in the competitive pressure from outsiders affects incentives. Besides affecting prices, competitive pressure in our model also affects the threshold of reputation below which firms choose to erase their past. We find that an increase in the competitive pressure may boost incentives through an increase in the price differential between qualities, and also –perhaps counterintuitively– through an increase in the "forgetfulness" of the market.

JEL Classification: C7, D8, L1
Keywords: reputation, incentives, free entry, competitive pressure

1 Introduction

In many markets the quality of the goods is not easily observable at purchase; this poses a moral hazard problem to the firm that is able to choose or manipulate the quality it delivers to the market. Many authors have studied how reputation may have a role in reinstating these incentives (Klein and Leffler, 1981, Kreps and Wilson, 1982, Milgrom and Roberts, 1982). This paper studies how those incentives differ across different competitive environments.

We consider Walrasian equilibria: firms and consumers are price takers. Within that boundary, we will be considering different regimes, which vary in the level of competitive pressure:

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i. Blockaded entry. In the first situation, there are almost as many firms that are able to trade as consumers. For example, there may be regulatory barriers to entry (e.g., a medallion is needed to operate, and the authority has fixed the number of available medallions slightly below what would be necessary to cover the whole demand).

ii. Free entry of inept firms. In the second situation, entry is free. However, only inept firms are available to enter. Perhaps those firms that could be competent in this market are in other industries, or perhaps being competent entails possessing a resource in fixed supply. Potential entrants exert a pressure over the price level, which must be the smallest compatible with the market clearing.

iii. Free entry of inept and competent firms. In this last situation, new competent and inept firms are at all times available to enter the market. Since high quality is valuable to consumers, the newly born competent firms will have an incentive to enter.

Our concern is how incentives vary between these regimes. Our main result is that competitive pressure need not be detrimental to incentives, as has been suggested in the literature (Bar-Isaac, 2005, Kranton, 2003).

The literature on competitive markets was pioneered by Tadelis [1999], Hörner [2002] and Tadelis [2002]. There is a growing literature on competition and reputation, that includes Vial [2010] Ordonez, Board and Meyer-ter Vehn, 2010, Board and ter Vehn, 2010, E and Ferreira and Atkeson et al., 2012, among others.

2 The model

The model is that of Vial and Zurita (2013), which follows closely that of Mailath and Samuelson [2001]. Time is discrete: $t = ... - 2, -1, 0, 1, 2...$ Consumers live only for one period, while firms are long run players subject to a constant probability of replacement $\lambda > 0$.

Information. There are two qualities of an experience good (or service), high (H) and low (L). Quality is unobservable to consumers at the time of purchase. After a sale is made there is an imperfect public signal of the quality of that unit, denoted by r. r is an absolutely continuous random variable, with cdf F_H if quality was high, and F_L if low. The associated likelihood ratio $R(r) \equiv \frac{f_H(r)}{f_L(r)}$ is assumed to be monotonically increasing from 0 to ∞. Consumers observe (recall) the whole history of signals of a firm operating under a particular name, and update a (common) prior accordingly. There is also an unobserved replacement process: a firm dies with probability λ, and is replaced by another firm which inherits its name, but which may or may not be of the same type. Let ϕ be the probability that the replacing firm is competent.

Let μ denote the conditional probability of being competent, or **reputation**. It takes into account the observable history of signals under the current name, and the possibility of being replaced. As usual, this conditional probability can be defined recursively by Bayes' rule (and the equilibrium strategies), as a function of the prior probability. Iterating this function, we could also write the reputation of the firm as a function of the observed history under the current name.

However, if the firm changes its name, consumers are not able to associate the old name's signals to the new name's. Changing the name is thus a means for firms to make consumers forget about (or erase) their past. Thus, any firm that starts operation under a new name (regardless of whether it operated under a different name in the past or didn't operate at all) has an empty history and carries the same entry-level reputation μ_E. This reputation will be endogenously determined.

Firms. There is a continuum of firms of mass larger than 1. Each firm can produce at most one unit of the good; if a firm produces one unit of the good, it is called active at t, otherwise it is inactive at t. There are two types of firm, Competent and Inept. Competent firms can choose the quality, while inept firms can only produce the low quality variety. Producing one unit of the high-quality variety costs c_H, and one unit of the low-quality variety c_L, where $c_H > c_L \geq 0$.

Firms are long-run players that maximize discounted profits, with a discount factor δ and a survival probability $(1-\lambda)$, which define an effective discount factor $\tilde{\delta} \equiv \delta\,(1-\lambda)$.

