Collective versus Brand
Reputations for Geographical Indication Labelled Foods".

by

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Abstract:

For many geographical indication labelled products, firms can benefit from a reputation for quality that is derived from both its individual brand and its production region. This paper analyzes the quality choice for a firm whose return to investing in quality is two-fold: collective and firm reputation. Consumer's uncertainty regarding quality is modeled as a time lag between the changes in product quality and the resulting adjustment in collective and firm reputation. While the lag time is unique for the collective reputation process, we assume that individual firms have different "visibility", and therefore the speed of the firm reputation updating process is specific to each producer.

Key words: Collective reputation, Geographical Indication, Labels

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Introduction

Specialty, regional, authentic, and local food products have become a more important part of consumer purchases in recent years. Recent food scares, such as BSE, and the threat of bioterrorism has made some consumers choose to eat food produced locally. Firms have responded by marketing food products that come from specific geographic areas. This trend in consumers' preferences has led to a greater reliance on geographical identifications (GI). According to the World Trade Organization (WTO), "Geographical indications are place names (in some countries also words associated with a place) used to identify the origin and quality, reputation or other characteristics of products (for example, "Champagne", "Tequila" or "Roquefort")."[1] In the United States, there are popular state products which carry labels such as Washington apples, Idaho potatoes, and Florida oranges.

Reputation plays an important role in assuring product quality in markets where consumers can only imperfectly judge the product quality until after consumption. The concept of collective reputation is directly applicable to GI labeled food products, where, in general, individual producers are not known directly by the consumer. Since food products are typically experience goods, consumers rely on the reputation of the producer group and region that guarantees and promotes the particular product. When the collective reputation of a regional product is highly positive, a GI is a powerful tool to signal quality.

In this article, the reputation of the GI product is assumed to be similar to a common

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[1] Accessed from the WTO website (6/10/05)

property resource, which is exclusive to the group of firms that are marketing the product. In the spirit of Tirole's idea of collective reputation, it is assumed that the firms in the group share a common reputation, which is based on the group's *past* average quality. Since reputation is a dynamic concept, we can apply tools from differential game theory. The dynamic problem of collective reputation is similar to the common property natural resource extraction problem studied by Levhari and Mirman and many others.

If there is unrestricted access to a natural resource, agents perceive its shadow value to be zero and extract too rapidly. Applying this idea to collective reputation, an individual firm has an incentive to "extract" from the stock of reputation in the sense that it sells low-quality products at high prices determined by the high past levels of quality. Alternatively, a firm could build on the group's reputation if it provides a product with a quality level which is higher than the expected level of quality.

This article analyzes firm's incentives to supply quality when the return of investing in quality is two-fold: collective and firm reputation. Therefore, the producer's reputation for quality plays a significant role in directing consumer choices. Reputation can be associated with an individual brand or a group of producers or region (collective reputation), such as is often the case with a GI product. The characteristics of the market for a given good determine which kind of reputation is developed. When producers are not traceable, collective reputations develop, generally associated with the region of production (referred to as production district hereinafter).

Background

In 1992, the EU passed a package of legislation (EC Regulations 2081/92 and 2082/92), which

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http://www.wto.org/english/tratop_e/trips_e/gi_background_e.htm#protection.

provides protection of food names on a geographical basis. The 1994 WTO agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) set standards to regulate intellectual property (IP) and established standards for GIs, which are considered to be IP. The IP should be thought of as the food product's reputation for quality that is associated with its geographic origin. The U.S. Patent and Trademarks Office offers Washington apples, Idaho potatoes, and Florida oranges as examples of GIs.

As with most policies, there are potential tradeoffs. New entrants can be shut out of the market, and if market power is exercised, then deadweight loss in welfare can result. However, we will discuss in this article that the protecting the producers from loss of reputation is real. Further, this protection can increase consumer choice. Without protection, we show that individual do not have the appropriate incentive to supply high quality. There is also the issue of consumer information. If consumers care about credence good characteristics such as the product's authenticity and origin, then a GI label can increase their utility.

Related Literature

A significant body of literature investigated the issues related to the establishment of producer's reputation for quality when consumers have imperfect information. For many products, referred to as experience goods, quality cannot be assessed until after consumption. Collective reputation is important for GI food products because they can generally be classified as "experience goods" or "credence goods," which are goods whose quality is unobservable until they are consumed or never observable by the consumer, respectively. There is empirical evidence that collective reputation is an important factor in determining price premiums for GI products. Landon and Smith find that reputation is a significant factor in determining the price premium for wine, and Quagrainie, McCluskey, and Loureiro find that a common reputation exists and has a positive effect on the price of Washington apples relative to apples from other U.S. states.

Although many researchers have analyzed firm-specific reputations, only a few have focused on collective reputation. Tirole used a matching game to consider firm quality, where the firm should be thought of as the aggregate of individual workers. He found that a low (high)-corruption steady state only occurs when information about individual quality is good (poor). Winfree and McCluskey (2005) investigated the public good aspect of collective reputation, with an application to agricultural products. Using a dynamic optimization framework, they show that with positive collective reputation and no traceability, there is an incentive to extract rents by producing at lower quality levels. Furthermore, they show that the sustainable level of collective reputation decreases as the number of firms in the production district grows larger, and propose the implementation of minimum quality standards to sustain collective reputation. Carriquiry and Babcock (2007) further elaborate on the use of quality assurance systems, and their effects on the equilibrium quality level under different market structure scenarios. They conclude that monopolists are more likely to invest heavily on quality, as they can capitalize the full return from investing in reputation.

Yue et al. (2006) consider the use of brand advertisement and geographical indication in the wine market, extending their analysis to the case of firms that produce at different level of quality. Using a two-stage duopoly model and assuming that producers can decide whether to direct their marketing efforts towards the development of collective reputations or invest in brand advertising, they show that geographical indications are preferable for producers that decide not to invest in quality improvements, while quality improving producers will prefer the brand advertisement instrument.

In the area of international trade, there is an extensive literature dealing with the quality perceptions of products based on location of origin (for example, see Chiang and Masson,1988 and Haucap, Wey and Barmbold, 1997). If the country-of-origin affects also the market of PGI or PDO products, the success of many products will already be conditioned by the location of the production, and not the quality of the product *per se*. Summarizing, there are many issues besides the quality of the product that makes a PGI or PDO label successful or not. The efficiency of the quality signals, the consumer's perceptions about the collective reputation of the product and finally, the "country-of-origin" effect, are important components of the success of an "image" label such as the PGI or PDO labels.

Loureiro and McCluskey (2000) used a hedonic approach to calculate consumers' willingness to pay for fresh meat products that carry the Protected Geographical Identification (PGI) label, "Galician Veal," in Spain. Their results indicate that if the PGI label is present on high quality cuts of meat, one can obtain a premium up to a certain level of quality. The label is not significant for either quality extreme.

The model

Firms produce one unit of output each production cycle and adjust their quality level over time to maximize their stream of profits. The quality level set by firm *i*, q_i, determines the cost of production according to the function $c(q_i)$. Market price is related to the collective reputation of the firms in the district, *R*, and the individual firm reputation r_i, via $P(R, r_i)$. Both collective and firm reputations are in quality units. Assuming the standard structural forms, $c'(q) > 0$, $c''(q) > 0$, $P_R'(R,r) > 0$, $P_r'(R,r) > 0$, and $P_{RR}''(R,r) > 0$, $P_{rr}''(R,r) > 0$. The condition that $c''(q) > P''_{RR}(R,r) + P''_{rr}(R,r)$ ensures that the quality choice is bounded. Whether individual or collective reputation is more effective at influencing prices is inherently an empirical question from which we wish to abstract. Therefore, in this model $\left(\frac{\partial P}{\partial R} = \frac{\partial P}{\partial r}\right)\Big|_{R=r}$ and $\left(\frac{\partial^2 P}{\partial R^2} = \frac{\partial^2 P}{\partial r^2}\right)\Big|_{R=r}$. While this might seem to be a strong assumption, it only implies that at parity of reputation (and quality when quality is not changing), the market values equally collective and firm reputation. For simplicity, we also assume that $P''_{Rr}(R,r) = 0$. As in Winfree and McCluskey, reputation evolves as a Markovian process of past reputation and present quality. If there are *N* firms in the district, each firm solves the following maximization problem:

(0.1) $$\max_{q_i \geq 0} \int_0^\infty e^{-\delta t} \left[p_i(R, r_i) - c(q_i) \right] dt$$

subject to:

(0.2) $$\dot{R} = \gamma \left(\sum_{j=1}^{N} \left(\frac{q_j}{N} \right) - R \right), \text{ with } R(0) \geq 0$$

and:

(0.3) $$\dot{r} = \gamma \beta_i (q_i - r_i), \text{ with } r_i(0) \geq 0.$$

Where t indexes time, and δ is the discount rate. The parameter $\gamma \in (0,1)$ simulates the lag between the realization of a quality level and the learning process of consumers (or "speed of consumer learning" as in Shapiro, 1982), as consumers might not buy the product continuously. The parameter $\beta_i \in (0,1)$ is a producer-specific parameter that captures the visibility of a firm. Therefore, all firms are identical except for the value of their visibility parameter. The rationale for such difference is that, due to factors such as size, market share or distribution system, certain firms might have a faster updating process in their reputation than others. The genesis of the visibility parameter is exogenous to the model, so that there is no contradiction with our normalization of the per-firm quantity produced. Also, it should be noticed that collective reputation will also have an associated visibility parameter, which we normalized to one. The present-value Hamiltonian for firm *i* can be represented as:

(0.4) $$H_i = [p_i(R,r_i) - c(q_i)] + \lambda_i \gamma \left(\frac{q_i}{N} + \left(\frac{N-1}{N} \right) \varphi(R) - R \right) + \mu_i k_i (q_i - r_i)$$

Where $k_i = \gamma \beta_i$ and $\varphi(R)$ is firm's *i* representation of the strategy adopted by players $j \neq i$.