The choices they have to make at each date t are: (i) whether to produce or not (i.e., be active at t or not, the **participation decision**); (ii) if active, whether to sell under its last period's name or under a new one (the **naming decision**), and (iii) if competent, whether to produce a high quality unit or a low quality one (the **quality decision**).

Timeline. The timeline is as in Figure 1.

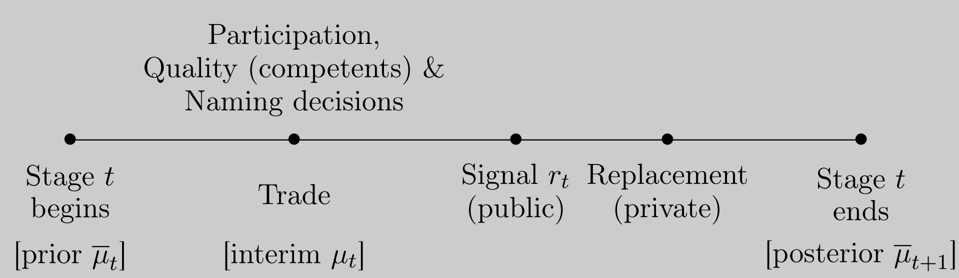

Figure 1: Timeline for the date-t stage game

At the beginning of the stage game at time t, each firm carries a **prior reputation** $\overline{\mu}_t$. After the participation and naming decision, this reputation is updated to μ_t; we refer to this as the **interim reputation** of the firm. This is the reputation under which the firm will trade (if active). Then, after the signals are observed, and taking into account the possibility of replacement, the reputation is updated to the **posterior reputation** $\overline{\mu}_{t+1}$, which will be the prior at the next stage game.

Consumers. There is a continuum of homogeneous consumers of mass 1. Each consumer can purchase at most one unit of the good. Their willingness to pay for a high-quality unit of the service is β (with $\beta > 0$), while for a low-quality one it is normalized to zero. Hence, when facing a reputation-μ firm, the expected utility of buying is:

$$E[u] = \mu\beta - p, \tag{1}$$

Consumers are indifferent between two firms with reputations μ and μ' if $p(\mu) - p(\mu') = \beta(\mu - \mu')$. We assume throughout that β is high enough so that there are always gains from trade.

Equilibrium. We study a steady state equilibrium of the infinitely repeated game. We focus on Markovian strategies regarding participation, quality and name choice for the firms. The state variables for a firm are its type $\tau \in \{C, I\}$–which determines its available choices–and its prior reputation $\overline{\mu}$.

The market is Walrasian: all consumers take as given a price function $p(\mu)$ and choose a provider of reputation μ; all firms choose whether to sell or not, and the competent ones also choose whether to deliver a high quality or a low quality unit, and charge the given price that corresponds to their reputation μ, $p(\mu)$. At $p(\mu)$, the market clears.

We focus on an equilibrium where competent firms always choose high quality. Since inept firms cannot provide high quality, the event of getting a high-quality unit is the same as the event of facing a competent firm. Hence, *ceteris paribus* consumers would prefer to buy from better reputation providers. It follows that the equilibrium price function must be increasing so that consumers are indifferent among providers.

In turn, this means that the firms–ceteris paribus–would prefer to have a better reputation. Then, the naming strategy becomes simple: firms will choose the highest reputation among the alternatives, which are to keep the name that carries the prior $\overline{\mu}$, or to start over with a new one under the entrants' reputation μ_E. Hence, the interim reputation is given by:

$$\mu = \max\{\mu_E, \overline{\mu}\} \tag{2}$$

Notice that this is a pure strategy, that entails the following zero-probability events: (1) that a firm changes its name when it isn't supposed to do it, i.e., having a prior above the threshold μ_E, and (2) that a firm keeps its name when it was supposed to change it, i.e., when $\overline{\mu} < \mu_E$. Since upon changing the name consumers forget the firm's history, (1) is not observable by consumers. In contrast, (2) is an observable, off-equilibrium event. This equilibrium is supported by any pessimistic interpretation of the deviation, this is to say, any interpretation that does not improve the deviant firm's reputation over the threshold μ_E. In particular, we assume for simplicity that the event is uninformative, so that the interim reputation after such zero-probability event is the same as the prior.