Scenario I: the myopic model

In this section, we examine the case in which firms take the quality choice of other firms in the district as given when making their own decision on quality. Let us first consider the maximization problem limiting the total number of firms to two. We will later generalize the results to the case of *N* firms. The current-value Hamiltonian for firm 1 under this duopoly scenario is:

(0.5) $$H_1 = [p_1(R,r_1) - c(q_1)] + \lambda_1 \gamma \left(\frac{q_1 + q_2}{2} - R \right) + \mu_1 k_1 (q_1 - r_1) .$$

Where λ and μ represent the shadow prices of collective and firm reputation. The first-order conditions for of the current-valued Hamiltonian of this game are:

(0.6) $$\frac{\partial H_i}{\partial q_i} = 0$$

(0.7) $$\dot{\lambda}_1 - \delta \lambda_1 = -\frac{\partial H_1}{\partial R}$$

(0.8) $$\dot{\mu}_1 - \delta \mu_1 = -\frac{\partial H_1}{\partial r_1} .$$

Which respectively imply:

(0.9) $$c'(q_1) = \frac{1}{2}\lambda_1\gamma + k_1\mu_1$$

(0.10) $$\dot{\lambda}_1 = \lambda_1(\delta + \gamma) - P_R$$

(0.11) $$\dot{\mu}_1 = \mu_1(\delta + k_1) - P_{r1}.$$

Solving for the isoclines, we derive:

(0.12) $$\lambda_1 = \frac{P_R}{\delta + \gamma}$$

(0.13) $$\mu_1 = \frac{\mathrm{P}_{r1}}{\delta + k_1},$$

and substituting into equation (9):

(0.14) $$c'(q_1) = \frac{1}{2}\gamma_\delta P_R + k_{\delta 1}\,\mathrm{P}_{r1}$$

where $\gamma_\delta = \frac{\gamma}{\delta + \gamma}$; $\kappa_{\delta 1} = \frac{k_1}{\delta + k_1}$ and $0 < \kappa_{\delta 1} < \gamma_\delta < 1$. Equation (0.14) equates the marginal cost of investing in quality to the sum of the marginal returns from collective and firm reputation and could be called the "economic equilibrium" for firm 1. The parameters γ_δ and $\kappa_{\delta 1}$ embed the discounting effect due to the fact that an investment in quality now realizes its effects on collective and firm reputation in the future, as consumers become aware of the change in quality. While equation (0.14) defines an economic equilibrium , it does not directly identify the final quality equilibrium of the dynamic system for any value of *q, R* and *r*. To solve for it, we specify the cost and prices equations as quadratic functional forms. Therefore, $c(q_i) = c_0 + c_1 q_i + c_2 q_i^2$ and $p(q_i) = a_0 + a_1 R + a_2 R^2 + a_1 r_i + a_2 r_i^2$. The previous general structural assumptions regarding the first and second order derivatives of the cost and price functions are retained, so that we can sign $a_1 + 2a_2 R > 0$; $a_1 + 2a_2 r_i > 0$ and $c_2 > 2a_2 > 0$. Substituting the functional forms into equation (0.14) yields:

$$c_1 + 2c_2 q_1 = \frac{1}{2}\gamma_\delta \left(a_1 + 2a_2 R\right) + \kappa_{\delta 1}\left(a_1 + 2a_2 r_1\right), \tag{0.15}$$

We can then obtain an explicit relationship between, q, R and r for firm 1:

$$q_1(R, r_1) = \frac{1}{2c_2}\left[-c_1 + \left(\frac{1}{2}\gamma_\delta + \kappa_{\delta 1}\right)a_1\right] + \frac{1}{2}\frac{a_2}{c_2}\gamma_\delta R + \frac{a_2}{c_2}\kappa_{\delta 1} r_1, \tag{0.16}$$

which is a an explicit representation of the quality choice of firm one under the economic equilibrium rule of equation (0.14).

Quality equilibrium in the two-firm system

A sufficient condition for an equilibrium to exist is that quality choices do not change through time. This condition sets $q_1 \equiv r_1$ in (0.16). Solving for $q_1(R)$:

$$q_1(R) = \frac{-c_1 + \left(\frac{1}{2}\gamma_\delta + k_{\delta 1}\right)a_1}{2\left(c_2 - k_{\delta 1} a_2\right)} + \frac{1}{2}\frac{\gamma_\delta a_2}{\left(c_2 - k_{\delta 1} a_2\right)} R, \tag{0.17}$$

a relationship that linearly links the firm quality decision to the collective reputation of the district. By symmetry:

$$q_2(R) = \frac{-c_1 + \left(\frac{1}{2}\gamma_\delta + k_{\delta 2}\right)a_1}{2\left(c_2 - k_{\delta 2} a_2\right)} + \frac{1}{2}\frac{\gamma_\delta a_2}{\left(c_2 - k_{\delta 2} a_2\right)} R. \tag{0.18}$$

We confine the equilibrium analysis to the more interesting case in which firms produce at some positive level of quality when the collective reputation is zero, i.e. $\left(\frac{1}{N}\gamma_\delta + k_{\delta i}\right)a_1 > c_1$. It should be emphasized that $q_i(R)$ is the same for both firms, with the only exception of the firm-specific visibility parameter k_i. The slope of equations (0.17 and 0.18) is

$\frac{dq_i}{dR} = \frac{1}{N} \frac{\gamma_\delta a_2}{\left(c_2 - k_{i\delta} a_2\right)} > 0$, which is unambiguously less than one and increasing in k_i.