Moreover, intuitively the pessimistic interpretations are the reasonable ones. If this event were to improve the deviant's reputation above μ_E, both types of firm would actually prefer to keep their names, which would imply that the fraction of competent firms among the "deviants" is actually $\overline{\mu}$.

Individual reputations. Upon observation of a signal and under the awareness of the possibility of a replacement, an interim reputation μ changes into:

$$\varphi(\mu, r) \equiv \lambda\phi + (1-\lambda)\frac{R(r)\mu}{R(r)\mu + 1 - \mu} \tag{3}$$

where $\lambda\phi$ is the probability of a replacement by a competent firm, $(1-\lambda)$is the probability of not having been replaced, and $\frac{R(r)\mu}{R(r)\mu+1-\mu}$ is the updated probability of competent conditional on not having been replaced.

Define the functions $\tilde{r}(x, \mu)$ and $\tilde{\mu}(x, r)$ from $x = \varphi(\mu, r)$ as:

$$r = \tilde{r}(x, \mu) \Leftrightarrow x = \lambda\phi + (1-\lambda)\frac{R(\tilde{r}(x, \mu))\mu}{R(\tilde{r}(x, \mu))\mu + 1 - \mu}, \tag{4}$$

$$\mu = \tilde{\mu}(x, r) \Leftrightarrow x = \lambda\phi + (1-\lambda)\frac{R(r)\tilde{\mu}(x, r)}{R(r)\tilde{\mu}(x, r) + 1 - \tilde{\mu}(x, r)}. \tag{5}$$

The first function, $\tilde{r}(x, \mu)$, says what the signal value should be for a firm of current reputation μ to have a reputation x the next period. The second function, $\tilde{\mu}(x, r)$, indicates what the reputation was in the previous period of a firm with a signal r that currently enjoys a reputation x. Similarly, $\varphi(\mu, r)$ is the reputation in the next period of a firm that started off with a reputation μ and whose signal was r.

Given the naming strategy, the interim reputation μ at a given stage becomes the interim reputation μ' the next stage according to:

$$\mu' = \max\{\mu_E, \varphi(\mu, r)\} \tag{6}$$

Participation decision. In this equilibrium, then, each firm's reputationμ' is increasing in its signal r. Since competent firms draw their signals from a better distribution, they are likely to have better reputation. In turn, since the price is increasing in the firm's reputation, the competent firms earn more on average than the inept ones. This has the consequence that the participation condition is more stringent for inept firms than for competent ones.

Let $v_C(\mu)$ denote the value function for a competent firm under the policies (1) participate always, (2) change the name whenever the prior falls below μ_E, and (3) always prefer high quality:

$$v_C(\mu) = (1-\delta)(p(\mu) - c_H) + \delta(1-\lambda)\int_0^1 v_C(\mu')\, dF_H$$

In the next section we study under what conditions (3) is indeed optimal. In equilibrium it will be verified that $v_C(\mu) > 0$ for all μ in the support, so that (1) holds.

Similarly, let $v_I(\mu)$ denote the value function for an inept firm under the policy (2). Recall that inept firms do not have a choice of quality.

$$v_I(\mu) = \max\left\{\delta(1-\lambda)\int_0^1 v_I(\mu_E)\,dF_L,\ (1-\delta)(p(\mu)-c_L) + \delta(1-\lambda)\int_0^1 v_I(\mu')\,dF_L\right\}$$

In a free-entry equilibrium, market clearing requires that entrants be indifferent. When all competents are active and market clearing requires the participation of a positive mass of inept firms, the free entry condition becomes:

$$v_I(\mu_E) = 0$$

so that

$$v_I(\mu) = (1-\delta)(p(\mu)-c_L) + \delta(1-\lambda)\int_0^1 v_I(\mu')\,dF_L > 0$$

for all reputations strictly above μ_E.

Distributions. The participation, quality and naming decisions, together with Bayes' rule, imply that the population-wide posterior reputation distributions are a function of the interim reputation distributions:

$$\begin{pmatrix} \overline{G}^C_{t+1}(x) \\ \overline{G}^I_{t+1}(x) \end{pmatrix} \equiv \begin{pmatrix} \frac{\theta(1-\lambda+\lambda\phi)}{\theta-\eta} & \frac{(1-\theta)\lambda\phi}{\theta-\eta} \\ \frac{\theta\lambda(1-\phi)}{1-\theta+\eta} & \frac{(1-\theta)(1-\lambda\phi)}{1-\theta+\eta} \end{pmatrix} \begin{pmatrix} \int_0^1 G^C_t(\tilde{\mu}(x,r))\,dF_H \\ \int_0^1 G^I_t(\tilde{\mu}(x,r))\,dF_L \end{pmatrix} \tag{7}$$

where $\theta = \phi + \frac{\eta}{\lambda}$ is the mass of competent firms in the population; we assume it is strictly smaller than 1.

Indeed, the firms that are competent at $t+1$ are:

- those who were competent at t (a mass θ) and weren't replaced (an event with probability $(1-\lambda)$) plus those that were replaced by another competent firm (an event with probability $\lambda\phi$); all these firms chose high quality, so that their signals were drawn from the F_H distribution. The fraction of them that has a smaller reputation than any given x is the fraction who had a smaller prior than $\tilde{\mu}(x,r)$; plus
- those firms who were active and inept at t (a mass $1-\theta$) who were replaced by competents (an event with probability $\lambda\phi$). All these firms provided low quality, so that their signals were drawn from the F_L distribution. The fraction of them that has a smaller reputation than any given x is the fraction who had a smaller prior than $\tilde{\mu}(x,r)$.

Similarly, the firms that are inept at $t+1$ are

- those who were competent at t (a mass θ) and were replaced by an inept firm (an event with probability $\lambda(1-\phi)$); these firms chose high quality, so that their signals were drawn from the F_H distribution. The fraction of them that has a smaller reputation than any given x is the fraction who had a smaller prior than $\tilde{\mu}(x,r)$; plus
- those firms who were active and inept at t (a mass $1-\theta$) who weren't replaced (an event with probability $(1-\lambda)$) and those that were replaced by other inept firms (en event with probability $\lambda(1-\phi)$). All these firms provided low quality, so that their signals were drawn from the F_L distribution. The fraction of them that has a smaller reputation than any given x is the fraction who had a smaller prior than $\tilde{\mu}(x,r)$.

After the unobserved replacement process, the fraction of competent firms among the previously-active firms becomes $\theta-\eta$.

The exit-entry process changes these distributions in two ways. First, firms whose reputation fell below the threshold μ_E replace their reputation with μ_E, so that the evolution of μ_t is actually defined by $\mu_t = \max\{\varphi(\mu_{t-1}, r_{t-1}), \mu_E\}$. All competent firms remain active, since competent firms with a low reputation clean up their names and re-enter immediately. Second, there is a mass η of newly born competent firms.

These cdf's are transformed by the entry-exit process as follows:

$$G_{t+1}^{C}(x) = \begin{cases} 0 & \text{if } x < \mu_E \\ \frac{1}{\theta}\left(\eta + (\theta-\eta)\overline{G}_{t+1}^{C}(x)\right) & \text{if } x \geq \mu_E \end{cases}$$
$$G_{t+1}^{I}(x) = \begin{cases} 0 & \text{if } x < \mu_E \\ \frac{1}{1-\theta}\left(-\eta + (1-\theta+\eta)\overline{G}_{t+1}^{I}(x)\right) & \text{if } x \geq \mu_E \end{cases} \tag{8}$$

This system defines an operator on interim reputation distributions whose fixed point is the pair of steady state distributions (G^C, G^I), with associated prior distributions $(\overline{G}^C, \overline{G}^I)$, which depend parametrically on μ_E. Vial and Zurita [2013] show that this steady state is unique for a given μ_E.

Entry-level reputation. The entry-level reputation is a consistent belief, namely, μ_E must be the fraction of competent firms among the firms with new names. Since the size of the industry is constant (because we are looking at a steady state), the mass of new names must be equal to the mass of lost names, $\overline{G}(\mu_E)$. The competents operating under a new name are the new competents born outside the market (which have mass η) and the old competents whose reputation fell below μ_E (which have mass $(\theta-\eta)\overline{G}^C(\mu_E)$):

$$\mu_E = \frac{(\theta-\eta)\overline{G}^C(\mu_E)+\eta}{\overline{G}(\mu_E)}. \tag{9}$$

Vial and Zurita [2013] show that there exists a unique solution to this equation. Moreover, when $\eta > 0$, $\mu_E > \lambda\phi$ and there is a positive mass of entrants each period; however, when $\eta = 0$ the adverse selection among entrants is too acute, and $\mu_E = \lambda\phi$. Notice that in general μ_E depends on the parameters ϕ, η and λ both, directly and though the reputation distributions.