Furthermore, the intercept is also increasing in k_i. Figure 1 represent equations (0.17 and 0.18), for the case of two firms with visibility parameters $k_1 > k_2$. As it appears clear in the graph, points to the left of point A cannot be an equilibrium, since both firms are producing above the existing level of collective reputation (identified by the 45 degree line), and therefore the reputation of the district must be increasing. A similar argument goes for points to the right of B, as both firms are free riding and diminishing the collective reputation. Clearly, an equilibrium will be reached were $q_1(R)$ and $q_2(R)$ are equidistant the $q = R$ line, that is, at point C.

The distance between the $q_i(R)$ lines and $q = R$ can be found as $q_i(R) - R$ and point C is therefore defined by the relationship $q_1(R) - R = -\left[q_2(R) - R\right]$. Solving for R we get $\overline{R} = -\frac{\mathrm{B}_0 + \Gamma_0}{\mathrm{B}_1 + \Gamma_1 - 2}$, where $\mathrm{B}_0, \mathrm{B}_1, \Gamma_0, \Gamma_1$ are the intercepts and slopes of the $q_1(R)$ and $q_2(R)$ lines respectively. Substituting in the parameter values from equations (0.17 and 0.18) and simplifying terms yields the equilibrium average quality in the production district as a function of the parameters of the model:

$$(0.19)\ \overline{Q}_{m(R,r)} = \frac{\left\{\left[-c_1 + \left(\frac{1}{2}\gamma_\delta + k_{\delta 1}\right)a_1\right]\left(c_2 - k_{\delta 2} a_2\right)\right\} + \left\{\left[-c_1 + \left(\frac{1}{2}\gamma_\delta + k_{\delta 2}\right)a_1\right]\left(c_2 - k_{\delta 1} a_2\right)\right\}}{4\left(c_2 - k_{\delta 1} a_2\right)\left(c_2 - k_{\delta 2} a_2\right) - \left[\left(c_2 - k_{\delta 1} a_2\right) + \left(c_2 - k_{\delta 2} a_2\right)\right]\gamma_\delta a_2},$$

where we use the fact that at equilibrium, average quality $\overline{Q} \equiv \overline{R}$ and the subscript $m(R,r)$ indicate the myopic model with both collective and firm reputation. Clearly, $\overline{Q}_{m(R,r)}$ will be a positive quantity under the provision that the first term in the denominator is greater than the second. Therefore, our first finding is that, when firms have different visibility, it is possible to find an equilibrium in which one firm (the more visible) produces above average quality, and the other is to some extent free riding. Also, observing equation (0.19) shows that the discounting effects due to speed of consumer learning and firm visibility are long lasting and persist even at equilibrium. This model also provides insight on the dynamics of quality and reputation, showing that when collective reputation is below a certain critical level (point A in figure 1), firms find it profitable to produce at higher quality levels, increasing the reputation of the district. Conversely, when collective reputation is above a certain level (point B in figure 1), it is economically convenient for both firms to erode it.

Generalization to N firms and Comparative Statics

We now evaluate how changes in the parameters of the model affect the firm's quality choice. Before we study the comparative statics, let us first generalize equation (0.16) to the case of *N* firms:

$$q_i(R,r_i) = \frac{1}{2c_2}\left[-c_1 + \left(\frac{1}{N}\gamma_\delta + \kappa_{\delta i}\right)a_1\right] + \frac{1}{N}\frac{a_2}{c_2}\gamma_\delta R + \frac{a_2}{c_2}k_{\delta i}r_i\,; \tag{0.20}$$

From (0.20) we can see that $\frac{\partial q_i}{\partial N} = -\frac{(a_1 + 2a_2R)\gamma_\delta}{2c_2N^2} < 0$, which means that for any given level of collective reputation, all firms will lower quality as a response to an increase in the number of firms in the production district. Conversely, all firms increase quality in response to an increase in their visibility, according to $\frac{\partial q_i}{\partial k_i} = \frac{(a_1 + 2a_2r_i)}{2c_2}\left(\frac{\partial\gamma_\delta}{\partial k_i}\right) > 0$, where $\frac{\partial\gamma_\delta}{\partial k_i} = \frac{\delta}{(\delta + k_i)^2}$. Both of these effects are increased in magnitude by the fact that $\frac{dq_i}{dR} = \frac{1}{N}\frac{\gamma_\delta a_2}{c_2} > 0$, and therefore as collective reputation decreases or increases in response to changes in *N* or $k_{i,}$ firms further adjust their quality level in response to the ongoing change in collective reputation.