3 Incentives

In the high quality equilibrium, the firm after any history chooses to produce the high quality variety, and to change its name if and only if its reputation falls below the threshold μ_E. In this section we study the incentives to do so, namely, the payoff difference between that policy and the one-deviation policy of doing exactly that from $t+1$ onwards, but instead choosing low quality at t.

$$v_C(\mu) - \left((1-\delta)(p(\mu) - c_L) + \delta(1-\lambda)\int_0^1 v_C(\mu')\, dF_L\right) \geq 0$$

This is equivalent to:

$$b(\mu) \equiv \frac{\delta(1-\lambda)}{1-\delta}\left(\int_0^1 v_C(\overline{\varphi}(\mu, r, \mu_E))(f_H(r) - f_L(r))\, dr\right) \geq c_H - c_L$$

The function $b(\mu)$ represents the gross benefit of choosing high quality, which has to be compared with the cost differential of high over low quality.

The function $b(\mu)$ has an inverted-U shape: low at the extremes values of μ, higher at intermediate values, and concave. This shape obeys to one characteristic of Bayes' rule: the signals (information) have a small effect on the posterior when the priors are extreme, namely $\frac{\partial\mu'}{\partial r}$ approaches 0 near the edges. Figure 2 depicts an example.

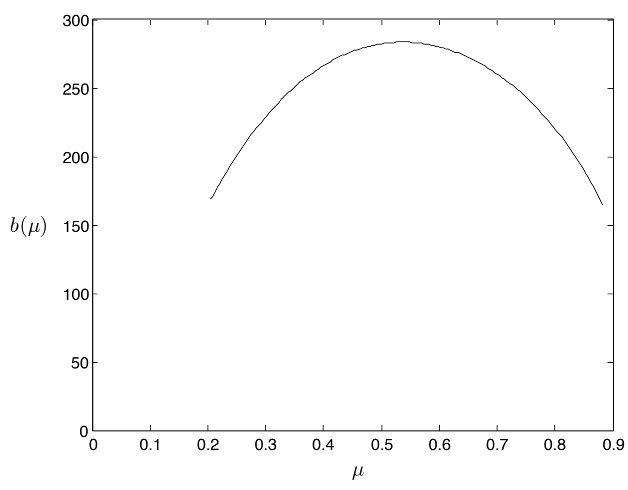

Figure 2: The gross benefit function $b(\mu)$

Notes: $r|_H \sim Be(r \mid 3, 2)$ and $r|_L \sim Be(r \mid 2, 3)$. The parameters are $\mu_E = 0.21$, $\lambda = 0.15$, $\phi = 0.25$ and $\delta = 0.94$.

Integrating by parts, we get:

$$b(\mu) \equiv \widetilde{\delta} \int_0^1 \underbrace{\left(\frac{\partial \mu'}{\partial r}\right)}_{A} \underbrace{\left(\frac{\partial p(\mu')}{\partial \mu'} + \frac{\widetilde{\delta}}{1-\delta} E_{r'|_H} \left[\frac{\partial v_C(\mu'')}{\partial \mu''} \frac{\partial \mu''}{\partial \mu'}\right]\right)}_{B} \underbrace{(F_L(r) - F_H(r))}_{C} \mathrm{d}r \tag{10}$$

The gross benefit function $b(\mu)$ is thus the integral of the product of three components (A, B and C in Equation 10). B and C are always positive. A represents the effect that a signal has on the firms' next-period reputation. For high values of the signal r (namely, $r \geq \tilde{r}(\mu, \mu_E)$), next period's reputation is given by φ. When $\mu \in (0,1)$, $\frac{\partial \varphi}{\partial r} = \frac{\mu(1-\mu)(1-\lambda)}{R(r)\mu+1-\mu} \frac{dR}{dr}$ is strictly positive (because of the MLR assumption), strictly concave, and has a unique maximum; at the boundaries $\mu \in \{0,1\}$ it vanishes. This explains why the $b(\mu)$ function is smallest for the lowest and highest values of μ, and indeed it would also vanish if we didn't have the replacement process (as Cripps et al., 2004, showed). This is because the states of certainty are absorbing states in the reputation process. Under imperfect monitoring, when consumers are almost sure about the firm's type they attribute the dissonant signals to chance. For low values of the signal r (namely, $r < \tilde{r}(\mu, \mu_E)$), next period's reputation will be μ_E since the firm will change its name, so that today's signal will have no effect over the firm's reputation in the margin. Hence, we can write:

$$b(\mu) = \widetilde{\delta} \int_{\tilde{r}(\mu,\mu_E)}^1 \left(\frac{\partial \mu'}{\partial r}\right) \left(\frac{\partial p(\mu')}{\partial \mu'} + \frac{\widetilde{\delta}}{1-\delta} E_{r'|_H} \left[\frac{\partial v_C(\mu'')}{\partial \mu''} \frac{\partial \mu''}{\partial \mu'}\right]\right) (F_L(r) - F_H(r)) \mathrm{d}r \tag{11}$$

It is apparent that an increase in μ_E will decrease $b(\mu)$. Mathematically, the lower limit of the integral depends directly on it. Economically, an increase in μ_E means that less signal values are going to be "shown" to the public or, equivalently, more signal outcomes would lead to a change of name (and concealing of the history). Since the benefit of choosing high quality stems from the possibility of displaying better signals, the benefits of high quality to the firm are decreased.

Nevertheless, this is so for a given reputation μ. An increase in μ_E also compresses (from the left) the range of reputations the firm may reach. The fact that the lowest reputations become unreachable has a perhaps surprising effect over incentives. If the lowest gross benefits of choosing high quality occurred at the lowest reputation levels, an increase in μ_E may actually improve incentives by avoiding that the firms get trapped at very low reputations from which they cannot escape even upon good signals.

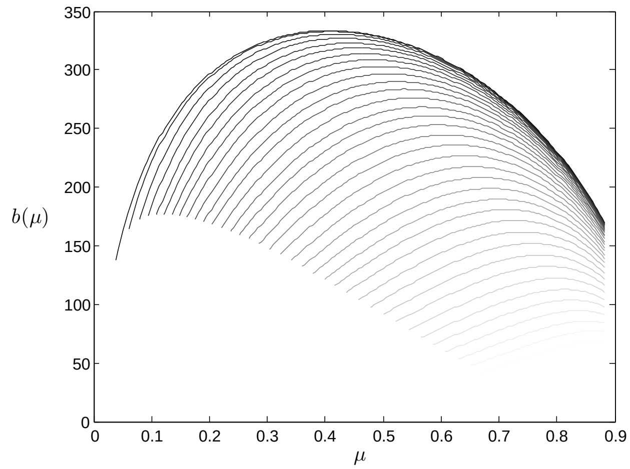

Figure 3: $b(\mu)$ for different values of μ_E

Notes: $r|_H \sim Be(r \mid 3, 2)$ and $r|_L \sim Be(r \mid 2, 3)$. The parameters are $\lambda = 0.15$, $\phi = 0.25$ and $\delta = 0.94$.

B depends primarily on the slope of the equilibrium price function. Should there be no reputation premia, there would be no incentives at all to provide high quality.

Observe that the gross benefit function depends on all the parameters that affect the value function, i.e., it could be written as $b(\mu; \mu_E, \lambda, \delta, \phi)$. The optimal strategy of the competent firm will be to deliver high quality for all μ if this inequality holds for all–hence, for the lowest possible values, i.e.:

$$\xi(\mu_E, \lambda, \delta, \eta, \phi) \equiv \min_{\mu \in [\mu_E, 1-\lambda+\lambda\phi]} b(\mu; \mu_E, \lambda, \delta, \eta, \phi)$$

The inverted-U shape of $b(\mu)$ implies that the critical points will occur at the boundaries of $[\mu_E, 1 - \lambda + \lambda\phi]$. We define $\underline{b} \equiv b(\mu_E; \mu_E, \lambda, \delta, \eta, \phi)$ and $\overline{b} \equiv b(1 - \lambda + \lambda\phi; \mu_E, \lambda, \delta, \eta, \phi)$ to be the function evaluated at the boundaries. The set of parameter values $(c_H, c_L, \lambda, \delta, \eta, \phi)$ that sustain the high quality equilibrium for a given pair (F_H, F_L) is thus defined by:

$$\xi(\mu_E(\lambda, \eta, \phi), \lambda, \delta, \phi) \geq c_H - c_L \tag{12}$$

4 Competitive pressure

4.1 Benchmark: Blockaded entry

In the first situation we analyze, there are almost as many firms that are able to trade as consumers. For example, there may be regulatory barriers to entry (e.g., a medallion is needed to operate, and the authority has fixed the number of available medallions slightly below what would be necessary to cover the whole demand). The equilibrium price function is the consumers' willingness to pay

$$p(\mu) = \beta\mu$$

since the demand side is the long side of the market. This implies that consumers' surplus is null, and that all active firms want to participate.