Scenario II: the Cournot Model

In this scenario, we consider the decision process of a firm that takes into account the effects of its quality level on the choice of other producers in the district when maximizing its own stream of profits. We model this using a Cournot-style model in which firm *i* considers the quality adjustment due to changes in R of firm $j \neq i$, and incorporates it into the maximization problem. In contrast with the classical Cournot models, this modeling framework does not imply that firms are making a once-and-for-all decision on quality, as any firm will still be able to adjust their quality choice in response to exogenous shocks to the level of collective reputation, or revert to the myopic approach. For the case of a duopoly, firm 2 Hamiltonian is:

(0.21) $$H_2 = [p_2(R,r_2) - c(q_2)] + \lambda_2\gamma\left(\frac{q_1(R,r_1)+q_2}{2} - R\right) + \mu_2\kappa_2(q_2 - r_2),$$

where $q_1(R,r_1)$ represents equation (0.16) from the myopic model. Solving the first order conditions yields the set of equations analogous to (0.9 to 0.11):

(0.22) $$c'(q_2) = \frac{1}{2}\lambda_2\gamma + k_2\mu_2$$

(0.23) $$\dot{\lambda}_2 = \lambda_2\left\{\delta - \gamma\left[\frac{1}{2}q_{1R}'(R,r_1) - 1\right]\right\} - P_R$$

(0.24) $$\dot{\mu}_2 = \mu_2(\delta + k_2) - P_{r2}.$$

Solving for the isoclines we obtain:

(0.25) $$\lambda_2 = \frac{P_R}{\left\{\delta + \gamma\left[1 - \frac{1}{2}q_{1R}'(R,r_1)\right]\right\}}$$

(0.26) $$\mu_2 = \frac{\mathrm{P}_{r2}}{\delta + k_2},$$

which substituted in equation (0.22) yields the economic equilibrium rule for firm two:

(0.27) $$c'(q_2) = \frac{1}{2}\frac{\gamma}{\left\{\delta + \gamma\left[1 - \frac{1}{2}q_{_{1R}}'(R, r_1)\right]\right\}}P_R + k_{\delta 2}\,\mathrm{P}_{r2}$$

Quality equilibrium in the two-firm system

Using the same functional forms as in scenario I, and recalling that $q_{_{1R}}'(R, r_1) = \frac{1}{2}\frac{\gamma_\delta a_2}{c_2}$, we obtain:

(0.28) $$c_1 + 2c_2 q_2 = \frac{1}{2}\Delta_2[a_1 + 2a_2 R] + \kappa_{\delta 2}[a_1 + 2a_2 r_2],$$

where $\Delta_2 = \frac{\gamma}{\left\{\delta + \gamma\left[1 - \frac{1}{4}\gamma_\delta \frac{a_2}{c_2}\right]\right\}}$. Solving for q_2 yields the analogous to (0.16):

(0.29) $$q_2(R, r_2) = \frac{1}{2c_2}\left[-c_1 + \left(\frac{1}{2}\Delta_2 + k_{\delta 2}\right)a_1\right] + \frac{1}{2}\frac{a_2}{c_2}\Delta_2 R + \frac{a_2}{c_2}k_{\delta 2}r_2.$$

The average quality in the production district, $\overline{Q}_{c(R,r)}$, where c indicates the Cournot model, can be obtained following the same steps used in the myopic model. As equation (0.29) differs from (0.16) only for the fact that Δ_2 in (0.29) replaces γ_δ in (0.16), the equilibrium quality can be easily found substituting the terms in (0.19), which yields:

(0.30) $$\overline{Q}_{c(R,r)} = \frac{\left\{\left[-c_1 + \left(\frac{1}{2}\Delta_2 + k_{\delta 1}\right)a_1\right]\left(c_2 - k_{\delta 2}a_2\right)\right\} + \left\{\left[-c_1 + \left(\frac{1}{2}\Delta_2 + k_{\delta 2}\right)a_1\right]\left(c_2 - k_{\delta 1}a_2\right)\right\}}{4\left(c_2 - k_{\delta 1}a_2\right)\left(c_2 - k_{\delta 2}a_2\right) - \left[\left(c_2 - k_{\delta 1}a_2\right) + \left(c_2 - k_{\delta 2}a_2\right)\right]\Delta_2 a_2}.$$

Examining (0.30) we find that the average quality in the district at equilibrium is an increasing function in Δ_2. Since it is easy to show that $\Delta_2 > \gamma_\delta$, it follows that $\overline{Q}_{c(R,r)} > \overline{Q}_{m(R,r)}$: the equilibrium average quality under the Cournot model is larger than under myopic one. This last finding deserves to be commented further. The rationale for the quality increase from the myopic to the Cournot model lies in the fact that firms under this scenario realize that their quality choice will affect the collective reputation of the district, and that the other firms will respond to an increase in R according to $\frac{\partial q_i}{\partial R} > 0$. That is, when producers benefit from a collective reputation, there is a positive externality in investing in quality.

Generalization to *N* firms and comparative statics

Generalizing to (0.29) to the case of *N* firms we obtain:

(0.31) $$q_i = \frac{1}{2c_2}\left[-c_1 + \left(\frac{1}{N}\Delta_N + k_{\delta 2}\right)a_1\right] + \frac{1}{N}\frac{a_2}{c_2}\Delta_N R + \frac{a_2}{c_2}k_{\delta 2} r_i \,,$$

where $\Delta_N = \dfrac{\gamma}{\left\{\delta + \gamma\left[1 - \dfrac{1}{N^2}\gamma_\delta \dfrac{a_2}{c_2}\right]\right\}}$.