In this case, even if there are competents outside of the market, no entry is allowed. Consequently, we will assume that $\eta = 0$, which implies that $\theta = \phi$, i.e., the probability of being replaced by a competent firm is exactly the unconditional probability of being competent. Hence, the fraction of competent firms in the industry is always θ.

Firms may change their names at will, but since there are no competents to pool with upon entrance, firms actually prefer to keep their names. Indeed, as only the firms with lower reputation than the threshold μ_E would want to change their name, consumers associate a smaller probability than μ_E to the event that a firm operating under a new name is in fact competent. Thus, μ_E becomes the lowest reputation in the market: $\mu_E = \lambda\phi$.

4.2 Free entry of bad types

In the second situation, entry is free. We assume that there is a mass θ of competent firms, and still there are no competents being born outside the market: $\eta = 0$. The entry-level reputation is as before, and there are no actual entry or exit flows.

Potential entrants, however, exert a pressure over the price level, which must now be the smallest among those compatible with market clearing. Indeed, the free-entry condition becomes:

$$v_I(\mu_E) = 0$$

This implies that inept firms must produce at a loss at the date when they enter (or change their names): $p(\mu_E) < c_L$. On the other hand, consumers must be indifferent among providers, so that $\frac{\partial p(\mu)}{\partial \mu} = \beta$. It follows that $p(\mu) = \alpha + \beta\mu$ for some $\alpha < 0$.

In comparing this situation with the blockaded entry case, we see that the set of parameters that sustain the high-quality equilibrium (as defined by Equation 12) is the same.

It is important to realize that the incentives for producing the high-quality variety are exactly the same, even though the price function dropped perhaps substantially. Some authors (e.g., Bar-Isaac and Tadelis, 2008) have argued that a high price level is necessary for the reputation mechanism to work, and that competition by eroding rents would not be an appropriate environment for keeping incentives aligned. Usually the literature considers equilibria where the punishment for bad results (signals) is being forced to leave the market. This example shows that this need not be the case. What matters for incentives in our example is the price difference, not the level, because the punishment for bad results (signals) is a decreased reputation, but the firm can continue operating. This softer punishment may be enough to

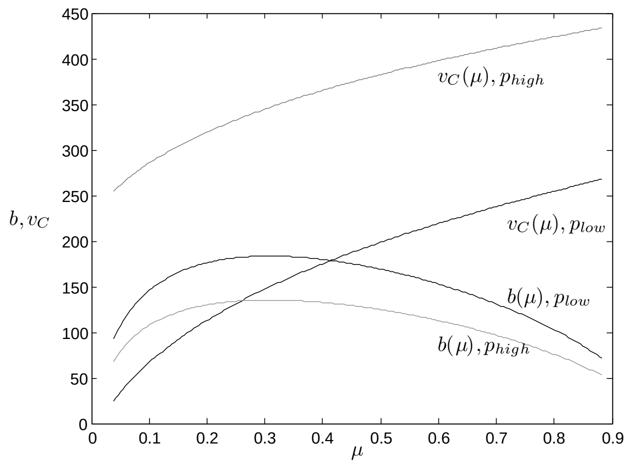

Figure 4: Price function dropping, incentives improving

keep incentives aligned, and from an efficiency point of view is actually better, as the abilities of the competent firms are not wasted.

Indeed, it is even conceivable a situation where the price level drops and incentives improve. This would be the case if on the demand side we had income effects. If the good were a normal good, the drop in the price level would generate an increase in the marginal willingness-to-pay for quality, increasing the price function's slope. A steeper price function increases the gross benefit of high-quality, as can be seen in Equation 10 (component B). Figure 4 presents an illustration of this point with a Cobb-Douglas utility function. In the plot, p_{low} is the price function that yields the free-entry condition. A lower price level decreases the value function for competent firms, yet the gross benefit of high quality increases.

4.3 Free entry of bad and good types

The third situation we examine is that where there is a constant flow $\eta > 0$ of new competents been born outside the market. We assume that the rate of competents been born inside the market ϕ is constant; hence, the mass of competent firms must increase. There is increased competitive pressure in the sense that firms face "tougher" competitors.