Taking the derivative (0.31) with respect to *N* yields: $\frac{\partial q_i}{\partial N} = -\frac{(a_1 + 2a_2 R)\left(\Delta_N - N\frac{\partial \Delta_N}{\partial N}\right)}{2c_2 N^2} < 0$,

since $\frac{\partial \Delta_N}{\partial N} = -\frac{2a_2\gamma^2\gamma_\delta}{c_2\left[\delta + \gamma\left(1 - \frac{a_2\gamma_\delta}{c_2 N}\right)\right]^2 N^3} < 0$. Comparing this result with the one obtained in the myopic scenario, we can easily see that the decrease in quality response due to the increase of firms is much larger in the Cournot model, as $\Delta_N > \gamma_\delta$ and $-N\frac{\partial \Delta_N}{\partial N}$ is a negative quantity.

Taking the derivative of equation (0.31) with respect to k_i, returns $\frac{\partial q_i}{\partial k_i} = \frac{(a_1 + 2a_2 r_i)}{2c_2}\left(\frac{\partial \gamma_\delta}{\partial k_i}\right) > 0$,

which is the same as in the myopic model. Nevertheless, the feedback effect due to $\frac{\partial q_i}{\partial R}$, which

will increase both $\frac{\partial q_i}{\partial N}$ and $\frac{\partial q_i}{\partial k_i}$, is larger under the assumptions of this scenario as

$\frac{\partial q_i}{\partial R} = \frac{1}{N}\frac{a_2}{c_2}\Delta_N > 0$ is strictly greater than $\frac{dq_i}{dR} = \frac{1}{N}\frac{a_2}{c_2}\gamma_\delta$ from the myopic scenario. A important thing to notice is that $\lim_{N\to\infty} \Delta_N = \gamma_\delta$. That is, as the number of firms grows larger, the Cournot model converges in results to the myopic model and equations (0.31) and (0.20) become equivalent. It is straightforward now to realize the reason behind it: as the number of firm increases, the positive externality on collective reputation of investing in quality approaches zero. Therefore, firms belonging to a production district with a large number of firms behave myopically and take the quality choice of the other firms as given.

Special cases: collective reputation or firm reputation only

It is useful to compare the results obtained so far to the ones that can be derived from models considering exclusively returns on collective reputation (as in Winfree and McCluskey, 2005) or firm reputation only (as Shapiro,1982). Such results can be easily derived under the same general assumptions adopted in this article as special cases of the economic equilibrium rules represented by equations (0.14) and (0.27).

For the case of markets in which firm reputation only exists, the myopic and Cournot equilibria will coincide, as both equations simplify to: $c'(q_i) = k_{\delta i}\,\mathrm{P}_{ri}$. Substituting in the cost and price functional forms yields: $q_i(R,r_i) = \dfrac{-c + (a_1 + 2a_2 r_i)\kappa_{\delta i}}{2c_2}$ and using the equilibrium condition $q_i = r_i$ we have: $q_i = \dfrac{-c_1 + a_1}{2(c_2 - a_2 k_{\delta i})}$. The duopoly equilibrium average quality is easily derived as

(0.32) $$\overline{Q}_r = \frac{q_1 + q_2}{2} = \frac{(-c_1 + a_1)\left[(c_2 - a_2 k_{\delta 1}) + (c_2 - a_2 k_{\delta 2})\right]}{4(c_2 - a_2 k_{\delta 1})(c_2 - a_2 k_{\delta 2})}$$

For the case of collective reputation only, equation (0.14) reduces to $c'(q_1) = \frac{1}{2}\gamma_\delta P_R$. Therefore, in the absence of firm-specific reputation all firms have the same quality response function $q_i(R) = \dfrac{1}{2c_2}\left[-c_1 + \dfrac{1}{2}\gamma_\delta (a_1 + 2a_2)R\right]$ and the equilibrium quality can be found as the intersection of the $q_i(R)$ line with the 45 degree line in figure 1. Solving for $\overline{R}$ from $q_i(R) = R$ we have: $\overline{Q}_{m(R)} = \dfrac{-c_1 + \frac{1}{2}\gamma_\delta a_1}{2(c_2 - a_2\gamma_\delta)}$. Similarly, we can find the equilibrium level for the Cournot model derived in scenario II as $\overline{Q}_{c(R)} = \dfrac{-c_1 + \frac{1}{2}\Delta_2 a_1}{2(c_2 - a_2\Delta_2)}$. Generalization of these models to the case of N firm and the comparative statics are analogous to the ones obtained so far (see table 1), with the obvious proviso that $\dfrac{\partial q_i}{\partial N} = 0$ and $\dfrac{\partial q_i}{\partial R} = 0$ for the firm-reputation-only model and $\dfrac{\partial q_i}{\partial ki}$ is irrelevant for the collective-reputation-only model.

Comparing these results to the ones we obtained so far, we find that the following inequalities hold: $\bar{Q}_{c(R,r)} > \bar{Q}_{m(R,r)} > \bar{Q}_{r} > \bar{Q}_{c(R)} > \bar{Q}_{m(R)}$. That is, the highest sustainable level of quality for a duopoly is achieved in the Cournot scenario with collective and firm reputation, followed by its analogous myopic case. The equilibrium quality level progressively decreases as we consider markets with own reputation only and the Cournot model with collective reputation only. The lowest quality level is achieved in markets with collective reputation only and firms behaving myopically. An additional results is that, when N is large, $\bar{Q}_{m(R,r)} = \bar{Q}_{c(R,r)} > \bar{Q}_{r} > \bar{Q}_{m(R)} = \bar{Q}_{c(R)}$. That is, the quality levels of the Cournot models collapse to their myopic counterparts.

Discussion and conclusions

Firms who sell a regional or specialty product often share a common or collective reputation, which is based on the group's aggregate quality. Collective reputation should be thought of as a common property resource for the group of producers. If there is more than one firm in a producer group, they have the incentive to produce lower quality and free ride on the good group reputation. However, firms may receive a return to brand reputation, which is at the individual firm level. This analysis is a good fit for many GI labeled products, where firms can benefit from both brand reputations and production region reputation. Bonnet and Simioni (2001) found that brand information is more relevant than the PDO label for French Camembert cheese, but for other GI products, the return may be larger for the collective reputation.

The model developed in this article provides a broad framework under which the relationship between quality, collective reputation and firm reputation in markets for experience goods can be analyzed. The case of markets with collective reputation only or firm reputation only are special cases of this general model. A summary of the resulting findings is presented in

Table 1, which we will discuss under the assumption that higher levels of quality are more desirable than lower.

Under our assumptions, three general rules regarding the dynamics of quality can be derived: 1) quality is increasing in the visibility of the single firm, and 2) quality is decreasing in the number of firms in the production district and, 3) when the number of firm is large enough, firms behave myopically, taking the quality of other firms in the district as given. Regarding the static equilibria we can summarize: 1) the speed of consumer learning and the visibility of the individual firms have long lasting effects on the quality decision of each firm, which persist at equilibrium 2) given a set of parameter values, the equilibrium quality will be highest in market with both collective and firm reputation, intermediate for the case of own reputation only, and markets with collective reputation only will yield the lowest equilibrium quality levels. Furthermore, the model provides insight regarding the conditions under which collective reputation is increased or eroded and shows that it is possible to achieve equilibria in which certain firms produce above the average quality of the district, and other firms are free riding by producing below average quality.

Several real-world phenomena are interpretable at the light of our conclusions. For example, the common good problem pointed out by Winfree and McCluskey (2005) for the case of the collective reputation of Washington apples is consistent with these findings. Furthermore, Winfree and McCluskey and Carriquiri and Babcock (2007) argue that having traceable firms and the developing minimum quality standards could be a solution to the common good problem of collective reputation. According to our results, we can argue that, if firms are traceable and consumers can recognize them, producers will automatically increase their quality and minimum quality standards might be unnecessary. On the other hand, when information regarding the identity of the individual producer is impossible or difficult to deliver to consumers, quality assurance systems might be a necessity.

The theory outlined in this article also sheds some light on the recent changes affecting the wine industry. Yue et al. (2006) present evidence that the European wine producers are losing market share to the wineries in California, Chile and Australia. According to their article, wineries from the "old world" relied extensively on the use of geographical indications to market their wines, while the new entrants seemed to have focused their marketing efforts in brand advertisement. The authors suggest that the problems affecting collective reputation might be one of the reasons for the decline of European wineries and argue that the small average firm size in the old world might prevent the implementation of costly quality-improving practices.

According to our theory on quality, we can argue that the cost of improving quality is likely not the only reason for the decline of European wines: small firms, inherently less recognizable by the consumers, will have a smaller incentive to invest in their own reputation, which will result in a lower quality output. Conversely, examples of successful wine regions such as Champagne in France or Napa Valley in California convincingly fit our description of the recipe for high quality products: a production district with few, highly recognizable producer.