The existence of competent firms coming into the market alleviates the adverse selection that entrants face. Now the lowest reputation firms will wish to hide themselves with the new competents. The option to change the name, replacing a prior reputation $\overline{\mu}$ by μ_E becomes valuable, and there is a constant flow of new names in the market. Notice that "a few" η explains a potentially "large" entry flow $\overline{G}(\mu_E)$.

The ability to change the name after a sequence of bad results increases the firms' payoffs, but is detrimental to incentives. Punishment for bad behavior becomes softer. This can be

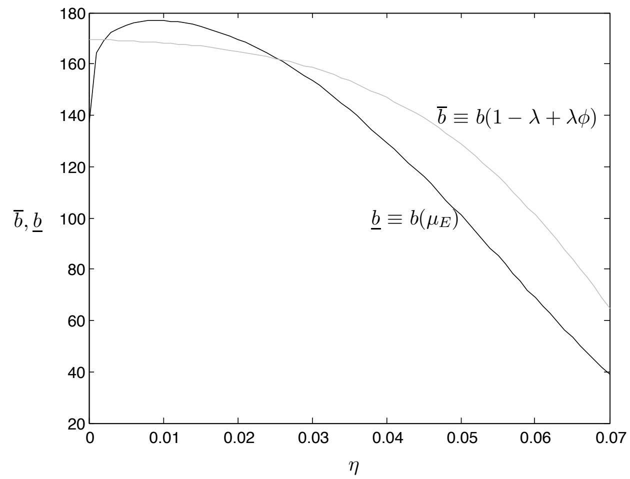

Figure 5: Varying η

appreciated in Equation 11, since $\frac{\partial \mu'}{\partial r}$ vanishes for low values of r, namely, those that would yield a posterior below the threshold μ_E: $r < \tilde{r}\left(\mu, \mu_E\right)$. The firm may now hide its history, thereby softening the punishment for bad luck or bad behavior. This ability will naturally be more valuable to inept firms, which are more likely to have worse records. At any rate, $b\left(\mu\right)$ decreases.

In spite of this, it is interesting to observe that in some situations this effect may actually improve incentives. Remember that incentives are "weaker" at the very lowest and very highest reputations in the support. An increase in μ_E means that the left limit of the support increases, so that the firm will not reach a reputation level where it was so hard to keep the incentives. So, an apparent paradox may present itself: $b\left(\mu\right)$ may decrease while ξ may increase, so that the set of parameter values for which a high quality equilibrium obtains become larger. This can be appreciated in Figure 3. The lighter lines correspond to higher values of η, which imply higher values of μ_E. The minimum values of $b\left(\mu\right)$ are depicted in Figure 5. Since $b\left(\mu\right)$ decreases point-wise as η (and μ_E) increase, $\overline{b}\left(\eta\right)$ decreases. However, $\underline{b}\left(\eta\right)$ is $b\left(\mu\right)$ evaluated at μ_E, which changes. The increase of μ_E dominates for low values of η, where–in the example– was the critical situation from the incentive point of view. Hence, incentives improved when the competitive pressure increased. On the contrary, for larger values of η where the critical point for incentives occur at the highest reputations, the "softer-punishment effect" dominates.

The increased option value of name-changing increases the firms' payoffs, so that at the same prices, the zero profit condition no longer holds. In equilibrium, the price function must be lower: α must decrease. Again, the drop in the price level would have an additional positive effect over incentives should the good be a normal good.

5 Concluding remarks

We have studied two margins in which competitive pressure increases. The first is a discrete margin: we compare a blockaded-entry industry with the same industry operating under free entry. In this case, there is a substantial difference in the price level, but other than that the equilibrium looks the same. In particular, there are no exit nor entry flows in either situation, and consequently the reputation distribution is the same. An increase in competitive pressure has no effect over incentives because it affects the price level, but doesn't affect its slope. It is the reputation premium what makes the firm's incentives aligned, not the rents *per se*. Moreover, if the good were a normal good, the slope could increase, improving incentives.

The second is a continuos margin: we ask what would happen if the inflow of competent firms were to increase. This second form of increased competitive pressure has an effect on the entry-level reputation. The ability to exit the market and come back under a new name is valuable to the firms but detrimental to incentives in general, as it implies that the punishment to bad behavior becomes softer. However, we have shown that this may not be the whole story. The ability to change names, avoiding punishment, also allows the firm to avoid those reputation levels where it may be too hard to maintain incentives for good behavior. Perhaps surprisingly, we find that the reputation mechanism may work better with some degree of forgiveness–or forgetfulness, which is not equal but is the same.

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