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Tables

Table 1. Summary of Findings

Model	**Results**		
	$\frac{\partial q_i}{\partial N} < 0$	$\frac{\partial q_i}{\partial k_i} > 0$	[1]Two-firm $\bar{Q}$
Cournot(R,r)	$-\frac{(a_1 + 2a_2R)\left(\Delta_N - N\frac{\partial \Delta_N}{\partial N}\right)}{2c_2N^2} - \left[\frac{1}{N}\frac{a_2}{c_2}\Delta_N\right]$	$\frac{(a_1 + 2a_2r_i)\left[\frac{\partial k_\delta}{\partial k_i}\right]}{2c_2} + \left[\frac{1}{N}\frac{a_2}{c_2}\Delta_N\right]$	$\frac{\left\{\left[-c_1 + \left(\frac{1}{2}\Delta_2 + k_{\delta 1}\right)a_1\right](c_2 - k_{\delta 2}a_2)\right\} + \left\{\left[-c_1 + \left(\frac{1}{2}\Delta_2 + k_{\delta 2}\right)a_1\right](c_2 - k_{\delta 1}a_2)\right\}}{4(c_2 - k_{\delta 1}a_2)(c_2 - k_{\delta 2}a_2) - \left[(c_2 - k_{\delta 1}a_2) + (c_2 - k_{\delta 2}a_2)\right]\Delta_2 a_2}$
Miopic(R,r)	$-\frac{(a_1 + 2a_2R)\gamma_\delta}{2c_2N^2} - \left[\frac{1}{N}\frac{a_2}{c_2}\gamma_\delta\right]$	$\frac{(a_1 + 2a_2r_i)\left[\frac{\partial k_\delta}{\partial k_i}\right]}{2c_2} + \left[\frac{1}{N}\frac{a_2}{c_2}\gamma_\delta\right]$	$\frac{\left\{\left[-c_1 + \left(\frac{1}{2}\gamma_\delta + k_{\delta 1}\right)a_1\right](c_2 - k_{\delta 2}a_2)\right\} + \left\{\left[-c_1 + \left(\frac{1}{2}\gamma_\delta + k_{\delta 2}\right)a_1\right](c_2 - k_{\delta 1}a_2)\right\}}{4(c_2 - k_{\delta 1}a_2)(c_2 - k_{\delta 2}a_2) - \left[(c_2 - k_{\delta 1}a_2) + (c_2 - k_{\delta 2}a_2)\right]\gamma_\delta a_2}$
Miopic(r) Cournot(r)	-	$\frac{(a_1 + 2a_2r_i)\left[\frac{\partial k_\delta}{\partial k_i}\right]}{2c_2}$	$\frac{(-c_1 + a_1)\left[(c_2 - a_2k_{\delta 1}) + (c_2 - a_2k_{\delta 2})\right]}{4(c_2 - a_2k_{\delta 1})(c_2 - a_2k_{\delta 2})}$
Cournot(R)	$-\frac{(a_1 + 2a_2R)\left(\Delta_N - N\frac{\partial \Delta_N}{\partial N}\right)}{2c_2N^2} - \left[\frac{1}{N}\frac{a_2}{c_2}\Delta_N\right]$	-	$\frac{-c_1 + \frac{1}{2}\Delta_2 a_1}{2(c_2 - a_2\Delta_2)}$
Miopic(R)	- $-\frac{(a_1 + 2a_2R)\gamma_\delta}{2c_2N^2} - \left[\frac{1}{N}\frac{a_2}{c_2}\gamma_\delta\right]$	-	$\frac{-c_1 + \frac{1}{2}\gamma_\delta a_1}{2(c_2 - a_2\gamma_\delta)}$

1: equilibrium quality is decreasing along the column from top to bottom

Figures

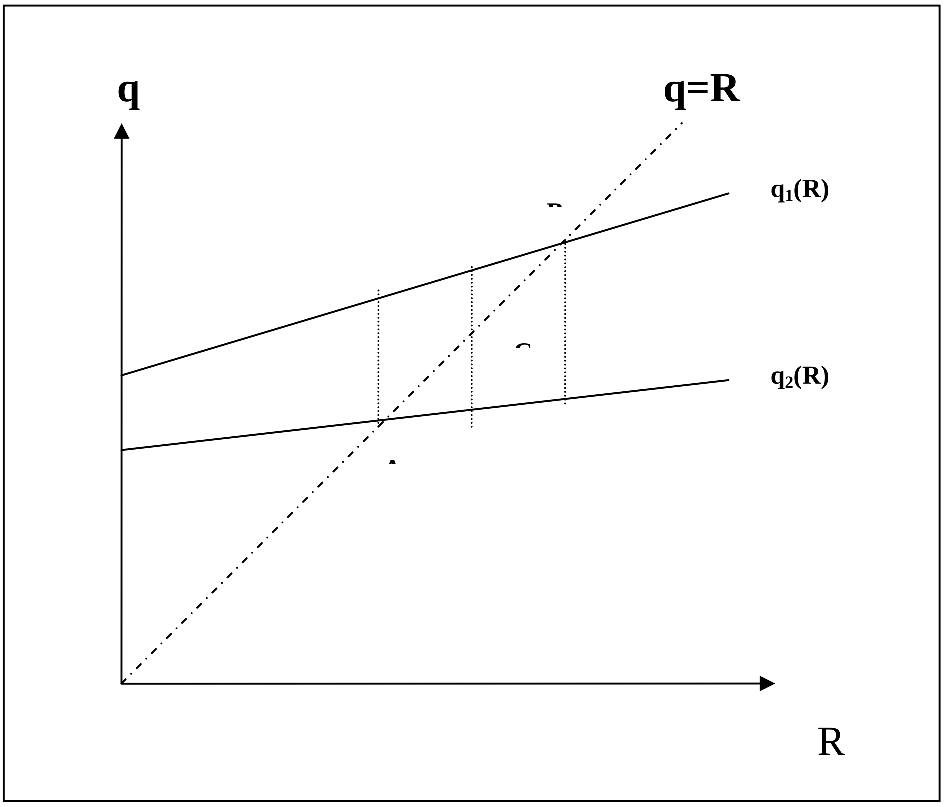

Figure 1: Optimal Response of Firm 1 and 2 to Changes in Collective Reputation, with a Graphical Solution for the Equilibrium Level of Collective Reputation